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**SECTION TS-  
CHAIN LINK FENCING**

**-01. GENERAL:**

The extent of chain link fencing is indicated on the drawings. Provide fences and gates complete, including all erection accessories, fittings and fastenings.

Installer must be experienced in fence installations and must examine conditions under which fence and gates are to be installed. Notify the Architect/Engineer in writing of improper conditions of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer. Do not proceed until final grading is completed.

**-02. MATERIALS:**

**A. POSTS, RAILS AND BRACES**

All structural and roll-formed shapes shall conform to provisions of ASTM A123 for galvanized coating. All tubular members shall comply with provisions of ASTM A120, Schedule 40, for weight and coating.

1. End, Corner and Pull Post: Fence up to and including 12'-0" in height: 32" x 32" roll-formed corner section shall have a minimum bending strength of 452 pounds. (2.875" O.D., Schedule 40 Pipe with a minimum bending strength of 381 pounds.)
2. Line Posts: Fabric up to 8'-0" in height: "C"-Section, Standard roll-formed, 1.875" x 1.625" with minimum bending strength of 245 pounds. (1.90" O.D., Schedule 40 Pipe with minimum bending of 117 pounds.)
3. Gate Posts:
  - a. Gate leaves up to and including 6'-0" wide: 32" x 32" roll-formed section (2.875" O.D., Schedule 40 pipe).
  - b. Gate leaves over 6'-0" and up to and including 13'-0" wide: 4" O.D. Schedule 40 pipe.
  - c. Gate leaves over 13'-0" and up to and including 18'-0" wide: 6e" O.D. Schedule 40 pipe.
  - d. Gate leaves over 18'-0" wide: 8e" O.D. Schedule 40 pipe.
4. Top Rail: 1.625" x 1.25" roll-formed section, with minimum bending strength of 192 pounds. (1.660" O.D., Schedule 40 pipe, with minimum bending strength of 202 pounds.)

Furnish in manufacturer's standard lengths, of approximately 21'0" with couplings approximately 6" long for each joint, one coupling in each 5 shall have expansion spring. Provide means for attaching top rail securely to each gate, corner, pull and end posts. Top rail shall form continuous brace from end-to-end to each run of fence.

5. Tension Wire: (In lieu of top rail and/or bottom of fabric) 7 gage

galvanized or aluminum coated coil spring wire.

6. Post Bracing Assembly: Shall match top rail. Brace rail assembly shall be complete with d diameter rod and adjustable take-up.

**-03. CHAIN LINK FABRIC:**

- A. One piece of fabric widths for fences up to 12'0"-2" mesh, 6 fa., or 11 ga., as indicated on contract drawings.
- B. Selvage edges: Fabric 72 inches and over shall be knuckled at bottom selvage and twisted and barbed at top.
- C. Finishes: Heavy galvanized - 2.0 ounces zinc per square foot, complying with ASTM A392, Class II or \*aluminum coated - 0.40 ounces aluminum per square foot, complying with ASTM A491, Class II.

**-04. ACCESSORIES:**

- A. All accessories, except tie wires and barbed wires shall be galvanized to comply with ASTM A153.
- B. Barbed Wire Supporting Arms: Heavy pressed steel, complete with provisions for anchorage to tubular end, corner, and pull posts attaching 3-rows of barbed wire to each arm. Barbed wire arms are not required on roll-formed terminal posts. Single arms shall be integral with a post top weather cap. Intermediate arms shall have hole for passage of top rail. Arms shall be capable of withstanding, without failure, 250 lbs. downward pull at outermost end of arm.
- C. Barbed Wire: 2-strand, 122 ga. wire with 14 ga., 4 point round barbs spaced approximately 5" O.C. finishes as follows:
  - Galvanized: ASTM A121, Class 3
  - Aluminized: ASTM A585, Class 2
- D. Post Tops: Pressed steel, or malleable iron, (Designed as a weather tight closure cap for tubular posts.) Where top rail is used, provide tops to permit passage of top rail.
- E. Stretcher Bars: (For tubular end, corner, pull or gate posts only.) One piece lengths equal to full height of fabric with a minimum cross-section of  $\frac{3}{16}$ " x :". Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post.
- F. Stretcher Bar Bands: Heavy pressed steel, spaced not over 15" O.C. to secure stretcher bars to tubular end, corner pull and gate post.

**-05. GATES:**

- A. Fabricate gate perimeter frames of 1.90" O.D. tubular members galvanized, ASTM A120. Provide additional horizontal and vertical members to insure proper gate operation and for attachment of fabric, hardware and accessories. Assemble gate frames by welding or fittings and rivets for rigid connections. Use same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges, and tie at top and bottom edges. Attach stretcher bars to gate frame at not

more than 15" O.C. Attach hardware with rivets or by other means which will provide security against removal or breakage. Provide diagonal cross-bracing consisting of d" diameter adjustable length truss rods on gates where necessary to provide frame rigidity without sag or twist.

1. Gate Hardware: Provide the following hardware and accessories for each gate; finish - heavy galvanized:
  - a. Hinges: Pressed steel or malleable iron to suit gate size, non-lift-off-type, offset to permit 180 F. gate opening. Provide one pair of hinges for each leaf.
  - b. Latch: Forked type or plunger-bar type to permit operation from either side of gate. Provide padlock eye as integral part of latch.
  - c. Keeper: Provide keeper for all vehicle gates, which automatically engages the gate leaf and holds it in the open position until manually released.
  - d. Double Gates: Provide gate stops for all double gates, consisting of mushroom type of flush plat with anchors. Set in concrete to engage the center drop rod or plunger bar. Provide locking device and padlock eyes as an integral part of the latch, requiring one padlock for locking both gate leaves.
  - e. Sliding Gates: Provide manufacturer's standard heavy-duty track, ball bearing hanger sheaves, overhead framing, and supports, guides, stays, bracing, and accessories as required.

**-06. MISCELLANEOUS MATERIAL AND ACCESSORIES:**

- A. Wire Ties: For tying fabric to line posts, use 11 ga. steel wire clips for "C"-section posts and a minimum 9 ga. aluminum wire ties for tubular posts, spaced 14" O.C. For tying fabric to rails and braces, use 9 ga. aluminum wire ties spaced 24" O.C. For tying fabric to tension wire, use 11 FA. hog rings spaced 24" O.C.
- B. Concrete: Provide concrete consisting of Portland cement complying with ASTM C150, aggregates complying with ASTM C33 and clean water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 2500 psi, using at least 4 sacks of cement per cubic yard.

**-07. EXECUTION:**

**-08. INSTALLATION:**

- A. Do not begin prior to completion of final grading. Drill holes for post footings in firm, undisturbed or compacted soil. Holes shall have a diameter equal to three times the diameter of the post. Excavate hole depths approximately 3" deeper than post bottom, with bottom of posts set not less than 36" in concrete base. Place concrete around posts in a continuous pour, tamp for consolidation. Check each post for vertical and top alignment.

1. Accessories: Set keepers, stops, sleeves and other accessories into

concrete as required.

2. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
3. Tension Wire: Install tension wires before stretching fabric and tie to each post with ties or clips.
4. Fabric: Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.
5. Stretcher Bars: Thread through fabric and secure to posts with metal bands spaced not over 15" O.C.
6. Barbed Wire: Install 3 parallel wires on each extension arm; on security side of fence, unless otherwise shown. Pull wire taut.
7. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage, as recommended by the fence manufacturer. Adjust hardware for smooth operation.

SECTION 02401 DEWATERING AND COFFERDAM

**PART 1 - GENERAL**

1.01 SCOPE:

- A. Summary or Work: The CONTRACTOR shall furnish all labor, material and equipment necessary for the removal of all surface and subsurface waters from excavation areas. This section includes the construction of temporary cofferdams with steel sheet piling and bracing. The work includes the removal of temporary sheet piling at the completion of the work.

1.02 APPLICABLE PUBLICATIONS:

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A 36 - Standard Specification for Carbon Structural Steel
  - 2. ASTM A328 - Standard Specification for Steel Sheet Pile

1.03 DEFINITIONS: (Not Used)

1.04 SUBMITTALS: The CONTRACTOR shall make submittals in accordance with SECTION 01300 and the following:

- A. The CONTRACTOR shall submit to the DISTRICT a dewatering plan, which includes the cofferdam design and dewatering equipment, safety procedures, sequence of construction, and re-watering procedures, prior to the start of any such operations.
- B. Submit certification from a practicing structural engineer registered in the State of SC that the temporary cofferdam has been designed to meet the criteria specified herein.
- C. Two sets of sealed prints of the cofferdam system shall be submitted to the DISTRICT for reference.
- D. Acquire all permits required to discharge water and protect waterways from turbidity during the dewatering operation. Discharge of waters off the canal right-of-way will not be permitted.

1.05 QUALIFICATIONS: (Not Used)

1.06 RESPONSIBILITIES:

- A. This is a performance specification. Except as otherwise specified or indicated, selection of equipment, materials, and methods shall be CONTRACTOR's responsibility. The dewatering of any excavation areas and disposal of all water handled shall be in strict accordance with all local and state government rules and regulations.
- B. The CONTRACTOR shall be responsible for the design of the dewatering system including, but not necessarily limited to, the temporary cofferdam, required pump equipment, temporary shoring, as well as any miscellaneous temporary structures required.

1.07 CERTIFICATIONS AND TESTING: A registered professional engineer in the State of Florida hired by the CONTRACTOR shall inspect, accept, and certify the used sheet piling for dewatering purposes.

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the DISTRICT as requested for inspection. The Contractor shall provide 48 hours notice of its intention to begin new WORK activities.

1.09 WARRANTY: (Not Used)

## **PART 2 - PRODUCTS**

- 2.01 PRODUCT REQUIREMENTS: All materials used in the construction of the dewatering facilities shall be selected, furnished and installed by the CONTRACTOR in accordance with the design as submitted to the DISTRICT.
- 2.02 SHEET PILE: The CONTRACTOR shall provide new or used sheet piling for use in the cofferdam conforming to the requirements of ASTM A328.
- 2.03 STRUCTURAL STEEL: The CONTRACTOR shall provide structural steel for use in the cofferdam conforming to the requirements of ASTM A36.

## **PART 3 - EXECUTION**

- 3.01 PERFORMANCE: The CONTRACTOR shall furnish and install cofferdams in accordance with the following.
- A. The CONTRACTOR shall employ the services of a structural engineer registered in the State of Florida for the design of the cofferdam system. The walls and bracing shall be designed to withstand, without damage, the maximum water elevations indicated in the Regulation Schedule below (Paragraph 3.05).
  - B. Approximate locations of cofferdam, structural characteristics and embedment depths shall be determined by the engineer designing the cofferdam.
  - C. The layout and design of the interior and exterior bracing system for the cofferdam shall fully accommodate with appropriate factors of safety, all applied loading indicated. Those loadings may be increased if considered appropriate by the engineer designing the cofferdam.
- 3.02 DEWATERING:
- A. The CONTRACTOR shall provide adequate equipment for removal of storm, subsurface or cofferdam leakage waters, which may accumulate in the cofferdam interior.
  - B. The CONTRACTOR shall perform all work for the water control structure in the cofferdam interior free from water. The CONTRACTOR shall furnish, install, maintain, and operate all necessary pumping and other equipment necessary for dewatering the work area.
    - 1. All dewatering equipment shall be in first-class condition and shall at all times be maintained and operated at the efficiency and capacity necessary for maintaining the cofferdam interior free from standing water or wet conditions that prevent proper construction.
  - C. The CONTRACTOR shall provide dewatering facilities with stand-by pumps with 100 percent standby capacity.
  - D. The CONTRACTOR shall comply with all local, state and federal regulations when disposing of water generated by dewatering operations.
- 3.03 TURBIDITY BARRIER: The CONTRACTOR shall install and maintain suitable turbidity barriers as described in SECTION 01530.
- 3.04 REMOVAL OF DEWATERING SYSTEM AND COFFERDAMS:
- A. The CONTRACTOR shall remove the dewatering system in such a manner as to allow groundwater elevations to slowly return to natural elevations.

- B. The CONTRACTOR shall slowly flood the dewatered area to establish water surface elevations upstream of water control structure and equal to tailwater downstream of water control structure prior to removal of temporary cofferdams.
- C. If a portion of the cofferdam is incorporated into the structure, the CONTRACTOR shall review the drawings to determine what portion of the sheet pile of the cofferdam that shall be removed.

3.05 REGULATION SCHEDULE:

- A. Canal Water Levels: Should the water level in the seepage canal come up due to heavy rains, the contractors dewatering pump discharges or other circumstances, the contractor shall be responsible for maintaining the water level in the seepage canal south of the earthen-berm as directed by the District. The Districts modified the existing STA-1E/STA-1W EFA Permit (No. 0279449-001-EM) for the automation of the S-376 Structure. Dewatering General Water Use Permit (as described in Rule 40E-20.302(2), F.A.C.) category, thresholds are for a duration of less than one year, and propose to volumes are less than 10 million gallons per day with a total project volume of less than 1800 million gallons.
- B. Canal By-Pass: N/A
- C. Noise Abatement: The CONTRACTOR shall furnish, install, and maintain throughout the course of the work, mufflers, noise-control enclosures, or other noise control methods, measures, and features on and around all dewatering pumps and their prime movers such that steady noise emanating from this equipment does not exceed the permissible sound levels defined in the local County ordinances.

END OF SECTION

**522.3.07 Contractor Warranty and Maintenance**

General Provisions 101 through 150.

**522.4 Measurement**

This work is not measured separately for payment.

**522.4.01 Limits**

General Provisions 101 through 150.

**522.5 Payment**

This work will be paid for at the Contract Price for shoring complete in place, maintained, and removed.

Payment will be made under:

Item No. 522	Shoring	Per linear foot
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**522.5.01 Adjustments**

General Provisions 101 through 150.

**Section 523—Dynamic Testing of Pile**

**523.1 General Description**

Specifications for this work will be included elsewhere in the Contract.

**Section 524—Drilled Caisson Foundations**

**524.1 General Description**

Specifications for this work will be included elsewhere in the Contract.

**Section 525—Cofferdams**

**525.1 General Description**

This work consists of designing, constructing, maintaining, dewatering, removing, and disposing of cofferdams, which are necessary for constructing substructures and for protecting personnel and adjacent structures, roadbeds, tracks, channels, slopes, or other property (public or private) whether on or off the Rights-of-Way from water, caving soil, and other dangers.

**525.1.01 Definitions**

General Provisions 101 through 150.

**525.1.02 Related References**

**A. Standard Specifications**

Section 109—Measurement and Payment

Section 211—Bridge Excavation and Backfill



Section 500—Concrete Structures

**B. Referenced Documents**

General Provisions 101 through 150.

**525.1.03 Submittals**

**A. Drawings**

The Engineer may require the Contractor to submit drawings of proposed cofferdams for review. If this is required, the Contractor shall not start work until the Engineer completes the review.

The review will not relieve the Contractor of the responsibility for providing an adequate and safe cofferdam.

**525.2 Materials**

Materials used in cofferdam construction may be of any type suitable for the design requirements and for the particular dam being constructed, subject to the Engineer's approval.

Earth dams, sand bags, or dams constructed using excavated materials are not considered cofferdam construction.

**525.2.01 Delivery, Storage, and Handling**

General Provisions 101 through 150.

**525.3 Construction Requirements**

**525.3.01 Personnel**

General Provisions 101 through 150.

**525.3.02 Equipment**

**A. Pumps**

Supply sufficient pumping capacity to dewater the cofferdam.

**525.3.03 Preparation**

General Provisions 101 through 150.

**525.3.04 Fabrication**

General Provisions 101 through 150.

**525.3.05 Construction**

**A. Designing Cofferdams**

Cofferdams shall be structurally adequate to withstand external and internal forces including the following:

1. Forces and pressures from an excavation depth of not less than 6 ft (1.8 m) below the elevation of the bottom of the footing
2. Forces and pressures from surcharge loads from adjacent structures, roadbeds, tracks, slopes, and equipment.

Design the cofferdam to meet these conditions:

- Cofferdams shall permit placing pumping equipment outside the footing forms.
- Cofferdams shall permit driving piling between braces.

**B. Correcting Cofferdams**

Correct to the Engineer's satisfaction cofferdams that tilt or move laterally during construction.

**C. Lowering Cofferdams**

Substructure elevations shown on the Plans are approximate; therefore, the Engineer may require that both substructures and cofferdams be lowered by a specified amount.

**D. Dewatering Cofferdams**

Try to dewater cofferdams without using seal concrete unless the Plans require seals.

1. Dewatering Cofferdams Without Seal Concrete

Use all reasonable methods to provide a dewaterable enclosure, including the following:

- a. Drive all sheeting within the cofferdam to a depth of at least 1 ft (300 mm) below the bottom of the excavation.
- b. Provide a double-walled cofferdam lined with clay or other reasonably impervious material.

The Engineer decides if the Contractor has used all reasonable methods to provide watertight cofferdams.

If the enclosures are not dewaterable, and the Engineer decides the Contractor has not used all reasonable methods to provide watertight cofferdams, the Engineer may do either of the following:

- Require the Contractor to place Seal Concrete at the Contractor's expense.
- Permit the Contractor to place Seal Concrete at the Contractor's expense instead of trying further dewatering methods without a seal.

2. Dewatering Cofferdams with Seal Concrete

If all reasonable methods to provide a dewaterable enclosure have been used and the Engineer determines that seal concrete is necessary, place the concrete as outlined in Subsection 500.3.05.V, "Place Seal Concrete."

When using seal concrete, dewater the cofferdam no earlier than 24 hours after the concrete is placed unless the Engineer determines that a longer period is necessary.

**E. Removing Cofferdams**

Unless otherwise specified, completely remove all cofferdam material. This material shall remain the property of the Contractor.

**525.3.06 Quality Acceptance**

General Provisions 101 through 150.

**525.3.07 Contractor Warranty and Maintenance**

General Provisions 101 through 150.

**525.4 Measurement**

**A. Measuring Cofferdams for Separate Payment**

Cofferdams will be measured for separate payment only when set up as a Pay Item on the Plans.

Separate measurement will be made only for cofferdams constructed at the specific locations required on the Plans, regardless of cofferdams built at other locations within the limits of the structure and regardless of site conditions.

The Contractor may request permission to enclose more than one footing in a single cofferdam at a pay measurement location. If the Engineer approves, the number of cofferdams measured for payment will equal the number of footings enclosed within that single cofferdam.

If cofferdams are not set up as a Pay Item on the Plans and their use becomes necessary, they will not be measured for payment.

**B. Measuring Lowered Cofferdams for Payment**

The following restrictions apply to lowered cofferdams:

1. If lowering a footing requires lowering a separately measured cofferdam, lower the cofferdam enough distance to permit construction at an elevation not to exceed 6 ft (1.8 m) below Plan elevation at the Contractor's expense.
2. Any lowering of a cofferdam to permit construction at an elevation more than 6 ft (1.8 m) below Plan elevation will be paid for as Extra Work.
3. The Specifications intend that no Extra Work be paid for lowering a separately measured cofferdam until the Contractor completes the cofferdam to the extent that footings or substructure can be successfully constructed at an elevation no more than 6 ft (1.8 m) below Plan elevation.

No Extra Work shall be done under this Item until the requirements of Subsection 109.05, "Extra Work" have been met.

**525.4.01 Limits**

General Provisions 101 through 150.

**525.5 Payment**

**A. Cofferdams Measured for Separate Payment.**

Each cofferdam eligible for separate measurement and payment will be paid for at the Contract Price per each, complete in place, maintained, dewatered, removed, and disposed of.

**B. Cofferdams Not Measured for Separate Payment.**

The cost of cofferdams not measured for separate payment will be included in the Contract Price for bridge excavation.

If lowering a footing requires lowering a cofferdam not measured for separate payment, the compensation for extra depth excavation provided for in Subsection 211.5.A, "Bridge Excavation", will be full compensation for the cost of lowering the cofferdam.

Payment for cofferdams eligible for separate measurement will be made under the following:

Item No. 525	Cofferdams	Per each
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**525.5.01 Adjustments**

**A. Partial Payment Adjustments**

Partial payment for measured cofferdams will be made as follows:

1. After a satisfactory initial dewatering of the cofferdam, 75 percent of the Contract Price per cofferdam will be included in the next statement.
2. The remaining 25 percent will be included in the next statement after the satisfactory removal and disposal of the cofferdam.

**B. Extra Work Qualifications**

When the excavation elevation reaches 1.8(2 m) below the Plan elevation and the cofferdam is satisfactory (as determined by the Engineer) for dewatering to that elevation, then any lowering of the cofferdam to permit construction at an elevation more than 6 ft (1.8 m) below Plan elevation will be considered Extra Work.

The top of the pile footings should be a minimum of 2 feet below ground, with the following exceptions for the bridges over the streams:

- a) If the bridge is located in one of the coastal counties and the waterway has very low flow velocity and low debris potential (such as in a coastal swamp), then the bottom of the footing will be located 1 foot above mean water level. This is known as a “pedestal bent”.
- b) If the bridge requires a large number of cofferdams for pile footing construction, pedestal bents could be used to eliminate the high cost cofferdams. However, use of this option must be approved by the Bridge Office.

When the BFI or the Office of Construction recommends setting up Type II backfill material under a footing, do not increase the bridge excavation quantity for this material since the GDOT Standard Specification covers additional excavation up to three feet below the plan elevation of the bottom of footing.

## 4.2.6 Cofferdams and Seals

### 4.2.6.1 General

When a bridge with concrete footings crosses a stream or its footings are located close to the water table, cofferdams and/or seal concrete may be necessary for intermediate bent construction. Since the need for cofferdams and/or seals is determined by the Office of Construction, the designer shall send a transmittal to the State Bridge Construction Engineer requesting a recommendation in accordance with Section 1.6.9.2.1.

Seals should not be used except as recommended by the Office of Construction due to the possibility of future voids under the seal. Contractors should not be allowed to substitute a concrete seal in lieu of dewatering cofferdams.

### 4.2.6.2 Dimensions and Elevations

Seals are typically 1'-6" wider on each side than the footprint of the footing. Use the following seal concrete thickness and strength that have been determined to resist the buoyant force from the hydraulic head (H) on the other side of the cofferdam:

- Seal concrete thickness for pile footings =  $0.25 \times H \geq 2$  feet
- Seal concrete thickness for spread footings =  $0.4 \times H \geq 2$  feet
- Seal concrete strength = 2.0 ksi

The Plan and Elevation sheet should show the elevation of the bottom of the seal for spread footings, but the bottom of the footing for pile footings. The water elevation used to determine the footing height should be shown on the intermediate bent sheet.

### 4.2.6.3 Seal Concrete Payment

If the plans do not include seal concrete but field conditions require it, the seal concrete price is based on the cost of Class A concrete according to the GDOT Standard Specifications. When the plans include cofferdams but do not include either seal concrete or Class A concrete, a special provision is required to address payment for seal concrete.

## 4.3 END BENTS

### 4.3.1 General

The following note shall be added to all end bent sheets that references Georgia Standard 9037 for drainage details required at end bents:

***“SEE GA. STD. 9037 FOR DRAINAGE DETAILS AT END BENTS.”***

The GDOT Standard Specifications state that no separate measurement will be made under the item of Bridge Excavation for any excavation necessary for end bent construction. Unusual situations, such as spread footing abutments, may require the following note on the General Note sheet for clarity:

***“END BENT EXCAVATION – ALL COSTS FOR END BENT EXCAVATION SHALL BE INCLUDED IN THE OVERALL BID SUBMITTED”***

### 4.3.2 End Bent Caps

Typically, a pile is placed under each beam, so the bent cap is subjected to minimal shears and moments. Use a 3' wide by 2' deep cap with typical reinforcement that can be found in the GDOT Bridge Cell Library. A 2-foot 6-inch wide cap can be used for unskewed RCDG bridges. When the skew angle causes the clearance from the bearing pad to the edge of cap to be less than 2 inches, the cap should be widened in 3-inch increments.

