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PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Work under this SECTION covers requirements for materials, tools, equipment and services necessary to complete the drainage systems for this project. The work shall include, but is not necessarily limited to, completion of the following work:

1. Field engineering
2. Complete installation of all waterways
3. Terraces construction
4. Riprap ditches, ditch construction and riprap placement
5. Pipe outlets
6. Terrace intakes
7. Underground outlets
8. All excavation, backfill, and compaction necessary to complete these drainage systems

1.2 REFERENCE SPECIFICATIONS

A. The following specifications or standards are incorporated by reference into this SECTION:

1. SECTION 02120– SEDIMENT AND EROSION CONTROL

B. Above-mentioned references, which do not appear printed with the Contract Documents, can be provided to Contractor upon request.

1.3 QUALITY ASSURANCE

A. Contractor shall use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this SECTION.

B. Contractor shall use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

C. In addition to complying with the requirements of governmental agencies having jurisdiction, Contractor shall comply with the directions of Engineer and Division.

1.4 SUBMITTALS

A. Submit material certification, including material type and gradation, for all riprap and porous backfill.

B. Submit manufacturer's certification and material data for all material delivered to the project site for the work of this section.

C. Submit weight tickets and/or shipping tickets for all materials delivered to the Project site for the work of this SECTION.

PART 2 - PRODUCTS

2.1 SPOIL MATERIALS

A. Drainage way subgrades and backfill for pipe, tiling and risers shall be constructed of spoil materials from the required excavation. Backfill material shall be sorted as needed to become free of debris and rocks larger than one and one-half (1-1/2) inches adjacent to the tiling, and four (4) inches thereafter to the surface.

2.2 QUARRIED STONE MATERIALS

A. Porous Backfill for subdrain shall be non-calcareous material meeting IDOT Item 4131, Gradation No. 29. Limestone porous backfill will not be allowed unless its use is specifically directed by Engineer.

B. Pipe bedding used for support and backfill around pipe shall be crushed stone generally known as “one (1) inch clean angular crushed stone”. Pipe bedding shall meet the requirements of Class I bedding material as specified in SUDAS Section 3010, 2.02, A. Table 02300-01 specifies the gradation of pipe bedding.

Table 02300-01: Pipe Bedding Material Gradation

Sieve	Percent Passing
1.5”	100
1”	95 to 100
0.5”	25 to 60
No. 4	0 to 10
No. 8	0 to 5

C. Macadam stone: Refer to SECTION 02120, PART 2

D. Erosion stone: Refer to SECTION 02120, PART 2

E. Riprap: Refer to SECTION 02120, PART

2.3 DRAINAGE CONDUITS

A. Various material types and sizes are specified for drainage conduits as noted on the Plans or in the Supplemental Specifications. The conduit material used shall meet the minimum requirements as specified below. All drainage conduit used at the site shall be non-perforated unless specified otherwise.

B. “Tiling” shall be understood to mean single wall or dual wall, corrugated plastic drainage conduit that is shipped to the project site in continuous rolls or coils. Rolls or coils of tiling are usually installed by a tiling machine that mechanically places the conduit in a relatively narrow trench immediately following a trenching wheel, chain, or plow.

C. “Pipe” shall be understood to mean drainage conduit that is shipped to the site in straight lengths from the manufacturer to be installed in a trench created by an excavator bucket.

D. The following nomenclature for various drainage conduits are noted on the plans and defined below.

1. Single Wall Corrugated Polyethylene, Tiling (SWPE): SWPE conduit and fittings shall be non-perforated, corrugated polyethylene tubing equal to IDOT Section 4143.01-B. Fittings may be made from polyethylene resin meeting this specification or polyvinylchloride (PVC) meeting Schedule 40 or SDR-26 thickness.

