SECTION 35 31 19.20

UNIFORM SECTION MAT

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Engineer's Seal

Digital Signature

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SECTION 35 31 19.20

UNIFORM SECTION MAT

PART 1 - GENERAL

1.01 SCOPE

A. Surface Preparation

B. Supplying labor, equipment, and materials for the preparation of the soil-cement surface to receive the filter point mat overlay. The extents of the filter point mat overlay shall be as shown on the Drawings. Surface preparation involves initial cleaning to remove any sediments, vegetation, and/or loose debris using hand tools or low-pressure washing (above the water level) and suction dredging (below the water level); followed by pressure washing with a medium-pressure water jet. Alternative means for surface preparation can be proposed by the Supplier, subject to approval by the Owner's Representative. Disposal of dredge sediments using best practices to maintain turbidity levels within the specified range should also be considered part of this Specification.

C. Excavation and Backfill of Bottom Key Trench

Supplying labor, equipment, and materials for the underwater excavation of a key trench along the upstream embankment toe as shown on the Drawings. Disposal of excavated soils and sediments using best practices to maintain turbidity levels within the specified range should also be considered part of this Specification.

D. Excavation and Backfill of Side Key Trench

Supplying labor, equipment and materials for the above water and underwater excavation of a key trench along the sides of the proposed USM overlay as shown on the Drawings. Disposal of excavated soils and sediments using best practices to maintain turbidity levels within the specified range should also be considered part of this Specification.

E. Excavation and Backfill of Top Key Trench

Supplying labor, equipment, and materials for the excavation of a key trench at the base of the slope transition of the proposed USM overlay and at the top of slope as shown on the Drawings. Disposal of excavated soils and sediments using best practices to maintain turbidity levels within the specified range should also be considered part of this Specification.

F. Fabric Formed Concrete Revetment Uniform Section Mat (USM)

The work shall consist of furnishing all labor, materials, equipment, and incidentals required and performing all operations in connection with the installation of the fabric formed concrete revetment in accordance with the lines, grades, design, and dimensions shown on the Contract Drawings and as specified herein.

The work shall consist of installing the specially woven, double-layer synthetic fabric form on the prepared sub-grade and filling it with a pumpable fine aggregate concrete to the required thickness, weight, and configuration.

The contractor shall provide proof of adequate experience in the installation, fabrication,

and pumping of the fabric formed concrete revetments. Contractors without adequate experience may utilize the services of a "Manufacture's Representative" to provide on-site technical assistance.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

A.1 Concrete

- ASTM C 31: Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- ASTM C 109: Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or (50 mm) Cube Specimens).
- ASTM C 42: Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- ASTM C 150: Standard Specification for Portland Cement.
- ASTM C 260: Standard Specification for Air-Entraining Admixtures for Concrete.
- ASTM C 494: Standard Specification for Chemical Admixtures for Concrete.
- ASTM C 618: Standard Specification for Coal Fly Ash and Calcined Natural Pozzolan for Use in Concrete.
- ASTM C 685: Standard Specification for Concrete Made by Volumetric Batching.
- ASTM D 6449: Standard Method for Flow of Fine Aggregate Concrete for Fabric Formed Concrete.

A.2 Fabric Form Material

- ASTM D 3786: Standard Test Method for Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method.
- ASTM D 4491: Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
- ASTM D 4533: Standard Test Method for Trapezoidal Tearing Strength of Geotextiles.
- ASTM D 4595: Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
- ASTM D 4632: Test Method for Breaking Load and Elongation of Geotextiles (Grab Method).
- ASTM D 4751: Test Method for Determining Apparent Opening Size for a Geotextile.
- ASTM D 4884: Test Method for Seam Strength of Sewn Geotextiles.
- ASTM D 5199: Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes.
- ASTM D 5261: Test Method for Measuring Mass per Unit Area of Geotextiles.
- ASTM D 6241: Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 2-inch [50-mm] Probe.