Cap step lengths do not need to match the calculated skewed beam distance so detail the cap steps to the nearest 1”.

Detail a 3-inch diameter by 12-inch deep hole at each dowel bar or anchor bolt location. A deeper hole may be required for steel spans longer than 100 feet. For RCDGs, detail a No. 10 dowel bar to be cast in place.

If the elevation difference between adjacent cap steps is less than 1/2 inch, detail both steps to the lower elevation. No change to the D-dimension is necessary for this adjustment.

When different beam sizes or severe cross-slopes cause the top of cap step to be more than 6” above the main reinforcing, additional reinforcement will be required for that step. In this case, detail two No. 4 bars in the same direction of the main reinforcement at the top of the cap step

**-01. SCOPE:**

The work shall consist for dams required by the drawings and specifications and disposal of the excavated materials.

**-02. GENERAL:**

Earth fill in dams, levees and other structures designed to restrain the movement of water shall be placed so as to meet the following additional requirements:

A. The distribution of materials throughout each zone shall be essentially uniform, and the fill shall be free from lenses, pockets, streak or layers of material differing substantially in texture or gradation from the surrounding material.

B. If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed.

C. The top surfaces of embankments shall be maintained approximately level during construction except that a crown or cross-slope of not less than 2 percent shall be maintained to ensure effective drainage, and except as otherwise specified for drain fill zones. If the drawings or specifications require or the Engineer directs that fill be placed at a higher level in one part of an embankment than another, the top surface of each part shall be maintained as specified above.

D. Dam embankments shall be constructed in continuous layers from abutment to abutment except where openings to facilitate construction or to allow the passage of stream flow during construction are specifically authorized.

E. Embankments built at different levels as described under C or D above shall be constructed so that the slope of the bonding surfaces between embankment in place and embankment to be placed is not steeper than 3 feet horizontal to 1 foot vertical. The bonding surface of the embankment in place shall be stripped of all loose material, and shall be scarified, moistened and recompactd when the new fill is placed against it as needed to ensure a good bond with the new fill and to obtain the specified moisture content and density in the junction of the in place and new fill.

F. Embankment slopes shall be constructed outside their design limits and then cut back so as to leave the exposed face to the required degree of compaction, as shown on the drawings.

**-01. GENERAL:**

Work covered by this section includes the removal of all existing items and material, including existing structures, docks, pipes, poles, equipment, and all other items shown on the drawings or necessary to accomplish the intended works under this contract.

**-02. BARRIERS AND DUST PARTITIONS:**

Barriers, barricades and dust partitions to protect the Owner's property from damage from demolition operations shall be erected. The Contractor shall maintain any existing buildings completely weatherproof, dustproof, and secure from unauthorized entry at all times during the period of demolition and construction of new work.

**-03. DEMOLITION WORK:**

All portions of existing buildings and other structures as indicated and as required to accomplish the new work shall be demolished and removed. The Contractor shall provide protection to persons and property and the existing buildings by providing shoring, bracing, barricades, temporary walls and partitions, and other protective materials and devices as required to provide the protection and security specified. All active utilities to remain shall be protected and preserved in operating condition, including but not limited to electric services, water mains, sewers, drains, manholes, catch basins, valves, valve boxes, poles, guys and other appurtenances. Any damage to such utilities and to work under this contract shall be repaired at no additional cost to the Owner. Demolition material and debris shall not be allowed to accumulate on the site. Materials resulting from the demolition operations, except salvage materials to be delivered to the Owner, shall become the property of the Contractor and shall be removed from the site.

Before demolition operations begin, the Contractor shall arrange for an inspection and decision covering all salvage items by an authorized representative of the Owner, the Engineer, and the Contractor.

**-04. MEASUREMENT AND PAYMENT:**

Demolition work will be paid for at the lump sum price therefore appearing in the Bid Schedule for each of the Sections delineated on the General Plan.

# DUCTILE IRON PIPE AND FITTINGS SPECIFICATION

## REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

ANSI/AWWA C104/A21.4	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
ANSI/AWWA C105/A21.5	Polyethylene Encasement for Ductile-Iron Pipe Systems
ANSI/AWWA C110/A21.10	Ductile-Iron and Gray-Iron Fittings, 3-in through 48-in for Water and Other Liquids
ANSI/AWWA C111/A21.11	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
ANSI/AWWA C115/A21.15	Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
ANSI/AWWA C150/A21.50	Thickness Design of Ductile-Iron Pipe
ANSI/AWWA C151/A21.51	Ductile-Iron Pipe, Centrifugally Cast for Water
ANSI/AWWA C153/A21.53	Ductile-Iron Compact Fittings, 3-in through 24-in and 54-in through 64-in for Water Service
ANSI/AWWA C600	Installation of Ductile-Iron Water Mains and their Appurtenances
ANSI/AWWA C606	Grooved and Shouldered Joints
ANSI/AWS D11.2	Guide for Welding Iron Casting

## QUALITY ASSURANCE

Require submitted evidence that the ductile iron pipe and fitting manufacturer has a minimum of ten years experience in material production of diameters noted on the plans and specifications. All ductile iron pipe shall be domestically manufactured in the United States. All pipe material suppliers shall be ISO registered or provide the services of an independent inspection agency. Prior to the start of manufacturing, any manufacturer not meeting the ISO registration requirements shall submit to the owner and owner's engineer the names of an independent inspection agency for approval. The independent inspection agency shall be responsible for sample monitoring of chemical and mechanical test, sample visual inspection of quality assurance tests performed on in-process pipe and fittings, and a sample visual and dimensional inspection of finished product for this project. A certified inspection report from the independent inspection agency of all witnessed tests shall be supplied to the owner or owner's engineers within ten (10) days of completion of pipe manufacturing. Chemical samples shall be taken from each ladle of iron and the manufacturers' chemical control limits shall be maintained for at least the following elements: carbon, sulfur, phosphorus,



silicon, magnesium, chromium, manganese, tin, aluminum, cerium, copper, and lead. When chemical values fall outside the manufacturer's control limits, additional mechanical property tests shall be performed to assure minimum mechanical properties are met.

### **DUCTILE IRON PIPE**

Ductile iron pipe shall be in accordance with ANSI A21.50/AWWA C150 and conform to the requirements of A21.51/AWWA C151, latest standards. All ductile iron pipe shall be domestically manufactured in the United States. Push-on and restrained joint pipe shall have a minimum rated working pressure of 150 psi. All buried pipe shall be pressure class as follows:

Pipe Sizes (inch)	Pressure Class (psi)
4-12	350
14-20	250
24	200
30-64	150

- Pipe wall thickness shall be in accordance to bury depth as shown on drawings.
- Flange pipe or Victaulic grooved pipe shall be class 53.
- Direct tapping may be used in lieu of service saddles as per AWWA C-800.
- Welded-on outlets may be used where appropriate in lieu of fittings.

### **WELDED-ON OUTLETS**

Welded-on outlets may be used in lieu of the tees shown on the plans. All welded-on outlets shall be rated for a working pressure of 250 psi and shall have a minimum safety factor of 2.0; except that 36" welded-on outlets for 54"-64" parent pipe diameters shall be rated at 200-psi. Welded-on outlets may be provided as a radial (tee) outlet, a tangential outlet, or a lateral outlet. Parent pipe and branch pipe shall meet hydrostatic test requirements in accordance with AWWA C151, section 51-9, prior to fabrication.

All joints on welded-on branch outlets shall be provided in accordance with the latest revision of ANSI/AWWA C111/A21.11 and/or ANSI/AWWA C115/A21.15, as applicable. All outlets shall be fabricated from centrifugally cast ductile iron pipe designed in accordance with ANSI/AWWA C150/A21.50 and manufactured in accordance with ANSI/AWWA C151/A21.51.

All welds must be produced using 55% nickel iron welding rod or wire. Carbon steel electrodes will not be acceptable. Both branch and parent outlet pipe shall be class 53. After fabrication each outlet pipe shall be air tested to 15 psi to insure weld integrity. A soap and water solution shall be applied during the testing procedure to inspect the weld for leakage. Any welds that show air seepage shall be refabricated and retested.

The type of pipe end for the branch outlet shall be as specified or indicated on the drawings. The maximum size and laying length of the welded-on branch outlet shall be recommended by the pipe manufacturer and acceptable to the Engineer for the field conditions and connecting pipe or valve. Pipe embedment material and trench backfill shall be placed and compacted under and around each side of the outlet to hold the pipe in proper position and alignment during subsequent pipe jointing, embedment, and backfilling operations.

## HYDROSTATIC TESTING

All pipe 4"-24" shall be tested per AWWA standards to 500 psi. All pipe, 30"-inches and larger, shall be subject to a factory hydrostatic test of at least 500 psi for a period of not less than 10 seconds after which time the pressure is to be elevated to a peak pressure that induces a stress in the pipe wall equivalent to 75% of the minimum specified yield of ductile iron (42,000 psi) as calculated by the following formula:

$$p = \frac{2f_s t}{D}$$

Where:

- p** = peak hydrostatic pressure
- f<sub>s</sub>** = stress in pipe wall during hydrostatic test, which shall be 0.75 times the minimum yield strength of the ductile iron in tension, i.e.: 42,000 psi
- t** = nominal wall thickness, in.
- D** = outside diameter, in.

Factory Hydrostatic Test Pressures for Ductile Iron Pipe (30 in and Larger)										
Pressure Class	150		200		250		300		350	
Pipe Size/ Outside Diameter	"t" (in)	Test Press. (psi)	"t" (in)	Test Press. (psi)	"t" (in)	Test Press. (psi)	"t" (in)	Test Press. (psi)	"t" (in)	Test Pres s. (psi)
30" / 32.00	0.34	669	0.38	748	0.42	827	0.45	886	0.49	965
36" / 38.30	0.38	625	0.42	691	0.47	773	0.51	839	0.56	921
42" / 44.50	0.41	580	0.47	665	0.52	736	0.57	807	0.63	892
48" / 50.80	0.46	570	0.52	645	0.58	719	0.64	794	0.70	868
54" / 57.60	0.51	558	0.58	635	0.65	711	0.72	788	0.79	865
60" / 61.60	0.54	552	0.61	624	0.68	695	0.76	777	0.83	849
64" / 65.70	0.56	537	0.64	614	0.72	691	0.80	767	0.87	835

## DUCTILE IRON PIPE AND FITTING JOINTS

General: Ductile Iron Pipe and fittings shall be furnished with push-on joints, push-on restrained joints, mechanical joints, flanged joints, and grooved joints as required. Pipe ends (spigot end, bell, and socket) for all pipe shall be gauged with suitable gauges at sufficiently frequent intervals to ensure compliance to the standard dimensions of ANSI/AWWA C151/A21.51, latest addition. Unless otherwise specified gasket material shall be standard styrene butadiene copolymer (SBR.)

Push-on Joints shall conform to ANSI A21.11/AWWA C111 approved Fastite, Tyton, or Bell-tite, or equal. Unless otherwise specified gasket material shall be standard styrene butadiene copolymer (SBR.)

Flange Joints shall conform to ANSI A21.15/AWWA C115, or to ANSI A21.10/AWWA C110 or ANSI A21.53/AWWA C153. Bolts and nuts shall conform to ANSI A21.11/AWWA C111. Candidate pipe

for 4”- 54” flanged pipe thread-fabrication shall be Special Thickness Class 53 and for 60” – 64” flanged thread-fabrication shall be Pressure Class 350 ductile iron pipes, all in accordance with AWWA C115. Toruseal flange gaskets, or equal are required for all 16” and larger diameter flanged ductile iron connections.

Mechanical Joints shall conform to AWWA C111. Bolts shall be high strength low alloy steel per AWWA C111. Unless otherwise specified, gasket material shall be standard styrene butadiene copolymer (SBR) per this standard.

Restrained Joints shall be Amarillo Fast-Grip gasket, Flex-Ring, Field Flex-Ring, Lok-Ring, Barracuda orange gasket, US Pipe Red Field Lok gaskets, TR Flex, Ebba Megalug or equal. Restrained joint gaskets shall be colored, non-black. The color shall be consistent throughout the entire cross section of the gasket and not be attained by surface coating; the color shall be inherent within the rubber. Gaskets shall meet applicable requirements of AWWA/ANSI C111/A21.11 and shall be ANSI/NSF Standard 61 certified. Restrained gaskets shall be manufactured in the United States. Restrained joints shall be rated at a minimum as follows:

- 350 psi for 4”-18” diameter
- 250 psi for 20”-24” diameter
- 150 psi for 30”-64” diameter

Grooved Joints. Should grooved joint be called for, groove joints shall be in accordance with AWWA C606. Grooved ductile iron pipe shall be Special Thickness Class 53 for 4” – 16”, Class 54 for 18”, Class 55 for 20”, and Class 56 for 24” – 36”.

Welded-on Thrust Collars: Welded-on thrust collars, for wall pipe and pipe thrust restraint, shall be welded steel collars designed for the thrust generated by 250 psi working pressure with a safety factor of at least two (2.0) against failure.

Subaqueous ductile iron pipe (as required per plans) shall be American Flex-Lok (ball and socket) or equal. Ball and socket pipe shall be class 56 minimum, with an allowable 25 degrees deflection for 4”- 12” diameters and 15 degrees for 14”-54” diameters. The ductile iron spherical socket for 14”-54” shall be threaded onto the ductile iron pipe barrel with threads conforming to ANSI B2.1 adapted to standard ductile iron diameters. The ball end for 14”-54” shall be threaded onto or integrally cast with the pipe barrel and machined to fit the adjoining pipe socket to provide constant compression of the gasket through the entire range of deflection of the assembled joint. Underwater lubricant is required with all ball and socket pipe.

## **Marking Pipe**

Unless bar codes are provided, the weight, class or nominal thickness, and casting period shall be shown on each pipe. The manufacturer’s mark, country where cast, year in which the pipe was produced, and the letters “DI” or “DUCTILE” shall be cast or metal stamped on the pipe, and letters and numerals on pipe sizes 14” (.356mm) and larger shall be not less ½ in. (13 mm) in height. When required in the purchaser’s specifications, initials not exceeding four in number shall be cast or stamped on the pipe. All required markings shall be clear and legible, and all cast or metal –stamped marks shall be on or near the bell.

## **DUCTILE IRON FITTINGS**

Mechanical Fittings / Restrained Fittings shall conform to ANSI A21.53/AWWA C153 or A21.10/AWWA C110, latest standard.

Flanged Fittings shall conform to ANSI A21.10/AWWA C110. The AWWA C110 fitting flanges shall have facing and drilling which match AWWA C115 threaded-on flanges which also match ANSI B16.1 class 125 flanges except where class 250 are specifically noted.

### **Marking Fittings**

Each fitting shall distinctly cast on the outside of the body the identity of the AWWA standard, the pressure rating; nominal diameter of openings; manufacturer's identification; the country where cast; the letters DI or word Ductile; and the number of degrees or fraction of the circle on all bends.

## **LININGS - Ductile Iron Pipe & Fittings**

Water and Reuse Water Linings – (Cement mortar lining is advisable for lines handling pH levels ranging from 6-10.) Ductile iron pipe, specials, and fittings shall be lined with cement mortar lining in accordance with AWWA C104.

Sewage Service Linings- (Protective linings are advisable for ductile iron handling pH levels below 6.) Ductile iron pipe and fittings shall receive an interior lining of 40-mil nominal ceramic epoxy. The lining shall be either Protecto 401, Tnemec Series 431 Perma-Shield, or Permax.

### **Scum & Grit Lining**

Glass lined per manufacturers recommendation.

## **COATINGS - Ductile Iron Pipe**

The exterior of ductile iron pipe for buried service or where noted on the plans shall be coated with a layer of arc-sprayed zinc. The mass of the zinc applied shall be 200 g/m<sup>2</sup> of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils.

The zinc coating system shall conform to ISO 8179 standard.

All pipe shall be manufactured and zinc coated in the United States at the pipe manufacturer's facility.

Unless otherwise noted, the exterior of ductile iron pipe for exposed service shall be primed with Wasser FerroClad, or Tnemec 37H-77, or Tnemec 140-1211 or equal. All primed material to receive a field coating as specified by the design engineer. Contact ductile iron manufacturer for additional recommended primers.

## **Coatings - Ductile Iron Fittings**

Ductile iron fittings for buried service shall receive a 1 mil asphaltic coating in accordance per AWWA C151/ANSI A21.51.

Ductile iron fittings for exposed service shall be primed in accordance to pipe requirements with Wasser FerroClad, or Tnemec 37H-77, or Tnemec 140-1211 or equal. All primed material to receive a field coating as specified by the design engineer. Contact ductile iron manufacturer for additional recommended primers.

**Polyethylene Encasement**- If required and noted per plans, polyethylene encasement for use with ductile iron pipe and fittings shall be VBio and meet all the requirements for ANSI/AWWA C105/A21.5, Polyethylene Encasement for Ductile Iron Pipe Systems. Polyethylene encasement for use with ductile iron pipe systems shall consist of three layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than eight mils.

The inside surface of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a blend of anti-microbial biocide to mitigate microbiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion. Ductile iron pipe and the polyethylene encasement used to protect it shall be installed in accordance with AWWA C600 and ANSI/AWWA C105/A21.5 and also in accordance with all recommendations and practices of the AWWA M41, Manual of Water Supply Practices.

## **INSTALLATION AND HANDLING**

All ductile iron pipe and fittings shall be handled and installed in accordance to ANSI/AWWA C600, latest edition and per manufacturer's recommendations.

**-01. SCOPE:**

The work shall consist of the excavation required by the drawings and specifications and disposal of the excavated materials.

**-02. GENERAL:**

All excavation of every description and of whatever substances encountered shall be performed to the depths indicated on the drawings or as specified herein. Excavation shall be made by the open-cut method except as otherwise specified or shown on the drawings.

The Contractor's attention is directed to current local, state, or federal safety regulations, e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations. Such regulations are strictly enforced and, if they are not followed, the Owner, Contractor, and/or earthwork and utility subcontractors could be liable for substantial penalties.

**-03. CLASSIFICATION:**

A. Excavation will be classified as common excavation or rock excavation in accordance with the following definitions or will be designated as unclassified.

1. Common Excavation shall be defined as the excavation of all materials that can be excavated, transported, and unloaded by the use of heavy ripping equipment and wheel tractor-scrappers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by means of excavators having a rated capacity of one cubic yard and equipped with attachments (such as shovel, bucket, backhoe, dragline or clam shell) appropriate to the character of the materials and the site conditions.
2. Rock Excavation shall be defined as the excavation of all hard, compacted or cemented materials the accomplishment of which requires blasting or the use of excavators larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than one cubic yard in volume encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation.

B. Excavation will be classified according to the above definitions by the Engineer, based on his judgment of the character of the materials and the site conditions.

C. The presence of isolated boulders or rock fragments larger than one cubic yard in size will not in itself be sufficient cause to change the classification of the surrounded material.

D. For the purpose of the classification, the following definitions shall apply:

1. Heavy ripping equipment shall be defined as rear-mounted, heavy duty, single-tooth, ripping attachment mounted on a tractor having a power rating of at least 200 net horsepower (at the flywheel).
2. Wheel tractor-scraper shall be defined as self-loading (not elevating) and unloading scraper having a struck bowl capacity of at least 12 yards.

3. Pusher tractor shall be defined as a track type tractor having a power rating of at least 200 net horsepower (at the flywheel) equipped with appropriate attachments.

**-04. UNCLASSIFIED EXCAVATION:**

Items designated as "Unclassified Excavation" shall include all materials encountered regardless of their nature or the manner in which they are removed. When excavation is unclassified, none of the definitions or classifications stated in Section -02 of this specification shall apply.

**-05. BLASTING:**

The transportation, handling, storage, and use of dynamite and other explosives shall be directed and supervised by a person of proven experience and ability in blasting operations.

Blasting shall be done in such a way as to prevent damage to the work or unnecessary fracturing of the foundation and shall conform to any special requirements of this specification. Blasting shall not be accomplished without the prior knowledge and approval of the Engineer, or his representative.

**-06. USE OF EXCAVATED MATERIALS:**

To the extent they are needed, all suitable materials from the specified excavations shall be used in the construction of required permanent earth fill or rock fill. The suitability of materials for specific purposes will be determined by the Engineer. The Contractor shall not waste or otherwise dispose of suitable excavated materials.

**-07. DISPOSAL OF WASTE MATERIALS:**

All surplus or unsuitable excavated materials will be designated as waste and shall be disposed of at the locations approved by the Engineer.

**-08. BRACING AND SHORING:**

Excavated surfaces too steep to be safe and stable if unsupported shall be supported as necessary to safeguard the work and workmen, to prevent sliding or settling of the adjacent ground, and to avoid damaging existing improvements. The width of the excavation shall be increased if necessary to provide space for sheeting, bracing, shoring, and other supporting installations. The Contractor shall furnish, place and subsequently remove such supporting installations.

**-09. STRUCTURE AND TRENCH EXCAVATION:**

Structure and trench excavation shall be completed to the specified elevations and to sufficient length and width to include allowance for forms, bracing and supports, as necessary, before any concrete or earth fill is placed or any piles driven within the limits of the excavation.

**-010. BORROW EXCAVATION:**

When the quantities of suitable materials obtained from specified excavations are insufficient to construct the specified fills, additional materials shall be obtained from the designated borrow areas. The extent and depth of borrow pits within the limits of the designated borrow areas shall be as directed by the Engineer.

Borrow pits shall be excavated and finally dressed in a manner to eliminate steep or unstable side slopes or other hazardous or unsightly conditions.



**-011. OVER EXCAVATION:**

Excavation in rock beyond the specified lines and grades shall be corrected by filling the resulting voids with Portland cement concrete made of materials and mix proportions approved by the Engineer. Concrete that will be exposed to the atmosphere when construction is completed shall contain not less than 6 sacks of cement per cubic yard of concrete. Concrete that will be permanently covered shall contain not less than 4 sacks of cement per cubic yard. The concrete shall be placed and cured as specified by the Engineer.

Excavation in earth beyond the specified lines and grades shall be corrected by filling the resulting voids with approved compacted earth fill, except that, if the earth is to become the subgrade for riprap, rock fill, sand or gravel bedding, or drain fill, the voids may be filled with material conforming to the specifications for the riprap, rock fill, bedding or drain fill.

**-012. MEASUREMENT - PAYMENT:**

Excavation, except rock excavation, will be subsidiary to the various elements of construction indicated on the plans and shown in the Bid Schedule. Payment under such items will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the performance of the work except that extra payment for backfilling required over excavation will be made if the excavation outside specified lines and grades is directed by the Engineer to remove unsuitable material and if the unsuitable condition is not a result of the Contractor's operations.

Rock excavation will be paid for at the unit contract price for that type of excavation as shown in the Bid Schedule. Where rock is encountered the contractor will notify the engineer before removing same so that field measurements may be taken to determine the quantity actually removed.



