TECHNICAL SPECIFICATIONS

for

CLOSURE OF
PHASE III ASH/MSW LANDFILL
LAKE COUNTY, FLORIDA

Prepared for:

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TECHNICAL SPECIFICATIONS

CENTRAL LANDFILL – PHASE III ASH/MSW CELL
LAKE COUNTY, FLORIDA

PHASE III ASH/MSW CELL CLOSURE

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SECTION 01000

GENERAL REQUIREMENTS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Description: The work to be done consists of the furnishing of all labor, materials and equipment, and the performance of all work included in this Contract. The summary of the work is presented in Section 01010.

B. Requirements Included:

1. The Contractor shall furnish all labor, superintendence, materials, power, light, heat, fuel, water, tools, appliances, equipment, supplies, and other means of construction necessary or proper for performing and completing the work, from the date of Notice to Proceed until the date of Final Completion and Acceptance by County. The Contractor shall obtain and pay for all required permits. The Contractor shall perform and complete the work in the manner best calculated to promote rapid construction consistent with safety of life and property and to the satisfaction of the County, and in strict accordance with the Contract Documents. The Contractor shall clean up the work and maintain it during and after construction, until accepted, and shall do all work and pay all costs incidental thereto. The Contractor shall repair or restore all structures and property that may be damaged or disturbed during performance of the work.

2. The cost of incidental work described in these General Requirements, for which there are no specific Contract Items, shall be considered as part of the general cost of doing the work and shall be included in the prices for the various Contract Items. No additional payment will be made, therefore.

3. The Contractor shall provide and maintain such tools, and equipment as may be necessary, in the opinion of the Engineer, to perform in a satisfactory and acceptable manner all the work required by this Contract. Only equipment of established reputation and proven efficiency shall be used. The Contractor shall be solely responsible for the adequacy of Contractor's workmanship, materials and equipment, prior approval of the Engineer notwithstanding.

C. Utility Installations and Structures:

1. Utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, house service connections, vaults, manholes and all other appurtenances and facilities pertaining thereto whether owned or controlled by the County, other governmental bodies or privately owned by individuals, firms or corporations, used to serve the public with transportation, traffic control, gas, electricity, telephone, sewerage, drainage, water or other public or private property which may be affected by the work shall be deemed included hereunder.

2. The Contract Documents contain information relative to existing utility installations, monitor well locations, liner limits, and structures above and below the ground surface. This information is not guaranteed as to its completeness or accuracy, and it is the responsibility of the Contractor to investigate on its own to be fully informed of the character, condition and extent of all such installations and structures as may be encountered and as may affect the construction operations.

3. The Contractor shall protect all utility installations, monitoring well locations, liner limits, and structures from damage during the work. Access across any buried utility installation or structure shall be made only in such locations and by means approved by the Engineer. The Contractor shall so arrange its operations as to avoid any damage to these facilities. All required protective devices and construction shall be provided by the Contractor at the Contractor's expense. All existing utilities damaged by the Contractor, which are shown on the Drawings or have been located in the field by the utility, shall be repaired by the Contractor, at the Contractor's expense, as directed by the Engineer. No separate payment shall be made for such protection or repairs to utility installations or structures.

4. Utility installations or structures owned or controlled by the County or other governmental body which are shown on the Drawings to be removed, relocated, replaced or rebuilt by the Contractor shall be considered as a part of the general cost of doing the work and shall be included in the prices bid for the various contract items.

5. Where utility installations of structures owned or controlled by the County or other governmental body are encountered during the course of the work, and are not indicated on the Drawings or in the Specifications, and when, in the opinion of the Engineer, removal, relocation, replacement or rebuilding is necessary to complete the work under this Contract, such work shall be accomplished by the utility having jurisdiction, or such work may be ordered, in writing by the Engineer, for the Contractor to accomplish. If such work is accomplished by the utility having jurisdiction, it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement or rebuilding as required. If the Contractor accomplishes such work, it will be paid for as extra work as provided in the General Conditions.

6. The Contractor shall, at all times in performance of the work, employ approved methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage or destruction of utility installations and structures; and shall, at all times in the performance of the work, avoid unnecessary interference with, or interruption of, public utility services, and shall cooperate fully with the owners thereof to that end.

7. All County and other governmental utility departments and other owners of public utilities which may be affected by the work will be informed in writing by the County within two weeks after the execution of the Contract or Contracts covering the work. Such notice will set out, in general, and direct attention to, the responsibilities of the County and other governmental utility departments and other owners of utilities for such installations and structures as may be affected by the work and will be accompanied by one set of Drawings and Specifications covering the work under such Contract or Contracts.

8. In addition to the general notice given by County, the Contractor shall give written notice to County and other governmental utility departments and other owners of utilities of the location of the proposed construction operations, at least 7 days in advance of breaking ground in any area or on any unit of the work.

9. The maintenance, repair, removal, relocation or rebuilding of utility installations and structures, when accomplished by the Contractor as herein provided, shall be done by methods approved by the County of such utilities.

1.02 DRAWINGS AND PROJECT MANUAL

A. Drawings:

1. The Drawings referred to in the Contract Documents bear the general project name and number as shown in the Invitation to Bid (Advertisement).

2. When obtaining data and information from the Drawings, figures shall be used in preference to scaled dimensions, and large-scale drawings in preference to small-scale drawings.

B. Copies Furnished to Contractor:

1. After the Contract has been executed, the Contractor will be furnished one (1) complete set of reproducible sheets (24 inches by 36 inches) or electronic files and one (1) copy of the Conformed Documents that will include a copy of the executed documents, Bidder's/Contractor's submittals to the County, Drawings and Specifications sections updated with the RFP addendums.

2. The Contractor shall furnish each of the subcontractors, manufacturers, and material men such copies of the Contract Documents as may be required for their work. All copies of the Contract Documents shall be printed from the reproducible sets furnished to the Contractor. All costs of reproduction and printing shall be borne by the Contractor.

C. Supplementary Drawings:

1. When, in the opinion of the Engineer, it becomes necessary to explain more fully the work to be done or to illustrate the work further or to show any changes which may be required, drawings known as Supplementary Drawings, with specifications pertaining thereto, will be prepared by the Engineer and the Contractor will be furnished one (1) complete set of reproducible sheets (24 inches by 36 inches) or electronic files and one (1) copy of the Specifications.

2. The Supplementary Drawings shall be binding upon the Contractor with the same force as the Drawings. Where such Supplementary Drawings require either less or more than the estimated quantities of work, credit to the County or compensation therefore to the Contractor shall be subject to the terms of the Contract Documents.

D. Contractor to Check Drawings and Data:

1. The Contractor shall verify all dimensions, quantities and details shown on the Drawings, Supplementary Drawings, schedules, Specifications or other data received from the Engineer, and shall notify Engineer of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty construction or improper operation resulting therefrom nor from rectifying such conditions at the Contractor's own expense. Contractor will not be allowed to take advantage of any errors or omissions, as the Engineer will furnish full instructions, should such errors or omissions be discovered.

2. All schedules are given for the convenience of the Engineer and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quality of materials and equipment included in work to be done under the Contract.

E. Specifications: The Technical Specifications consist of three parts: General, Products and Execution. The General Section contains General Requirements, which govern the work. Products and Execution modify and supplement these by detailed requirements for the work and shall always govern whenever there appears to be a conflict.

F. Intent:

1. All work called for in the Specifications applicable to this Contract, but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Drawings or in the Specifications, but involved in carrying out their intent or in the complete and proper execution of the work, is required and shall be performed by the Contractor as though it were specifically delineated or described.

2. The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Specifications shall be made upon that basis. In the event of inconsistencies in the requirements of the Drawings and Specifications, the more expensive will be required.

1.03 MATERIALS

A. Manufacturer:

1. The names of proposed manufacturers, suppliers and dealers who are to furnish materials, fixtures, or other fittings shall be submitted to the Engineer for approval, as early as possible, to afford proper investigation and checking. Such approval must be obtained before Shop Drawings will be checked. No manufacturer will be approved for any materials to be furnished under this Contract unless manufacturer shall be of good reputation and have a plant of ample capacity. Manufacturer shall, upon the request of the Engineer, be required to submit evidence that they have manufactured a similar product to the one specified and that it has been previously used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.

2. All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request, in writing to the Engineer, that the manufacturer or subcontractor deal directly with the Engineer. Any such transactions shall not in any way release the Contractor from the Contractor's full responsibility under this Contract.