2. Dual Wall High Density Polyethylene Pipe (DWPE): DWPE pipe shall be non-perforated, high density, high molecular weight, polyethylene dual-wall pipe meeting the requirements of AASHTO M 294, Type S

corrugated exterior and smooth interior. The pipe shall conform to ASTM D3350 with a minimum cell classification value of 345420C and the minimum pipe stiffness at five percent five (5) percent deflection per ASTM D2412. The fittings supplied shall be made from polyethylene resin which meets this same specification.

3. Polyvinyl Chloride Pipe (PVC): PVC pipe shall be non-perforated, plastic PVC – ASTM D3034-SDR26 Type 1, Grade 1. Joints shall meet ASTM D3033/D3034 Standards.

4. Dual Wall Polypropylene High Performance Pipe (PPHP): PPHP shall have a smooth interior and annular exterior corrugations meeting ASTM F2736 for diameters up to thirty (30) inches and meeting ASTM F2881 for diameters of thirty-six (36) through sixty (60) inches. Polypropylene compound for pipe and fitting production shall be impact modified copolymer meeting the material requirements of ASTM F2736 – Section 4, ASTM F-2881 – Section 5, and AASHTO M330 – Section 6.1 for the respective diameters. Table 02300-03 specifies the minimum pipe stiffness based on diameter when tested in accordance with ASTM D2412.

Table 02300-03

Nominal Pipe (I.D) (inches)	12	15	18	24	30	36	42	48	60
Min. Pipe Stiffness @ 5% Deflection (#/in/in)	75	60	56	50	46	40	35	35	30

PPHP sections shall be joined with gasketed, integral, bell & spigot joints that conform to ASTM F2736 and ASTM F2881 for the respective diameters. The joints can be either spun-on, welded, or an integral bell and spigot. Pipe bells shall be reinforced with a polymer composite band installed by the manufacturer. Each spigot shall have two gaskets meeting the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gaskets are free from debris. These joints shall meet the watertight joint performance requirements of ASTM D3212.

E. Dam and/or Wetland Pipes – See SECTION 02310 – Drainage Systems, Dams and Structures

2.4 OUTLETS FOR TILING OR PIPE

A. The last 20 (twenty) lineal feet, minimum, of a run of SWPE or DWPE conduit to daylight shall be solid PVC pipe, Schedule 40 or SDR-26, sized to match the incoming conduit. Where a specified diameter of PVC pipe is not available in a single twenty (20) foot length, up to two (2) shorter lengths of PVC pipe may be used to construct an installed length exceeding twenty (20) lineal feet. The excess PVC need not be removed; the incoming conduit may be trimmed to accommodate the excess PVC.

B. The PVC pipe shall be furnished with no more than one joint. The joint shall be solvent-welded or mechanically fastened with at least four one-fourth (4 ¼) inch dia. self-tapping stainless steel screws. The minimum length of the fasteners shall be at least twice the thickness of the PVC pipe being joined.

C. Outlet Tees, where required, shall be solid PVC, Schedule 40, or SDR-26 sized to match the incoming PVC outlet pipe. Outlet Tees shall be fastened with at least four one-fourth (4 ¼) inch dia. self-tapping stainless steel screws. The minimum length of the fasteners shall be at least twice the thickness of the PVC pipe being joined.

D. Non-perforated DWPE pipe may be substituted for PVC pipe if approved by Engineer, except where the run daylights into a stream or channel.

E. A PVC Outlet for the last twenty (20) lineal feet of a run of PPHP to daylight is not required unless otherwise specified.

2.5 TERRACE RISERS AND OPEN SIDED AREA INTAKES

A. Terrace Risers

1. Risers shall be made from high density polyethylene as manufactured by Hickenbottom, Precision or approved equal. Sizes shall be as shown on the Plans.
2. The top three (3) feet shall be perforated with at least forty (40), one (1) inch diameter holes and at least thirty (30) open square inches per foot of riser.
3. Below grade, the riser shall be non-perforated. If perforations are below grade, then the openings shall be completely sealed with three (3) wraps of polyethylene tape or other suitable tape.
4. The riser shall connect onto the drainage conduit with a manufactured tee of a size to match the outgoing conduit diameter. Tees that constrict flows shall not be used.