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**SECTION TS-**  
**EXCAVATING AND BACKFILLING FOR STRUCTURES**

**-01. SCOPE:**

This section covers excavating, filling and backfilling for building construction work and incident thereto.

**-02. DEFINITIONS:**

- A. Unsatisfactory materials include those conforming to classes PT, OH, CH, MH, or OL, or as described in the Unified Soil Classification System, as adopted by the Corps of Engineers and the Bureau of Reclamation in January 1952.
- B. **COHESIONLESS AND COHESIVE MATERIALS:** Cohesionless materials include gravel, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravel, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clay silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture density curves and cohesive soils will show normal moisture-density curves.

**-03. SITE PREPARATION:**

The work area shall be stripped of all topsoil, vegetation, timber, debris and other rubble. Loose soil from stump removal shall be removed from stump holes. Where required, stump holes shall be backfilled with clean earth and compacted as specified on the drawings. Areas containing soft, organic or other objectionable material shall be removed as directed by the Engineer.

**-04. EXCAVATION:**

- A. **GENERAL:** The excavation shall conform to the dimensions and elevations indicated for each building and structure, except as specified hereinafter. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms, installation of services, and for inspection, except where the concrete for walls and footings is authorized to be deposited directly against excavated surfaces. Excavations carried below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material shall be excavated below the grades shown, as directed, and replaced with satisfactory material. Excavation methods shall comply with codes and ordinances of governing authorities having jurisdiction and to the requirements of OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations.  
  
Material removed below the depths indicated without specific direction of the engineer shall be replaced, at no additional cost to the Owner, to the indicated excavation grade with satisfactory materials placed and compacted as specified except that concrete footings shall be increased in thickness to the bottom of overdepth in earth excavation and overbreak in rock excavation.
- B. **DRAINAGE:** Excavation shall be performed in such manner that the area of the site and the area immediately surrounding the site will be continually and

effectively drained by gravity. Water shall not be permitted to accumulate in the excavation. The excavation shall be drained by satisfactory methods to prevent softening of the foundation bottom, undercutting of footings, or other actions detrimental to proper construction procedures.

- C. SHORING: Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Shoring, bracing, and sheeting shall be removed as excavations are backfilled, in a manner to prevent caving.
- D. BORROW: Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials shall be obtained from the borrow areas from approved sources off Owner-controlled land at the Contractor's responsibility. The necessary clearing and grubbing of borrow area disposal and burning of debris therefrom, the development of sources including any access roads for hauling and the necessary right-of-way, and the satisfactory drainage of the borrow areas shall be considered as incidental items to borrow excavation. Borrow areas shall be neatly trimmed and trained after borrow excavations are completed.
- E. EXCAVATED MATERIALS: Satisfactory excavated material required for backfill shall be placed in the proper section of the permanent work required under this section, or shall be separately stockpiled if it cannot be readily placed. Satisfactory excavated material in excess of that required for the work under this section shall be made available for use in other portions of the permanent overall site work required for the contract project. Satisfactory material in excess of that required for the permanent work and unsatisfactory material shall be disposed of in designated spoil areas as a part of the Contractor's responsibility. No satisfactory material shall be wasted or used for the convenience of the Contractor unless so authorized. Stockpiles shall be placed, graded, compacted and shaped for proper drainage.
- F. FINAL GRADE: Care shall be taken not to disturb the bottom of the excavation, and excavation to final grade shall not be made until just before concrete is to be placed.

**-05. COMPACTION OF FILLS:**

All fills shall be compacted in layers not thicker than eight inches by rolling, tamping, vibrating, or combination thereof. When material varies from optimum moisture content, it shall be treated as follows:

- A. When wet, moisture shall be reduced by scarifying and aerating the soil until optimum moisture is obtained.
- B. When dry, moisture shall be added by sprinkling, and thoroughly mixing to incorporate into the uncompacted soil.
- C. Fill and cut areas will be sloped so as to drain properly and prevent accumulation of water.

When existing or cut areas are to be covered with less than one foot of fill, the surface shall be scarified to a depth of eight inches and compacted to the same density as adjacent areas. The

compaction obtained shall be no less than 95 per cent of the Standard Proctor Maximum. The top 12 inches of all filled areas shall be compacted to 100 per cent of the Standard Proctor Maximum.

**-06. FIELD DENSITY DETERMINATIONS:**

Field density determinations may be made to determine the compaction of the fill. These tests will be made in each two foot lift of the fill, and in sufficient number laterally to give complete coverage and assure proper compaction of the entire fill.

**-07. BACKFILLING:**

Backfilling shall not begin until construction below finish grade has been approved, underground utility systems have been inspected, tested, and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade. Backfill shall not be placed in wet or frozen areas. Backfill shall be of satisfactory materials placed and compacted as specified. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted by power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes to avoid damage to coatings. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall.

**-08. PROTECTION:**

Settlement or washing that occurs in graded or backfilled areas prior to acceptance of the work shall be repaired and grades re-established to the required elevations and slopes.

**-09. MEASUREMENT AND PAYMENT:**

No separate measurement or payment will be made for excavation and backfill performed under this section. Payment therefore will be included in the contract price for the structure or installation to which such excavation and backfill is incidental.

**-01. SCOPE:**

The work covered by this section of specifications consists of furnishing all labor, equipment, appliances, and materials, and in performing all operations in connection with the installation of flowable fill work, complete, in strict accordance with this specification and the applicable drawings, and subject to the terms and conditions of the Contract.

**-02. FLOWABLE FILL MIX DESIGN:**

The mixes fall into the categories of “very flowable” and “less flowable,” which is controlled by the amount of water that is added. The less flowable mix should be used when it is desirable to put traffic back on a roadway quickly (usually 8 to 10 hours) or when being used to backfill pipes which could “float” out of position due to the buoyant effect of the very flowable fill mix. This mix will still self-consolidate around pipes without any “honeycomb” areas. Adding water to flowable fill to obtain the desired plastic characteristics will not compromise the quality of the hardened flowable fill.

Less Flowable Mix (Mix 1)

<u>Weights</u>	<u>Volume</u>	<u>Reference</u>
Min. 50 lbs.	Cement 0.25	ASTM C150, Type I or II
Min. 600 lbs.	Fly Ash 4.24	ASTM C618, Class C
SSD 2500 lbs.	Sand 15.17	
55gal. 458 lbs. Chlorides	Water <u>7.34</u>	Clean, potable, < 500 ppm
Total Cubic Feet		27

Above values are based on specific gravities - cement 3.15, fly ash 2.27, sand 2.64, and water 1.00. Anticipated unconfined compressive strength is 80 psi at 28 days and 150 psi at 56 days. For “very flowable” fill (Mix 2), add 10 gallons of water per cubic yard of Mix 1.

**-03. INSTALLATION OF FLOWABLE FILL:**

The trench shall be prepared and the pipe joints placed as normal. There should be at least 6 inches of flowable fill above any utility line. Once the pipe is covered, it will be sufficiently anchored and water may be added to the remaining flowable fill to ease placement without danger of floating the pipe. If it is important to quickly return traffic to the roadway, the flowable fill mixture shall not be altered by the addition of water.

The flowable fill may be discharged from the ready-mix truck into the space to be filled, or by other methods approved by the Utilities Department representative. The mix may be placed in part depth or full depth as conditions at the site dictate. Formed walls or other bulkheads shall

be constructed to withstand the mounded soil rather than wood or metal forms. When backfilling utility lines, flowable fill shall be distributed evenly to prevent movement of the line.

The material is self-consolidating and there is no need to use vibrators. Finishing can be accomplished with a square shovel if the fill surface is at the bottom of pavement or with a wood float if the surface will be temporarily used as a finished surface.

Once the flowable fill is in the trench, the self-consolidating material displaces the extra water not needed for maximum density. Provision shall be made for this bleed water to run off and away from the surface of the hardening flowable fill (use of vapor barriers such as plastic sheets is not desired). The material will usually support foot traffic within an hour after the bleeding ends. Typically, full traffic can be allowed on the hardened flowable fill within 8 to 20 hours (depending on site conditions, volume to be backfilled, etc.). Without damage to the fill or any structures below. If it is necessary to return traffic in less than 8 hours, or if there is concern that traffic flow will "rut" the hardening flowable fill, steel plates shall be used to bridge over the hardening flowable fill as directed by the Utilities Department representative. If the filled cavity is too wide to bridge, steel plates shall be placed on top of the hardening flowable fill as soon as it is able to support foot traffic (one hour after bleeding ends), and full traffic can be allowed without damage to the fill or structure below.

As the extra water is displaced from the consolidating flowable fill, there will be an initial subsidence of about one-eighth ( $\frac{1}{8}$ ) of an inch per vertical foot. Once the flowable fill hardens, there will not be future settlement. The hardened flowable fill can be shaped to grade the next day to allow the patch thickness required. The patch may be applied directly to the cured flowable fill.

It will be the responsibility of the Contractor to furnish the necessary information to obtain approval of the mix design and to use the necessary construction techniques to assure that the finished material will perform as intended.

**-04. MEASUREMENT AND PAYMENT:**

Payment for Flowable Fill will be made for the total volume, in place, as shown on the bid schedule.

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**SECTION TS**  
**GRADED AGGREGATE BASE COURSE**

**-01. SCOPE:**

This section covers a graded aggregate base course to receive bituminous paving under another section, complete.

**-02. GENERAL SPECIFICATIONS:**

The graded aggregate base course shall conform to all applicable specifications of Section 300 and 306 of the Standard Specifications for Highway Construction of the South Carolina State Highway Department, Latest Edition.

**-03. PREPARATION OF SUBGRADE:**

The subgrade to receive the graded aggregate base course shall be constructed in accordance with requirements of Section 306.8 of the Standard Specifications for Highway Construction of the South Carolina State Highway Department.

**-04. MATERIALS AND CONSTRUCTION FOR BASE COURSE:**

Materials and construction for the graded aggregate base course shall be in accordance with Section 306 of the Standard Specifications for Highway Construction of the South Carolina State Highway Department. No blast furnace slag is allowed.

The aggregate base course shall be compacted to a minimum of 98% maximum density ASTM D-698 at an optimum moisture content of  $\pm 2\%$ .

Construction for the graded aggregate base course shall be in accordance with Section 306.09 of the Standard Specifications for Highway Construction of the South Carolina State Highway Department.

**-05. PAYMENT:**

Payment for graded aggregate is included in the lump sum amount for base and paving in the bid schedule and no separate payment will be made therefore.



## VIRTUAL POLYMER COMPOUNDS, LLC

10478 Ridge Road • Medina, New York 14103  
Phone: 585-735-9668 • Toll Free: 888-290-9522  
Fax: 585-735-9965 • [www.virtualpolymercompounds.com](http://www.virtualpolymercompounds.com)  
Administrative Office: One John James Audubon Pkwy • Amherst, NY 14228

OR APPROVED  
EQUAL

# Specifications Parshall Flume

**Note to User:** These specifications are provided to aid the Engineer in the design and complete specification of a Parshall Flume for open channel flow monitoring. Proper selection for use of any primary measuring device requires the services of a Professional Engineer specialized training. These documents are not to be used in lieu of the services of a design professional.

Product: (48") Fiberglass Parshall Flume  
Project: (BJWSA Raw Water Canal Improvements)  
Manufactured By: Virtual Polymer Compounds, LLC

### SPECIFICATION SECTION 11301 FIBERGLASS PARSHALL FLUME

#### **PART ONE: GENERAL INFORMATION**

- 1.01 Furnish (1) fiberglass composite Parshall Flume(s) with a (48") inch throat section width. The Flume is designed for a maximum flow of (43.9) MGD at a head of (2.50) feet.
- 1.02 Specification section that may relate to this work:
  - A. Section 03300 - Cast In Place Concrete
  - B. Section 13122 - Pre-Engineered Fiberglass Buildings
  - C. Section 13411 - Water Monitoring Equipment
- 1.03 References and related standards
  - A. ANSI/AWWA F101 - Contacted molded, Fiberglass-Reinforced Plastic Wash Water Troughs
  - B. ASTM D 256 - Standard Test Method for Determining Pendulum Impact Resistance of Notched Specimens of Plastic.
  - C. ASTM D 638 - Standard Test Method for Determining Tensile Properties of Plastic
  - D. ASTM D 790 - Standard Test Method for Determining Flexural Properties of Plastic
  - E. ASTM D 2583 - Standard Test Method for Determining the Surface Hardness of Plastic using a Barcol Instrument.
  - F. ASTM D 648 - Standard Test Method for Determining the Distortion of Plastic under controlled Exposure to Elevated Temperatures
- 1.04 Submittals
  - A. Submit under the provisions of Section 01300.
  - B. Product data to include
    1. Type, Product Name and Resin Manufacture
    2. Test results of fiberglass laminate used.
  - C. Shop Drawing showing all critical dimensions of Flume

D. Shop Drawing showing location and plan of all Flume options

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**B**

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E. Complete off loading, storage and installation instructions.

1.05 Delivery, Off Loading and Storage

- A. Off load flume according to manufacture's instructions
- B. Inspect Flume completely and report any damage during shipping
- C. Store Flume indoors and protect from construction traffic and damage.

**PART TWO: PRODUCT**

2.01 Products

- A. Provide product manufactured by Virtual Polymer Compounds, LLC of 10478 Ridge Road, Medina NY 14103; Tel. (585)735-9668.
- B. Request for substitution will be considered only if submitted and approved in advance of bid date. Substitution request must include evidence that the product meets all standards submitted herein; that the manufacturer has ten years of experience fabricating the product; there is a complete quality assurance program in place such as ISO 9001.
- C. Substitution not submitted in and approved bid date will not be considered.

2.02 Material of Construction

- A. Gel Coat; All exposed surfaces will be smooth with a 20 mil polyester based gel coat. Color of the gel coat will be white of beige.
- B. Structural laminate will be nominal ¼" thick. It will be composite of 30% by weight chopped strand glass fiber mat and high grade polyester resin.  
*(Flumes can be fabricated from high grade vinyl ester chemical resident resins selected to meet special industrial application. Typically in this application gel coat is omitted. Contact Manufacturer for more information.)*
- C. The resin will meet the following standards:
  - 1. Tensile Strength ASTM D 638 14000 psi
  - 2. Flexural Strength ASTM D 790 25,0000 psi
  - 3. Flexural Modulus ASTM D 790 1000000 psi
  - 4. Impact, Notched ASTM D 256 10 ft-lbs/1
  - 5. Barcol Hardness ASTM D 2583 40
  - 6. High Temperature Limit 150 F
  - 7. Chemical Resistance ANSI/AWWA F10 Type II

2.03 Method of Construction; Single piece contact molded fiberglass reinforced plastic construction side mounted angles.

2.04 Metallic mounting hardware is to be 18-8 grade stainless steel.

2.05 The Flume is to include the following standard option(s): *(Include only those required and adjust line numbering accordingly)*

- A. Provide Fiberglass Ultrasonic Transducer Mounting Bracket and pre drill flange for installation. Include required hardware for installation.
- B. Fabricate with integral Staff Gauge graduated feet and tenth of a foot
- C. Fiberglass Inlet End Adapter with *(insert size)* inch fiberglass pipe stubs
- D. Fiberglass Outlet End Adapter with *(insert size)* inch fiberglass pipe stubs

- E. Provide Integral fiberglass stilling well (*insert size of 8,10,12*) inch ID.
- F. Provide fixed Stainless Steel Bubble Tube
- G. Provide fixed Stainless Steel Sampler Tube
- H. Fabricate with integral pH Probe Mounting Cavity
- I. Fabricate with integral Pressure Transducer Cavity
- J. Provide neoprene rubber pipe couplers that will couple (*insert size*) inch ID fiberglass pipe to (*Insert size and type of existing piping*)
- K. Fiberglass wing walls to match open channel of

### **PART THREE - EXECUTION**

- 3.01 Carefully remove Flume from original crating only at the time of installation. Examine the unit completely and report any damage to the unit prior to installation.
- 3.02 Verify that the dimensions of the open channel designated for installation are correct and suitable for Flume installation. Report any anticipated problems at once.
- 3.03 Installation:
  - A. Install according to installation instructions provided by the manufacturer.
  - B. Ensure the Flume is set plum, true and level.
  - C. Properly brace Flume prior to grouting in place.
  - D. Set Flume at the specified elevation.
  - E. Fasten Flume to existing re bar or wall fasteners using the clips provided and No. 10 PVC Coated Tie Wire.
  - F. Place non-shrink grout along bottom and sides of Flume. Ensure that all void are filled and all air displaced. Install grout in lifts of a depth to ensure no floating or wall deflections. At no time should a lift exceed 1/3 the total depth to be grouted.
- 3.04 After installation, clean Flume gel coat surface in accordance with manufacturer's instruction. Remove all installation and shipping debris from site.

- - - End of Section - - -



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# Fiberglass Parshall Flume Installation Recommendations and General Notes

1. Remove flume from shipping crate and carefully examine flume to insure that it has not been damaged in transit. If damage is noted report to freight company and Virtual Polymer Compounds, LLC at once.
2. Installation of this flume requires a level base of concrete or suitable building material. Consult local project Civil Engineer for specifications and directions on base construction. Best results have been experienced with a structural base of reinforced concrete that has been poured, allowing for a minimum of 6" clearance between the lowest portion of the flume and the structural base.
3. Prior to installation the flume should be internally braced using standard plywood and spreaders. Actual size, spacing and number of plywood sheets and spreaders will vary depending on the flume size. Adequate bracing is required to support flume from the external load of concrete or grout used to place the flume. Flumes can be ordered with internal bracing in place for a nominal additional cost. If bracing is installed in the field, care must be taken to avoid damage to the interior surfaces of the flume. Should damage occur, contact Virtual Polymer Compounds, LLC for further instructions.

Note: *Until such time as the space between the flume floor and the base is completely grouted or filled with concrete, the flume will not support a load. Do not stand on the interior floor of the flume.*

4. Each flume is supplied with clip anchors that are used to tie the flume to the concrete reinforcing or special anchors. These ties should be made with PVC coated number 8 tie wire. All ties should be made before the floor of the flume is grouted.
5. The space between the flume floor and the concrete base should be completely filled. For best results use a high strength, zero shrink grout. This grout must be mixed to a flowable state.
6. Grout should be allowed to cure to a strength that will support additional load and maintain its bond to the base. Consult the project Civil Engineer for specifications on the type, placement and cure time of the grout. If the area to be filled is too large to fill with grout, then a base fill of concrete can be considered. Contact

Virtual Polymer Compounds, LLC for further information regarding this application.

7. The floor grouting should be poured only to the depth of the highest elevation of the floor plus 1/2". Do not try to grout the floor and wall void at one time.
8. Once the floor void grout is cured the interior floor of the flume can be counter weighted to avoid hydraulic rise while grouting the flume wall.
9. The flume walls are to be grouted in the same manner. Depending on the depth of the flume, the wall may require multiple lifts. Consult project Civil Engineer for hydraulic lift and grouting instructions.
10. Finish exposed grout surface to desired texture.

*Disclaimer: Virtual Polymer Compounds, LLC provides these procedures as a guideline for installation. Each project has its own special requirements. Services of a Civil Engineer are required for complete engineering of the project installation. Installation of the equipment and failure relating to installation are not the responsibility of Virtual Polymer Compounds, LLC.*

#### GENERAL NOTES

- A. The coating on the interior surface of the flume is known as the "gel-coat". It is important that this coating remain intact to protect the unit from UV exposure and water damage over a period of time. This coating should become damaged, protect the flume from the weather and contact Virtual Polymer Compounds, LLC for repair procedures.
- B. Most flumes are self-scouring by design, the smooth fiberglass surface aids in this cleaning. Cleaning of the flume can be accomplished with standard household cleaner and a brush.
- C. Flumes should be stored in their shipping crate until installation. This will protect the flume and help it hold its shape until it is in a fixed and supported location. Do not stack flumes or equipment on the flume.
- D. For the flume to function correctly the project Civil Engineer's elevation must be observed.
- E. Care should be taken during installation to insure that the flume walls are not distorted due to grouting. Pouring concrete or grout with too great a drop and over vibration are two common causes of wall distortion.

## SEEDING

SCDOT Designation: SC-M-810-4 (07/17)

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### 1.0 Seeding

This Supplemental Specification replaces section 810, *Seeding*, in the *South Carolina Department of Transportation (SCDOT) Standard Specifications for Highway Construction*, 2007 Edition. This supplemental specification replaces *Supplemental Technical Specification SC-M-810*, *Supplemental Technical Specification SC-M-810-2*, and *Supplemental Technical Specification SC-M-810-3*.

### 1.1 Description

This work consists of permanent cover, permanent grassing for non permitted resurfacing projects and temporary cover including liming and fertilizing (when specified), and applying mulch on all areas shown on the Plans or where directed by the Resident Construction Engineer (RCE) in accordance with these Specifications. The Contractor coordinates permanent cover and temporary cover with the construction of fill and cut slopes. In order to limit the area of erodible material, the RCE may require that partially completed slopes be brought to the required slope and the Contractor perform permanent or temporary cover operations at that time.

### 1.2 Permanent Cover

Where land disturbing activities have permanently ceased on the Project and will not resume for a period exceeding 14 calendar days, initiate permanent cover on all disturbed areas within 7 calendar days. Where land disturbing activities are resumed within 14 days, stabilization measures are not required to be initiated on that portion of the Project. Initiate permanent cover measures as soon as practicable for areas where initiating permanent cover measures within 7 days is infeasible (e.g., where snow cover, frozen ground, or drought conditions prevent stabilization).

#### 1.2.1 Seeding Dates and Rates of Application

Select seed in accordance with Section 1.5 of this Specification. Using the pre-blended permanent seed mixtures included in *SCDOT Qualified Product List 88 (QPL 88)* or the seeding tables of this Specification, the Contractor will create a seeding plan and determine all rates of application necessary to produce the required stand of grass and follow the application procedures of this Specification. The RCE reserves the right to reject or approve all seeding plans before permanent cover applications are initiated.

Uniformly sow seed at the rate specified by the use of approved mechanical seed drills, rotary hand seeders, hydraulic equipment, or any other type of equipment that produces a uniform seed application.

Perform seeding work during the periods and at the rates specified in Section 1.5 of this Specification. Do not perform permanent cover when the ground is frozen and/or when the 10-day forecasted low temperature remains below 35 degrees Fahrenheit. Do not perform permanent cover when the ground is excessively wet. Do not conduct permanent cover work when the ground is excessively dry (periods of drought) unless watering is specified in the Contract or directed by the Resident Construction Engineer (RCE). During periods of adverse conditions, use temporary cover by mulch according to this Specification.

#### 1.2.2 Seedbed Preparation

Ensure the seedbed conforms to the finished grade and cross-section shown on the Plans or as otherwise directed by the RCE. Perform minor shaping and evening of uneven and rough areas outside of graded

sections as directed by the RCE in order to provide more effective erosion control and for ease of mowing operations.

Use select material, compost or other acceptable soil amendments as directed by the RCE for shoulders and slopes if good seedbed material is not located on site.

Loosen the seedbed (including cut slopes) to a minimum depth of three (3) inches before select material, compost, other acceptable soil amendments, agricultural lime, fertilizer, mulch, or seed is applied. Prepare the seedbed in a manner that ensures the seeding application remains on slopes and germinates. The acceptable method is grooving the slopes parallel with the adjacent roadway.

Ensure that the seedbed is uniform and remove stones larger than two and one-half (2½) inches in any dimension, large clods, roots, or other debris brought to the surface.