3. Any two or more pieces of material of the same kind, type or classification, and being used for identical types of service, shall be made by the same manufacturer.

B. Delivery:

1. The Contractor shall deliver materials in ample quantities to insure the most speedy and uninterrupted progress of the work so as to complete the work within the allotted time.

2. The Contractor shall also coordinate deliveries in order to avoid delay in, or impediment of, the progress of the work of any related Contractor.

1.04 INSPECTION AND TESTING

A. General:

1. The Contractor will provide for the testing of materials unless otherwise specified.

2. The testing personnel shall make the necessary inspections and tests and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Contract Documents. PDF electronic files of the reports shall be submitted, and authoritative certification thereof must be furnished to the County as a prerequisite for the acceptance of any material.

3. If, in the making of any test of any material, it is ascertained by the County that the material does not comply with the Contract Documents, the Contractor will be notified thereof and will be directed to refrain from delivering said material, or to remove it promptly from the site or from the work and replace it with acceptable material, without cost to the County.

B. Costs:

1. All inspection and testing of materials furnished under this Contract will be provided by the Contractor, unless otherwise expressly specified.

2. Materials submitted by the Contractor as the equivalent to those specifically named in the Contract may be tested by the County for compliance. The Contractor shall reimburse the County for the expenditures incurred in making such tests of materials, which are rejected, for noncompliance.

C. Inspection of Materials:

1. The Contractor shall give notice in writing to the County, sufficiently in advance of their intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. Such notice shall contain a request for inspection, the date of commencement and the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, the County will arrange to have a representative present at such times during the manufacture as may be necessary to inspect the materials or the County will notify the Contractor that the inspection will be made at a point other than the point of manufacture.

2. The Contractor must comply with these provisions before shipping any material. Such inspection shall not release the Contractor from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

D. Certificate of Manufacture:

1. When inspection is waived or when the County so requires, the Contractor shall furnish to County authoritative evidence in the form of Certificate of Manufacture that the materials to be used in the work have been manufactured and tested in conformity with the Contract Documents.

2. These certificates shall be notarized and shall include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

E. Failure of Tests:

1. Any defects in the materials or their failure to meet the tests, guarantees or requirements of the Contract Documents shall be promptly corrected by the Contractor by replacements or otherwise. The decision of the County as to whether or not the Contractor has fulfilled its obligations under the Contract shall be final and conclusive.

2. The Contractor shall reimburse the County for all failed tests or shall pay for all re-tests.

3. If the Contractor fails to make these corrections or if the improved materials, when tested, shall again fail to meet the guarantees or specified requirements, the County, notwithstanding its partial payment for work, and materials, may reject the materials and may order the Contractor to remove them from the site at their own expense.

4. In case the County rejects any materials, then the Contractor shall replace the rejected materials within a reasonable time. If the Contractor fails to do so, the County may, after the expiration of a period of thirty (30) calendar days after giving Contractor notice in writing, proceed to replace such rejected materials and the cost thereof shall be deducted from any compensation due or which may become due the Contractor under the Contract.

F. Final Inspection: During such final inspections, the work shall be clean and free from standing water. In no case will the final estimate be prepared until the Contractor has complied with all requirements set forth and the County has made the final inspection with the Contractor of the entire work and is satisfied that the entire work is properly and satisfactorily constructed in accordance with the requirements of the Contract Documents.

1.05 TEMPORARY STRUCTURES

A. Temporary Fences:

1. If, during the course of the work, it is necessary to remove or disturb any fence or part thereof, the Contractor shall provide a suitable temporary fence, within the same day it was removed, at its own expense.

2. The Engineer shall be solely responsible for the determination of the necessity for approving a temporary fence and the type of temporary fence to be used.

B. Responsibility for Temporary Structures: In accepting the Contract, the Contractor assumes full responsibility for the sufficiency and safety of all temporary structures or work and for any damage which may result from their failure or their improper construction, maintenance or operation and will indemnify and save harmless the County from all claims, suits or actions and damages or costs of every description arising by reason of failure to comply with the above provisions.

1.06 TEMPORARY SERVICES

A. Accident Prevention:

1. Precautions shall be exercised at all times for the protection of person and property. The safety provisions of applicable laws, building and construction codes shall be observed and adhere to the approved Health and Safety Plan provided for the Work.

2. The Contractor shall comply with the U.S. Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596). Hours and Safety Standards Act (PL 91-54), except where state and local safety standards exceed the federal requirements and except where state safety standards have been approved by the Secretary of Labor in accordance with provisions of the Occupational Safety and Health Act, shall be complied with.

B. First Aid: The Contractor shall keep upon the site, at each location where work is in progress, a completely equipped first aid kit and shall provide ready access thereto at all times when personnel are employed on the work.

1.07 LINES AND GRADES

A. Grade:

1. All work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings, or as given by the Engineer. The full responsibility for keeping alignment and grade shall rest upon the Contractor.

2. The County has established benchmarks and base line controlling points for the Contractor to use. Reference marks for lines and grades as the work progresses will be located to cause as little inconvenience to the prosecution of the work as possible.

3. The Contractor shall so place excavation and other materials as to cause no inconvenience in the use of the reference marks provided. Contractor shall remove any obstructions placed by Contractor contrary to this provision.

B. Surveys:

1. The Contractor shall furnish and maintain, at their own expense, stakes and other such materials for setting project control points.

2. The Contractor shall check the County’s permanent reference points by such means as may deemed necessary and, before using them, shall call the Engineer's attention to any inaccuracies.

3. The Contractor shall, at their own expense, establish all working or construction lines and grades as required from the County’s permanent reference marks set by the County, and shall be solely responsible for the accuracy thereof. Contractor shall, however, be subject to the check and review of the County.

C. Safeguarding Marks:

1. The Contractor shall safeguard all points, stakes, grade marks, monuments and bench marks made or established on the work, bear the cost of reestablishing them if disturbed, and bear the entire expense of rectifying work improperly installed due to not maintaining or protecting or to removing without authorization such established points, stakes and marks.

2. The Contractor shall safeguard all existing and known property corners, monuments and marks adjacent to but not related to the work and, if required, shall bear the cost of reestablishing them if disturbed or destroyed.

1.08 ADJACENT STRUCTURES AND LANDSCAPING

A. Responsibility:

1. The Contractor shall also be entirely responsible and liable for all damage or injury as a result of the Contractor's operations to all other adjacent public and private property, structures of any kind and appurtenances thereto met with during the progress of the work.

2. The cost of protection, replacement in their original locations and conditions or payment of damages for injuries to such adjacent public and private property and structures affected by the work, whether or not shown on the Drawings, and the removal, relocation and reconstruction of such items called for on the Drawings or specified shall be included in the various Contract Items.

3. Contractor is expressly advised that the protection of landfill and appurtenances, buildings, structures, tunnels, tanks, pipelines, etc. and related work adjacent and in the vicinity of the Contractor's operations, wherever they may be, is solely the Contractor's responsibility.

4. Conditional inspection of buildings or structures in the immediate vicinity of the project which may reasonably be expected to be affected by the work shall be performed by and be the responsibility of the Contractor.

5. Contractor shall, before starting operations, make an examination of the interior and exterior of the adjacent structures, buildings, facilities, stormwater structures, roadways, etc., and record by notes, measurements, photographs, etc., conditions which might be aggravated by open excavation and construction. Repairs or replacement of all conditions disturbed by the construction shall be made to the satisfaction of the County. This does not preclude conforming to the requirements of the insurance underwriters. Copies of surveys, photographs, reports, etc., shall be given to the County.

6. Prior to the beginning of any excavations, the Contractor shall advise the County of all buildings or structures on which work is intended to be performed or which performance of the project work will affect.

B. Protection of Trees (Section 01000, Part 1.08, B.1., 2. and 3., do not apply to this Work):

1. All trees and shrubs shall be adequately protected by the Contractor with boxes and otherwise and in accordance with ordinances governing the protection of trees. No excavated materials shall be placed so as to injure such trees or shrubs. Trees or shrubs destroyed by negligence of the Contractor or employees of the Contractor shall be replaced by Contractor with new stock of similar size and age, at its proper season and at the sole expense of the Contractor.

2. Beneath trees or other surface structures, where possible, pipelines may be built in short tunnels, backfilled with excavated materials, except as otherwise specified, or the trees or structures carefully supported and protected from damage.

3. The County may order the Contractor, for the convenience of the County, to remove trees along the line or trench excavation. If so ordered, the County will obtain any permits required for removal of trees.