B. Open Sided Area Intakes

1. Area intakes shall meet the specifications of SUDAS Specification Section 6010 and shall follow details for 'SW-513 Open-Sided Area Intake' and can be either pre-cast or cast-in place.
2. The locations, quantity, and dimensions shall be as indicated on the plan sheets.

C. Dam and/or Wetland Intakes – See SECTION 02310 – Drainage Systems, Dams and Structures.

2.6 EROSION CONTROL MAT

A. Erosion control mats, where indicated on plans, shall be placed on slopes, channels, and spillways in conjunction with completion of the drainage system outlets to reduce sediment loss and erosion.

B. Refer to SECTION 02120 2.1 H for further information regarding erosion control mat. Erosion Control Mat shall be considered synonymous with Temporary Rolled Erosion Control Products (RECP).

2.7 FILTER FABRIC

A. Filter fabric shall meet the requirements of IDOT Section 4196.01-C, Engineering Fabric - Embankment Erosion Control.

2.8 CONCRETE

A. All connections in piping where a change in pipe size or type occurs, and every joint where there is a sudden change in pipe direction, shall be sealed with tile tape and buttressed with concrete. Concrete can be ready-mix, hand-mix, or packaged gravel-mix concrete and should extend a minimum of three (3) inches all around the perimeter of the joint. Packaged concrete mix shall be hydrated before placement. Areas where concrete is known to be needed include:

1. PE tubing to PVC outlets, all sizes
2. Riser connections, all sizes
3. Tiling to main line tiling at wye or tee, all sizes
4. Any other locations shown on plans

B. Concrete used for open sided intakes shall meet the requirements of SUDAS 6010.

2.9 GROUT

A. Grout shall be composed of ten (10) sacks or nine-hundred forty (940) pounds of Type I or II Portland cement with approximately two thousand two hundred (2,200) pounds of fine aggregate material conforming to IDOT 4110.01, Gradation No. 2 for each cubic yard. Potable water shall be added to provide a thick creamy consistency and should not exceed forty-seven (47) gallons per cubic yard. Air entraining admixtures conforming to ASTM C 260 shall be added to provide an air content of between six (6) to ten (10) percent.

B. Flyash can also be substituted for Portland cement in the grout mixture provided the flyash used meets the requirements of IDOT Section 4108 and does not exceed twenty (20) percent of the Portland cement.

2.10 RODENT GUARDS

A. Electroplated zinc-coated rodent guards for the appropriate size of piping, shall be as distributed by Agri Drain Corp. or approved equal. Rodent guards shall be hinged to allow debris to exit the drainage conduit when flows are present.

2.11 TRASH RACKS/BAR GUARDS

A. Bar Guard Intakes: Trash racks shall be Bar Guard Intakes as distributed by Agri Drain Corp., or approved equal. Sizes shall be as shown on the Plans.

B. Other Trash Racks or Guards shall be as specified on the Plans or the Supplement Specifications.

2.12 PIPE STRAPS

A. Pipe straps used to restrain bell and spigot joints of DWPE and/or PPHP shall be Agri-Drain Pipe Straps or approved equal.

B. Pipe straps shall be constructed with flat, woven, high-strength nylon fabric with welded stainless steel “D” rings. The loops at the ends of each strap shall be double sewn. Each sewn loop shall contain two (2) “D” rings.