### 1.2.3 Permanent Cover Application

Following the preparation of the seedbed according to this Specification, perform permanent cover within 3 working days or prior to a rainfall event that compacts the prepared seedbed. If a rain event occurs that compacts or erodes the seedbed prior to performing permanent cover, the seedbed must be re-prepared as determined by the RCE.

After sowing permanent seed, apply an appropriate mulch as listed in this Specification within 3 working days or prior to a rainfall event that compacts the prepared seedbed. On small areas inaccessible to machinery, the seed may be covered by hand rakes or other methods satisfactory to the RCE. Add fertilizer and lime as directed by a soil analysis.

### 1.2.4 Acceptance of Permanent Cover

Before acceptance of permanent cover, a uniform perennial vegetative cover with a density of 70% of each square yard of the seeded area is required by the Contractor. A well-developed root system must be established to sufficiently survive dry periods and winter weather and be capable of reestablishment in the spring.

### 1.2.5 Payment for Permanent Cover

Payment for the accepted quantity for each pay item, measured in accordance with this Specification, is determined using the Contract unit bid price for the applicable pay item. The payment includes all direct and indirect costs and expenses necessary to complete the work.

Payment for permanent cover is full compensation for furnishing all materials (excluding agricultural granular lime, granular fertilizer, mulch, straw or hay with tackifier, HECF, RECF, Inlet Structure Filter Type F - Non-Weighted Slope Interruption Devices, select material, compost, other acceptable soil amendments and watering for vegetation) and includes all other materials, seed, fast acting lime, biological growth stimulants, labor, soil samples and analysis, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, Specifications, and other terms of the Contract. Payment is 100% of the Contract unit price for permanent cover upon installation meeting the requirements of this Specification.

If a satisfactory stand of perennial vegetative cover with a uniform density of 70% of the seeded area is not achieved within 45 days of sowing the permanent seed, the seeded area will be re-assessed by the RCE. If re-seeding is necessary, the Contractor is required to reapply permanent cover within 7 days at no additional cost to SCDOT.

## 1.3 Permanent Grassing for Non Permitted Resurfacing Projects (PGNPRP)

Non permitted resurfacing projects are defined as projects consisting of improving shoulders with a width of less than six feet due to backfill from resurfacing or upgrading deficient shoulders that are also exempt from coverage under the NPDES General Permit for Stormwater Discharges from South Carolina Department of Transportation Construction Activities (SCR160000).

### 1.3.1 Seeding Dates and Rates

Select seed in accordance with Section 1.5 of this Specification. Using the pre-blended permanent seed mixtures included in QPL 88 or the seeding tables of this Specification, the Contractor will create a seeding plan and determine all rates of application necessary to produce the required stand of grass and follow the application procedures as specified herein. The RCE reserves the right to reject or approve all seeding plans before permanent grassing for non permitted resurfacing projects applications are initiated.

Perform seeding work during the periods and at the rates specified in Section 1.5 of this Specification.

### 1.3.2 Seedbed Preparation

Ensure that the seedbed is prepared and uniform, remove stones larger than two and one-half (2½) inches in any dimension, large clods, roots, or other debris brought to the surface. The acceptable method is grooving the slopes parallel with the adjacent roadway.

Use select material, compost or other acceptable soil amendments as directed by the RCE for shoulders and slopes if good seedbed material is not located on site.

### 1.3.3 Application

Select nutrients based on applying slow release nitrogen (N) at a 120 lb/acre application rate and select phosphorus (P) and potassium (K) based on experience and past success. Soil samples, watering and any other section of this Specification can be used to obtain better results but are not required unless directed by the RCE. If granular fertilizer and lime are used, sow seed within 24 hours following the application and preparation of the seedbed. Uniformly sow seed at the rate specified in Section 1.5 by the use of approved mechanical seed drills, rotary hand seeders, hydraulic equipment, or any other type of equipment that produces a uniform seed and nutrient application.

All permanent grassing for non permitted resurfacing projects requires the application of HECP Type 3 with a minimum application rate of 2,000 pounds per acre. Where applicable, groove slopes prior to seeding.

Do not use permanent grassing for non permitted resurfacing projects when the ground is frozen and/or when the 10-day forecasted low temperature remains below 35 degrees Fahrenheit. Do not perform permanent grassing for non permitted resurfacing projects when the ground is excessively wet. Do not perform permanent grassing for non permitted resurfacing projects when the ground is excessively dry (periods of drought) unless watering is specified in the Contract or directed by the RCE. During periods of adverse conditions, use temporary cover by mulch according to this Specification.

### 1.3.4 Acceptance of Permanent Grassing for Non Permitted Resurfacing Projects

Before acceptance of permanent grassing for non permitted resurfacing projects, a perennial vegetative cover with a uniform density of 70% of the seeded area is required by the Contractor. A well-developed root system must be established to sufficiently survive dry periods and winter weather and be capable of reestablishment in the spring.

### 1.3.5 Payment for Permanent Grassing for Non Permitted Resurfacing Projects



Payment for the accepted quantity for this pay item, measured in accordance with this Specification, is determined using the Contract unit bid price for this pay item. The payment includes all direct and indirect costs and expenses necessary to complete the work.

Payment for permanent grassing for non permitted resurfacing projects is full compensation for furnishing all materials, **including** seed, agricultural granular lime, fast acting lime, granular fertilizer, biological growth stimulants, HECF Type 3, select material, compost, other soil amendments, water, labor, equipment, tools, supplies, transportation, all other materials, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, Specifications, and other terms of the Contract. Payment is 100% of the Contract unit price for permanent grassing for non permitted resurfacing projects upon installation which meet the requirements of this Specification.

If a satisfactory stand of perennial vegetative cover with a uniform density of 70% of the seeded area is not achieved within 45 days of sowing the permanent seed, the seeded area will be re-assessed by the RCE. If re-seeding is necessary the Contractor is required to reapply PGNPRP within 7 days at no additional cost to SCDOT.

#### **1.4 Temporary Cover**

Where land disturbing activities have temporarily ceased on the Project and will not resume for a period exceeding 14 calendar days, initiate temporary cover by mulch or temporary cover by seeding on all disturbed areas within 7 calendar days. Where land disturbing activities on a portion of the Project are temporarily ceased, and the land disturbing activities are resumed within 14 days, temporary stabilization measures are not required to be initiated on that portion of the Project. Initiate temporary cover by seeding within 45 days if the Project will not be worked for a period longer than 60 days to ensure a stand of grass by day 60.

Initiate temporary stabilization measures as soon as practicable for areas where initiating temporary stabilization measures within 7 days is infeasible (e.g., where snow cover, frozen ground, or drought conditions preclude stabilization). Do not use temporary cover by seeding when the ground is frozen and/or when the 10-day forecasted low temperature remains below 35 degrees Fahrenheit. Temporary cover by mulch can be used in this situation.

Use temporary cover on slopes to coincide with the embankment work in 10-foot increments. When 10 feet of fill is in place, perform temporary cover on the slope.

Scarify all temporary cover areas before fill is placed on top of the temporary cover area.

##### **1.4.1 Temporary Cover by Mulch**

Use an appropriate mulch as listed in Table 4 of this Specification. Apply the mulch with a minimum continuous soil coverage of 95% that is maintained across the entire application area.

Temporary cover by mulch may be used on isolated problem areas or where it is not feasible or practicable to bring an area to final slope and grade. Finish the surface so that permanent cover can be performed without serious disturbance by additional grading.

##### **1.4.1.1 Acceptance of Temporary Cover by Mulch**

Before acceptance of temporary cover, the Contractor is required to produce temporary cover sufficient to control erosion for a given area and length of time before the next phase of construction or the establishment of permanent cover is to commence.

If the temporary cover is disturbed by the prime, grading, or other Contractor before acceptable temporary cover is established, the temporary cover will be re-established at no cost to the SCDOT.



The Contractor is required to produce a satisfactory stand of temporary cover meeting the requirements of this Specification regardless of the time of the year the work is performed.

#### 1.4.1.2 Payment for Temporary Cover by Mulch

Payment for the accepted quantity for each pay item, measured in accordance with this Specification, is determined using the Contract unit bid price for the applicable pay item. The payment includes all direct and indirect costs and expenses necessary to complete the work.

There is not a Contract unit bid price for temporary cover by mulch. Payment for temporary cover by mulch is included in the Contract unit bid price for the pay items straw or hay with tackifier, HECF Type 1, 2, 3,4 and ECB and is full compensation for furnishing all materials and includes all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, Specifications, and other terms of the Contract. Payment is 100% upon approval of acceptable application of mulch meeting the requirements of this Specification.

#### 1.4.2 Temporary Cover by Seeding

##### 1.4.2.1 Seeding Dates and Rates of Application

Using the seed specified in Section 1.5, the Contractor will create a seeding plan and determine all rates of application necessary to produce the required stand of temporary grass and follow the application procedures of this Specification. The RCE reserves the right to reject or approve all seeding plans before temporary cover by seeding is initiated.

##### 1.4.2.2 Seedbed Preparation

Loosen the seedbed (including cut slopes) to a minimum depth of three (3) inches before select material or compost, agricultural lime, fertilizer, mulch, other acceptable soil amendments, or seed is applied. The acceptable method is grooving the slopes parallel with the adjacent roadway.

Ensure that the seedbed is uniform and remove stones larger than two and one-half (2½) inches in any dimension, large clods, roots, or other debris brought to the surface.

Use select material, compost or other acceptable soil amendments as directed by the RCE for shoulders and slopes if good seedbed material is not located on site.

##### 1.4.2.3 Temporary Cover by Seeding Application

Soil samples, watering and any other section of this Specification can be used to obtain better results but are not required unless directed by the RCE.

Following the preparation of the seedbed according to this Specification, sow seed prior to a rainfall event that compacts the seedbed.

Uniformly sow seed at the rate specified by the use of approved mechanical seed drills, rotary hand seeders, hydraulic equipment, or any other type of equipment that produces a uniform seed application.

Perform seeding work during the periods and at the rates specified in Section 1.5 of this Specification. Do not perform temporary cover by seeding when the ground is frozen and/or when the 10-day forecasted low temperature remains below 35 degrees Fahrenheit. Do not perform temporary cover by seeding when the ground is excessively wet. Do not perform temporary cover by seeding when the ground is excessively dry (periods of drought) unless watering is specified in the Contract or directed by the RCE. During periods of adverse conditions, use temporary cover by mulch according to this Specification.

After sowing temporary seed, apply an appropriate mulch within 3 working days as listed in this Specification prior to a rainfall event that compacts the seedbed. On small areas inaccessible to machinery, the seed may be covered by hand rakes or other methods satisfactory to the RCE. When required by the RCE, add fertilizer and agricultural lime as directed by a soil analysis.

Temporary cover by seeding may be used in isolated problem areas or where it is not feasible or practicable to bring an area to final slope and grade. Finish the surface so that permanent cover can be performed without serious disturbance by additional grading.

#### 1.4.2.4 Acceptance of Temporary Cover by Seeding

Before acceptance of temporary cover, the Contractor is required to produce temporary cover sufficient to control erosion for a given area and length of time before the next phase of construction or the establishment of permanent cover is to commence.

If temporary cover by seeding is disturbed by the prime, grading, or other Contractor before an acceptable stand of temporary cover by seeding is established, the temporary cover by seeding will be re-established at no cost to the SCDOT.

The Contractor is required to produce a satisfactory stand of temporary cover meeting the requirements of this Specification regardless of the time of the year the work is performed.

#### 1.4.2.5 Payment for Temporary Cover by Seeding

Payment for the accepted quantity for each pay item, measured in accordance with this Specification, is determined using the Contract unit bid price for the applicable pay item. The payment includes all direct and indirect costs and expenses necessary to complete the work.

Payment for temporary cover by seeding is full compensation for furnishing all materials (excluding mulch, straw or hay with tackifier, HECP Type 1,2,3,4, ECB, granular fertilizer, agricultural granular lime, select material, compost, other acceptable soil amendments, and watering for vegetation) and includes all other materials, seed, fast acting lime, biological growth stimulants, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, Specifications, and other terms of the Contract. Payment is 100% of the contract unit price for temporary cover by seeding upon installation meeting the requirements of this specification.

If a satisfactory stand of temporary vegetative cover with a uniform density of 70% of the seeded area is not achieved within 14 days of sowing the temporary seed, the seeded area will be re-assessed by the RCE. If re-seeding is necessary the Contractor is required to reapply temporary cover by Seeding within 7 days at no additional cost to SCDOT.

### 1.5 Materials

#### 1.5.1 General

At the time of delivery, the Contractor will furnish the RCE with invoices and or documentation of all materials received in order to verify the application rate of materials.

#### 1.5.2 Seed

Use seed that conforms to all state laws and all requirements and regulations of the South Carolina Department of Agriculture (SCDA). Seeds containing species designated by the State Crop Pest Commission as a plant pest (i.e., noxious weeds) are not permitted. Use seed that is individually packaged or bagged and tagged. Each tag must clearly state:

- Name of company or responsible party for analysis (seller or grower)
- Net weight
- Botanical name
- Common name
- Variety
- Lot number
- Percent purity (pure seed)
- Percent germination  $\geq 80\%$
- Percent by weight other crop seed
- Percent by weight of inert matter
- Percent by weight common (non-noxious) weed seed  $\leq 1.0\%$  (99.0% weed free)
  - If weed seed is present, provide a list of species by botanical name
- Origin
- Date of packaging or date tested (date must be within 9 months of the planned date of seed application)

When mixtures of different types of permanent seed are called for in the seeding schedule it is preferred that the Contractor use pre-blended permanent seed mixtures listed on the most recent edition of the *SCDOT Qualified Product List 88* for the specific location and application. These pre-blended permanent seed mixtures are individually packaged or bagged and tagged with the tag specifying the botanical and common name of each species contained in the blend, and the percentages of each species.

Each seed species or pre-blended seed mixture is weighed and mixed in the proper proportions and the Contractor must complete and sign the SCDOT Seeding Inspection Form and submit the completed form at the time of installation to the RCE or a member of the RCE's staff, if not the RCE may deny payment.

SCDOT reserves the right to review, test, reject, or approve all seed before seeding operations begin.

Seed must be used within 9 months from the date of packaging. Seed exceeding nine (9) months from the date of packaging will not be accepted.

#### 1.5.2.1 Simplified Permanent Cover Seeding Schedule

Select a pre-blended permanent seed mixture from *SCDOT Qualified Product List 88* for the Upper State or the Lower State as applicable to the project. The Lower State consists of all counties east of and including Aiken, Lexington, Richland, Kershaw, and Chesterfield Counties. The Upper State consists of all counties west of the Lower State, i.e. all the remaining counties (see Figure 1).

Select the appropriate pre-blended permanent seed mixture based on the two applications (slopes, or shoulders/medians) and the time of year of the application (spring/summer or fall/winter).

#### 1.5.2.2 Detailed Permanent Seeding Schedule

For sites where a pre-blended permanent seed mixture from *SCDOT Qualified Product List 88* is not applicable, select seed from Table 1, Perennials, and Table 2, Annuals, for the Upper State and the Lower State as applicable to the project. The Lower State consists of all counties east of and including Aiken, Lexington, Richland, Kershaw, and Chesterfield Counties. The Upper State consists of all counties west of the Lower State, i.e. all the remaining counties (see Figure 1).

If the seed listed in the tables is not available, the Contractor may select the most practicable alternative seed available as a substitute. The Contractor must submit data to the RCE showing that the substitute seed is appropriate for the specific application.

If the Common Name of the seed listed in Table 1 or Table 2 is not available, use the listed Botanical Name of the seed.

### Permanent Cover for Slopes

Select a minimum of two (2) seed types from Table 1 for all permanent cover for slopes based on the specific application, the time of year of the application and the availability of the seed. A minimum of one (1) of the seed types selected must be a turf-type species.

The Contractor must also add a minimum of one (1) acceptable annual nurse crop species from Table 2 at the rate shown in Table 2, or a mix of two (2) or more annual nurse crops species from Table 2 with one species applied at a minimum rate of approximately 75% of the rate shown in Table 2 and the other species applied at a rate that does not exceed approximately 50% of the rate shown in Table 2.

When utilizing two (2) perennial seed types from Table 1, apply the primary turf type species at the rate shown in Table 1 and the Contractor may apply the additional perennial seeds at a rate less than the rate shown in Table 1.

### Permanent Cover for Medians and Shoulders

Use a minimum of one (1) turf-type species from Table 1 and one (1) acceptable annual nurse crop from Table 2 for medians and shoulders in the Upper State and Lower State based on the specific application, the time of year of the application and the availability of the seed.

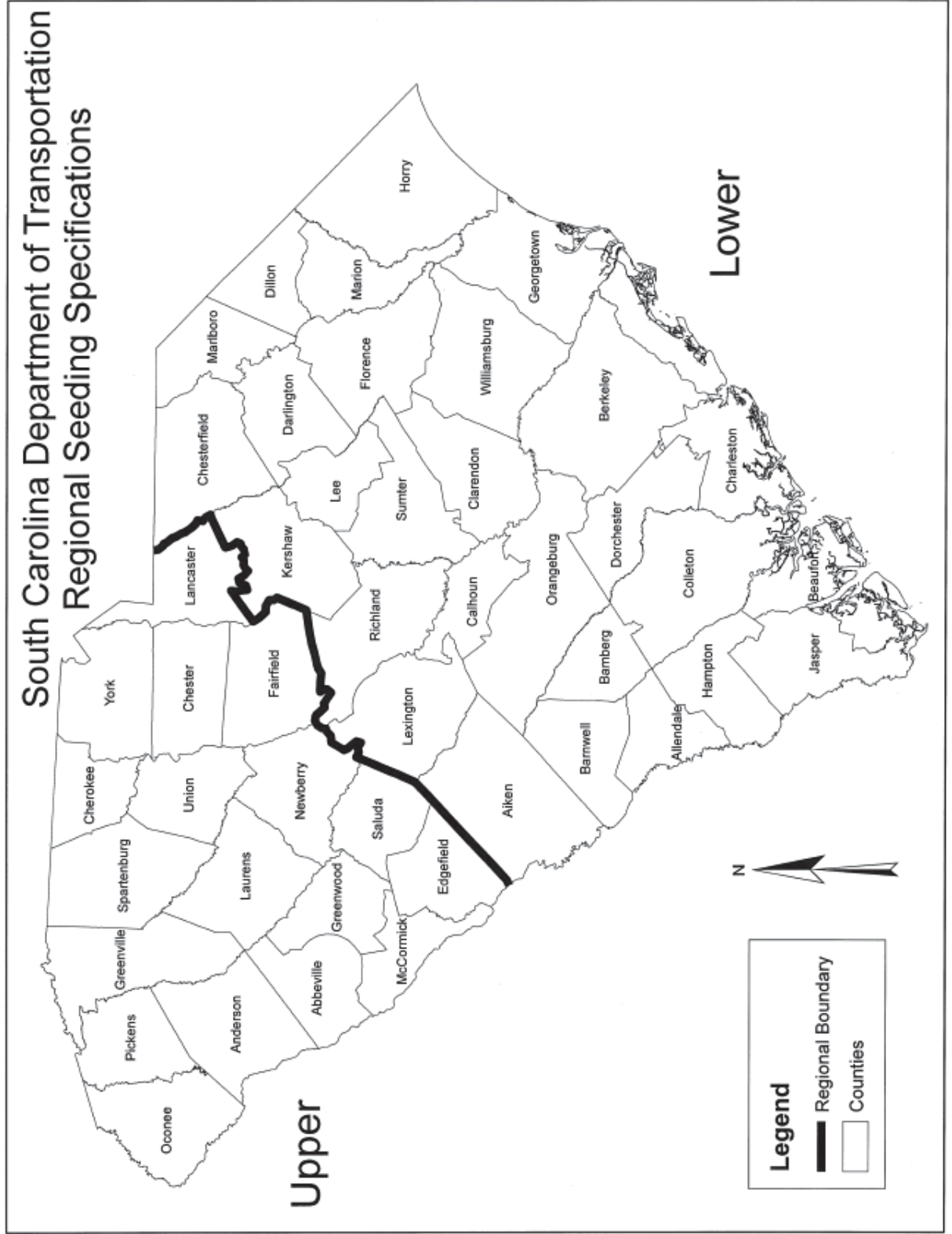
#### 1.5.2.3 Temporary Cover by Seeding

Select a minimum of one (1) seed type from Table 2 for all temporary cover by seeding based on the specific application, the time of year of the application and the availability of the seed.

#### 1.5.2.4 Seeding Plan

Prepare and submit a seeding plan to the RCE utilizing the seeding schedule for all permanent cover and temporary cover by seeding applications. The RCE reserves the right to reject or approve all seeding plans before temporary cover by seeding and permanent cover applications are initiated.

FIGURE 1: UPPER AND LOWER STATE MAP



**TABLE 1: PERRENIALS**

\* Months shaded in gray represent applicable planting dates.

COMMON NAME <sup>6</sup>	BOTANICAL NAME	APPROVED SITE(S)	PLANTING RATE (lbs/acre)	PLANTING LOCATION	Planting Dates*															
					JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC				
<b>TURF-TYPE GRASSES (SELECT ONE)</b>																				
Bahiagrass <sup>1</sup>	Paspalum notatum	Shoulders, Slopes, or Medians	30	Upper State Lower State																
Common Bermudagrass <sup>2</sup> (hulled = hull absent)	Cynodon dactylon	Shoulders, Slopes, or Medians	50	Upper State Lower State																
Common Bermudagrass <sup>2</sup> (unhulled = hull present)	Cynodon dactylon	Shoulders, Slopes, or Medians	60	Upper State Lower State																
Carpet Grass / Centipedegrass Combo	Axonopus affinis Eremochloa ophiuroides	Shoulders, Slopes or Medians	15 10	Upper State Lower State																
Tall Fescue (KY-31) <sup>3</sup>	Festuca arundinacea	Shoulders, Slopes, or Medians	75	Upper State Lower State																
<b>GRASSES</b>																				
Weeping Lovegrass	Erograstis curvula	Slopes	10	Upper State Lower State																
Indiangrass	Sorghastrum nutans	Slopes	10	Upper State Lower State																
Little Bluestem	Andropogon scoparius	Slopes	10	Upper State Lower State																
Coastal Panicgrass	Panicum amarum	Slopes	20	Upper State Lower State																
Switchgrass	Panicum virgatum	Slopes	10	Upper State Lower State																
Perennial Rye Grass <sup>4</sup>	Lolium perenne	Shoulders, Slopes, or Medians	15	Upper State Lower State																
Virginia Wild Rye	Elymus virginicus	Shoulders, Slopes, or Medians	6	Upper State Lower State																
<b>LEGUMES<sup>4</sup></b>																				
White Clover	Trifolium repens	Shoulders, Slopes, or Medians	5	Upper State Lower State																
Crownvetch	Coronilla varia	Slopes	25	Upper State Lower State																
Sericea Lespedeza (Scarified seed)	Lespedeza cuneata	Slopes	50	Upper State Lower State																
Sericea Lespedeza (Unscarified seed)	Lespedeza cuneata	Slopes	80	Upper State Lower State																

\* Months shaded in gray represent applicable planting dates.

<sup>1</sup>Bahiagrass: Use at discretion of RCE based on project location.  
<sup>2</sup>Common Bermudagrass: Do not use Giant Bermudagrass (NK-37).  
<sup>3</sup>Tall Fescue (KY-31): Do not use Tall Fescue (Lolium arundinacea).  
<sup>4</sup>Perennial Rye Grass: Do not use Annual Italian Rye grass (Lolium multiflorum).  
<sup>5</sup>Only use pre-inoculated legumes or use an appropriate inoculant with the seed at plant  
<sup>6</sup>If Common Name of seed is not available, use seed with the listed Botanical Name.