C. Lawn Areas: Lawn areas shall be left in as good condition as before the starting of the work. Where sod is to be removed, it shall be carefully removed, and later replaced, or the area where sod has been removed shall be restored with new sod in the manner described in the Workmanship and Materials section.

D. Restoration of Fences:

1. Any fence, or part thereof, that is damaged or removed during the course of the work shall be replaced or repaired by the Contractor and shall be left in as good condition as before the starting of the work.

2. The manner in which the fence is repaired or replaced and the materials used in such work shall be subject to the approval of the County.

3. The cost of all labor, materials, equipment, and work for the replacement or repair of any fence shall be deemed included in the appropriate Contract Item or items, or if no specific item is provided therefor, as part of the overhead cost of the work, and no additional payment will be made, therefore.

1.09 PROTECTION OF WORK AND PUBLIC

A. Barriers and Lights:

1. During the prosecution of the work, the Contractor shall put up and maintain at all times such barriers and lights as will effectually prevent accidents.

2. The Contractor shall provide suitable barricades, red lights, "danger" or "caution" or "street closed" signs and watchmen at all places where the work causes obstructions to the normal traffic or constitutes in any way a hazard to the public.

B. Smoke Prevention: The Contractor shall use hard coal, coke, oil or gas as fuel for equipment generating steam. A strict compliance with ordinances regulating the production and emission of smoke will be required.

C. Noise:

1. The Contractor shall eliminate noise to as great an extent as practicable at all times. Air compressing plants shall be equipped with silencers and the exhaust of all gasoline motors or other power equipment shall be provided with mufflers.

2. Except in the event of an emergency, no work shall be done between the hours of 5:00 P.M. and 7:00 A.M. Monday through Friday, on Saturdays, on Sundays and legal holidays without written permission of the County. If the proposed and efficient prosecution of the Work requires operations during the aforementioned non-working hours and days, off-hour Work may be authorized by the County, if requested in writing at least 72 hours in advance by the Contractor before starting such items of the Work.

D. Access to Public Services: Neither the materials excavated nor the materials or plant used in the construction of the work shall be so placed as to prevent free access to all fire hydrants, valves or manholes.

E. Dust Prevention: The Contractor shall keep a properly functioning water truck onsite at all times. The Contractor shall prevent dust nuisance from its operations or from traffic by keeping the roads and/or construction areas sprinkled with water at all times.

1.10 CUTTING AND PATCHING

A. The Contractor shall do all cutting, fitting or patching of its portion of the work that may be required to make the several parts thereof join and coordinate in a manner satisfactory to the Engineer and in accordance with the Drawings and Specifications.

B. The work must be done by competent personnel skilled in the trade required by the restoration.

C. Where existing pavement, curb, curb and gutter, sidewalk, or unpaved road is removed only for the purposes of constructing or removing culverts, pipes, etc., such pave, etc., shall be replaced and restored to as good condition, as determined by the Engineer, as before removal. The replaced pavement or unpaved road shall be the same or similar type as removed unless otherwise directed.

1.11 CLEANING

A. During Construction:

1. During construction of the work, the Contractor shall, at all times, keep the site of the work and adjacent premises as free from material, debris and rubbish as is practicable and shall remove the same from any portion of the site if, in the opinion of the County and Engineer, such material, debris, or rubbish constitutes a nuisance or is objectionable.

2. The Contractor shall remove from the site all of surplus materials and temporary structures used by the Contractor when no further need therefore develops. Contractor shall be responsible and liable for all spillage and incur all associated costs including, but not limited to, costs related to repair and maintenance resulting from damages thereof.

B. Final Cleaning:

1. At the conclusion of the work, all erection plant, tools, temporary structures and materials belonging to the Contractor shall be promptly taken away, and Contractor shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances.

2. The Contractor shall thoroughly clean all materials installed by Contractor and shall deliver such materials undamaged in a bright, clean, polished and new operation condition.

1.12 MISCELLANEOUS

A. Protection Against Siltation and Bank Erosion:

1. The Contractor shall arrange its operations and construct erosion control devices to minimize siltation and bank erosion on construction sites and on existing or proposed watercourse and drainage ditches.

2. At the Contractor's own expense, Contractor shall remove any siltation deposits and correct any erosion problems as directed by the County, which results from Contractor's construction operations.

B. Protection of Wetland Areas:

1. The Contractor shall properly dispose of all surplus material, including soil, in accordance with local, State and federal regulations.

2. Under no circumstances shall surplus material be disposed of in wetland areas as defined by the Florida Department of Environmental Protection or U.S. Army Corps of Engineers.

C. Existing Facilities: The work shall be so conducted to maintain existing facilities in operation insofar as is possible. Requirements and schedules of operations for maintaining existing facilities in service during construction shall be as described in the Specific Provisions.

D. Use of Chemicals: All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfection, polymer, reactant, or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions. Contractor must maintain a file on site of MSDs for above materials. All truck and equipment maintenance performed onsite shall be performed in such a manner to prevent fluids leaking on the ground.

E. Cooperation with Other Contractors and Forces:

1. During progress of work under this Contract, it may be necessary for other contractors and persons employed by the County to work in or about the project.

2. The County reserves the right to put such other contractors to work and to afford such access to the site of the work to be performed hereunder at such times as the County deems proper.

3. The Contractor shall not impede or interfere with the work of such other contractors engaged in or about the work and shall so arrange and conduct work that such other contractors may complete their work at the earliest date possible.

F. Construction shall be conducted and shall result in construction of the improvements of this project in full accordance with the conditions of the permits granted for the project.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01010

SUMMARY OF WORK

PART 1 – GENERAL

1.01 LOCATION OF WORK

A. Work included in this Contract will be done at the Lake County Solid Waste Management Facility (Astatula) Phase III Ash/MSW Landfill, 13130 County Landfill Road, Tavares, Florida 32778. The Lake County Phase III landfill is owned by the Lake County Board of County Commissioners and operated by the Lake County Public Works Division.

1.02 DESCRIPTION OF WORK

A. The Work is for closure of the Phase III Ash/MSW Landfill Cell at the Central Landfill site, which consists of approximately 4.7 acres. The Work includes furnishing all labor, materials, equipment, tools, transportation, services, incidentals, health and safety, and performing all work necessary to close a Class I landfill cell consisting of:

- Erosion and sediment control,
- Clearing and grubbing,
- Excavation and backfill,
- Grading,
- Geomembrane,
- Geocomposite,
- Protective soil cover,
- Stormwater structures,
- Sodding,
- Other pertinent construction.

The Work is to be complete, in place, and ready for operation and use by the County, in accordance with the Drawings and Specifications titled: Exhibit E – Closure Construction Specifications for Lake County Central (Astatula) Solid Waste Management Facility Phase III Landfill and Exhibit F – Closure Construction Drawings for Lake County Central (Astatula) Solid Waste Management Facility Phase III Landfill.

The closure of the Phase III Ash/MSW Landfill Cell shall proceed in an orderly manner as to protect the materials placed.

B. This project is a lump sum cost basis contract. Contractor shall be aware that this project is a solid waste landfill site (Florida Class III), and thus aware of the potential difficulties this may pose.

The topographic data provided in the bid documents may not represent the site conditions at the time of bidding or start of construction. Neither the County nor the Engineer express, imply, or guarantee that the actual amount of Work to be accomplished will correspond to the quantities given. The Bidders must assume that the quantities are inaccurate and therefore, the Bidders must satisfy themselves by personal examination of the project location and site conditions, estimate the quantity and extent of Work based on the Bid drawings, technical specifications and any Addendum thereof, and by such other means as they choose, as to the

actual conditions and requirements of the Work and the accuracy of the estimates given in the Plans, Specifications, and Contract Documents. The Bidder shall not, at any time after submission of Bid, dispute any such estimate of the County and Engineer, nor assert that there has been any misunderstanding in regard to the nature, site conditions or the amount of work to be done.

Topographic surveys performed by the Contractor as a part of the work shall be in AutoCAD 2018 (or later) format with contours of assigned elevations and shall be submitted to the Engineer in electronic format.

C. The Contractor shall complete all work described above and all other work incidental whether specifically mentioned or not in accordance with the Plan Drawings, Specifications, and Contract Documents.