C. Pipe straps may be used in lieu of concrete collar subject to engineer approval.

D. Pipe straps shall not be used with single wall corrugated tubing.

2.13 TILE TAPE

A. Tile tape shall be provided to seal subsurface joints in tiling, riser, wye, and tee connections.

B. Tile tape shall be as distributed by Agri-Drain Inc. or approved equal

C. Tile tape shall be made from PVC material having the following properties:

1. Tensile strength: 20 psi, minimum
2. Elongation: 230%
3. Dielectric capacity: 8800 volts

2.14 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by Contractor, subject to the approval of Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Contractor shall examine the areas and conditions under which work of this SECTION will be performed and shall correct conditions detrimental to timely and proper completion of the work. Contractor shall not proceed until unsatisfactory conditions are corrected.

B. Known tile that will be impacted by this project are noted and addressed as needed on the Plans. Any additional tile found during construction shall be brought to the attention of Engineer immediately.

3.2 PROTECTION

A. Contractor shall use means necessary to prevent dust from becoming a nuisance to the public, to neighbors and to other work being performed on or near the site.

B. Contractor shall maintain access to adjacent areas at all times as needed.

C. Contractor shall protect previous construction from damage while constructing drainage systems.

D. Contractor shall protect drainage systems from damage during subsequent construction in the areas.

E. Contractor shall follow all guidelines for trench safety provided by OSHA.

3.3 CARE OF WATER

A. Contractor shall furnish and operate sufficient pumps and/or provide other means including materials, labor, and equipment to prevent interference to any work by water, ice or snow. No structure or pipe shall be laid in water, and no water shall be allowed to run into or over any work or pipe until installation is capable of accepting water without damage or deterioration. Damage of any kind resulting from insufficient pumping facilities or similar lack of proper conduct of the work shall be corrected by Contractor at no cost to Division.

3.4 FLOW LINES AND GRADES

A. Construct drainage systems precisely to lines and grades as shown on the Plans or as required for proper functioning.

B. Pipe runs shall be installed straight with a uniform slope to meet entrance and exit conditions at both ends of the pipe run. Slopes shall be uniform in so far as practical. Piping shall be installed with a minimum of two (2) percent slopes unless conditions indicate flatter slopes are required.

C. Match flow lines and provide smooth transitions between intersecting riprap ditches, between terrace tile outlets and riprap ditches, between subdrain outlet and grassed swale, and between terrace tile outlets and grassed swales.

3.5 TERRACES

A. Terraces shall be installed after rough grading is completed. The flow line grades of the terraces must be adjusted as needed if terraces are constructed after placement of tile and risers.

B. Terraces shall be constructed in conformance with details and dimensions shown on the Plans. Fill placement and compaction shall be as specified in Section 02200 EARTHWORK - ROUGH GRADING, Item *3.9 Fill Placement and Compaction*.