**TABLE 2: ANNUALS** \* Months shaded in gray represent applicable planting dates.

COMMON NAME <sup>5</sup>	BOTANICAL NAME	APPROVED SITE(S)	NURSE CROP RATE (lbs/acre)	TEMP COVER RATE (lbs/acre)	PLANTING LOCATION	Planting Dates*																		
						JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC							
Crimson Clover <sup>1</sup>	Trifolium incarnatum	Shoulders, Slopes, or Medians	20	20	Upper State Lower State																			
Lespedeza <sup>1</sup> Kobe / Korean	Lespedeza striata / stipulacea	Shoulders, Slopes	15	60	Upper State Lower State																			
Browntop Millet <sup>2</sup>	Panicum ramosum	Shoulders, Slopes, or Medians	10	40	Upper State Lower State																			
German Millet <sup>2</sup> (Foxtail Millet)	Setaria italica	Shoulders, Slopes, or Medians	10	40	Upper State Lower State																			
Japanese Millet <sup>2</sup>	Echinochloa crusgalli	Slopes	10	50	Upper State Lower State																			
Oats	Avena sativa	Slopes	40	110	Upper State Lower State																			
Hairy Vetch <sup>1</sup>	Vicia villosa	Slopes	15	50	Upper State Lower State																			
Pearl Millet	Pennisetum glaucum	Slopes	15	50	Upper State Lower State																			
Sudangrass	Sorghum bicolor	Slopes, Buffers	20	60	Upper State Lower State																			
Barley	Hordeum vulgare	Slopes	55	110	Upper State Lower State																			
Wheat <sup>4</sup>	Triticum spp.	Slopes, Buffers	35	110	Upper State Lower State																			
Rye Grain <sup>3,4</sup>	Secale cereale	Shoulders, Slopes, or Medians	40	110	Upper State Lower State																			

<sup>1</sup> Only use pre-inoculated legumes or an appropriate inoculant with the seed at planting.

<sup>2</sup> Mow Millet (no lower than 3 inches) once it reaches a height of 18 - 24 inches or at the discretion of the RCE to reduce competitiveness with permanent vegetation.

<sup>3</sup> Rye Grain: Do not use Annual Italian Rye Grass (*Lolium multiflorum*).

<sup>4</sup> Mow Wheat and Rye Grain (no lower than 3 inches) once they reach a height of 18 - 24 inches or at the discretion of the RCE to reduce competitiveness with permanent vegetation.

<sup>5</sup> If the Common Name of the seed listed is not available, use seed with the listed Botanical Name. Do not use Wild Bird, Wild Animal, or Domestic Feed Seed.

\* Months shaded in gray represent applicable planting dates.



### 1.5.3 Lime

#### 1.5.3.1 Agricultural Granular Lime

Use solid agricultural granular lime for all permanent cover applications that is agricultural grade, standard ground limestone conforming to the current *Rules, Regulations, and Standards of the Fertilizer Board of Control*. These rules, regulations, and standards are promulgated and issued by the Fertilizer Board of Control at Clemson University in accordance with Section 16 of the *South Carolina Liming Materials Act*. Ensure that each bag has affixed in a conspicuous manner a tag or label, or in the case of bulk sales, a delivery slip showing brand or trade name, calcium carbonate equivalent, percent by weight passing prescribed U. S. Standard Sieves, and other pertinent information to identify lime as being agricultural grade, standard ground limestone.

#### 1.5.3.2 Fast Acting Lime

Use fast acting liquid forms and/or dry forms of lime for all permanent cover and temporary cover by seeding applications that meet all of the requirements of agricultural grade granular lime specified herein, except percent by weight passing U.S. Standard Sieves.

### 1.5.4 Fertilizer and Biological Growth Stimulants

#### 1.5.4.1 Granular Fertilizer

Use slow release granular fertilizer for all permanent cover applications that complies with state fertilizer laws. In a mixed fertilizer such as 10-10-10, the first number represents the percent of nitrogen required, the second number represents the percent of available phosphoric acid required, and the third number represents the percent of water soluble potash required in the fertilizer.

**Use fertilizer that incorporates a minimum of 50% slow release (water insoluble) nitrogen.**

The statements water insoluble, slowly available or slowly available soluble nitrogen also indicate slow release forms of nitrogen. Typically the slow release fertilizer will list the percentage of nitrogen (expressed as a percentage by weight of the package contents) that is in the slow release form. For example when a 10-10-10 fertilizer is labeled as 5% slow release nitrogen, divide the 5% slow release nitrogen by the 10% total N in the product and multiply by 100 to get the percentage of nitrogen that is in slow release form. In this example it is  $5\% / 10\% \times 100 = 50\%$  slow release nitrogen.

Use fertilizer that has a package slip clearly stating the percentage of nitrogen, percentage of slow release nitrogen, percentage of phosphoric acid, and percentage of potash along with the weight (pounds) of nitrogen, weight (pounds) of phosphoric acid, and weight (pounds) of potash. Animal by-product or municipal waste fertilizers are not acceptable under this Specification.

#### 1.5.4.2 Biological Growth Stimulants

Provide biological growth stimulants for all permanent cover and temporary cover by seeding applications. Use biological growth stimulants that provide an immediate seedbed adjustment to help stimulate seed germination, improve the availability of nutrients to the plant, increase the number and depth of root development, and generate robust plant growth that is more tolerant of changes in environmental conditions.

Use biological growth stimulants that:

- Contain natural components that encourage nutrient uptake, nitrogen metabolism, and carbohydrates storage,
- Improve fertilizer utilization in the soil by increasing the enzymatic and microbial nutrient conversion activity,



- Improve photosynthetic production resulting in greater root mass and improved disease resistance,
- Contain components to improve nutrient and water uptake by the plant,
- Contain plant growth hormones which act as a stimulant to improve vegetative growth and intake of micro nutrients and can reduce damage from disease and insect infestation, and
- Contain components that increases biological activity in the soil to improve stress tolerance/drought resistance, reduces sodium uptake in sandy soils, provides more phosphorus availability, and increases cation exchange capacity resulting in earlier germination and better root establishment.

Provide biological growth stimulants that contain compounds such as:

- Humic acid (humates),
- Humectants,
- Cold water processed seaweed/kelp extract,
- Beneficial microbes,
- Cytokinins,
- Gibberellins,
- Auxins (growth hormones), and
- Endo-mycorrhizae.

Animal by-products or municipal waste products are not acceptable biological growth stimulants under this specification. Liquid fertilizers **are not** acceptable as biological growth stimulants under this specification.

Provide biological growth stimulants composed of non-toxic materials.

Provide Biological Growth Stimulants that have no germination or growth inhibiting factors and do not form a water-resistant crust that can inhibit plant growth. Furnish biological growth stimulants where all components are pre-packaged by the manufacturer to assure material performance and compliance with the minimum requirements in Table 3.

**Table 3: Minimum Biological Growth Stimulant Requirements**

BGS Property	Test Method	Required Value
<b>Physical</b>		
Acute Toxicity	ASTM 7101 EPA Method 2021 or EPA Method 2002	Non Toxic
<b>Performance</b>		
Seed Germination	ASTM D7322 <sup>1</sup>	200% minimum
Plant Mass	ASTM D7322 <sup>1</sup>	110% minimum

<sup>1</sup> ASTM test methods developed for Rolled Erosion Control Products (RECPs) that have been modified for comparison to control between 14 and 21 days.

Provide biological growth stimulants from a manufacturer listed on the most recent edition of the *SCDOT Qualified Product List 74* and provide documentation of testing at an approved independent laboratory demonstrating performance based on enhanced plant germination.

#### 1.5.5 Mulch

Mulch is required for all permanent cover, temporary cover, and permanent grassing for non permitted resurfacing projects applications. Only use mulch that is certified weed free. Wood chip mulch is not acceptable for seeding applications.

#### 1.5.5.1 Straw or Hay Mulch with Tackifier

Use straw or hay mulch material that consists of certified weed free straw or hay. Use straw that consists of stalks of wheat, rye, barley, oats, or other approved straw. Use hay that consists of Timothy, Peavine, Alfalfa, Coastal Bermuda, or other grasses from approved sources. Use materials that are reasonably dry and reasonably free from mature seed-bearing stalks, roots, or bulblets of Johnson grass, Nutgrass, Sandburg, Wild Garlic, Wild Onion, Wild Mustard, Crotolaria, Pigweed, Witchweed, and Cocklebur. Comply with all state and federal domestic plant quarantine regulations. Do not use straw mulch in urban areas or in areas adjacent to sidewalks, guardrails, curbs, curb and gutters, or concrete medians.

Do not use straw or hay mulch with tackifiers for temporary cover by mulch applications on slopes steeper than 4H:1V.

Anchor straw mulch material using one of the following tacking agents:

##### 1.5.5.1.1 Organic or Chemical Tackifier

Use an organic or chemical tackifier that consists of guar gum, plantago, polysaccharides, polymer synthetic resin, polypectate, liquid latex, or other material that will give similar adhesive properties as asphalt emulsion when sprayed on straw mulches. Organic or chemical tackifiers require approval by the RCE.

##### 1.5.5.1.2 Hydraulic Straw Tackifiers

Use Hydraulic Erosion Control Products (HECP) as hydraulic straw tackifiers that meet the requirements of this Specification. Apply HECP at the manufacturer's recommended rate for straw binding.

##### 1.5.5.1.3 Emulsified Asphalt

Use Emulsified Asphalt that meets the requirements of Subsection **407.2.4** of the *South Carolina Department of Transportation (SCDOT) Standard Specifications for Highway Construction*, 2007 Edition. Dilute Emulsified Asphalt at the manufacturing plant with water, if necessary, to provide a homogenous and satisfactory material for spraying.

#### 1.5.5.2 Hydraulic Erosion Control Products (HECPs)

Refer to *SCDOT Supplemental Technical Specification for HECP (SC-M-815-11)* or latest revision for HECP description, materials, and construction requirements.

#### 1.5.5.3 Compost Mulch

Refer to *SCDOT Supplemental Technical Specification for Compost (SC-M-815-3)* or latest revision for compost mulch description, materials, and construction requirements.

#### 1.5.5.4 Temporary Erosion Control Blankets (ECBs)

Refer to *SCDOT Supplemental Technical Specification for Rolled Erosion Control Products (RECP) (SC-M-815-9)* or latest revision for Temporary Erosion Control Blanket (ECB) description, materials, and construction requirements.

#### 1.5.5.5 Turf Reinforcement Matting (TRMs)

Refer to *SCDOT Supplemental Technical Specification for Rolled Erosion Control Products (RECP) (SC-M-815-9)* or latest revision for Turf Reinforcement Matting (TRM) description, materials, and construction requirements.

## 1.5.6 Slope Interruption Devices

The maximum allowable continuous slope length for all straw and hay mulch, HECP, compost mulch, and ECB applications is 50 feet. Slope interruption devices or TRMs are required for continuous slope length longer than 50 feet. Refer to *SCDOT Supplemental Technical Specification for Inlet Structure Filters Type F – Non Weighted (SC-M-815-8) or latest revision* for slope interruption device description, materials, and construction requirements. At the discretion of the RCE, use slope interruption devices on slope lengths less than 50 feet when slope erosion is observed.

## 1.6 Construction Requirements

### 1.6.1 Soil Amendments

#### 1.6.1.1 Compost

Note: Compost is used to establish a bid price in CY in the event that the RCE determines that compost is necessary. Compost is not intended to be used for all projects or an entire project site.

For seedbeds that have little or no topsoil, and are determined to be deficient from the results of the soil analysis, furnish, place, and mix certified weed free compost to a minimum depth of three (3) inches into the seedbed in order to ensure a good stand of grass. Refer to *SCDOT Compost Supplemental Technical Specification (SC-M-815-3) or latest revision* for description, materials, and construction requirements.

As directed by the RCE, provide compost when seedbeds are excessively nutrient deficient to the extent of requiring costly fertilizer additions and or have excessively low pH values (lower than 5.0) to the extent of requiring costly lime additions.

#### 1.6.1.2 Select Material

Note: Select material is used to establish a bid price in CY in the event that the RCE determines that select material is necessary. Select material is not intended to be used for all projects or an entire project site.

For seedbeds that have little or no topsoil, or are determined to be deficient from the results of the soil analysis, furnish, place, and mix select material to a minimum depth of 3 inches into the seedbed in order to ensure a good stand of grass.

As directed by the RCE, provide select material for seedbeds that are excessively nutrient depleted to the extent of requiring costly fertilizer additions and or have excessively low pH values (5.0 or lower) to the extent of requiring costly lime additions.

Select material consists of a friable material containing grass roots and is comparatively porous, capable of growing grass, and stable in nature. When compacted, select material will resist erosion and be capable of supporting vehicles when relatively wet.

### 1.6.2 Soil Analysis

A soil analysis is not required for permanent grassing on non permitted resurfacing projects and temporary cover by seeding unless directed by the RCE. A soil analysis is required prior to all permanent cover applications. A soil analysis is required on all representative soil types for the specified vegetation species prior to agricultural granular lime and granular fertilizer applications. The RCE determines where distinguishable representative soil types are located on the project site. Representative soil types include existing predominate soils on the project site, cut slopes, fill material, and areas of exposed subsoil.

Collect one (1) soil sample for each distinguishable representative soil type. One (1) sample consists of mixing ten (10) sub-samples taken uniformly over each distinguishable representative soil type. Soil

samples should be taken from stockpiles where the material will be the top six (6) inches of the seedbed. Take each sub-sample within the top four (4) to six (6) inches of the soil surface.

Submit a separate soil sample for each representative soil type to a SCDOT certified soil testing laboratory.

The soil analysis determines the need and rate of agricultural granular lime and slow release nitrogen, phosphoric, potash granular fertilizer applications. At a minimum, a standard soil test includes pH, buffer pH, extractable phosphorus, potassium, lime requirements and recommendations, calculations for CEC (cation exchange capacity), and fertilizer requirements and recommendations. At the discretion of the RCE, a soil organic matter test may be required.

### 1.6.3 Applying Lime

#### 1.6.3.1 Agricultural Granular Lime

Use agricultural granular lime for all permanent cover applications. A soil analysis is required prior to agricultural granular lime applications. The soil analysis determines the need and rate of granular lime application for a given application area. Based on the results of the soil analysis, furnish granular lime to provide a long term pH adjustment. Following advance preparation and placing of soil amendments when called for in the Contract or directed by the RCE, uniformly spread lime over the designated areas. Thoroughly mix agricultural granular lime with the soil to a depth of approximately two (2) inches. Mixing is not required when spreading lime with hydraulic methods.

Adequately scarify all slopes subject to slides and inaccessible to power equipment. Lime may be applied by approved mechanical spreaders or by hydraulic methods as a mixture of lime and seed.

Apply all agricultural granular lime at a rate that is within  $\pm 10\%$  of the weight recommendation of the soil analysis. Do not apply more than 4,000 lbs/acre of agricultural lime in a single application. If a soil analysis recommends greater than 4,000 lbs/acre, apply agricultural lime by:

- Surface apply 4,000 lbs/acre initially, after 3 months, surface apply the additional lime not to exceed 4,000 lbs/acre to meet the overall recommended application.
- If the initial soil analysis recommends greater than 6,000 lbs/acre, provide select material, compost or other acceptable soil amendments to the seedbed according to this Specification, and then perform an additional soil analysis to determine the recommended agricultural lime application.

Agricultural granular lime is not required for temporary cover by seeding applications unless a soil analysis is requested by the RCE and indicates a pH below 5.0.

#### 1.6.3.2 Fast Acting Lime

Use fast acting liquid or fast acting dry forms of lime for all permanent cover and temporary cover by seeding applications. Fast acting liquid and dry lime provides an immediate pH adjustment. Apply fast acting liquid lime at a rate of 5 gallons per acre or per the manufacturer's recommendations. Apply fast acting dry lime at a rate of 100 pounds per acre or per the manufacturer's recommendations.

### 1.6.4 Applying Fertilizer and Biological Growth Stimulants

#### 1.6.4.1 Agricultural Granular Fertilizer

A soil analysis is required prior to agricultural granular fertilizer applications. The soil analysis determines the need and rate of fertilizer applications for the specific vegetation species. Following advance seedbed preparation and placing of soil amendments when called for in the Contract or directed by the RCE, uniformly spread fertilizer over the designated areas.

Adequately scarify all slopes that are inaccessible to power equipment. Fertilizer may be applied by approved mechanical spreaders or by hydraulic methods. When fertilizer is applied with combination seed and fertilizer drills, no further incorporation is necessary. Apply the fertilizer and seed together when hydraulic methods of seeding are used.

Use fertilizer that incorporates a minimum of 50% slow release (water insoluble) nitrogen for all permanent cover applications under this Specification. Apply nitrogen at a rate of 120 lbs per acre (60 lbs of slow release nitrogen per acre).

Apply all fertilizer at a rate that is within  $\pm 10\%$  of the weight recommendation of the soil analysis. Apply fertilizer that is within  $\pm 2$  percentage points of the recommendation of the soil analysis.

When a fertilizer blend meeting the soil analysis requirements is not readily available, the Contractor may combine fertilizers of different compositions to meet the soil analysis composition requirements. Apply the fertilizer at a rate to achieve the amount of nitrogen, phosphoric acid, and potash that would have been accomplished by utilizing the fertilizer specified by the soil analysis.

In all cases, under the guidelines of this Specification, apply nitrogen and phosphorus at a rate that does not exceed the soil analysis recommendation while keeping the actual nitrogen and phosphorus rate as close to the soil analysis recommended rate to the maximum extent practicable.

Payment is made for the number of pounds of fertilizer applied as required by the soil analysis. Use a separate payment for each of the three fertilizer components (nitrogen, phosphoric acid, and potash).

#### 1.6.4.2 Biological Growth Stimulants

Use biological growth stimulants for all permanent cover and temporary cover by seeding applications. Ensure that all biological growth stimulant applications strictly follow the manufacturer's rates and recommendations to avoid damage or burning of the seedbed. Use approved hydraulic methods to apply biological growth stimulants.

Deliver materials and products sealed in factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage from weather, excessive temperatures, and construction operations.

## 1.6.5 Mulch

Apply mulch according to Table 4.

**TABLE 4: MULCH**

Mulch <sup>1,5</sup>	Applicable Slopes <sup>2</sup>	Minimum Application Rate (lbs/acre -dry) <sup>3</sup>	Min Slope Length (ft)
Straw or Hay with Tackifier	≤ 4:1	2,000	N/A
HECP Type 1 - Tracer under RECP	Per RECP	1,000	N/A
HECP Type 1	≤ 4:1	2,000	N/A
HECP Type 2	4:1 < S ≤ 3:1	2,500	N/A
HECP Type 3	3:1 < S ≤ 2:1	3,000	N/A
HECP Type 4	2:1 < S ≤ 1:1	3,500	N/A
	> 1:1	4,000 (temp cover only) <sup>4</sup>	
Compost Mulch	≤ 2:1	200 CY/acre	N/A
When site constraints exceed the acceptable application for mulch, use Rolled Erosion Control Products (RECPs); Erosion Control Blankets (ECB) or Turf Reinforcement Matting (TRM)			
Temporary ECB <sup>2</sup> or Type 1 TRM	≤ 2:1	N/A	5
Type 2 TRM	≤ 1.5:1	N/A	5
Type 3 TRM	≤ 1:1	N/A	5

- 1 A higher level of mulch may be applied than as specified on the Plans, Specifications, and other terms of the Contract. In this situation, the higher level mulch is applied at the specified mulch rate for the actual slope conditions of the site in accordance with the mulch tables. Payment is made for the mulch specified not the higher level mulch.
- 2 The maximum allowable continuous slope length for all straw and hay mulch, HECP, compost mulch, and ECB applications is 50 feet. *Slope interruption devices or TRMs are required for continuous slope length longer than 50 feet. At the discretion of the RCE, use slope interruption devices on slope lengths less than 50 feet when slope erosion is observed.*
- 3 Strictly comply with the manufacturer's mixing recommendations and installation instructions for the actual slope steepness and the actual continuous slope length of the application.
- 4 HECP Type 4 may be used for permanent cover applications on slopes 1:1 or greater at a minimum rate of 4,500 pounds per acre as directed by the RCE **only** when proper TRM installation is not practicable due to site constraints. *Slope interruption devices or TRMs are required for continuous slope length longer than 50 feet. At the discretion of the RCE, use slope interruption devices on slope lengths less than 50 feet when slope erosion is observed.*
- 5 Wood chips or shredded woody materials generated during the clearing stage when trees are shredded using large tub grinders is an acceptable temporary mulch. At the discretion of the RCE, place wood chip mulch on slopes ≤ 3:1. Wood chip mulch **is not** acceptable for temporary seeding or permanent seeding applications.

### 1.6.5.1 Straw or Hay Mulch with Tackifier

Uniformly apply straw or hay mulch material at the rate of 2,000 pounds per acre. Straw mulch may be spread either by hand, by appropriate mechanical spreaders, or by blowers. Apply straw mulch to allow sunlight penetration, air circulation, partial shading of the ground, and conservation of soil moisture. Secure newly laid straw mulch with an approved tackifier. Replace all straw mulch displaced during the tackifier application process.

#### 1.6.5.1.1 Organic or Chemical Tackifier

Consist of guar gum, plantago, polysaccharides, polymer synthetic resin, polypectate, liquid latex, or other material that will give adhesive properties when sprayed on straw mulches. Applications should be heavier

at edges, in valleys, and at crests of banks and other areas where the straw mulch may be moved by wind or water. All other areas must have a uniform application of the tackifier. Use tacking agents approved by the RCE, and apply them at the manufacturer's recommended rate.

#### 1.6.5.1.2 Hydraulic Straw Tackifiers

Apply hydraulic tackifiers at the manufacturer's recommended rate for straw binding.

#### 1.6.5.1.3 Emulsified Asphalt

Dilute Emulsified Asphalt at the manufacturing plant with an equal amount of water and uniformly apply it over the straw mulch material as a film. Apply the film at approximately 0.20 gallon of dilution per square yard to sufficiently bond together the straw mulch and prevent wind erosion without creating a heavy coating of asphalt material.

Emulsified Asphalt is not applicable for use in urban areas or along sidewalks, curb and gutters, bridges, and water bodies.

#### 1.6.5.2 Hydraulic Erosion Control Product (HECPs)

Refer to *SCDOT Supplemental Technical Specification for HECPs (SC-M-815-11)* or latest revision for HECP construction requirements.

#### 1.6.5.3 Compost

Refer to *SCDOT Supplemental Technical Specification for Compost (SC-M-815-3)* or latest revision for compost mulch construction requirements.

#### 1.6.5.4 Temporary Erosion Control Blankets (ECBs)

Refer to *SCDOT Supplemental Technical Specification for Rolled Erosion Control Products (RECP) (SC-M-815-9)* or latest revision for Erosion Control Blanket (ECB) construction requirements. For permanent cover applications using hydraulic methods for seed application, apply seed with HECP Type 1 as a tracer at a minimum rate of 1,000 pounds/acre prior to RECP installation. Payment for the application of HECP Type 1 as a tracer is a separate bid item.