D. Work shall conform to the following Drawings that form a part of these Contract Documents.

DRAWING INDEX	
DRAWING TITLE	**DRAWING NO.**
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COVER SHEET	G0
SYMBOLS AND LEGEND	G1
AERIAL PHOTOGRAPH	G2
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CLOSURE LINER GRADING PLAN	C1
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1.03 WORK BY COUNTY

A. County will continue the collection of waste within the active yard waste and citizens drop off areas. County will continue the use of the access road that runs through the construction area. Therefore, the access road must be kept open, and the Contractor is to furnish flagmen and/or all-weather bypass lanes when necessary.

B. If it is necessary in the course of operating the landfill for the Contractor to move its equipment and/or materials, they shall do so promptly and place that equipment and/or materials in an area that does not interfere with landfill operations.

C. Construction Quality Assurance (CQA): County will provide on-site inspection and quality assurance during construction. Quality control procedures will involve construction observation of the material and equipment components. Some of the functions are as follows:

- Inspection of materials,
- Review of site layout,
- Inspection of liner system materials,
- Inspection of soils,
- Pipe placement and slope,
- Inspection of equipment; and
- Inspection of Contractor's CQA procedures associated with soil classification, permeability, and compaction verification.

Contractor shall adhere to CQA procedures and work in cooperation with representatives of the County and Engineer toward the successful completion of the project.

1.04 WORK BY CONTRACTOR

A. The Contractor shall furnish all labor, materials, equipment, tools, services and incidentals to complete all of the work required as shown on the Drawings and specified herein.

B. The Contractor shall complete the work, in place, ready for continuous service, and shall include repairs, testing, permits, cleanup, replacements, and restoration required as a result of any damage caused during construction.

C. All material, equipment, skills, tools, and labor which are reasonably and properly inferable and necessary for the proper completion of the work, in a substantial manner and in compliance with the requirements stated or implied by the Specifications or Drawings, shall be furnished and installed by the Contractor without additional compensation, whether specifically indicated in the Contract Documents or not.

D. The Contractor shall comply with all municipal, county, state, and federal laws, rules, guidelines, and codes, which are applicable to the work.

E. The Contractor will be responsible for any and all traffic control around the construction area including constructing any by-pass roads to avoid construction areas.

F. The Contractor shall maintain dust control on all roads used for access to construction and all construction areas.

G. Contractor cannot interfere with any groundwater/gas sampling that may be necessary for permit compliance on-site.

1.05 CONTRACTOR USE OF SITE

A. Access to Site: Work shall be performed so as to not block or hinder site access, except as authorized by the County.

B. Except in the event of special construction, County restricts Work to daylight hours, with a maximum 10-hour day. No Work shall be done between the hours of 5:00 p.m. and 7:00 a.m. Monday through Saturday, Sundays, and Lake County Holidays. If the proposed and efficient prosecution of the Work requires operations during the aforementioned non-working hours and days, off-hour Work may be authorized by the County, if requested in writing at least 72 hours in advance by the Contractor before starting such items of the Work.

The Contractor is hereby informed and understands that normal working hours for the County's Resident Project Representative and Quality Assurance Consultant's sampling and monitoring personnel are 10 hours per day, 60 hours per week. If the Contractor plans to work more than 10 hours per day, 60 hours per week, the written permission for any work beyond the normal operating hours for the Resident Project Representative and Quality Assurance Consultant's sampling and monitoring personnel is to be requested in writing at least 24 hours in advance. All compensation to the Resident Project Representative and Quality Assurance Consultant for working beyond the normal 60-hour weekly schedule is considered "overtime" compensation and shall be paid by the Contractor. The overtime rate for each Resident Project Representative is $105 per hour for each hour beyond 60 hours per week. The overtime rate for the Quality Assurance Consultant's sampling and monitoring personnel is $105 per hour for each hour beyond 60 hours per week. The Resident Project Representative's and Quality Assurance Consultant's overtime compensation shall be processed as part of the final Change Order. Work that the County requires to be conducted on a Sunday so that directed Work would not interfere with the County's operations will not require "overtime" compensation to be paid by the Contractor.

C. Construction Operations: Limited to Landfill Area, Contractor's storage and office areas, as noted on Drawings.

D. Limit Use of Landfill Property:

1. Allow use of active materials drop off areas by public and County personnel including utilization of paved entrance roads and of haul roads.
2. Allow all operational activities by County.

E. Utility Outages and Shutdown: Prior approval by County and minimized in duration.

F. Safety Precautions

1. No smoking on the landfill or within the construction site.
2. Explosive and hazardous gases may be present. Provide detection equipment and procedures for protection.

G. Observe regulations posted at the landfill entrance for disposal of materials and use of the landfill.

1.06 SITE CONDITIONS

A. In accordance with the Contract Documents, the Contractor shall be responsible for having determined to its satisfaction, prior to the submission of its Proposal, the conformation of the ground, the character and quality of the substrate, the types and quantities of materials to be encountered, the nature of the ground water conditions, the execution of the work, the general and local conditions and all other matters which can, in any way, affect the work under this Contract. No claim for extras based on substrate or ground water table conditions will be allowed.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.01 DESCRIPTION

A. The Contractor shall receive and accept the compensation provided in the Contract as full payment for furnishing all labor, equipment, and materials and for performing all construction/operations necessary to complete the Work as described in the Contract, and in full payment for all losses or damages incurred during the Work, for any discrepancies between actual and estimated quantities, or from any unanticipated difficulties which may arise during the WORK until final acceptance by the County.

B. The descriptions provided in the following Paragraphs are to be used by the Bidder in preparing the Bid. They generally indicate how the major work scope items and their respective costs are to be separated into the line items listed in the Bid. These descriptions are not fully representative nor all-inclusive of the Work required to complete the project in accordance with the Contract Documents. It is the Bidder's responsibility to include all required costs within the most appropriate line items.

C. Payment for the various items on the Contractor's Bid Form, as further specified herein, shall include all compensation to be received by the Contractor for furnishing all tools, equipment, supplies, and manufactured articles and for all labor, operations, supervision, overhead, and profit, and incidentals appurtenant to the items of work being described as necessary to complete the various items of the Work all in accordance with the requirements of the Contract Documents, including all appurtenances thereto, and including all costs of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor.

D. No separate payment will be made for any item that is not specifically set forth on the Contractor's Bid Form and all costs, therefore, shall be included in the prices named on the Contractor's Bid Form for the various appurtenant items of work. Payment for complying with the safety requirements for construction on the worksite shall be included in the contract lump sum price paid for the various items of work wherein it is required, and no separate payment will be made. Also, no separate payment shall be made for the following work, and all costs shall be included in the appropriate payment item in the lump sum portion of the Bid:

   a. Storm water runoff management and disposal of water during construction;
   b. Wastage; overlaps; soil volume changes;
   c. Soil losses due to transporting, storing, weathering, or placing;
   d. Unusable portions of the materials or products installed;
   e. Trash fencing, silt fencing, and turbidity barriers;
   f. Ditch blocks;
   g. Erosion control, protection of Work from storms and erosion, and construction of temporary; structures during construction;
   h. Cleaning stormwater inlets, culverts, and structures due to sediment generated by the construction;
   i. Hauling for disposal of construction waste material and site cleaning;

j. Traffic control activities;
k. Dust control;
l. Field verifications or locating buried utilities;
m. Taxes, insurance, bonds, overhead, and profit;
n. Preparation of and compliance with the Project Schedule; and
o. All other work required and incidental to the Contract.

E. The Lump Sum Base Bid Amount shall cover all work required by the Contract Documents. All costs in connection with the proper and successful completion of the Work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction equipment and tools; including all costs and expenses for taxes, commissions, transportation charges, and expenses, permit fees, patent fees, royalties, handling, and tests; and performing all necessary labor and supervision to fully complete the Work shall be included in the Bid price. All work not specifically set forth as a pay item on the Contractor's Bid Form shall be considered a subsidiary obligation of Contractor and all costs in connection therewith shall be included in the lump sum Bid.

F. There will be no payment for rejected or unused products. Payment will not be made for the following:

a. Loading, hauling, and disposing of rejected material;
b. Quantities of material wasted, eroded, washed away, or disposed of in a manner not called for under Contract Documents;
c. Rejected loads of material, including material rejected after it has been placed by reason of the failure of Contractor to conform to provisions of Contract Documents;
d. Material not unloaded from transporting vehicle;
e. Failure to submit an updated progress schedule with pay application;
f. Defective work not accepted by the County;
g. Work performed without approved shop drawing;
h. Material remaining on hand after completion of work.

G. The Contractor shall be responsible for establishing contracts with its subcontractors, which have a measurement and payment in accordance with this Section. If the Contractor establishes a contract with its subcontractors, which conflicts with this Section, any additional cost incurred will be borne by the Contractor.