3.6 TILING AND PIPE

A. Tiling

1. Install tiling in strict accordance with these Specifications, manufacturer's recommendations and the Plans. In case of discrepancy, the most stringent requirements shall apply. Install drainage conduit after completion of rough grading in affected areas.
2. Excavate trenches to a minimum depth of three one-half (3 1/2) feet below finish grades where grades permit. Rocks or other objects larger than one one-half (1 1/2) inches shall be removed from bottom of excavation where present. Additional excavation may be necessary to remove and replace soft, unstable material.
3. When a backhoe or excavator is used to place the tile, the trench width shall extend at least eight (8) inches and no more than fifteen (15) inches beyond each side of the spring line of the pipe to allow for compaction of material. The bottom of the trench should include a V-groove or semicular trough sized to accept the diameter of the tiling without excess movement.
4. Smaller trench widths are allowed when tiling is installed with a tiling machine equipped with a cutting edge that creates a ninety (90) degree V-groove, or a semi-circular trough of a size that accepts the tiling without excess movement.
5. After excavation, lay tiling in bottom of trench. All joints shall be placed with the bell or female end facing upslope. Any unsuitable material, such as larger rocks or sticks or frozen material, shall be separated from excavated material to be used as backfill. If excavated material is unsuitable, then Contractor shall provide an alternate source of suitable backfill from on site. Carefully place and compact backfill using hand held equipment within the area around and to within six (6) inches above the tile to ensure that backfill is placed under the pipe haunches and that the tiling is properly and fully supported. Care shall be taken to not collapse or displace the tile during backfilling procedures. Backfill placed within the remainder of trench shall be placed in lifts of no more than one (1) foot in structural areas and no more than two (2) feet in non-structural areas. Mass dumping of backfill shall not be allowed. Each lift shall be compacted with either the bucket of an excavator or the wheel of construction equipment. Reshape and/or compact adjacent ground surface as required.
6. When specified for deep installations, provide granular bedding and backfill around the tiling as shown on the plans.
7. The last twenty (20) feet, minimum, tiling which daylights shall be rigid PVC pipe as provided in 2.3 of this SECTION. Connect the outlet pipe to the corrugated PE tubing with a Fernco or approved equal coupler. Seal the connection with tile tape and place a concrete collar around the joint. Install a rodent guard within six (6) inches of the outlet end of all PVC piping.
8. Where outlet tees are required on t outlet pipes, install the rodent guard in the pipe ahead of the outlet tee. Fasten outlet tee to pipe using fasteners as provided in 2.3 of this SECTION.
9. If any tiling collapses due to improper installation or from routing of construction equipment over the trench, or it becomes clogged for whatever reason, correct the malfunction at no cost to Division. Correction of any malfunction shall also be required during the one (1) year guarantee period and shall be repaired at no cost to Division.

B. PIPES

1. Pipes shall be installed in strict accordance with these Specifications, manufacturer's recommendations and the Plans. In case of discrepancy, the most stringent requirements shall apply. Install pipes after completion of rough grading in affected areas.
2. Excavate trenches to the minimum depth as shown on the Plans and to widths to allow for twelve (12) inches of clearance on each side of the pipe. The trench shall have vertical side walls to the crown of the pipe with the remainder of the excavations sloped as needed for stability and to satisfy OSHA requirements.
3. Lay the pipe in the center of the trench with female joints facing upstream. Place joint sealant as required as each piece is placed. All gaskets shall be protected during installation, and each joint shall be completely pushed together.
4. Install pipe straps at every joint if required by the plans or Supplemental Specifications.
5. Backfill with suitable material in lifts not exceeding eight (8) inches and compacted by hand operated mechanical tampers to a height at least twelve (12) inches above the pipe. Exercise care not to cause the pipe to shift and/or to uplift while placing and compacting material up to the top of the pipe. Continue backfilling with compacted lifts to the surface. Mass dumping of the backfill will not be allowed. Settled areas shall be corrected by Contractor at no cost to Division.
6. When specified for deep installations, provide granular bedding and backfill around the tiling as shown on the plans. Furnish and encase the granular bedding in filter fabric
7. The last twenty (20) lineal feet, minimum, which daylights shall be rigid PVC pipe as provided in 2.3 of this SECTION. Connect the PVC outlet pipe to the corrugated PE tubing with a Fernco or approved equal coupler. Seal the transition joint with three (3) wraps of tile tape, and install a concrete collar around the wrapped joint. Pipe straps may be used in lieu of a concrete collar if the pipe strap can be prevented from slipping off the PVC outlet pipe.
8. Where indicated in the Supplemental Specifications or where approved by the Engineer, pipe straps may be used in lieu of a concrete collar. When using pipe straps with smooth PVC pipe, Install two (2) ¼" dia. stainless steel thru bolts into the PVC pipe to prevent slippage of the pipe strap. Bolts shall not puncture the pipe straps.
9. Install rodent guard within six (6) inches of the outlet end of all PVC piping.
10. If any pipe collapses due to improper installation or from routing of construction equipment over the trench, or it becomes clogged for whatever reason, correct the malfunction at no cost to Division. Correction of any malfunction shall also be required during the one (1) year guarantee period and shall be repaired at no cost to Division.