#### 1.6.5.5 Turf Reinforcement Matting (TRMs)

Refer to *SCDOT Supplemental Technical Specification for Rolled Erosion Control Products (RECP) (SC-M-815-9)* or latest revision for Turf Reinforcement Matting (TRM) construction requirements. For permanent cover applications, when using hydraulic methods for seed application, apply seed with HECP Type 1 as a tracer at a minimum rate of 1,000 pounds/acre prior to RECP installation. Payment for the application of HECP Type 1 as a tracer is a separate bid item.

#### 1.6.6 Slope Interruption Devices

Refer to *SCDOT Supplemental Technical Specification for Inlet Structure Filters Type F – Non Weighted (SC-M-815-8)* or latest revision for slope interruption device description, materials, and construction requirements. At the discretion of the RCE, use slope interruption devices on slope lengths less than 50-feet when slope erosion is observed.

#### 1.6.7 Protection of Structures

Cover any parts of bridges, culverts, guardrails, signs, sidewalks, curb and gutters, catch basins, pipe ends, and other structures as necessary to prevent discoloration before spraying organic or chemical tackifiers.



### 1.6.8 Selective Watering for Vegetation

Note: Selective Watering for Vegetation is used to establish a bid price per gallon of water in the event that the RCE determines that watering is necessary. Selective Watering for Vegetation is not intended to be used for all projects or an entire project site.

Selective Watering for vegetation consists of selectively applying water to seeded areas that are slow to develop or deficient in adequate density. Use Selective Watering to enhance germination and enhance root growth in poor growth areas. The Contractor shall coordinate with the RCE to determine if watering is necessary.

When directed by the RCE use the following guidelines in areas where germination has not occurred within 21 days after seeding:

- Keep the soil moist but not excessively wet until the seed germinates.
- Water a minimum of three (3) days a week for two (2) weeks preferably watering two (2) or three (3) times a day in small quantities.
- Use fine spray and low pressure to avoid soil wash and to prevent uncovering buried seeds.
- When applicable, water during early morning hours or early evening hours.
- Do not water when rain is forecasted for the area.

When directed by the RCE, use the following guidelines in areas where adequate density is a problem after emergence:

- Apply one (1) inch of water per irrigation event. (Note: 1-acre-inch = 27,154 gallons. This is the volume of water necessary to cover one (1) acre one (1) inch deep.)
- During summer, water two (2) to three (3) days per week.
- During winter, water once every ten (10) to fourteen (14) days.
- If rainfall occurs, suspend watering according to rainfall amount.

Closely monitor the deficient areas to ensure germination and density of cover. Further analysis of the soil, application of soil amendments, or re-seeding may be necessary if the problem area persists.

### 1.6.9 Mowing for Seeding (all seeding applications)

Mowing consists of mowing areas seeded or sodded under the Contract or other areas as necessary to provide adequate sight areas and to maintain the project in a satisfactory manner. Mowing is performed by the Contractor where directed by the RCE and such mowing will commence within seven (7) business days following verbal notification by the RCE. Failure of the Contractor to comply with this requirement may be grounds for stopping work on the project or withholding payment of the monthly construction estimate.

Mow shoulders, medians, and slopes when vegetation reaches a height of approximately eighteen (18) to twenty four (24) inches or as directed by the RCE. Do not perform mowing of slopes resulting in ruts, furrows or grooves. Do not perform mowing of slopes that damage or inhibits the establishment of the slope vegetation.

Use mowing equipment equipped with safety devices designed to prevent injury or property damage caused by flying debris propelled from under the mowing equipment. Keep all mowing equipment in good operating condition and keep the equipment maintained to provide a clean, sharp cut of vegetation at all times. If the RCE determines the equipment is defective to the point that the quality of work or safety is affected, immediately repair or replace the equipment.

Ensure that mowing results in a uniform vegetation height of four (4) to six (6) inches, unless otherwise directed by the RCE. Mow as closely as possible to all fixed objects exercising care not to damage trees, plants, shrubs, signs, delineators, or other appurtenances which are a part of the facility. Hand trimming around such objects will be required of the Contractor. If a separate pay item is not included for



Guardrail/Cable Rail Mowing, then all necessary hand trimming shall be incidental to the Mowing pay item.

Remove litter and debris prior to beginning mowing operations. Immediately remove and properly dispose of all litter and debris resulting from mowing operations. Mowed grass is not normally removed unless it becomes a hazard as determined by the RCE.

Do not perform mowing when, in the opinion of the RCE, slope, soil and weather conditions are such that rutting or other damage to the Project may occur. The seven-business-day period may be extended by the RCE until the soil and weather conditions become suitable for mowing on the project.

#### 1.6.10 Inspection

Ensure that all seed, fast acting lime, biological growth stimulants, agricultural granular lime, granular fertilizer, straw and hay mulch, HECs, compost mulch, other acceptable soil amendments, ECBs, TRMs, and Inlet Structure Filter Type F - Non-Weighted (Slope Interruption Devices) are applied according to this Specification.

The Contractor must complete and sign the SCDOT Seeding Inspection Form and submit the completed form at the time of installation to the RCE or a member of the RCE's staff. The RCE or member of the RCE's staff must document receipt of the submitted SCDOT Seeding Inspection Form.

#### 1.6.11 Maintenance

Perform all maintenance necessary to keep permanent cover, permanent grassing for non permitted resurfacing projects, temporary cover by seeding, and temporary cover by mulch areas in a satisfactory condition until the work is finally accepted. This includes mowing, repairing areas of erosion and washes, and applying additional seed, lime, fertilizer, and mulch to areas where a satisfactory stand of grass has not been achieved. Water seeded areas as directed by the RCE. The Contractor is not responsible for permanent cover, permanent grassing for non permitted resurfacing projects, temporary cover by seeding, and temporary cover by mulch areas damaged by insects, animals, or extreme rainfall events. An extreme rainfall event is defined as being a 25-year storm event or greater based on the inches of rain received per time interval (30-min, 1-hr, 3-hr, 6-hr, 24-hr etc.) for the particular location as determined from the current NOAA precipitation tables.

### 1.7 Measurement

Permanent Cover, Permanent Grassing for Non Permitted Resurfacing Projects and Temporary Cover by Seeding - The quantity of permanent cover, permanent grassing for non permitted resurfacing projects, and temporary cover by seeding is the ground surface area with acceptable vegetation or stand of cover and is measured by the one-acre (acre) unit, complete and accepted.

Lime - The quantity of agricultural granular lime is the weight applied and is measured by the pound (lb), complete and accepted. Weights are determined by approved scales or by guaranteed weight of sacks shown on the manufacturer's tag. Furnish invoices or documentation of the materials received on the project to the RCE.

Fertilizer - The quantity of fertilizer is the weight applied and is measured by the pound (lb), complete and accepted. Quantities are measured for each of the three fertilizer components (nitrogen, phosphoric acid, and potash). Weights are determined by approved scales or by guaranteed weight of sacks shown on the manufacturer's tag. Furnish invoices or documentation of the materials received on the project to the RCE.

Mulch - The quantity of mulch is the ground surface area covered and is measured by the one-acre (acre) unit, complete and accepted. Furnish invoices or documentation of the materials received on the project to the RCE.

Selective watering for vegetation - The quantity of selective watering for vegetation is the amount of water applied as directed by the RCE and is measured in gallons (gal). This is measured by actual gallons

utilized from a water tank equipped with a water meter, or by utilizing a measuring stick and volume tables for the tank, or the number of gallons applied by a pump based on the pump rating and the actual time the pump is operated.

Mowing - The quantity of mowing is the area of ground surface area mowed at the direction of the RCE and is measured by the one-acre (acre) unit, complete and accepted. Separate measurements will be made and added to the quantity for payment each time the area is mowed.

Compost - The quantity of compost is the volume of compost placed on the site as directed by the RCE and is measured by the cubic yard (CY), complete and accepted. The quantity of compost is the actual number of cubic yards measured and placed on site. Furnish invoices or documentation of the materials received on the project to the RCE.

Select Material - The quantity of select material is the volume of select material placed on the site as directed by the RCE and is measured by the cubic yard (CY), complete and accepted. The quantity of select material is the actual number of cubic yards measured and placed on site. The Contractor may elect to base the quantity measured on the loose volume at the point of delivery by scaling and counting the loads, with a deduction of 35% made for shrinkage.

## **1.8 Payment**

Payment for the accepted quantity for each pay item, measured in accordance with this Specification, is determined using the Contract unit bid price for the applicable pay item. The payment includes all direct and indirect costs and expenses necessary to complete the work.

Payment for Permanent Cover is located in section 1.2.5

Payment for Permanent Grassing for Non Permitted Resurfacing Projects is located in section 1.3.5

Payment for Temporary Cover by Mulch is located in section 1.4.1.2

Payment for Temporary Cover by Seeding is located in section 1.4.2.5

Agricultural Lime - Payment for agricultural granular lime is full compensation for furnishing and applying lime as specified or directed and includes all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, Specifications, and other terms of the Contract.

Granular Fertilizer - Payment for granular fertilizer is made for each of the three fertilizer components (nitrogen, phosphoric acid, and potash). Payment for granular fertilizer is full compensation for furnishing and applying fertilizer as specified or directed and includes all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, Specifications, and other terms of the Contract.

Mulch - Payment for mulch (straw or hay with tackifier and HECF Type 1,2,3, and 4) is full compensation for furnishing and applying mulch, as specified or directed, and includes all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, Specifications, and other terms of the Contract. If applicable, the installation must be accepted and certified by the manufacturer's representative or RCE prior to payment. When a higher level of mulch is applied than that specified on the Plans, Specifications, and other terms of the Contract, payment is for the mulch specified.

Selective Watering for Vegetation - Payment for selective watering for vegetation is full compensation for furnishing and applying water as specified or directed by the RCE and includes all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, Specifications, and other terms of the Contract.

Mowing - Payment for mowing is full compensation for mowing vegetation to an acceptable height in areas specified or directed and includes all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, Specifications, and other terms of the Contract. No adjustments in unit price will be made in case of overruns or under runs of this item.

Compost - Payment for compost is full compensation for furnishing and placing compost as directed by the RCE and includes all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, Specifications, and other terms of the Contract.

Select Material - Payment for select material is full compensation for furnishing and placing select material as directed by the RCE and includes all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, Specifications, and other terms of the Contract.

Payment for each item includes all direct and indirect costs and expenses required to complete the work. Payment will be made under a bid item number per Table 5.

**TABLE 5: BID ITEM NUMBER**

<b>Bid Item Number</b>	<b>Description</b>	<b>Units</b>
8100100	Permanent Cover	ACRE
8100102	Permanent Grassing for Non Permitted Resurfacing Projects	ACRE
8100200	Temporary Cover by Seeding	ACRE
8101100	Select Material	CY
8101105	Compost	CY
8101110	Straw or Hay Mulch with Tackifier	ACRE
8104005	Fertilizer (Nitrogen)	LB
8104010	Fertilizer (Phosphoric Acid)	LB
8104015	Fertilizer (Potash)	LB
8105005	Agricultural Granular Lime	LB
8109050	Selective Watering	GAL
8109901	Mowing for Seeding	ACRE
8151151	Turf Reinforcement Matting (TRM) Type 1	SY
8151152	Turf Reinforcement Matting (TRM) Type 2	SY
8151153	Turf Reinforcement Matting (TRM) Type 3	SY
8151150	Temporary Erosion Control Blanket (ECB)	SY
8151201	Hydraulic Erosion Control Product (HECP) Type 1	ACRE
8151209	Hydraulic Erosion Control Product (HECP) Type1 as Tracer under RECP	ACRE
8151202	Hydraulic Erosion Control Product (HECP) Type 2	ACRE
8151203	Hydraulic Erosion Control Product (HECP) Type 3	ACRE
8151204	Hydraulic Erosion Control Product (HECP) Type 4	ACRE
8152006	Inlet Structure Filter Type F - Non-Weighted (Slope Interruption Devices)	LF

## SILT FENCE SYSTEMS

SCDOT Designation: SC-M-815-2 (7/18)

### 1.0 Silt Fence Systems

This Supplemental Specification replaces Sections 815.2.5 and 815.4.6, *Silt Fences*, Section 815.2.12, *Steel Posts*, and Sections 815.5 and 815.6 for silt fence in the *South Carolina Department of Transportation Standard Specifications for Highway Construction*, 2007 Edition.

#### 1.1 Description

Silt fence systems are used as a temporary perimeter control around sites where there will be soil disturbance due to construction activities. Silt fence systems consist of filter fabric stretched across posts. The lower edge of the fence is vertically trenched into the ground and covered by compacted backfill.

#### 1.2 Materials

Provide material for silt fence systems complying with the requirements specified herein, on the Plans, on details, or as approved by the Resident Construction Engineer (RCE).

##### 1.2.1 Geotextile Filter Fabric and Steel Post System

This silt fence system is composed of geotextile filter fabric and steel posts.

##### 1.2.1.1 Steel Posts

Furnish steel posts meeting the following minimum physical requirements:

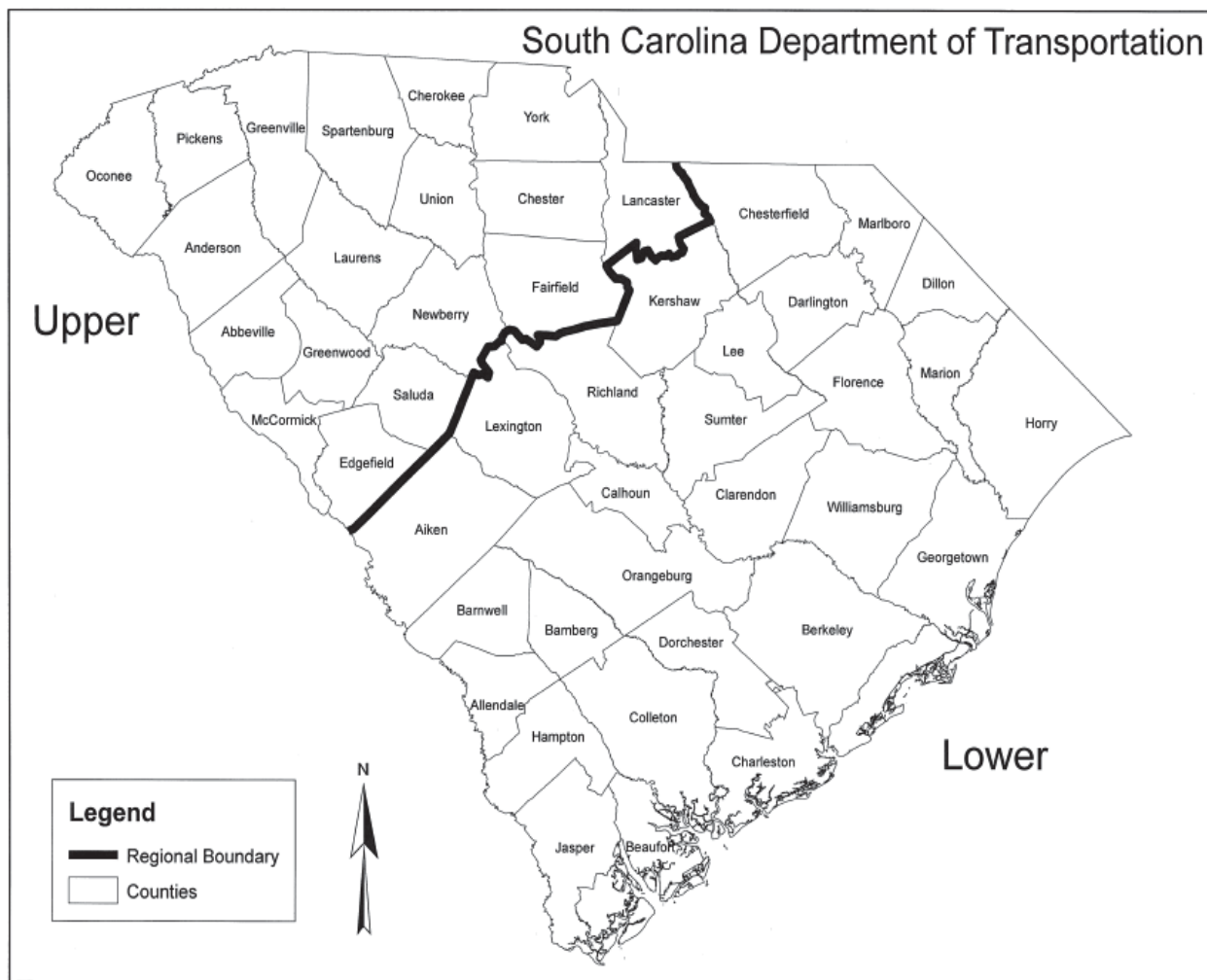
- Minimum length of 5 feet.
- Composed of high strength steel with minimum yield strength of 50,000 psi.
- Standard “T” section with a nominal face width of 1.38 inches and nominal “T” length of 1.48 inches.
- Weighs 1.25 pounds per foot ( $\pm 8\%$ ).
- Painted with a water based baked enamel paint.
- Has a soil stabilization plate made of 15-gauge steel with a minimum cross section area of 17 square inches attached for the Lower State.

Use steel posts with the addition of a metal soil stabilization plate welded near the bottom in the Lower State. A soil stabilization plate is not required in the Upper State. The Lower State consists of all counties east of and including Aiken, Lexington, Richland, Kershaw, and Chesterfield Counties. The Upper State consists of all counties west of the Lower State, i.e. all the remaining counties (see Figure 1). When the post is driven to the proper depth, the plate will be below the ground level for added stability. Attach soil stabilization plates to the steel posts according to Table 1.

**Table 1: Soil Stabilization Plate Requirements**

Post Length (feet)	Top of Soil Stabilization Plate Relative to Bottom of Steel Post (inches)
5.0 and 5.5	13.0
6.0, 6.5, and 7.0	15.25
8.0	17.5
10.0	19.5

FIGURE 1: UPPER AND LOWER STATE MAP



### 1.2.1.2 Geotextile Filter Fabric

Provide a geotextile filter fabric from the most recent edition of *SCDOT Qualified Product List 34*. Ensure that the filter fabric is composed of fibers consisting of long chain synthetic polymers composed of at least 85% by weight of polyolefins, polyesters, or polyamides. Ensure that the fibers are formed into a network so that the filaments or yarns retain dimensional stability relative to each other. Do not treat or coat the filter fabric with materials which might adversely alter its physical properties after installation. Do not use fabric with defects or flaws that significantly affect its physical and/or filtering properties. Provide a filter fabric with a minimum roll width of 36 inches.

Protect the filter fabric with a suitable wrapping for protection against moisture and extended ultraviolet exposure before placement.

Provide geotextile filter fabric meeting the minimum physical requirements of Table 2.

**Table 2: Minimum Geotextile Filter Fabric Performance and Physical Requirements**

Physical Property*	Test Method	Required Value
Filtering Efficiency Performance	ASTM D 5141 or Equivalent	80% Total Suspended Solids (TSS)
Clean Water Flow Rate	ASTM D 4491	4 gal/min/ft <sup>2</sup> Minimum
Tensile Strength	ASTM D 4632	90 lbs
Ultraviolet Stability (retained strength after 500 hrs of ultraviolet exposure)	ASTM D 4355	70%

\*Unless otherwise indicated, numerical values represent the MARV.

1.2.2 Belted Silt Retention and Wood Post System

This silt fence system is composed of belted silt retention fabric (BSRF) filter fabric and wood posts.

1.2.2.1 Wood Posts

Furnish wood posts meeting the following minimum physical requirements:

- Minimum length of 4 feet.
- Composed of a hardwood such as oak. Pine wood posts are not acceptable.
- Rectangular in shape with a minimum dimension of 1¼ inches by 1¼ inches.
- Has a 2-foot long, 1-inch wide, 3/8-inch thick bonding strip applied to secure the fabric to each wood post.

1.2.2.2 Belted Silt Retention Fabric (BSRF) Filter Fabric

Provide a BSRF fabric that is a spunbond polyester material with a fiberglass scrim or net sandwiched in between the layers. Ensure that the fabric is free of any treatment or coating that might adversely alter its physical properties after installation. Do not treat or coat the filter fabric with materials which might adversely alter its physical properties after installation. Do not use fabric with defects or flaws that significantly affect its physical and/or filtering properties. Provide a filter fabric with a minimum roll width of 36 inches.

Provide a BSRF filter fabric meeting minimum physical requirements of Table 3.

**Table 3: Minimum BSRF Filter Fabric Performance and Physical Requirements**

Physical Property*	Test Method	Required Value
Filtering Efficiency Performance	ASTM D 5141 or Equivalent	80% Total Suspended Solids (TSS)
Tensile Strength	ASTM D 4632	90 lbs
Ultraviolet Stability (retained strength after 500 hrs of ultraviolet exposure)	ASTM D 4355	70%

\*Unless otherwise indicated, numerical values represent the MARV.

### 1.3 Construction Requirements

#### 1.3.1 Installation

Construct the silt fence system in accordance with the Plans, *SCDOT Standard Drawing 815-605-00* or latest revision, or as approved by the RCE. Install the silt fence system before major construction in an area is started.

Install the fence perpendicular to the direction of flow at the proper distance from the toe of steep slopes to provide sediment storage and access for maintenance and cleanout.

**Table 4: Silt Fence Installation Dimensions**

Height of Fill (ft)	Fill Slope	Minimum Silt Fence Offset from Toe of Slope (ft)	Minimum Right of Way Offset From Toe of Slope (ft)	Check Length (ft)**
< 6	2:1 to 6:1	2	3	2
6-10	2:1	12*	13*	5
	3:1	7*	8*	4
	4:1	5*	6*	3
	5:1 or 6:1	3	4	3
> 10	2:1	12*	13*	5
	3:1	8*	9*	5
	4:1	6*	7*	4
	5:1 or 6:1	4	5	4

\* These minimum offsets may be reduced when curb and gutter or some other feature reduces the flow of water down the slope. The smaller offsets of each group of height of fill cannot be reduced.

\*\*Silt fence checks will have a maximum length of 5 feet or until they tie back into the slope.

##### 1.3.1.1 Geotextile Filter Fabric and Steel Post System

1. Install steel posts to a minimum depth of 2 feet. Posts should protrude 1 to 2 inches minimum above the fabric, but no more than 3 feet of the post should protrude above the ground. Space steel posts on a maximum of 6-foot centers.
2. Attach fabric to the steel posts using heavy-duty plastic ties that are evenly spaced and placed in a manner to prevent sagging or tearing of the fabric. In all cases, ties should be affixed in no less than 4 places.
3. Install the fabric to a minimum height of 24 inches above the ground. When necessary or as directed by the RCE, the height of the fence above ground may be greater than 24 inches.

In areas where conditions warrant, larger steel posts or reduced post spacing may be required to provide an adequate fence to handle the stress from sediment loading.

In tidal areas, extra silt fence height may be required. The minimum steel post length will be twice the exposed post height. Steel post spacing will remain the same and extra height fabric will be 4, 5, or 6 feet depending upon average tidal change.

When placing fabric by hand, excavate a trench approximately 6 inches wide and 6 inches deep and place 12 inches of geotextile fabric into the 6 inch deep trench, extending the remaining 6 inches towards the upslope side of the trench. Backfill the trench with soil or gravel and compact. Bury 12 inches of fabric into the ground when pneumatically installing silt fence with a slicing method.



Purchase geotextile fabric in continuous rolls and cut to the length of the barrier to avoid joints. When joints are necessary, wrap the fabric together at a support post with both ends fastened to the post, with a 6-inch minimum overlap. A 12-inch minimum overlap is required in tidal areas.