1.03 APPLICABLE PUBLICATIONS

A. Safe Diving Practices and Operations Manual

B. Association of Diving Contractors International Regulations and Guidelines

C. Occupational Safety and Health Administration, 29 CFR Part 1910, Subpart T Commercial Diving Operations

1.04 DEFINITIONS (NOT USED)

1.05 SUBMITTALS

A. All proposals and submissions by the Supplier and all responses by the Owner's Representative shall be in writing. Acceptance of the Supplier's proposals and submissions by the Owner's Representative shall not relieve the Supplier of his responsibility for the work as defined by the Contract.

B. The Supplier shall submit a detailed Surface Preparation Plan for review and approval to the Owner's Representative prior to beginning work. The plan shall include detailed information of the equipment to be used, surface preparation procedures, and disposal of the debris and sediments.

C. The Supplier shall submit a detailed excavation plan for review and approval to the Owner's Representative prior to beginning work. The plan shall include detailed information on the equipment to be used, excavation methods, and means/methods for the disposal of the excavated materials based on the type of excavation as well as the disposal location.

D. Fabric Formed Concrete

Furnish the manufacturer's certificates of compliance for the fabric formed concrete revetments as specified in this document. Also furnish the manufacturer's specifications, literature, installation manuals, and submittal drawings for the layout of the mats, and any recommendations, if applicable, that are specifically related to the project.

Alternative fabric formed concrete revetment materials may be considered. Such materials must be pre-approved in writing by Engineer prior to the bid date. Material testing reports must be prepared by a certified geotextile laboratory attesting to the alternative fabric material's compliance with this Specification. Material laboratory testing shall have been performed within ninety (90) days of bid date.

The contractor shall submit the fabric form Manufacturer's certificate that the supplied fabric forms meet the criteria of these Specifications, as measured in full accordance with the test methods and standards referenced herein. The certificates shall include the following information about each fabric form delivered:

Manufacturer's Name and Current Address
Full Product Name
Style and Product Code Number Composition of Yarn(s)
Manufacturer's Certification Statement

Submit a fine aggregate concrete mix design in accordance with this specification for approval by the Engineer.

Submit a layout plan for the fabric formed sections and seam attachments.

E. The Plan for all work shall include a detailed Job Hazard Assessment (JHA), with separate assessments for under water work.

1.06 QUALIFICATIONS (NOT USED)

1.07 RESPONSIBILITIES

A. The Supplier shall provide a full-time coordinator who shall be present at all times during the performance of the work and who shall be experienced in the procedures involved in this task.

B. The Supplier is responsible for performing the work described herein in accordance with all applicable regulations, adhering to the diving safety procedures, and monitoring plan.

C. The Supplier is responsible for obtaining any necessary environmental permits and conducting any necessary compliance monitoring.

D. The Supplier is responsible for disposal of the soils/sediments excavated from the trench at a location approved by the Owner's Representative.

E. The Owner's Representative will identify soil/sediment acceptable disposal areas within the project site.

F. The Supplier is responsible for providing, installing, and maintaining turbidity barriers in accordance with the Specifications.

G. The Supplier is responsible for taking all necessary precautions to minimize undermining of the toe of the embankment and soil-cement revetment during the excavation of the toe trench and construction of the USM key.

H. The Supplier is responsible for taking all necessary precautions to minimize undermining of the soil-cement revetment during the excavation of the side key trench and construction of the USM key.

I. The Supplier is responsible for taking all necessary precautions to minimize undermining of the soil-cement revetment or damage to the existing steepened upper slope during the excavation of the mid key trench and construction of the concrete key.

J. The Supplier is responsible for saw cutting the existing asphalt surface and some base material to create a clean edge for construction of the top key trench to the dimensions and grades shown on the Drawings.

K. The Supplier is responsible for providing, installing, and maintaining turbidity barriers during the excavation of the trench and disposal of the soils/sediments.

1.08 CERTIFICATIONS AND TESTING (NOT USED)

1.09 INSPECTION COORDINATION

A. The Supplier shall provide access to the Work for the Owner's Representative continually as required for inspection and testing.

1.010 QUALITY ASSURANCE

A. Manufacturer of the fabric formed concrete revetment material shall have been regularly engaged in the design and manufacturing of the fabrics, and whose product has proven reliability in similar service.