H. Partial Payment for Stored Materials and Equipment:

a. Partial Payment: Partial payment for liner materials will be made in the amount invoiced from the manufacturer, for liner materials which have been received and stored on site in accordance with Section 01611: Storage and Protection.
b. Final Payment: Will be made only for products incorporated in work and the product has been completed, tested, and accepted by the County.

1.02 LUMP SUM

A. For lump-sum items, payments shall be made to the Contractor based on the Lump Sum Bid items in accordance with an accepted Schedule of Values-based on actual work completed and accepted by the County at the time of partial payment request.

1.03 PAYMENT FOR INCREASED OR DECREASED QUANTITIES

A. The actual percentage of each lump sum price item completed by the Contractor and accepted by the County at the final completion of the Project will be paid to the Contractor.

1.04 DELETED ITEMS

A. Should any items contained in the Bid be found unnecessary for the proper completion of the Work contracted, the Engineer may eliminate such items from the Contract. This action shall in no way invalidate the Contract and no financial allowance or compensating payment for anticipated profit, overhead, etc., will be made for items so eliminated in making final payment to the Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 MEASUREMENT AND PAYMENT ITEMS

The descriptions provided in the following Paragraphs are to be used by the Bidder in preparing the Bid. They generally indicate how the major work scope items and their respective costs are to be separated into the line items listed in the Bid. These descriptions are not fully representative nor all-inclusive of the Work required to complete the project in accordance with the Contract Documents. It is the Bidder's responsibility to include all required costs within the most appropriate line item(s). All work items are to be paid on a lump sum basis as described below and shall constitute full compensation for all material, labor, equipment, and work incidental thereto, necessary to complete this item in accordance with the Contract Documents.

General

Item 1. - Mobilization/Demobilization (Lump Sum)

1. Measurement. The work required for this item shall not be measured for payment.

2. Payment. Payment shall cover all work as per Section 01025. This includes, but is not limited to, the movement of personnel, equipment, supplies, and incidentals to the project site. No price adjustments will be made for this item due to changes in the work. Demobilization includes removal from the site of all materials, resources, equipment, temporary support facilities, utilities, and all remaining construction debris at the completion of the project and includes the release of liens and other incidentals as specified as requirements of project closeout. The combined mobilization/demobilization cost shall not exceed five percent (5%) of the total contract price and shall be equally split.

   The final payment for mobilization/demobilization will not be made until all temporary facilities, temporary erosion and sedimentation controls, equipment, and appurtenances have been removed from the site.

Item 2. - Project Field Survey and Documentation (Lump Sum)

1. Measurement. The work required for this item shall be on a completed lump sum basis.

2. Payment. Payment will include project surveying for tying into the site coordinate and elevations by a Florida Licensed Land Surveyor; staking out and re-staking construction; and performing record surveying throughout the construction duration; subgrade liner elevation; liner elevations; protective soil cover elevations; stormwater piping connections and inverts. The as-built survey notes will identify such items as state plane coordinates, ground elevations, pipe depth, pipe slope, liner component elevations, grading elevations, top of pipe coordinates and elevations, pipe diameter, identification of fitting sizes, and construction, pipe, and fitting notes. The Contractor shall be paid on a prorated basis throughout the duration of the contract. Payment shall not exceed a maximum of 80% of this item before providing Record Drawings in accordance with the Specifications. Once the Record Drawings have been determined to be complete according to the Specification requirements, the entire price shall be paid to the Contractor.

Item 3. - Administration (Lump Sum)

1. Measurement. The work required for this item shall be on a completed lump sum basis.

2. Payment. Payment for this item includes, but is not limited to, obtaining all permits, insurance, and bonds; and any other pre-construction expense necessary for the start of the work; attending project meetings; preparing and submitting shop drawings, construction photographs and video, partial payment requests, contract forms; coordination with subcontractors and suppliers; providing and maintaining temporary equipment staging and storage of materials area(s), and providing temporary support facilities.

Closure Cap and Stormwater System

Item 4. – Clearing and Grubbing (Lump Sum)

1. Measurement. Measurement for this item shall be on a completed lump sum basis.

2. Payment. Payment for this item includes, but is not limited to, all labor, equipment, materials, compliance with health and safety requirements, and services necessary to clear and grub all areas within the limits of construction, including clearing vegetation, grubbing soil, loading, hauling, and unloading material at a location designated by the County. This item includes stripping vegetation and topsoil over the Phase III Ash/MSW cell project area and soil borrow area, and loading, hauling, unloading, and stockpiling soil in an on-site area designated by the County.

Item 5. Earthwork – Subgrade Preparation (Lump Sum)

1. Measurement. The work required for this item shall be on a completed lump sum basis.

2. Payment. Payment for this item includes, but is not limited to, all labor, equipment, materials, compliance with health and safety requirements, and services related to earthwork necessary to excavate soil from the onsite borrow area and construct the Phase III Ash/MSW Cell liner subgrade. The work includes excavating, storage, loading, hauling for material placement, placing, compacting, testing, and maintaining and protecting the complete earthwork to the required liner subgrades. All earthwork not explicitly covered in other items is included in this item such as excavating the anchor

trench except for stormwater ditches which will be paid under Item 10. The Contractor shall provide a record survey of the completed subgrade before geosynthetic installation. Partial payments shall be paid based on the percentage of completed and approved subgrade.

Item 6. - Geomembrane - 40-mil Textured LLDPE Liner (Lump Sum)

1. Measurement. The work required for this item shall be on a completed lump sum basis.

2. Payment. Payment for this item includes but is not limited to, all labor, equipment, materials, tools, compliance with health and safety requirements, certification of surveying, factory, laboratory and field testing, supervision, incidentals (including anchor trench), cleaning the tie-in area to existing liner and performing the tie-in with the existing liner, and services necessary to furnish and install the Geomembrane as shown on the Drawings and stated in the Specifications. Additional material placed in the anchor trenches, overlap, and geomembrane wastage shall be incidental to this work. Partial payments shall be paid based on the percentage of the area of the Geomembrane approved for overlying the approved Subgrade area, and is approved to be covered by the Composite Drainage Net.

Item 7. – Composite Drainage Net (Lump Sum)

1. Measurement. The work required for this item shall be on a completed lump sum basis.

2. Payment. Payment for this item includes but is not limited to, all labor, equipment, materials, tools, compliance with health and safety requirements, certification of surveying, factory, laboratory and field testing, supervision, incidentals (including anchor trench), and services necessary to furnish and install the Geocomposite Net as shown on the Drawings and stated in the Specifications. Additional material placed in the anchor trenches, overlap, and waste shall be incidental to this work. Partial payments shall be paid based on the percentage of the area of the Geocomposite Net approved that overlays the approved Geomembrane area, and is approved to be covered by the Protective Cover Soil.

Item 8. – Protective Cover Soil (Lump Sum)

1. Measurement. The work required for this item shall be on a completed lump sum basis.

2. Payment. Payment for this item includes, but is not limited to, all labor, equipment, materials, tools, compliance with health and safety requirements, and services relating to installing the Protective Cover Soil including but not limited to excavating soil from the on site borrow area, stockpiling, loading, hauling, placing, installing, compacting, grading, and services necessary to furnish and install the Protective Cover Soil including QC testing, reworking and retesting, correcting damage as a result of wind and stormwater effects, protection of stockpiled materials, and all related work as shown on the Drawings and stated in the Specifications. This item includes additional Protective Cover Soil required for constructing stormwater tack-on berms and additional Drainage Sand required for ballast in the west portion of the cell. This item includes installing edge-of-liner markers. The Contractor shall provide a record survey of the completed drainage soil layer with the surveying paid under Item 3. Partial payments shall be paid based on the area covered with a minimum of 24 inches of Protective Cover Soil including areas with greater thickness to meet the required finish grades.

Item 9. – Anchor Trench with Toe Drain (Lump Sum).

1. Measurement. Measurement for this item shall be on a completed lump sum basis.

2. Payment. Payment for this item includes, but is not limited to, all labor, equipment, materials, compliance with health and safety requirements, and services necessary to furnish and install an anchor trench with toe drain piping and discharge structures. The work includes all excavation, geomembrane, composite drainage net, piping, stone, geotextile, discharge pipe, concrete discharge structures; and furnishing and installing all appurtenances, fittings, fasteners, and incidentals to complete the work.

Item 10. - Stormwater System (Lump Sum).