Install silt fence checks every 100 feet at a maximum and at low points.

#### 1.3.1.2 Belted Silt Retention Fabric and Wood Post System

1. Install the wood posts into the ground to a minimum depth of 24 inches while allowing a minimum of 24 inches of BSRF fabric to be left above the ground. Space the wood posts on a maximum of 4-foot centers.
2. Tightly stretch the BSRF fabric along the inside 1¼-inch dimension of the wood post and attach the BSRF fabric to the wood post with a 2-foot long, 1-inch wide, 3/8-inch thick bonding strip with 1½-inch by ½-inch staples. The strip is used to tightly bond the fabric to the support post, preventing tear-down from the top and adds linear support by stabilizing the fabric. Use 4 staples to secure the BSRF fabric to the hardwood post.
3. Install the BSRF fabric at a minimum height of 24 inches above the ground. When necessary, the height of the fabric above ground may be greater than 24 inches.

In tidal areas, extra silt fence height may be required. The minimum wood post length will be twice the exposed post height. Wood post spacing will remain the same and extra height fabric will be 4, 5, or 6 feet depending upon average tidal change.

When placing BSRF fabric by hand, excavate a trench approximately 6 inches wide and 6 inches deep and place 12 inches of the BSRF fabric into the 6-inch deep trench, extending the remaining 6 inches towards the upslope side of the trench, backfill the trench with soil or gravel and compact. Bury 12 inches of BSRF fabric into the ground when pneumatically installing silt fence with a slicing method.

Purchase BSRF fabric in continuous rolls and cut to the length of the barrier to avoid joints. When joints are necessary, wrap the fabric together at a support post with both ends fastened to the post, with a 6-inch minimum overlap. A 12-inch minimum overlap is required in tidal areas.

#### 1.3.2 Inspection and Maintenance

Inspect the silt fence system every 7 days. Immediately correct any deficiencies. Check for sediment buildup and fence integrity. Check where runoff has eroded a channel beneath the fence, or where the fence has sagged or collapsed by fence overtopping.

Remove fabric and replace whenever it has deteriorated to such extent that it reduces the effectiveness of the silt fence system. In addition, review daily the location of silt fence systems in area where construction activities have changed the natural contour and drainage runoff to ensure that the silt fence systems are properly located for effectiveness. Install additional silt fence systems as directed by the RCE where deficiencies exist.

Maintain the silt fence system until its capacity has been reached or erosion activity in the area has been stabilized. Remove sediment accumulated along the fence when it reaches approximately one-third the height of the fence, especially if heavy rains are expected. Remove trapped sediment or stabilize on site.

If a silt fence system or portion of fence is located in an area where removing the sediment is not possible, install a second silt fence, if necessary, at the direction of the RCE. In this case, payment for both silt fence systems and portions involved is made at the unit price for silt fence systems.



Remove the silt fence system within 30 days after final stabilization is achieved or after temporary Best Management Practices (BMPs) are no longer needed. Permanently stabilize disturbed areas resulting from silt fence system removal. The fence material remains the property of the contractor and may be used in other locations provided the materials meet the appropriate requirements contained in this Specification and/or on the Plans.

### 1.3.3 Acceptance

The RCE will approve all silt fence system installations.

## 1.4 Measurement

Silt Fence System - The quantity of the silt fence system is the length of silt fence system installed and maintained and is measured by the linear foot (LF) of silt fence system in-place, complete and accepted.

Silt Fence Extra Height - The quantity of silt fence extra height is the length of extra height silt fence installed and maintained and is measured by the linear foot (LF) in-place, complete and accepted.

Removal of Silt Retained by Silt Fence System - The quantity for the removal of silt retained by silt fence system is the length of silt fence system in front of which silt deposit was removed as ordered by the RCE and is measured by the linear foot (LF) along the line of silt fence system, complete and accepted.

Repair/Replace of Silt Fence System - The quantity for the repair/replace of silt fence system is the length of silt fence system repaired or replaced because of failure of the silt fence system not the fault of the contractor and is measured by the linear foot (LF) along the line of silt fence system, complete and accepted.

## 1.5 Payment

Silt Fence System - Payment for silt fence systems is full compensation for installing silt fence systems as specified or directed and includes furnishing, placing, maintaining, inspecting, removing, and disposing of silt fence systems, providing filter fabric, posts, and ties or staples, and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.

Silt Fence Extra Height - Payment for silt fence extra height is full compensation for installing extra height silt fence as specified or directed and includes furnishing, placing, maintaining, inspecting, removing, and disposing of extra height silt fence, providing filter fabric, posts, and ties or staples, and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.

Removal of Silt Retained by Silt Fence Systems – Payment for removal of silt retained by silt fence systems is full compensation for removing and disposing of sediment deposits accumulated by silt fence systems as specified or directed and includes all material, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications and other terms of the Contract.

Repair/Replace of Silt Fence System - Payment for replace/repair silt fence systems is full compensation for repairing or replacing damaged or malfunctioned silt fence systems as specified or directed and includes furnishing or repairing filter fabric, posts, ties or staples, and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.

**Table 5: Bid Item Number**

<b>Bid Item Number</b>	<b>Description</b>	<b>Units</b>
8153000	Silt Fence System	LF
8153005	Silt Fence Extra Height	LF
8154050	Removal of Silt Retained by Silt Fence Systems	LF
8153090	Replace/Repair Silt Fence System	LF

# **AquaLINE® WATERPROOF EXPANSION JOINT – SPECIFICATIONS**

## **PART 1 GENERAL**

### 1.01 SCOPE

- A. Provide factory fabricated elastomeric expansion waterproofing joint, to prevent the penetration of water at control, expansion or building joints as indicated on architects/engineers drawings, in new or retrofit installations of potable water structures.

### 1.02 SUBMITTALS

- A. Submit to joint manufacturer drawings indicating location of joint and configurations.
- B. Manufacturers printed literature and installation instructions.

## **PART 2 PRODUCT**

### 2.01 DESCRIPTION

- A. Provide flat, vulcanized waterproofing joint integral with the waterproofing membrane to accommodate movements up to:  $\pm 2"$  [ $\pm 50$  mm] capable of 500% elongation at - 40 °F [- 40 °C] across its length and at all vulcanized points.
- B. All details and connections are factory fabricated by means of vulcanization.
- C. Joint material is to be AquaLINE as supplied by SITURA INC., 1-888-474-8872, batch certified to NSF-61.

## **PART 3 EXECUTION**

### 3.01 INSTALLATION

- A. Install all components of the system in accordance with the manufacturers most recent printed instructions. The system is to be wholly encapsulated in a two component, high viscosity, epoxy resin. Epoxy resin shall be certified for use in potable water.
- B. The epoxy resin is applied to the substrate and the bottom surface of the AquaLINE. The AquaLINE is embedded in to it, by pressing. The top surface of the AquaLINE is then covered by the epoxy resin and allowed to dry. The joint shall not obstruct water flow across its surface and forms a continuous monolithic waterproof barrier

### 3.02 PRECAUTIONS

- A. The applicator must observe the open pot time of the epoxy resin manufacturer

END OF SECTION

## SECTION 210

### FLOWABLE FILL

#### 210.1 Description

- 1 This section contains specifications for materials, equipment, construction, measurement, and payment for the use of flowable fill, its application, materials, proportioning, handling, maintenance, and protection. Flowable fill is a controlled low strength material (CLSM) that can be placed in a self-leveling consistency or in a less flowable state to reduce the fluid pressures exerted by the material. The ultimate unconfined compressive strengths are controlled at specified low levels to maintain the ability to re-excavate and the hardened flowable fill should not exhibit settlement.
- 2 Flowable fill is typically used for routine backfilling for bridge abutments, utility trenches, pipes, catch basins, drop inlets, manholes, etc., bedding and encasement of pipes, filling the voids of abandoned below ground structures including pipelines, culverts, and storage tanks; structural backfilling beneath foundations; and other applications specified by the Plans or by the RCE.

#### 210.2 Materials

- 1 Refer to **SC-M-210** for material requirements.
- 2 If a Foaming Agent is used as an additive to the concrete mix for flowable fill, ensure that it is in conformance with the requirements of ASTM C 869 when tested using ASTM C 796 and is obtained from a source appearing on the most recent edition of *SCDOT Qualified Product List 31*.

#### 210.3 Equipment

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.
- 2 Use equipment specified in **SC-M-210** to transport and place flowable fill.

#### 210.4 Construction

##### 210.4.1 Proportioning of Mixture

- 1 Select mixture proportions given in **SC-M-210**.

##### 210.4.2 Preparation and Placement

- 1 Properly prepare the site before placing flowable fill. Place pipe joints or other utility as normal. Provide at least 6-inch cover of flowable fill above any utility line.

- 2 The RCE will select the appropriate type of mix, as defined in **SC-M-210** for the application at the site. If covering pipes or other items, ensure that the item is sufficiently anchored to prevent floating.
- 3 Protect flowable fill from freezing for a period of 36 hours after placement. Do not place flowable fill when ambient air temperature is below 40°F. Make certain that the temperature of the flowable fill is at least 50°F at the time of delivery.
- 4 Discharge the flowable fill directly from the mixer truck into the space to be filled or by other methods approved by the RCE. Place the mix either in lifts or in full depth as conditions at the site dictate. Compaction of individual layers of flowable fill is not necessary. Construct formed walls or other bulkheads to withstand the hydrostatic pressure exerted by the flowable fill. Block trench ends outside the roadway with sandbags or mounded soil rather than wood or metal forms. When backfilling utilities such as pipe culverts, distribute the flowable fill evenly to prevent any movement of the line.
- 5 The routine use of vibrators is prohibited. If the mix does not self-consolidate, cease placement of the flowable fill material until an acceptable product is provided. Under some conditions, the RCE may allow placement of flowable fill under conditions of rain or standing water. Do not place flowable fill under these conditions without prior approval of the RCE. If the flowable fill placement is not proceeding satisfactorily, the RCE may rescind such approval at any time.
- 6 Once the flowable fill is in the trench, make provision for bleed water that is displaced during the consolidation process to run off and away from the surface of the hardening flowable fill. Do not use plastic sheets as vapor barriers.
- 7 An initial subsidence of  $\frac{1}{8}$  inch per vertical foot of depth of flowable fill is allowed as excess water is displaced. Once the flowable fill hardens, shape the material the following day to allow the patch thickness required by the RCE. Placement of the patch directly on top of the flowable fill is allowed.
- 8 The RCE will determine when full traffic may be allowed on the flowable fill. If it is necessary to return traffic in less than 8 hours, or if there is concern that traffic flow will cause damage to the fill or any structure below, use steel plates to bridge over the hardening flowable fill. If the filled cavity is too wide to bridge, place steel plates on the surface of the hardening flowable fill as soon as it is able to support foot traffic.

#### **210.5 Measurement**

- 1 The quantity for Flowable Fill is the volume of flowable fill furnished and placed as prescribed and is measured by the cubic yard (CY) of flowable fill delivered to the job site and incorporated into the work as shown on the Plans or otherwise directed by the RCE, complete, and accepted.

**210.6 Payment**

- 1 Payment for the accepted quantity for Flowable Fill, measured or determined in accordance with **Subsection 210.5**, is determined using the contract unit bid price for the pay item. Payment is full compensation for furnishing and placing the flowable fill material as specified or directed and includes proportioning, mixing, handling, hauling, placing, maintenance, and protection of the flowable fill; providing admixtures, shoring, and steel plates; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to necessary to complete the work in accordance with the Plans, the Specifications, and other terms of the Contract.
- 2 Payment for this item includes all direct and indirect costs and expenses necessary to complete the work.
- 3 Pay items under this section include the following:

Item No.	Pay Item	Unit
2103000	Flowable Fill	CY

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## Supplemental Technical Specification for

# Flowable Fill

## SCDOT Designation: SC-M-210 (06/11)

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### 1. SCOPE

- 1.1. This work consists of furnishing flowable fill as an alternate to compacted soil as approved by the Resident Engineer. Applications for this material include beddings, encasements, and closures for tanks and pipe, and general backfill for trenches and abutments.

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### 2. REFERENCED DOCUMENTS

- 2.1. SCDOT Standard Specification Section 210
- 2.2. SCDOT Standard Specifications Division 700
- 2.3. SCDOT Qualified Product Lists 1, 3, 5, 6, 28, and 31.

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### 3. SUBMITTALS

- 3.1. Provide mix designs for review to the Structural Materials Engineer at the Office of Materials and Research (OMR) at least 14 days prior to need. Provide copies of mix designs being submitted for review to the Resident Engineer.

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### 4. MATERIALS

- 4.1. Use materials that meet the requirements of Division 700 of the Standard Specifications with the following exceptions:
  - 4.1.1. *Fine Aggregate* – Any clean fine aggregate from an SCDOT-approved source, as shown on Qualified Product List 1, with 100% passing a 3/8 sieve and no more than 15% passing a No. 200 sieve may be used. Other fine aggregate gradations requirements are waived.
  - 4.1.2. *Air Entraining Admixtures* – High air generators or foaming agents as shown on Qualified Product List 31 may be used. Admixtures as given on Qualified Product List 5 are also approved for use in flowable fill.

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### 5. DELIVERY, STORAGE, AND HANDLING

- 5.1. All delivery, storage, and handling requirements are as given in Division 700, except that the revolution counter requirements are waived. Deliver flowable fill using concrete construction equipment. Place flowable fill by chute, pumping, or other methods approved by the Resident Engineer. When placing through water, tremie flowable fill.

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### 6. MIX DESIGN



- 6.1. Flowable fill will consist of a mixture of Portland cement, fly ash, fine aggregate, air entraining admixture, and water. Flowable fill is intended to contain a low cementitious content for reduced strength development.
- 6.2. Flowable fill is available in either Excavatable or Non-Excavatable proportions as specified by the Resident Engineer. The following table lists mix design proportion ranges for both types of flowable fill.

<b>Table 1 – Mix Designs for Flowable Fill</b>			
	<b>Excavatable</b>		<b>Non-Excavatable</b>
	<b>Air Entrained</b>	<b>Non-Air Entrained</b>	
Type 1 Portland Cement*	50-100 lbs/yd <sup>3</sup> **	20-40 lbs/yd <sup>3</sup>	75-150 lbs/yd <sup>3</sup>
Fly Ash	0-600 lbs/yd <sup>3</sup>	250-600 lbs/yd <sup>3</sup>	150-600 lbs/yd <sup>3</sup>
Water	See Note 1.	See Note 1.	See Note 1.
Air***	15-35%	Not applicable	5-20%
28-day Compressive Strength***	150 psi Maximum	150 psi Maximum	150 psi Minimum
Unit Weight (Wet)***	90-100 lbs/ft <sup>3</sup>	Not applicable	100-125 lbs/ft <sup>3</sup>

Note 1. – Select water content as necessary to produce a consistency that will result in a flowable, self-leveling product at the time of placement.

\*Other types of Portland cement meeting the requirements of Division 700 may be used with prior approval of the Structural Materials Engineer.

\*\*When using less than 75 lbs/yd<sup>3</sup> of Portland cement, the combined quantity of Portland cement and fly ash must be at least 100 lbs/yd<sup>3</sup>.

\*\*\*The requirements for air, 28-day compressive strength, and unit weight are for laboratory design only and are not jobsite acceptance requirements.

- 6.3. When low density flowable fill is specified, use an approved high air generator or foaming agent as given in Qualified Product List 31 and the following mix proportions:

<b>Table 2 – Mix Designs for Low Density Flowable Fill</b>	
Type 1 Portland Cement*	60 lbs/yd <sup>3</sup> Minimum
Air**	20-40%
28-day Compressive Strength**	50 to 145 psi
Unit Weight (Wet)**	Less than 90 lbs/ft <sup>3</sup>

\*Other types of Portland cement meeting the requirements of Division 700 may be used with prior approval of the Structural Materials Engineer.

\*\*The requirements for air, 28-day compressive strength, and unit weight are for laboratory design only and are not jobsite acceptance requirements.

Because of its high air content, the ability to pump low density flowable fill while maintaining the required air content is limited. Ensure that the flowable fill supplier is aware of any planned pumping of this material well in advance of placement.

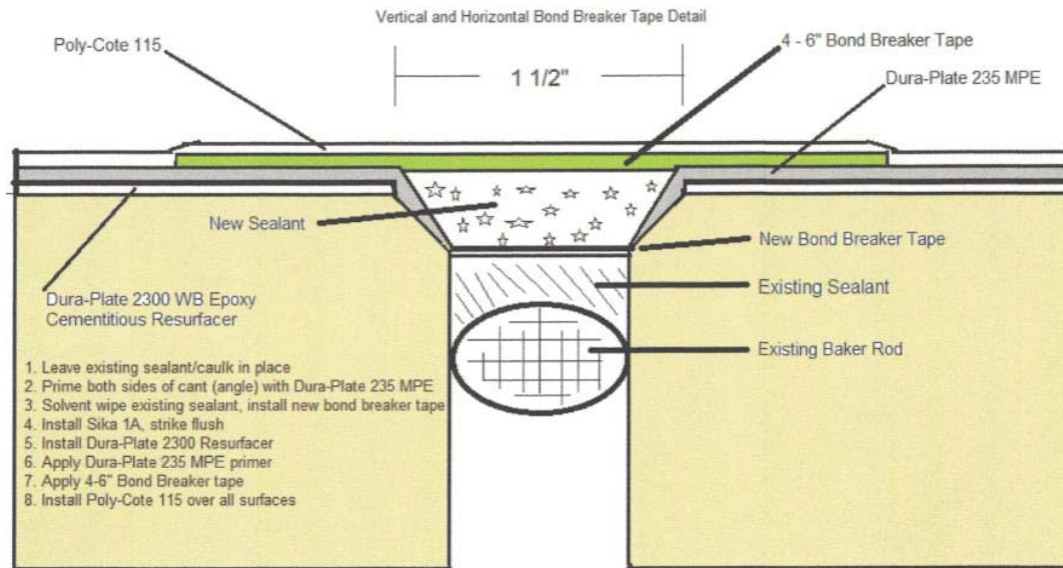
- 6.4. Flowable fill may also be specified as Rapid Set (RS) or Normal Set (NS). A minimum compressive strength of 35 psi is required at 16 hours for Type RS or at 48 hours for Type NS when cured under standard laboratory conditions. Report the laboratory compressive strength at these times as part of the mix design submittal.

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## 7. ACCEPTANCE

- 7.1. Prior to construction, the Structural Materials Engineer at OMR must have appropriately reviewed the mix design.
- 7.2. Furnish a delivery ticket to the Resident Engineer for each load of flowable fill delivered to the work. Ensure that each ticket contains the following information:
  - Project designation
  - Date
  - Time
  - Class and quantity of flowable fill
  - Quantity of water withheld

1. S1.4 Expansion Joint Detail-Base Bid



2. S1.4 Concrete Repair Detail – Base Bid

Repair Procedure:

1. Remove all loose concrete to a sound surface
2. Abrasive blast concrete per [SSPC SP-13/NACE 6 Surface Prep for Concrete](#), rebar per [SSPC SP-10 Near White Blast Cleaning](#). Remove all dust and debris.
3. Add Epoxy-Coated Rebar to ALL existing rebar with 20% or more loss of sectional area.
4. Coat existing rebar with [Sherwin Williams "Copolymer Primer"](#) 2-3 mils DFT.
5. Apply concrete bonding agent recommended from manufacturer of repair mortar
6. Patch Existing Spall with [AW Cook Rapid Cure Vertical Repair Mortar](#) per Manufacturer's specifications.
7. For unreinforced concrete, add the tie wire anchors (At least 2 per patch) and stainless steel tie wire.

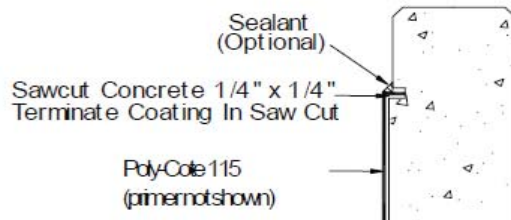
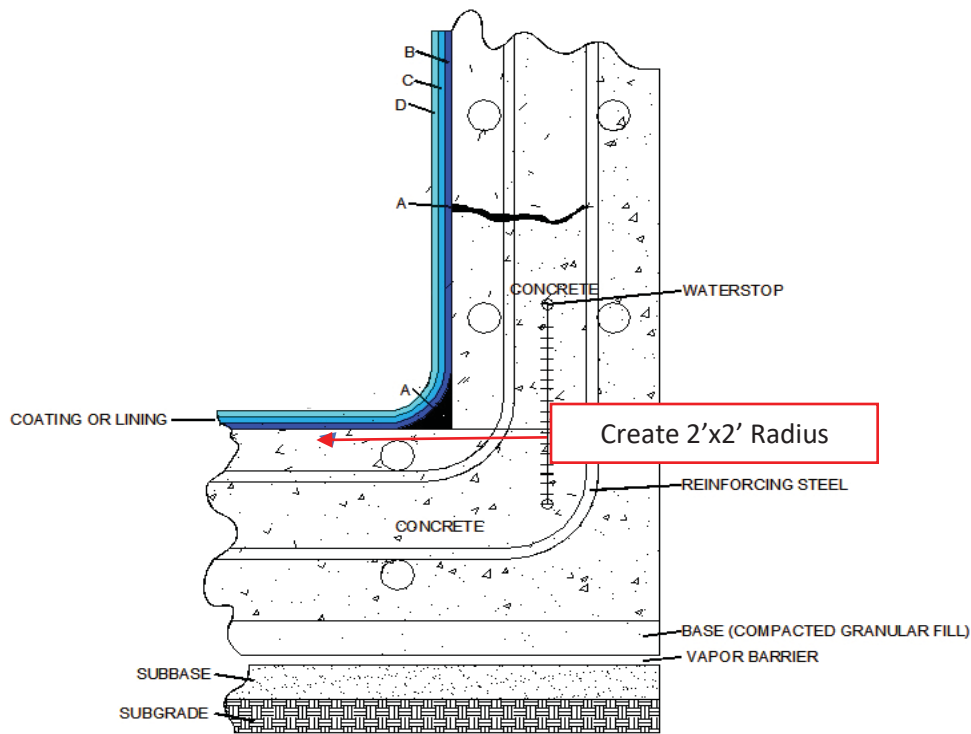
3. S1.4 Emseal "Submerseal" Expansion Joist Detail-No Changes

4. S1.4 Existing Flume Cross Section– Base Bid

Concrete Cove Detail

- A. AW Cook Thin Patch *Cementitious Resurfacer*, for crack repair.
- B. AW Cook Thin Patch to fill bug holes and smooth to plane.
- C. *Macropoxy 5500 LT NSF Epoxy* primer for outgassing \*
- D. Poly-Cote 115 Elastomeric Urethane Lining

\*Note: Dura-Plate 235 MPE may be applied prior to the Steel Seam FT910, but not AW Cemtec Thin Patch



**S1.4 Existing Flume Cross Section-Bid Alternate**

Repair “honey combs” and exposed aggregate smooth to plane with *AW Cook Rapid Cure Vertical Repair Mortar*

Apply Two Coats of Sherwin Williams Hydro Defend Silane SL-40

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**1.00 GENERAL**

**1.01 Scope**

- A. This specification covers the work necessary to furnish and install the Poly-Cote 115 100% solids polyurethane concrete tank lining system complete, as shown on the drawings and as specified herein. Work includes, but is not limited to, the following.
1. Patching compounds, resurfacing compounds, Caulking Penetrations
  2. Surface preparation, and installation of the Poly-Cote 115 Lining System, to include protection of surfaces not to be treated, touch-up, clean-up, and appurtenant work all in accordance with the requirements of the Contract Documents and this Specification.
  3. Surface preparation and protective coating of miscellaneous exposed structural and mechanical metals at the interior of the concrete tank.