1.011 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.01 GEOTEXTILE CONTAINERS (GEOTUBES)

A. If the excavation procedures involve the use of suction dredging with containment of the solids from the dredge slurry using geotubes, the Supplier is responsible for the adequacy of the geotubes.

B. Geotubes should be designed such that they have adequate permeability to accommodate the slurry flow while containing the dredged solids, and sufficient strength to withstand the pressures during filling and the anticipated stresses from handling once filled.

2.02 FABRIC FORMS

A. The fabric forms for casting concrete revetments shall be as specified, ARMORFORM® Uniform Section Mat (USM) as manufactured by Carolina Yarn and Fabrics, LLC, or approved equal.

B. The ARMORFORM® Uniform Section Mat (USM), designated as USM on the drawings, will indicate the fabric designation required from the choice of fabric styles shown in **Table 1** below.

C. The ARMORFORM® Uniform Section Mat (USM) shall be woven in such a manner as to provide interwoven spacer cords of uniform length to form a concrete lining of the specified average thickness. The cords shall be interwoven between the two layers of fabric, in parallel pairs, so that the two (2) cords together in the top layer and two (2) cords together in the bottom layer cross between layers at drop points. When pumped, the USM will have a comparatively uniform section with a cobblestone pattern surface appearance.

TABLE 1

ARMORFORM® Uniform Section Mat (USM)

Style	Nominal Thickness (in)	Avg. Unit Weight (lb./ft^2)	Concrete Coverage (ft^2/cy)
8USM	8.0	93	36

D. The fabric forms shall be composed of synthetic yarns formed into a woven fabric. Yarns used in the manufacture of the fabric shall be composed of polyester. Forms shall be woven with a minimum of 50% textured yarns (by weight). Partially oriented (POY), draw-textured, and/or staple yarns shall not be used in the manufacture of the fabric. Each layer of fabric shall conform to the physical, mechanical and hydraulic requirements Mean Average Roll Values listed in **Table 2**. The fabric forms shall be free of defects or flaws which significantly affect their physical, mechanical, or hydraulic properties.

TABLE 2

Property Requirements – ARMORFORM® Fabrics

PROPERTY	TEST METHOD	UNITS	VALUE
PHYSICAL			
Composition of Yarns	-	-	Polyester/ Nylon
Mass Per Unit Area (Double-Layer)	ASTM D 5261	oz/yd^2	14
Thickness (Single-Layer)	ASTM D 5199	mils	27
Mill Width (Woven)		inch	72
MECHANICAL			
Wide-Width Strip Tensile Strength - WARP | FILL	ASTM D 4595	lbs./inch	340|270
Elongation at Break - WARP | FILL -		%	12|12
Trapezoidal Tear Strength - WARP |	ASTM D 4533	lbs.	180|170
Grab Tensile Strength	ASTM D4632	lbf	364|310
Grab Tensile Elongation		%	25|21
CBR Puncture Strength	ASTM D 6241	lbs.	1525
HYDRAULIC			
Apparent Opening Size (AOS)	ASTM D 4751	U.S. Standard (mm)	20
Flow Rate	ASTM D 4491	gal/min/ft^2	125

E. Mill widths of fabric shall be a minimum of 72 inches. Mill width rolls shall be cut to the length required, and the double-layer fabric separately joined, bottom layer to bottom layer and top layer to top layer, by means of sewing thread, to form multiple mill width panels with sewn seams on not less than 68-inch centers.

F. Fabric form panels shall be factory-sewn, by joining together the layers of fabric, top layer to top layer and bottom layer to bottom layer, into predetermined custom sized panels.

Sewn seams shall be downward facing as shown on the Contract Drawings. All sewn seams and zipper attachments shall be made using a double line of U.S. Federal Standard Type 401 stitch. All seams sewn shall be not less than 100 lbf/inch when tested in accordance with ASTM D 4884.