1. Measurement. Measurement for this item shall be on a completed lump sum basis.

2. Payment. Payment for this item includes, but is not limited to, all labor, equipment, materials, compliance with health and safety requirements, and services necessary to furnish and install drainage structures, filling, compaction, testing, piping, end sections, and construction of ditches. The work includes all excavation, piping, all backfill material and compaction for drainage improvements. Structures, grout filled fabric revetment, geotextiles, and turf reinforcement mat; and furnishing and installing all appurtenances, fittings, and fasteners to complete the work. Partial payment for this item shall be on a percent of the total storm water system complete.

Item 11. – Passive Vents (Lump Sum).

1. Measurement. Measurement for this item shall be on a completed lump sum basis.

2. Payment. Payment for this item includes, but is not limited to, all labor, equipment, materials, compliance with health and safety requirements, and services necessary to furnish and install passive landfill gas vents. The work includes all boring, transportation of excavated refuse to the top of the Phase III hill for disposal, PVC piping (slotted and non-slotted), stone, soil, geomembrane, quality control, surveying, testing and other incidentals.

Final Grade Treatment

Item 12. - Sod (Lump Sum)

1. Measurement. Measurement for this item shall be on a completed and installed lump sum basis.

2. Payment. Payment for this item shall be on a completed and installed lump sum basis. Payment for sod is for the surface areas of the Phase III Ash/MSW cell, including, perimeter ditch area due to any excavation and ditch crossing, perimeter ditches, and any other areas as designated by the Contract Documents. Payment shall include any necessary surface regrading of equipment disturbed areas, installing new sod, fertilizing, and watering. Payment will not be made for any surface area repaired by the Contractor that the Engineer and County believes has been disturbed unnecessarily and sod needs to be placed. Installation shall be completed by the Substantial Completion date and watering shall continue through the Final Completion date.

END OF SECTION

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SECTION 01027

APPLICATION FOR PAYMENT

PART 1 – GENERAL

1.01 RELATED REQUIREMENTS

A. General provisions of Contract, including General and Supplementary Conditions

B. Division 1 through Division 15 Specification Sections

C. Section 01370 - Schedule of Valves

1.02 SECTION INCLUDES

A. Administrative and procedural requirements governing the Contractor's Schedule of Values and Applications for Payment.

1.03 SCHEDULE OF VALUES

A. Coordinate preparation of the Schedule of Values with preparation of the Progress Schedule.

B. Submit the preliminary and finalized Schedule of Values in accordance with the General Conditions.

C. Sub-Schedules: Where the work is separated into phases that require separately phased payments, provide sub-schedules showing values correlated with each phase of payment.

D. Format and Content:

1. Identification: Include the following Project Identification on the Schedule of Values:
   a. Project name and location.
   b. Name of the Engineer.
   c. Project or bid number.
   d. Contractor's name and address.
   e. Date of submittal.
2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
   a. Generic name.
   b. Related Specification Section.
   c. Change Orders (numbers) that have affected value.
   d. Dollar value.
   e. Percentage of Contract.
3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Separate principal subcontracts into several line items.

4. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.
5. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of indirect cost, general overhead, and profit margin.

E. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the Contract Price.

1.04 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Engineer and paid for by the County.

B. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

C. Payment Application Times: each progress payment date is as indicated in the General Conditions. The period of Construction work covered by each Application for Payment is the period indicated in the General Conditions.

D. Payment Application Forms: Applications for payment shall be made once per month.

E. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Contractor. Incomplete applications will be returned without action.

1. Entries shall match data on the Schedule of Values and Progress Schedule. Provide updated schedules if revisions have been made.
2. Include amounts of Change Orders and work Change Directives issued prior to the last day of the construction period covered by the application.

F. Transmittal: Submit three (3) complete original executed copies of each Application for Payment to the Engineer, including Contractor's Warranty of Title, Consent of Surety, waivers of liens from the Contractor, all subcontractors and vendors, and similar attachments, when required, each on the forms provided in the Contract Documents. For the Final Payment Application, provide one (1) additional original executed copy of each Application for Payment to the Engineer, including Contractor's Warranty of Title, final waivers of liens from the Contractors, all subcontractors and vendors, and similar attachments, when required, each on the forms provided in the Contract Documents.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application in a manner acceptable to the Engineer.

G. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics liens on the forms provided in the Contract Documents from Contractor and from subcontractors or sub-subcontractors and suppliers for the construction period covered by the previous application.

1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.

3. The County reserves the right to designate which entities involved in the work must submit waivers.
4. Submit Final Application for Payment with or proceeded by final waivers on the forms provided in the Contract Documents from every entity involved with performance of work, including material and/or equipment suppliers, covered by any Application for Payment who could lawfully be entitled to a lien.
5. Subcontract and Supplier lien waivers shall itemize the current cost and status of their contract with the Contractor, including change orders.
6. Waivers Form: Submit waivers of lien on the forms provided in the Contract Documents and executed in a manner acceptable to County.

H. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for County occupancy of designated portions of the Work.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01030

SPECIAL PROVISIONS

PART 1 – GENERAL

1.01 CONTRACTOR QUALIFICATIONS

A. Qualifications: The Contractor and any Subcontractor for general construction of a landfill closure liner, manufacturing of geosynthetic materials, and installation of geosynthetic materials shall have the following minimum qualifications. The qualification documents shall be submitted with the bid documents. If any Subcontractor cannot meet the following qualification in the opinion of the County and Engineer, the County reserves the right to require the Contractor to propose another company who can meet these minimum qualifications:

1. General Contractor: The Contractor's qualifications shall demonstrate, by submitting a list of previous projects and references, a minimum of three (3) similar size construction projects within the last five (5) years.
2. HDPE Geomembrane/GCL/CDN Manufacturer's qualifications shall demonstrate a minimum of five (5) years of successful development and production of at least 10 million square feet of material and a minimum of six (6) similar size active projects within the last five (5) years by submitting a list of previous projects and references.
3. HDPE Geomembrane/GCL/CDN installer qualifications shall demonstrate a minimum of five (5) years of successful installations of at least 10 million square feet of material and a minimum of six (6) similar size active projects within the last five (5) years by submitting a list of previous projects and references.
4. The Contractor shall submit resumes of its general construction and Subcontractor's (including installers) key personnel, including the Project Manager, Superintendent, and Supervisor highlighting experience with similar size landfill closure liner system and passive gas venting system construction projects.
5. The Contractor and Subcontractor shall submit United States Occupational Safety and Health Administration (OSHA) Certifications and resume for the proposed Site Safety Officer.

1.02 CONSTRUCTION SAFETY PROGRAM

A. The Contractor is advised that decomposing refuse produces landfill gas which is approximately 50 percent methane by volume. The Contractor is advised of the need for precautions against fire, explosion and asphyxiation when working in or near excavations which are in or near refuse-filled areas.

B. The Contractor shall perform all work in a fire-safe manner. Contractor shall supply and maintain, on the site, adequate fire-fighting equipment capable of extinguishing incipient fires. The Contractor shall provide and maintain, for the duration of the Contract, a Health and Safety Plan that will effectively incorporate and implement all required safety provisions for work in or near refuse-filled areas including complying with all federal, state and local safety codes, ordinances and regulations, including the requirements of the OSHA, in accordance with 29 CFR 1910, OSHA Standards and other such safety measures as may be required by the above-mentioned regulatory agencies. Where these regulations do not apply, applicable parts of the National Fire Prevention Standards for Safeguarding Building Construction Operations (NFPA No. 241) shall be followed. The Contractor shall appoint an employee who is qualified and

authorized to supervise and enforce compliance with the safety program. This person should be present at all times during construction and should be trained in the use of all of the recommended safety equipment.

C. All excavation shall comply with the applicable requirements as stated in the following:

1. OSHA excavation safety standards 29 CFR, 1926-650, subpart P.
2. State (Trench Safety Act Section 553.60-553.64 Florida Statutes) and County construction safety regulations.
3. Trench safety guidelines as specified in "*A Compilation of Landfill Gas Field Practices and Procedures"* developed by the Landfill Gas Division of the Solid Waste Association of North America (SWANA).

D. The duty of the Engineer or the County to conduct review of the Contractor's performance is not intended to include a review or approval of the adequacy of the Contractor's safety supervisor, the safety program, or any safety measures taken in, on, or near the project construction site. The Contractor has complete responsibility of the construction safety program based on all applicable federal, state, and local codes, ordinances, and regulations.