**1.02 Related Work Specified in Other Sections**

- A. Section 03300: Cast-in-Place Concrete
- B. Section 03251: Expansion and Construction Joints
- C. Section 07194: Under Slab Vapor Barrier
- D. Section 07200: Exterior Below Grade Waterproofing
- E. Section 07900: Joint Sealants
- F. Section 09900: Painting

**1.03 Referenced Specifications Codes and Standards**

- A. Without limiting the generality of other requirements of these specifications, all work hereunder shall conform to the applicable requirements of the referenced portions of the following documents, to the extent that the requirements therein are not in conflict with the provisions of this Section. All references and standards listed shall be the latest revisions. Joint and individual documents are referenced.
1. SSPC – The Society for Protective Coatings  
40 24<sup>th</sup> Street, 6<sup>th</sup> Floor  
Pittsburgh, PA 15222-4643  
(412) 281-2331
  2. NACE – National Association of Corrosion Engineers  
P.O. Box 218340

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Houston, TX 77218-8340  
(281) 492-0535

- a. SSPC-SP 13/NACE No. 6 Surface Preparation of Concrete
  - b. SSPC-TU 2/NACE 6G197 Design, Installation, and Maintenance of Coating Systems for Concrete Used in Secondary Containment
  - c. SSPC-SP 5/NACE No. 1, White Metal Blast Cleaning
  - d. SSPC-SP10/NACE No. 2, Near White Metal Blast Cleaning
  - e. SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning
  - f. NACE RP0892 "Linings over Concrete for Immersion Service"
  - g. NACE RP0188 "Discontinuity Holiday Testing of Protective Coatings"
  - h. NACE RP 6F-164 "Curing of Interior Tank Linings"
  - i. NACE RP 6F-166 "Recommended Practice for Inspection of Linings on Steel and Concrete"
3. ICRI – International Concrete Repair Institute  
1323 Shepard Dr., Suite D  
Sterling, VA 20164-4428  
(703) 450-0116
- a. Technical Guideline No.03372, "Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays"
  - b. Technical Guideline No. 03731, "Guide for Selecting Application Methods for the Repair of Concrete Surfaces"
  - c. Technical Guideline No. 03741/SSPC-TR 5/NACE Pub 02203, "Design, Installation, and Maintenance of Protective Polymer Flooring Systems for Concrete"
4. ASTM – American Society for Testing and Materials  
100 Barr Harbor Drive  
West Conshohocken, PA 19428-2959  
(610) 832-9585
- a. ASTM F1869 "Standard Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride"
  - b. ASTM E-337: Test Method for Measuring Humidity with a Psychrometer
  - c. ASTM D 4258 "Practice for Surface Cleaning Concrete for Coating"
  - d. ASTM D 4261 "Practice for Surface Cleaning Unit Masonry for Coating"
  - e. ASTM D 4262 "Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces"
  - f. ASTM D 4414 "Standard Practice for Measurement of Wet Film Thickness by Notch Gages"
  - g. ASTM Committee D01.23: Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings

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- h. Using an Ultrasonic Gauge  
ASTM D 4541 "Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers"
  - i. ASTM D 4787 "Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates"
  - j. ASTM D 5162 "Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates"
5. ACI – American Concrete Institute  
Box 19150, Redford Station  
Detroit, Michigan 48219  
(248) 848-3700
- a. ACI 344R-T "Design and Construction of Circular Pre-stressed Concrete Structures with Circumferential Tendons"
  - b. ACI 344R-W "Design and Construction of Circular Wire and Strand Wrapped Pre-stressed Concrete Structures"
  - c. ACI 350R-01 Requirements for Environmental Engineering Concrete Structures
  - d. ACI 350.1 "Testing of Reinforced Concrete Structures for Water Tightness"
  - e. ACI 350.2 "Concrete Structures for Containment of Hazardous Material"
  - f. ACI 503 "Use of Epoxy Compounds with Concrete"
  - g. ACI 504 "Guide to Sealing Joints in Concrete Structures"

**1.04 Submittals**

- A. Submit product data for each component specified including data substantiating that the proposed materials comply with specified requirements, and recommendations by the manufacturer covering all materials.
- B. Samples of the cured system as described in Part 3.03.D to include the following
  - 1. Finish texture as determined by the owner or owners' authorized representative.
  - 2. Stepped samples showing stages of multi-layer applications.

**1.05 Quality Assurance**

- A. Acceptable Manufacturers: The manufacturer of the specified products shall have in existence, for a minimum of five (5) years, a program of training, technically supporting a nationally organized Approved Contractor Program with annual recertification of its participants. Manufacturer must provide five (5) project histories with names, dates, addresses, and phone numbers of contact persons for projects of similar scope, two of which have been completed at least three (3) or more years ago.



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- B. Single Source Responsibility: Provide primers and undercoat materials produced by the same manufacturer, or recommended by manufacturer, for each type of Special Coating / Lining specified to ensure compatibility, and proper chemical and mechanical bond.
  
- C. Installer Qualifications: Engage only factory trained and qualified applicator that has successfully completed applications using specified materials on projects of similar size and scope. Provide references with name, address, and telephone number.
  - 1. Contractor shall be competent in the use of heated plural component equipment, and the specified polyurethane material. Provide written certification from the material manufacturer that the contractor is an approved contractor of the system specified. Contractor must provide proof of at least 5 other projects of a similar nature.
  
- D. Equipment Requirements:
  - 1. Correct material processing equipment is critical in achieving correct mix for the plural component system specified.
  - 2. Equipment must be heated plural component unit capable of consistently producing 4000 psi, at 140°F to 160°F.
  - 3. Acceptable pumps and spray gun: Graco Hydra-Cat. Equivalent application equipment may be substituted and must be approved in writing by Sherwin-Williams Technical Service Group
  
- F. Pre-Installation Conference
  - 1. The contractor, the installation sub-contractor, and the concrete tank tank lining system manufacturer's representative shall meet on site with the owner's representative. Particular emphasis shall be placed on these specifications, safety, weather conditions, surface preparation, material application, and inspection.
  - 2. The contractor shall submit to the owner's representative any revisions or changes agreed upon, reasons thereof, and parties agreeing or disagreeing with them.
  
- E. Substrate Conditions: Do not proceed with work until substrate preparation and tolerances have been approved by the owner's representative, concrete lining system manufacturer's representative, the approved installation sub-contractor, and the contractor.

**1.06 Delivery, Storage, and Handling**

- A. Deliver products to the job site in manufacturer's original, unopened containers bearing manufacturer's name and label and the following information

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1. Product name
  2. Product description (generic product classification)
  3. Manufacturer's lot number
  4. Color
- B. Store materials in sealed original manufacturer's containers. Store materials in a protected area out of direct sunlight. Keep containers clean and undamaged. Adhere to manufacturer's published storage temperature and shelf life recommendations. Protect all materials from freezing.

**2.00 PRODUCTS**

**2.01 Acceptable Manufacturers and Materials**

- A. The Elastomeric Coating and Lining System shall consist of one or more systems for concrete repair and corrosion protection. Products are specified as a standard of quality, and are manufactured by The Sherwin-Williams Company, Cleveland, Ohio.
1. Concrete repair– Designated areas to be treated shall receive application of Sherwin-Williams Steel-Seam FT910 epoxy patching and surfacing compound or appropriate AW Cook Repair Mortars. Thickness shall be sufficient to fill voids and restore the surface to required surface plane. The selection of cementitious or epoxy mortar shall be at the discretion of the contractor to meet the desired requirements of workability and cure time
  2. Stopping Leaks – Infiltration leakage shall be stopped by use of hydraulic cement plugging compound, chemical grouting compound, polyurethane injection resin, structural epoxy injection resin, or a combination of these materials as distributed by Sherwin-Williams Company.
  3. Concrete Crack and Joint Details – Exposed cracks, construction joints, contraction joints, coating system terminations, and isolation joints shall be prepared and detailed in accordance with the attached detail drawings. Should any conditions or joint design be discovered that is not detailed in the attached drawings, the contractor shall notify the owner and consult with the material manufacturer for recommendations.
  4. Miscellaneous Metals Lining System: All interior concrete tank exposed metal surfaces shall receive application of Sherwin-Williams' Poly-Cote 115 polyurethane lining system.
  5. Concrete Lining System: All interior concrete surfaces shall receive application of Sherwin-Williams' Poly-Cote 115 polyurethane lining system. Seamless transition from Floor and Walls.

**2.02 Performance Criteria**

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- A. The concrete tank lining system shall be resistant to the chemical concentrations, temperatures, and duration of exposure, as submitted by the owner or authorized owners' representative.
- B. The concrete lining system shall be resistant to cracking from concrete shrinkage and atmospheric thermal movement at construction joints and contraction joints up to 1/8" at temperatures down to -15° F.

**3.00 EXECUTION**

**3.01 Surface Preparation**

- A. Concrete
  - 1. The NACE/SSPC Joint Surface Preparation Standards for concrete surface preparation are incorporated in and made part of this specification. All references to SSPC-SP-13/NACE No. 6, designate the definitions and other requirements in these documents. The International Concrete Repair Institute (ICRI) Technical Guideline No. 03732, Guide to Surface Preparation of Concrete to Receive Sealers, Coatings and Polymer Overlays shall be used to visually evaluate the concrete surface profile. .
  - 2. Inspect concrete surface for soundness, flatness, levelness and overall condition. Report any discrepancies to the owner's representative.
  - 3. Create a minimum surface profile for the system specified in accordance with the methods described in ICRI No. 03732 to achieve profile numbers CSP-3 to CSP-5.
  - 4. Following surface preparation, concrete surfaces shall be tested for moisture vapor emissions in accordance with ASTM F1869, Standard Method for Measuring Moisture Vapor Emission Rate of Concrete Sub-floor Using Anhydrous Calcium Chloride Moisture Emissions Test. Report results to owner's representative and Sherwin-Williams' Industrial & Marine Representative.
  - 5. Stop concrete leaks and infiltration at cracks and joints by use of hydraulic cement, chemical grout, polyurethane injection and/or epoxy injection.
  - 6. Concrete Surface Repair: Bug holes, honeycombs and voids
    - a. Areas less than 1/2" deep shall be repaired with Steel-Seam FT910 epoxy patching or AW Cook Thin Patch repair mortar.
    - b. Areas that are greater than 1/2" deep shall be repaired with AW Cook Micro Silica repair mortar.
    - c. Overhead Repairs use AW Cook Rapid Cure Vertical Repair Mortar

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7. Provide a clean, saturated surface dry (SSD) concrete surface with no free standing or moving water, with a minimum surface profile as defined above. All substrates are to be vacuumed, swept and blown down with clean, dry air to remove spent abrasive, dust and other foreign material that might interfere with the adhesion of the primer and lining.

A. Iron and steel Including Ductile Piping

2. **Steel :** Remove all oil and grease form surface by solvent cleaning per SSPC-SP1. Minimum surface preparation is SSPC-SP10 / NACE No. 2, Near White Metal Blast Cleaning. Abrasive blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2-3 mils). Prime any bare steel the same day as it is cleaned and before flash rusting occurs.

**Ductile Iron:** NAPF 500-03-04 Surface Preparations Standard for "Abrasive Blast Cleaning of Ductile Iron Pipe" Before abrasive blast cleaning, deposits of oil or grease shall be removed by the methods outlined in the Standard for Solvent Cleaning or other agreed upon method. the exterior of ductile iron pipe surfaces which, when viewed without magnification, shall result in the surface being free of all visible dirt, dust, loose annealing oxide, loose rust, loose mold coating and other foreign matter. All oils, small deposits of asphalt paint and grease shall have been removed by solvent cleaning (see NAPF 500-03-01). After the entire surface to be coated is struck by the blast media, tightly adherent annealing oxide, mold coating and rust staining may remain on the surface provided they cannot be removed by lifting with a dull putty knife.

- a. Inspect the surfaces to be lined. All holes in the steel surfaces or pits greater than 1/8 inch shall be repaired in accordance with the tank owner's repair procedures.
- b. Remove or grind down all sharp burrs, edges, and weld spatter from all steel that is to be coated. Corners and edges shall be chamfered 1/16" at a 45° angle minimum or rounded to a 1/16" radius (1/8" diameter) minimum. The anchor profile shall be restored by abrasive blasting prior to the application of lining materials.
- c. All substrates are to be vacuumed, swept and blown down with clean, dry air to remove spent abrasive, dust and other foreign material that might interfere with the adhesion of the primer and lining.
- d. The maximum allowable residual salt contamination, as measured with a KTA Scat Kit or equivalent field test method, immediately prior to the application of the first coat is as follows:

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- 5 micrograms per square centimeter (50mg/m<sup>2</sup>) most commodities up to 120°F
  - 2 micrograms per square centimeter (20mg/m<sup>2</sup>) most commodities at 120°F and greater
  - 2 micrograms per square centimeter (20mg/m<sup>2</sup>) for demineralized (deionized, distilled) water
- e. Corrosion pits in the blasted steel shall be filled flush with the substrate with Steel-Seam FT910 epoxy patching and surfacing compound putty/patching and surfacing compound.
- f. Projections and lap joints on welded plates and on riveted plates to be coated shall be filled with Steel-Seam FT910 epoxy patching and surfacing compound putty/patching and surfacing compound in order to smooth out the surface and provide for a smooth transition of the lining over the substrate.

**3.02 Application**

- A. Comply with manufacturers written installation procedures and individual product data sheet application bulletins.
- B. Apply materials in accordance with the following material coverage.

**Concrete Tank Lining System**

<u>Products</u>	<u>Thickness (mils dft)</u>
Primer Concrete- <i>For outgassing</i> : Sherwin-Williams Macropoxy 5500 LT NSF Epoxy.	4-6 mils DFT
Steel- <i>Self Priming to hold Blast Only</i> : Macropoxy 5500 LT NSF Epoxy. <i>Primers to be top coated with 24 hours of application. Apply topcoat when primer still is tacky with no material transfer for optimum inter-coat adhesion.</i>	4-6 mils DFT
<b>Concrete repair/Patching and surfacing compound-<i>Fill voids and bug holes smooth</i></b>	
Steel Seam FT910 Epoxy Resurfacer	As needed
AW Cook Thing Patch, Micro Silica Mortar, Rapid Cure Vertical	As needed
Stopping Leaks- Avanti Polyurethane Grouts	As needed
Corrosion Resistant Caulking- <i>any penetration in the lining that cannot be encapsulated.</i> Poly-Cote 115 Polyurethane Field Repair	As needed
<b>Flexible Coating/Lining</b>	
Concrete: Poly-Cote 115 Aromatic Elastomeric Polyurethane <i>Pin hole Free Finish</i>	70 - 80 mils DFT
Miscellaneous Steel / Ductile Iron: Poly-Cote 115 Aromatic	30 - 35 mils DFT

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Elastomeric Polyurethane

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**3.03 Inspection and Testing**

- A. The owner or owner's authorized representative may require the services of an independent testing laboratory to test the installed system.
- B. If test results indicate noncompliance with the specification, the following corrective action may be required of the contractor
  - 1. Remove non-compliant systems or components.
  - 2. Replace system or components in (1)
  - 3. Assume the testing expenses.
- C. Minimum requirements of the chemical resistant coating/lining system are that it be free of the following
  - 1. Uncured material
  - 2. Inadequate thickness
  - 3. Pinholes
  - 4. Blisters
  - 5. Delamination
  - 6. Foreign matter
  - 7. Unspecified materials

**3.04 Protection**

- A. The Flexible Coating and Lining System shall be protected from damage or detrimental elements during cure and until the time of final acceptance.

SPECIFICATION  
Sections 07 90 00 / 07 95 00

Submerseal by EMSEAL

Preformed, Pre-Compressed, Self-Expanding, Sealant System with Silicone Pre-Coated Surface

Watertight, Primary Seal for Continuous Immersion in Chlorinated, Saline, or Potable Water  
Environments

*\*\*\*Note to Specifier:*

*The Submerseal SYSTEM features 50% total movement capability, dual sealing, a chlorine resistant silicone single-bellow coating, better low temperature flexibility, and improved high temperature stability. It achieves these improvements through EMSEAL's new cellular-acrylic impregnation technology and is free of any asphalt compounds. Additionally, the Submerseal SYSTEM is totally free of wax or wax compounds. Submerseal is installed with non-invasive anchoring, and operates by relieving tension at the bond-line unlike water-bar and caulked joints.\*\*\**

PART 1 – GENERAL

1.01 Work Included

- A. The work shall consist of furnishing and installing waterproof expansion joints in accordance with the details shown on the plans and the requirements of the specifications. Preformed sealant shall be silicone pre-coated, preformed, pre-compressed, self-expanding, sealant system.
- B. Related Work
  - Division 3 - Cast-in-Place Concrete
  - Division 7 - Thermal & Moisture Protection
  - Division 7 - Sealants, Caulking and Waterproofing

1.02 Submittals

- A. General – Submit the following according to Division 1 Specification Section.
- B. Standard Submittal Package – Submit typical expansion joint drawing(s) indicating pertinent dimensions, general construction, expansion joint opening dimensions and product information.
- C. Sample of material is required at time of submittal.
- D. All products must be certified by independent laboratory test report to be free in composition of any waxes or wax compounds using FTIR and DSC testing.
- E. All products shall be certified in writing to be: a) capable of withstanding 150°F (65°C) for 3 hours while compressed down to the minimum of movement capability dimension of the basis of design product (-25% of nominal material size) without evidence of any bleeding of impregnation medium from the material; and b) that the same material after the heat stability test and after first being cooled to room temperature will subsequently self-expand to the maximum of movement capability dimension of the basis-of-design product (+25% of nominal material size) within 24 hours at room temperature 68°F (20°C).

1.03 Product Delivery, Storage and Handling

- A. Deliver products to site in Manufacturer's original, intact, labeled containers. Handle and protect as necessary to prevent damage or deterioration during shipment,

handling and storage. Store in accordance with manufacturer's installation instructions.

#### 1.04 Basis of Design

- A. All joints shall be designed to meet the specified performance criteria of the project as manufactured by: (USA & International) EMSEAL JOINT SYSTEMS, LTD 25 Bridle Lane, Westborough, MA 01581-2603, Toll Free: 800-526-8365. (Canada) EMSEAL, LLC 120 Carrier Drive, Toronto, Ontario, Canada M9W 5R1 Toll Free: 800-526-8365. www.emseal.com
- B. Alternate manufacturers must demonstrate that their products meet or exceed the design criteria and must submit certified performance test reports performed by nationally recognized independent laboratories as called for in section 1.02 Submittals. Submittal of alternates must be made three weeks prior to bid opening to allow proper evaluation time.

#### 1.05 Quality Assurance

- A. The General Contractor will conduct a pre-construction meeting with all parties and trades involved in the treatment of work at and around expansion joints including, but not limited to, concrete, mechanical, electrical, landscaping, masonry, waterproofing, fire-stopping, caulking, flooring and other finish trade subcontractors. All superintendents and foremen with responsibility for oversight and setting of the joint gap must attend this meeting. The General Contractor is responsible to coordinate and schedule all trades and ensure that all subcontractors understand their responsibilities in relation to expansion joints and that their work cannot impede anticipated structural movement at the expansion joints, or compromise the achievement of watertightness or life safety at expansion joints in any way.
- B. Warranty – Manufacturer's standard warranty shall apply.
- C. LEED Building Performance Requirements: The VOC of the silicone must not exceed 50 grams/liter.

### PART 2 – PRODUCT

#### 2.01 General

- A. Provide traffic durable, watertight, expansion joint by EMSEAL Joint Systems for expansion joints and isolation joints in submerged applications. Typical locations include, but are not limited to the following: applications for joints where continuous or intermittent immersion or contact with chlorinated (up to 5ppm), saline, or potable water is planned, over occupied space, construction, and structural expansion joints. System shall perform waterproofing, traffic bearing and movement-accommodation functions as the result of a single installation and without the addition of gutters, vapor barriers, bladders, or other devices suspended beneath or within the system in any way.
- B. Provide Submerseal as manufactured by EMSEAL JOINT SYSTEMS LTD and as indicated on drawings for horizontal-plane expansion joint locations.
- C. Sealant system shall be comprised of three components: 1) cellular polyurethane foam impregnated with hydrophobic 100% acrylic, water-based emulsion, factory coated with chemically resistant, potable water safe silicone per NSF/ANSI Standard 61; NSF Standard 51, FDA Regulation CFR 177.2600; MIL-A-46146; an UL Flame Class 94 HB; 2) field-applied epoxy adhesive primer, 3) field-injected silicone sealant bands.



- D. Material shall be capable as of movements of +25%, -25% (50% total) of nominal material size. Standard sizes from 1/2" (12mm) to 4" (150mm). Depth of seal as recommended by manufacturer.
- E. Silicone coating to be low-modulus silicone applied to the impregnated foam sealant at a width greater than maximum allowable joint extension and which when cured and compressed will form a single bellow.
- F. Submerseal to be installed into manufacturer's standard field-applied epoxy adhesive.
- G. Submerseal is to be installed slightly recessed from the surface such that when the field-applied injection band of silicone is installed between the substrates and the foam-and-silicone-bellow, the system will be essentially flush with the substrate surface.
- H. Select the sealant system model appropriate to the movement, head pressure and design requirements at each joint location that meet the project specification or as defined by the structural engineer of record.
- I. Manufacturer's Checklist must be completed by expansion joint subcontractor and returned to manufacturer at time of ordering material.

## 2.02 Fabrication

- A. Submerseal by EMSEAL must be supplied precompressed to less than the joint size, packaged in shrink-wrapped lengths (sticks).
- B. Directional changes and terminations into horizontal plane surfaces to be provided by factory-manufactured universal-90-degree single units containing minimum 12-inch long leg and 6-inch long leg or custom leg on each side of the direction change or through field fabrication in strict accordance with installation instructions.

## PART 3 – EXECUTION

### 3.01 Installation

- A. Preparation of the Work Area
  1. The contractor shall provide properly formed and prepared expansion joint openings constructed to the exact dimensions and elevations shown on manufacturer's standard system drawings or as shown on the contract drawings. Deviations from these dimensions will not be allowed without the written consent of the engineer of record.
  2. The contractor shall clean the joint opening of all contaminants immediately prior to installation of expansion joint system. Repair spalled, irregular or unsound joint surfaces using accepted industry practices for repair of the substrates in question. Remove protruding roughness to ensure joint sides are smooth. Ensure that there is sufficient depth to receive the full depth of the size of the Submerseal being installed. Refer to Manufacturers Installation Guide for detailed step-by-step instructions.
  3. No drilling, or screwing, or fasteners of any type are permitted to anchor the sealant system into the substrate.
  4. System to be installed by qualified sub-contractors only according to detailed published installation procedures and/or in accordance with job-specific installation instructions of manufacturer's field technician.

3.02 Clean and Protect

- A. Protect the system and its components during construction. Subsequent damage to the expansion joint system will be repaired at the general contractor's expense. After work is complete, clean exposed surfaces with a suitable cleaner that will not harm or attack the finish.

END OF SECTION