3.7 RISERS AND OPEN SIDED INTAKES

A. Risers

1. Install terrace risers in strict accordance with these Specifications, manufacturer's recommendation and the Plans. In case of discrepancy, the most stringent requirements shall apply. Provide a tee for every riser. Depending on location, use an in-line tee or a blind tee with cap, as recommended by manufacturer. Fasten riser sections using stainless steel sheet metal screws. All riser tubing should be connected to the main run of tiling or pipe with a wye or a tee.
2. Seal all below-grade riser joints with three (3) wraps of tile tape or other suitable tape as provided in 2.3 of this SECTION and then cover joints with concrete collar that extends at least three (3) inches in each direction as shown on the Plans.

3. Backfill excavation with compacted lifts using excavated material unless this material is unsuitable. Provide suitable backfill material if necessary. Reshape and/or compact adjacent ground surface as required.
4. Contractor shall install two (2) steel fence posts on opposite sides of each riser and bind them together with No. 9 wire. Three (3) steel fence posts shall be used for risers that are ten (10) inches in diameter or greater.

B. Open-Sided Intakes

1. Open sided intakes shall be placed to the specific elevations and dimensions indicated on the plans.
2. Pipe connecting to the intakes shall be placed as shown on the Plans and in accordance with SUDAS 6010.
3. If precast open-sided intakes are used provide a granular leveling course of one (1) inch clean, angular limestone four (4) to six (6) inches thick at the bottom of the structure and around the pipe connection adjacent to the structure.
4. Backfill material shall be only be placed after adequate strength is acquired for the structure. Backfill shall consist of excavated material with rocks larger than four (4) inches in diameter sorted out. The backfill shall be placed in lifts of no more than six (6) inches and compacted using hand equipment.

3.8 FILTER FABRIC

A. Filter fabric shall be delivered to the job site in such a manner as to facilitate handling and incorporation into the work without damage. Material shall be stored in such a manner as to prevent exposure to direct sunlight and damage by other construction activities.

B. Prior to the installation of the fabric, the application surface shall be cleared of debris, sharp objects and trees. Tree stumps shall be removed to a depth of at least two (2) feet below the ground surface. In the case of subgrades, all wheel tracks or ruts in excess of three (3) inches in depth shall be graded smooth or otherwise filled with soil to provide a reasonably smooth surface.

C. Fabric may be installed on the application surface either by hand or mechanical methods, provided that the fabric is not torn or the surface rutted. Fabric of insufficient width or length to fully cover the specified area shall be lapped a minimum of twenty-four (24) inches, or sewn. If sewn, the minimum lap shall be four (4) inches and the seam strength shall be equal to or more than the minimum grab tensile strength of the fabric when wet tested.

D. Placement of material on the fabric shall be accomplished by spreading dumped material off of previously placed material with a bulldozer blade or end-loader, in such a manner as to prevent tearing or shoving of the cloth. Dumping of material directly on the fabric will only be permitted to establish an initial working platform. No vehicles or construction equipment shall be allowed on the fabric prior to placement of the granular blanket.

E. Fabric which is damaged during installation or subsequent placement of riprap, due to failure of Contractor to comply with these provisions, shall be repaired or replaced at his expense, including costs of removal and replacement of the riprap. Torn fabric may be patched in-place by cutting and placing a piece of the same fabric over the tear. The dimensions of the patch shall provide for at least two (2) feet of overlap in every direction, and it shall be weighted or otherwise secured to prevent the granular material from causing lap separation.

3.9 RIPRAP DITCHES & OTHER RIPRAP WORK

A. When rough grades have been achieved, excavate the area to receive riprap or erosion stone to permit placement of riprap or stone the full depth as shown on the Plans. Dispose of excavated material by incorporating it into general grading of the site. Care shall be taken to prevent placement of acidic spoil material on top of treated subgrade or cover material.