G. Baffles shall be installed at predetermined mill width intervals to regulate the distance of the lateral flow of fine aggregate concrete. The baffles shall be designed to maintain a full concrete lining thickness along the full length of the baffle. The baffle material shall be nonwoven filter fabric. The grab tensile strength of the filter fabric shall be not less than 180 lbf/inch when tested in accordance with ASTM D 4632.

H. Where groundwater conditions require provision for relief of hydrostatic uplift, 7/8" I.D. weep tube assemblies shall be inserted through the fabric. These weep tube assemblies shall be held in place during grout injection by means of a snap on collar attached to the lower end of the weep tube assembly. If the revetment has not been placed over a geotextile filter cloth, the lower end of the weep tube assembly shall be covered with a piece of filter cloth. The weep tube assemblies shall be located as called for on the plans.

I. The fabric forms shall be kept dry and wrapped such that they are protected from the elements during shipping and storage. If stored outdoors, they shall be elevated and protected with a waterproof cover that is opaque to ultraviolet light.

2.03 FINE AGGREGATE CONCRETE

A. Fine aggregate concrete consists of a mixture of Portland cement, fine aggregate (sand), and water, so proportioned and mixed as to provide a pumpable fine aggregate concrete.

B. The water/cement ratio of the fine aggregate concrete shall be determined by the ready-mix manufacturer, but generally should be on the order of 0.65 to 0.75. The pumping of fine aggregate concrete into the fabric forms causes a reduction in the water content by filtering excess mixing water through the permeable fabric. The reduction of mixing water substantially improves the water/cement ratio of the in-place fine aggregate concrete thereby increasing its strength and durability. With a typical loss of approximately 15% of the total mixing water, 27 ft^3 of pumpable fine aggregate concrete will reduce to approximately 25 ft^3 of hardened concrete.

C. The consistency of the fine aggregate concrete delivered to the concrete pump should be proportioned and mixed as to have a flow time of 9-12 seconds when passed through the ¾- inch orifice of the standard flow cone that is described in ASTM C6449. The water/cement ratio varies with the exact granulometry of the fine aggregate (sand) and should be determined by the ready-mix manufacturer using the above-referenced flow cone.

D. The required minimum 28-day compressive strength (f'c) must be 3,500 psi when specimens are made and tested in accordance with ASTM C109/C109M – 16a. If specimens do not test to strengths above, drilled cores may be obtained and tested in accordance with ASTM C42. The range of fine aggregate concrete mix proportions provided in **Table 3** has been developed under a variety of field conditions.

TABLE 3
Typical Range Mix Proportions

MATERIAL	MIX PROPORTIONS (lbs./yd^3)	MIX PROPORTIONS AFTER PLACEMENT (lbs./yd^3)
Cement	750-850	810-920
Sand	2030-2120	2195-2290
Water	485-555	360-430
Air	As Required	As Required

E. Portland Cement

Portland cement should conform to ASTM C150, Type I, II or V. Pozzolan grade fly ash may be substituted for up to 25% of the cement as an aid to pumpability. (The pumpability of fine aggregate concrete mixes containing coarse sand is improved by the addition of fly ash.) Pozzolan, if used, should conform to ASTM C 618, Class C, F, or N.

F. Fine Aggregate (Sand)

Fine aggregate should consist of suitable clean, hard, strong, and durable natural or manufactured sand. All fine aggregates should conform to ASTM C33. Aggregate gradation should follow **Table 4** below, should be reasonably consistent, and not exceed 3/8 inches in size.

TABLE 4
Fine Aggregate (Percent Passing by Weight)

SIEVE SIZE (in)	MIN	MAX
3/8	100	-
#4	95	100
#16	-	-
#50	35	70
#200	0	5

Fine aggregate failing to meet these grading requirements can be utilized provided that the supplier can demonstrate to the specifier that fine aggregate concrete of the class specified, made with fine aggregate under consideration, will have relevant properties at least equal to those of fine aggregate concrete made with same ingredients, with the exception that the referenced fine aggregate will be selected from a source having an acceptable performance record in similar fine aggregate construction.

G. Water

Water used for mixing and curing should be clean and free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials, or other substances that may be deleterious to concrete.