E. The Contractor shall make all reports as are, or may be, required by any authority having jurisdiction and permit all safety inspections of the work being performed under this Contract. Before proceeding with any construction work, the Contractor shall take necessary action to comply with all provisions for safety and accident prevention.

F. Payment for complying with the additional Safety Requirements for Construction on the work shall be included in the Contract price, and no separate payment will be made, therefore.

G. The Contractor shall prepare a written site-specific Health and Safety Plan (Plan) for use by the Contractor and Subcontractor site workers. This plan must be prepared to meet the 29 CFR 1910.120 OSHA regulations and shall include as a minimum, the following:

1. Organizational Structure to include general supervision, Health and Safety officer, lines of authority, and responsibility and communication. The Health and Safety Officer shall be a worker who will always be present during site construction, in addition to his/her other site duties.
2. Comprehensive Work Plan to include the work tasks and objectives, resources needed, and training requirements for workers (health and safety, machine operations license, etc.). This shall also include a section on safety procedures to be followed for excavation and well drilling.
3. If Work is within the disposal areas, an Asbestos Work Plan is required to include approach for workers to excavate and drill in environments with asbestos containing materials present. Plan shall include the Work tasks and objective and resources needed.
4. Health and Safety to include identification of possible site hazards, training levels for each category of site workers, personal protective equipment and medical surveillance needed, site control measures, and confined space entry procedures.
5. Emergency Response Plans to include all emergency telephone numbers, a highlighted map showing the quickest route to the nearest emergency care facility, and directions to such facility.

6. Air Monitoring Procedures to include frequency and type of air monitoring of exposed refuse and site worker areas, calibration of air monitoring equipment, and action levels of air contaminants for site worker protection. All equipment calibration and field gas measurements shall be recorded with the date and time of sample, and the sampler's name. Sampling shall be done by a Contractor worker trained in the use of the gas sampling equipment. These trained workers shall be designated in the Contractor's Plan.
7. Respiratory Protection Program to include written documentation of the Contractor's respiratory program.
8. A signature page for all site workers covered by the Plan (Contractor and Subcontractor site workers).

1.03 ENVIRONMENTAL PROTECTION

A. Excavations: No exposed solid waste shall be allowed at the end of the day. All solid waste shall be covered and prevented from mixing with storm water run-off.

B. Environmental Constraints:

1. Dust Control: Trucked water shall be used if necessary to prevent dust. The Contractor may obtain water for dust control from the on-site stormwater ponds or adjacent ditches.
2. Fire Control: Contractor shall be responsible for fire control and shall include fire control procedures (which will be adhered to during the entire contract time) in the Health and Safety Plan required in the above section.
3. Litter: The Contractor shall be required to control, collect, and truck all litter excavated or exposed by the work to an on-site location designated by the County. Any litter generated by the Contractor must be collected by the end of the workday.
4. Erosion Protection: Contractor is responsible for designing, providing, maintaining and removing temporary erosion and sedimentation controls as necessary to protect the work, prevent sedimentation from the Contractor's activities from entering water bodies or entering other parts of the County's site outside the construction limits, and maintain sedimentation within acceptable limits as established by agencies having jurisdiction.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01050

FIELD ENGINEERING AND SURVEYING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The Work shall consist of the performance of all necessary survey work related, but not limited to liner system grades and subgrades, staking out, layouts, establishment of lines, elevations, grades and slopes, stormwater piping and structures, and passive vents locations as required, in accordance with the Contract Documents, Construction Drawings, and as indicated by the CQA Manager.

B. The Work shall consist of providing all the survey work to prepare the required "as-built" record drawings.

1.02 RELATED WORK

A. Section 01720 **–** Project Record Documents

B. Section 02776 – Linear Low Density Polyethylene (LLDPE) Geomembrane

1.02 QUALITY CONTROL

A. The Contractor's Surveyor shall be a Land Surveyor registered in the State of Florida.

B. Preserve field books, stakeout data, and as-built data until one year after final acceptance of Work.

1.03 SUBMITTALS

A. Submit name, address, telephone number, and qualifications of Surveyor before starting survey work.

B. On request, submit documentation verifying accuracy of survey work performed by the Surveyor.

1.04 PROJECT RECORD DOCUMENTS

A. Maintain a complete and accurate log of control and survey work as it progresses.

B. On completion of the Work, the Contractor shall prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site Work.

C. Submit Record Documents under provisions of Section 01720. The Contractor is to submit three prints for each record drawing required and one electronic copy of all drawings.

D. Record drawings shall be prepared by the Contractor at a scale of 1 inch = 100 feet with a 1-foot contour interval, unless otherwise directed by the Engineer. All record drawings shall be signed and sealed by a Surveyor licensed in the State of Florida.

1.06 EXAMINATION

A. The Contractor shall verify locations of survey control points prior to starting work.

B. The Contractor will promptly notify the CQA Manager of any discrepancies discovered.

1.07 SURVEY REFERENCE POINTS

A. The County will be responsible for establishing primary reference points. The Contractor shall be responsible for all other survey and layout work. Maintenance of the reference points established by the County shall be the responsibility of the Contractor.

B. Control datum for survey will be provided by County.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to the CQA Manager the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to the CQA Manager.

1.08 SURVEY REQUIREMENTS

A. All work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings or as directed by the CQA Manager. County will provide benchmark with appropriate horizontal and vertical control. Elevation of existing ground, structures and appurtenances are believed to be reasonably correct but are not guaranteed to be absolute and, therefore, are presented only as approximations. Any error or apparent discrepancy in the data shown, or omissions of data required for accurately accomplishing the stakeout survey shall be referred immediately to the CQA Manager for interpretation or correction.

B. Other general requirements include:

1. Provide field surveying services. Utilize recognized engineering survey practices.
2. The Contractor shall furnish for the survey work and stakeout, competent and qualified personnel acceptable to the County.
3. The Work shall proceed immediately upon issuance of the Notice to Proceed and shall be expeditiously progressed to completion in a manner and at a rate satisfactory to the County. The Contractor shall keep the County fully informed as to the progress of the survey.
4. It shall be the Contractor's responsibility to maintain the survey and stakeout stakes in their proper position and location at all times.

5. Any existing stakes or markers defining property lines and survey monuments which may be disturbed during construction shall be properly tied in to fixed reference points and accurately reset in their proper position upon completion of the Work.

C. The Contractor will verify in the field that the topographic map provided in the Drawings of the work area is accurate. Discrepancies in the topographic mapping or field verification identified by the Contractor are to be immediately brought to the attention of the CQA Manager and the County.

D. The exact position of all Work shall be established from control points, base line points or other points which are shown on the Drawings or as modified by the CQA Manager.

E. Any error, apparent discrepancy, or absence in or of data shown or required for accurately accomplishing the stakeout survey shall be referred to the CQA Manager for interpretation or for furnishing when such is observed or required.

F. The Contractor shall be responsible for the accuracy of its work and shall maintain all reference point stakes, etc., throughout the life of the Contract. Damaged or destroyed points, benchmarks or stakes or any reference points made inaccessible by the progress of the construction shall be replaced or transferred by the Contractor. Existing or new control points that will be destroyed during construction shall be transferred or reestablished before they are damaged or destroyed and all reference ties recorded therefore shall be furnished to the CQA Manager.

G. All stakeout survey work shall be referenced to the lines shown on the plans or as directed by the CQA Manager.

H. All computations necessary to establish the exact position of the Work from control points shall be made and preserved by the Contractor. All computations, survey notes and other records necessary to accomplish the Work shall be neatly made, shall be made available to the CQA Manager or Engineer upon request, and shall become the property of the County and delivered to the Engineer prior to final acceptance of the project.

I. The County or CQA Manager may check all or any portion of the stakeout survey work or notes made by the Contractor. Any necessary correction to the Work shall be made immediately by the Contractor. Such field checking shall not relieve the Contractor of any responsibilities for the accuracy or completeness of his work.

J. The Contractor shall place offset stakes or references as required for construction and at such points as the CQA Manager may direct. From computations and measurements made by the Contractor, these stakes shall be clearly marked with the offset and cut or fill so as to permit the establishment of the exact location and elevation during construction. If markings become faded or blurred for any reason, they shall be restored by the Contractor at the request of the CQA Manager. The Contractor shall locate, and place all cut, fill, slope, grade or other stakes and points as the CQA Manager may direct for the proper progress of the Work. All control points shall be properly guarded and flagged for easy identification.

K. Structures shall be staked out by the Contractor at the locations and elevations shown on the Drawings or as ordered by the CQA Manager.