B. Unless otherwise specified in plan details, riprap or erosion stone shall be placed over a six (6) inch thick filter layer of macadam stone, where required, in areas shown on the Plans and in a manner which shall produce a reasonably well-graded mass of stone with the minimum practical percentage of voids. All material shall be placed and distributed such that there shall be no objectionable accumulations of either the larger or smaller sizes of stone, and such that the entire mass of stone shall be in accordance with the lines, grades and thickness as shown on the Plans.

C. Filter fabric may be used as an underlayment below the riprap in level plunge pools or stilling basins, but it shall not be used as an underlayment in drainage ditches lined with riprap or erosion stone. When filter fabric is specified, Contractor shall place the riprap or erosion stone so as to not tear, puncture, or shift the filter fabric. Riprap or stone shall not be dropped more than two (2) feet when being placed on filter fabric. Tears or rips in the fabric shall be repaired in accordance with manufacturer's recommendations.

D. It is the intent of this Specification to produce a fairly compact riprap or stone protection in which all sized of material are placed in their proper proportions. Placing or rearranging of individual stones by hand or mechanical equipment should be anticipated and may be required to the extent necessary to secure the specified results.

E. Contractor shall complete the following in riprap ditches requiring grout:

1. Larger spaces between stones shall be filled with smaller pieces of riprap. The stones shall be compacted to give them firm bearing and stability.

2. After stone surface has been inspected and approved, the spaces between the stones shall be completely filled with grout. The grout shall be brushed or broomed into the spaces to ensure proper filling.

3. Grout placement and curing shall meet the requirements of IDOT Section 2507.03 E, Grouting.

3.10 EROSION CONTROL MAT

A. Careful installation of erosion control mat is critical for its immediate and long term performance. Contractor shall install per details shown on the Plans and in strict accordance with manufacturer's recommendations. Where details on the Plans show more stringent requirements, drawing details shall apply. Staking patterns shall be based on the design discharge rates as determined by the Engineer. The upper most portion of the mat shall be installed in an anchor trench in per the manufacturer's recommendations.

B. Contractor shall fine grade the surface as uniformly as possible and remove any rocks, roots and other deleterious substances. The success of the mat relies heavily on its placement such that it is uniformly in contact with the ground. Proceed with seeding operations in Section 02700 –SEEDING, including soil testing, seedbed preparation, liming, fertilizing, seeding and mulching.

C. After seeding and mulching has been performed in accordance with Section 02700, Contractor shall install erosion control mat as and where shown on the Plans.

D. Contractor shall reseed all disturbed areas by hand. A light overseeding by hand of the overall mat area may be beneficial but is not mandatory.

PART 4 - MEASUREMENT AND PAYMENT

4.1 UNIT PRICES

A. The construction cost of all work included in this Section of the Construction Specifications shall be included in Contractor's unit prices set forth in the Proposal and Schedule of Prices (*Document C*) for the work items described below. The unit price for each of these items shall include its pro rata share of overhead so that the sum of the products obtained by multiplying the unit prices so set forth by the amount of the work actually constructed, measured as described herein, shall constitute full payment to Contractor for performance of the work included in this SECTION.

B. Measurement and payment for each work item in this SECTION shall be in accordance with the following:

1. *Terrace*: The unit price for terraces in this SECTION shall include materials, equipment and work required to construct (grade) the terraces in conformance with details and dimensions shown on the Plans. The length of installed terraces shall be measured to the nearest foot jointly by Contractor and Engineer.

2. *Riser - Terraces*: Unit prices shall include all materials and work required for installation of risers in conformance with details and dimensions shown on the Plans, these Construction Specifications, and as may be required by the manufacturer. Unit prices shall include furnishing and installing risers, fittings, tape, concrete, excavation, backfill, metal stakes, and all other incidental construction including furnishing and installing silt fencing around the riser, cleaning of sediment, maintenance and repairs. Measurement for payment of risers shall be based on the number and size of specified risers, properly installed and maintained.