H. Plasticizing and Air Entraining Admixtures

Grout fluidifier, water-reducing, or set time controlling agents may be used as

recommended by their manufacturers to improve the pumpability and set time of the fine aggregate concrete.

Any air-entraining agent or any other admixture may be used, as approved, by the Engineer- in-charge to increase workability, to make concrete impervious and more durable. Air entraining admixture should conform to ASTM C494 and ASTM C260, respectively. Mixes designed with 5% to 8% air content will improve the pumpability of the fine aggregate concrete, freeze-thaw, and sulfate resistance of the hardened concrete.

2.04 GEOTEXTILE FILTER FABRIC

A. The geotextile filter fabric shall conform to the properties described in **Table 5**.

TABLE 5

Geotextile Filter Fabric Properties

Minimum Permittivity (Sec^{-1}) per ASTM D4491	0.5
Maximum AOS (US Sieve No.) per ASTM D4751	40
Minimum Grab Tensile Strength (lbs.) per ASTM D4632	180
Mass per Unit Area (oz/sy) per ASTM D5261	Provide Test Result
Minimum Puncture Strength (lbs.) per ASTM D6241	223
Minimum Trapezoidal Tear (lbs.) per ASTM D4533	35
Minimum UV Resistance per ASTM D4355 (% Retained Strength)	50% @500 hours

B. The geotextile filter fabrics shall be composed of synthetic fibers or yarns formed into a nonwoven fabric. Fibers and yarns used in the manufacture of filter fabrics shall be composed of at least 85% by weight of polypropylene, polyester, or polyethylene. They shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including selvages. The geotextile shall be free of defects or flaws which significantly affect its mechanical or hydraulic properties.

C. The geotextile filter fabric must be permitted to function properly by allowing relief of hydrostatic pressure; therefore, fine soil particles shall not be allowed to clog the geotextile.

D. The geotextile filter fabric shall be kept dry and wrapped such that they are protected from the elements during shipping and storage. If stored outdoors, they shall be elevated and protected with a waterproof cover that is opaque to ultraviolet light.

PART 3 - EXECUTION

3.01 INITIAL CLEANING

A. The above-water portion of the soil-cement to be rehabilitated shall be cleaned to remove any sediment, vegetation, and loose debris using hand tools or low-pressure washing. If low-pressure washing is used, sufficient time should be allowed for the sediments washed onto the pond water to settle before proceeding with the underwater cleaning.

B. The underwater portion of the soil-cement to be rehabilitated shall be cleaned using suction dredging methods. The dredge slurry should be pumped into a designated settling area identified by the Owner's Representative. The settling area should be enclosed by full depth turbidity curtains. Alternatively, geotextile containers (geotubes) can be used to separate soils/sediments from the dredge slurry. The solids collected in the geotubes can be disposed of outside the Lake at a suitable area identified by the Owner's Representative. The soils shall then be spread within the area enclosed by turbidity barriers in a manner that will minimize the suspension of fines and the development of turbidity.

3.02 PRESSURE WASHING

A. The entire surface of the soil-cement revetment to receive the filter point mat overlay shall be pressure washed with a stream of water under a pressure of 1,000 to 2,000 psi to remove any loose/deteriorated soil-cement, cement-based patches, and/or any deleterious deposits adhered to the soil-cement surface. Care should be exercised to prevent erosion of the sound soil-cement mass.

3.03 SURFACE LEVELING

A. After a 48 hour drying period, any identified areas that are $\geq$0.2' below the adjacent grades shall be brought to grade by placing sand cement mortar as approved by the Engineer.

B. The existing eroded area shall be very slowly filled with a granular soil classified as SP by the USCS soil classification system. Shape to grades shown on Drawings and compact to achieve unyielding surface. Schedule this slope repair area so that it will be stabilized with geotextile fabric and the USM as soon as practical. Supplier shall be responsible for maintaining earthen slope and repairing any erosion of the slope to design grade at no additional compensation.

3.04 TRENCH EXCAVATION

A. The trench shall be sized as needed to allow the construction of a USM key with the minimum dimensions shown in the Drawings.