3. *Open-Sided Intakes:* Unit price shall include all materials and work required for installation of open-sided intakes in conformance with details and dimensions shown on the Plans and these Specifications. Unit prices shall include furnishing and installing the intake, connecting pipes, concrete, excavation, backfill, and all other incidental construction including cleaning of sediment, maintenance and repairs. Measurement and payment of intake shall be based on the number of each type and size of riser properly installed and maintained.

4. *Tiling*: The unit prices shall include all materials and work required for installation of the tile and fittings (SWPE and PVC as applicable) in conformance with details and dimensions shown on the Plans. The unit prices shall include furnishing and installing the pipe, fittings, trenching, removal and disposal of excess trench material, dewatering, backfill, compaction, and all other work items incidental thereto, including tape and concrete for sealing below-grade connections. Tees required on the ends of tiling shall also be incidental to this work item. Measurement for payment shall be based on the length of tiling for a specified diameter actually installed as determined from field measurements and rounded to the nearest foot. The measured length of tiling shall not include the length of Pipe Outlet conduit.

5. *Pipes*: The unit prices shall include all materials and work required for installation of the various pipes and fittings in conformance with details and dimensions shown on the Plans. The unit prices shall include furnishing and installing the pipe, fittings, excavating, removal and disposal of excess trench material, dewatering, backfill, compaction, and all other work items incidental thereto, including sealing of below-grade connections. Measurement for payment shall be based on the length of various pipes for each specified diameter actually installed as determined from field measurements and rounded to the nearest foot.

6. *Outlet Pipe*: The unit price for PVC outlets at the end of tile sections shall include all materials, equipment, and work required to install the outlets as shown on the plans including rodent guards, concrete, joint adapters, or pipe straps. Measurement and payment shall be based on the number of each type and size of outlet properly installed.

7. *Filter Fabric*: Filter fabric used on the project, in accordance with the Plans and/or approved by Engineer, shall be measured and paid in this Item. The quantity of in-place fabric shall be measured to the nearest square yard jointly by Contractor and Engineer. Laps and waste shall not be measured.

Only material placed in accordance with the Plans and these Construction Specifications shall be measured and paid. *Note: Plans and Supplemental Specifications may indicate that Filter Fabric is incidental to associated work items.*

8. *Riprap and Erosion Stone*: The unit prices shall include all materials and work required for installation of the riprap or erosion stone in conformance with these Construction Specifications and the Plans, including excavation, removal and disposal of excavated material, and furnishing and placing the stone. Measurement for payment shall be based on the tonnage of riprap or erosion stone actually installed as determined from weight tickets, rounded to the nearest one-hundredth (0.01) ton. Only material placed in accordance with the Plans and these Specifications shall be measured and paid.
9. *Grout*: This unit price shall include all materials and work required for installation of grout (riprap channels, stilling basins, etc.) in conformance with these Construction Specifications and the Plans. Measurement for payment shall be based on cubic yards of grout actually installed as determined from delivery tickets, rounded to the nearest cubic yard. Only material placed in accordance with the Plans and these Construction Specifications or otherwise approved by Engineer or Division shall be measured and paid.
10. *Erosion Control Mat*: Erosion control mat will be paid as indicated in Specification SECTION 02120 – SEDIMENT AND EROSION CONTROL provided it is not considered incidental to other work items.

4.2 SUMMARY – UNITS OF MEASURMENT

Proposal Bid Items applicable to work covered by this SECTION are as follows:

Description	Unit
Terrace	Lineal Foot
Riser - Terrace	Each
Open Sided Intakes	Each
Tiling - (size)	Lineal Foot
Pipes - (size)	Lineal Foot
Outlet Pipe– (size)	Each
Filter Fabric	Square Yard
Riprap	Tons
Erosion Stone	Tons
Grout	Cubic Yard

END OF SECTION 02300