B. If the trench is excavated using mechanical methods, the excavated soils can be disposed of at the bottom of the Lake, in close proximity to the excavation. The soils shall be spread within the area enclosed by the turbidity barriers in a manner that will minimize the suspension of fines and the development of turbidity.

C. If the trench is excavated using suction dredging methods, the dredge slurry should be pumped into a designated settling area identified by the Owner's Representative. The settling area should be enclosed by full depth turbidity curtains. Alternatively, geotextile containers (geo-tubes) can be used to separate

soils/sediments from the dredge slurry. The solids collected in the geo-tubes can be disposed of outside the Lake at a suitable area identified by the Owner's Representative or deposited at the bottom of the Lake after it is stabilized. If the sediments are deposited at the bottom of the Lake, the Supplier shall remove the geo-tube fabric in its entirety and dispose of it offsite. The soils shall then be spread within the area enclosed by the turbidity barriers in a manner that will minimize the suspension of fines and the development of turbidity.

D. The trench must be founded in well-consolidated soils. Before placement of reinforcement and concrete, the trench shall be cleaned of debris and fine materials that would be subject to settlement.

3.05 TRENCH BACKFILL

A. After the concrete in the USM has set and any formwork removed, the trench shall be backfilled with tremie concrete.

3.06 FABRIC FORMED CONCRETE OVERLAY

A. SITE PREPARATION

Areas on which fabric forms are to be placed shall be prepared as described in the USM Surface Preparation specification.

Excavation and preparation of aprons as well as anchor, terminal, or toe trenches shall be done in accordance with the lines, grades, contours, and dimensions shown on the Contract Drawings.

The terminal edges of the fabric form lining should be keyed into the subgrade to the lines, grades, and dimensions shown on the Contract Drawings.

Immediately prior to placing the filter fabric, the prepared subgrade will be inspected by the Engineer and/or the Owner's 's representative. No fabric or fabric formed concrete revetments will be placed thereon until that area has been approved.

B. PLACEMENT OF GEOTEXTILE FILTER FABRIC

Place geotextile filter fabric in accordance with the lines, grades, and dimensions shown in the Contract Drawings.

At a minimum, the geotextile filter fabric shall be placed directly on the prepared area, in intimate contact with the subgrade, and free of folds or wrinkles. The geotextile filter fabric shall be placed so that the upstream roll of fabric overlaps the downstream roll. The longitudinal and transverse joints will be overlapped at least two (2) feet or shall be field sewn with a minimum overlap of two (2) inches. The geotextile will extend at least one (1) foot beyond the top and bottom concrete lining termination points, or as required by the engineer. Secure geotextile filter fabric to the soil-cement surface as recommended by the manufacturer.

C. PLACEMENT OF FABRIC FORMS

Factory assembled fabric form panels shall be placed over the geotextile filter fabric and within the limits shown on the Contract Drawings. Fabric forms panels are to be placed loosely, without folds, to allow for proper filling with fine aggregate concrete.

When placing panels an allowance for approximately 10% contraction of the form in each direction which will occur as a result of fine aggregate concrete filling. The contractor shall gather and fold the additional slope direction fabric form in the anchor

trench to be secured in such a manner as to be gradually released as fabric forms contract during filling. The contractor shall gather the additional transverse direction fabric form at each baffle for self-release during filling.

Adjacent fabric form panels shall be joined in the field by means of sewing or zippering closures. Adjacent panels shall be joined top layers to top layer and bottom layer to bottom. All field seams shall be made using two lines of U.S. Federal Standard Type 101 stitches. All sewn seams shall be downward facing. All seams sewn in the field shall not be less than 90 lbf/in when tested in accordance with ASTM D4884. Colored thread is advised for all field sewn seams to facilitate inspection.

When conventional joining of fabric forms is impractical or where called for on the Contract Drawings, adjacent forms may be overlapped a minimum of 3 ft to form a lap joint, pending approval by the Engineer. Based on the predominant flow direction, the upstream form shall overlap the downstream form. In no case shall simple butt joints between forms be permitted.

Curves or turns may be accomplished by panels with one or more angled mill widths. Panels with angled mil widths should be carefully prefabricated or field assembled by cutting and sewing the mill widths of the fabric form(s) to obtain true angles and edges.

After the fabric form panels have been positioned, the designated sides of the panes should be folded into the anchor trenches, flank trenches, and toe trenches.

Immediately prior to filling with fine aggregate concrete, the assembled fabric forms shall be inspected by the Engineer, and no fine aggregate concrete shall be pumped therein until the fabric seams have been approved.

D. PLACEMENT OF FINE AGGREGATE CONCRETE

Following the placement of the fabric forms over the geotextile filter fabric, fine aggregate concrete shall be pumped between the top and bottom layers of the fabric form through small slits to be cut in the top layer of the fabric form or manufacturer-supplied valves. The slits shall be of the minimum length to allow proper insertion of a filling pipe inserted at the end of a 2-inch I.D. concrete pump hose. Fine aggregate concrete shall be pumped between the top and bottom layers of fabric, filling the forms to the recommended thickness and configuration.

Beginning at the designated starting point, check and adjust the fabric form panel's seams to assure that they are perpendicular to the longitudinal alignment line. Care should be exercised in the alignment and securing of the first fabric form panel. This will ensure the aesthetics of the concrete lining or mat and will also hasten the installation of subsequent panels. The fabric should be placed loosely at the connection or anchor to allow for contraction in both directions during filling.

A tight seal will be made by wrapping a piece of nonwoven fabric around the pipe. When the pipe is withdrawn, the nonwoven fabric will be stuffed into the hole to provide a temporary closure. When the concrete has stiffened and is no longer fluid, the fabric must be removed, and the concrete surface smoothed by hand.

Fine aggregate concrete shall be pumped in such a manner that excessive pressure on the fabric forms is avoided. Baffles shall be installed by the Manufacturer to facilitate the pumping process by providing a termination point at pre-determined locations within a single fabric formed panel. Cold joints shall be avoided. A cold joint is defined as one in which the pumping of the fine aggregate concrete into a given section of form is

discontinued or interrupted for an interval of forty-five (45) or more minutes.

The sequence of fine aggregate concrete shall be such as to ensure complete filling of the fabric formed concrete lining to the thickness specified by the Engineer. The flow of the fine aggregate concrete shall first be directed into the lower edge of the fabric form and working back up the slope, followed by redirecting the flow into the anchor trench.

Prior to removing the filling pipe from the current concrete lining section and proceeding to the fine aggregate concrete filling of the adjacent lining section, the thickness of the current lining section shall be measured by inserting a length of stiff wire through the lining at several locations from the crest to the toe of the slope. The average of all thickness measurements shall be not less than the specified average thickness of the concrete lining. Should the measurements not meet the specified average thickness, pumping shall continue until the specified average thickness has been attained.

Excessive fine aggregate concrete that has inadvertently spilled on the concrete lining surface shall be removed. The use of a high-pressure water hose to remove spilled fine aggregate concrete from the surface of the freshly pumped concrete lining shall not be permitted.

Foot traffic will not be permitted on the freshly pumped concrete lining when such traffic will cause permanent indentations in the lining surface. Walk boards shall be used where necessary.

After the fine aggregate concrete has set, all anchor, flank, and toe trenches shall be backfilled and compacted flush with the top of the concrete lining. The integrity of the trench backfill must be maintained to ensure a surface that is flush with the top surface of the concrete lining for its entire service life. Toe trenches shall be backfilled as shown on the Contract Drawings. Backfilling and compaction of trenches shall be completed in a timely fashion to protect the completed concrete lining.

E. METHOD OF MEASUREMENT

The fabric formed concrete revetment lining shall be measured by the number of square feet or square yards computed from the lines and cross-sections shown on the Contract Drawings or from payment lines established in writing by the Engineer. This includes fabric forms, fine aggregate concrete, and geotextile filter fabric installed and accepted. This includes the area on the slopes as well as the trenches. Slope preparation, excavation, and backfilling are separate pay items.

END OF SECTION