L. During the progress of the construction, the Contractor will be required to furnish all of the surveying and stakeout incidental to the proper location by line and grade for each phase of the Work.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 SURVEY REFERENCE POINTS

A. Locate and protect control points prior to starting site Work and preserve all permanent reference points during construction. All Work will be referenced to the North American Vertical Datum of 1988 (NAVD 88) and the Florida State Plane, East Zone.

B. Make no changes or relocations without prior written notice to the CQA Manager.

C. Report to the CQA Manager when any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations.

D. Replace control points which may be lost or destroyed at no additional cost to the County. Establish replacements based on original survey control.

3.02 TOLERANCES

A. Each design feature shall be staked by the Contractor to the lines and grades as shown on the Construction Drawings to within 0.1 feet.

3.03 PROJECT SURVEY REQUIREMENTS

A. Establish temporary benchmarks as needed, referenced to data established by survey control points. Record locations, with horizontal and vertical data, on the Record Drawings.

B. The Contractor's surveyor shall make available to the CQA Manager electronic files and AutoCAD version 2018 drawing files, on a CD or USB flash drive, of each survey to verify pay quantities from Contractor's estimates.

C. Submit a certified survey drawing referenced to the site coordinate system for survey submittals as specified in Section 01720, Project Record Documents.

D. Establish lines and levels, locate and layout, by instrumentation and similar appropriate means:

1. Pre-Construction Layout:

    a. County will provide latest topographic survey for the project area.
    b. Contractor will submit an as-built liner subgrade survey to the CQA Manager. Liner placement may not commence until the as-built conditions are approved, in writing, by the CQA Manager.

2. Site improvements:

    a. Piping slopes and invert elevations (every 50 feet and at every grade break, connection, angle change and discharge location).
    b. Grades prior to placement of liner.
    c. Top of Liner System.
    d. Final site elevations. The Contractor shall submit a Digital Terrain Model (DTM) format of the survey and calculated quantities to the CQA Manager to verify the Contractor's placement of at least 2-feet of protective cover over the liner.
    e. Stormwater structures and ditches.
    f. Liner limits.

3.04 RECORDS

A. On a monthly basis, or other frequency specified by the County verify layouts by same methods to be submitted as part of Partial Pay Request.

B. Maintain a complete, accurate log of all control and survey work as it progresses.

3.05 SUBMITTALS

A. At the request of the CQA Manager, submit documentation to verify accuracy of field engineering work, within 48 hours.

B. Submit certificate signed by a Florida Registered Surveyor certifying that elevations and locations of improvements are in conformance, or nonconformance, with the Contract Documents.

C. Submit record documents under provisions of Section 01720 including but not limited to:

1. Maintain a complete, accurate log of all controls and survey work as it progresses.
2. Submit record documents under the provisions of Section 01720.
3. At end of the project, submit a certified site survey and record drawing information in PDF format.
4. All survey information should be tied into site coordinate system.
5. Liner and leachate collection piping shown in 1”=50’ scale.
6. Catch basins, stormwater piping and structures require invert elevations.
9. (As-Built) Record drawing grade elevations will be required before liner installation and after placement of liner cover soils. The Contractor's licensed Florida Land Surveyor will provide and maintain as-built notes and a finished as-built drawing at the completion of liner installation, and cover. The liner subgrade must be accepted by the CQA Manager in writing before the start of liner installation. As-built drawings shall show actual grades, lengths, elevations and quantities of constructed items if different from those shown on the construction plans. As-built grade information shall be provided for the liner component phases listed below depicting high points and low points of liner construction and at all changes in grades at intervals of no greater than 200 feet. The construction tolerance is $\pm$0.1 foot, but as-built record drawings must demonstrate that at least 2-feet of soil have been placed over the liner. In addition, the following information must be provided:

a. Pre-construction Survey.
b. Liner system subgrade.
c. Liner system elevation after installation to determine any changes in grade. According to Section 02776, 7.02.
d. Anchor trench.
e. Finish grade of Protective soil layer.
f. Edge of Liner markers.
g. Concrete structures.
h. Topographic survey of site including all construction areas.

10. Results of topographic surveys shall be plotted in plan to a scale similar to the Drawings and shall be submitted to the CQA Manager.

END OF SECTION

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SECTION 01200

PROJECT MEETINGS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The Engineer will schedule and administer a preconstruction conference, periodic construction progress meetings, and specially called meetings throughout the progress of the work.

1. Prepare agenda for meetings.
2. Make physical arrangements for meetings.
3. Preside at meetings.
4. Prepare and distribute meeting minutes to all attendees.

B. Representatives of contractors, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. The Contractor shall attend meetings to ascertain that work is expedited consistent with Contract Documents and construction schedules.

D. Related Work Described Elsewhere:

1. Section 01310: Progress Schedule and Report.
2. Section 01340: Shop Drawings, Working Drawings, and Samples.
3. Section 01720: Project Record Documents.

1.02 PRECONSTRUCTION CONFERENCE

A. A preconstruction conference shall be scheduled by the Engineer and shall be held before earthwork activities and geosynthetic installation begin.

B. Location: The location of the conference shall be a central site, convenient for all parties, designated by the Engineer.

C. Attendance Requested:

1. County's representative.
2. Resident project representative (RPR).
3. Engineer and their professional consultants.
4. Construction Quality Assurance Manager/Monitors (CQAM).
5. Contractor's representative.
6. Subcontractor's representative.
7. Others, as appropriate.

D. Suggested Agenda:

1. Provide attending parties with relevant documents.
2. Define lines of communication, authority, responsibility, and assignments of the County’s representatives.

3. Review the construction drawings, specifications, CQA plan, work area security, safety procedures, and related issues.
4. Critical and suggested work sequencing: Relationships and coordination with facility operation.
5. Major equipment deliveries and priorities.
6. Project coordination and control.
7. Procedures and processing of:
    a. Field decisions.
    b. Proposal requests.
    c. Submittals.
    d. Change orders.
    e. Applications for payment.
8. Submittal of Shop Drawings.
9. Procedures for maintaining Record Documents.
10. Project schedule and schedule of submittals.
11. Use of premises:
    a. Office, work and storage areas.
    b. County's requirements.
    c. Access and traffic control.
12. Construction facilities, controls, and construction aids.
13. Temporary facilities, field trailers, utilities.
14. Safety and first aid procedures.
15. Check of required Bond and Insurance certifications.
16. Completion time for contract and liquidated damages.
17. Request for extension of contract time.
18. Request for a weekly job meeting for all involved.
19. Security procedures.
20. Procedures for making partial payments.
21. Guarantee on completed work.
22. Equipment to be used.
23. Field Surveying.
24. Project inspection.
25. Labor requirements.
26. Laboratory testing of material requirements.
27. Inventory of material stored on site provisions.
28. Requirements of railroads, highway departments, and other organizations.
29. Rights-of-way and easements.
30. Housekeeping procedures.
31. Posting of signs.
32. Pay request submittal dates.
33. Permits.
34. Conduct a site inspection to discuss work areas, stockpile areas, laydown areas, access roads, haul roads, temporary facilities area, and related items.

1.03 WEEKLY PROGRESS MEETINGS

A. Regular periodic construction progress meetings will be scheduled. During the liner system construction period (liner subgrade preparation, liner material installation, etc.), the meeting shall be held at least weekly.

B. Meetings shall be held as required by progress of the work.

C. Location of the meetings: The location of the conference shall be a central site, convenient for all parties, designated by the Engineer.

D. Attendance:

1. Engineer and their professional consultants (as needed).
2. Contractor.
3. County's representative.
4. Subcontractors (as appropriate to the agenda).
5. Suppliers (as appropriate to the agenda).
6. Others (as appropriate).

E. Suggested Agenda:

1. List day number of total contact days.
2. List the number of days remaining to Substantial Completion date.
3. Review approval of minutes of previous meeting.
4. Review of work progress since previous meeting.
5. Review of the Number of Rain days and “Abnormal Rain Days”.
6. Review of Temporary Erosion Control conditions and any problems.
7. Field observations, problems, and conflicts.
8. Problems which impede the Construction Schedule.
9. Review of off-site fabrication and delivery schedules.
10. Corrective measures and procedures to regain projected schedule.
11. Revisions to Construction Schedule.
12. Progress schedule during succeeding work period.
13. Coordination of schedules.
14. Shop Drawing submittals.
15. Maintenance of quality standards.
16. Review proposed changes for:
    a. Effect on Construction Schedule and on completion date.
    b. Effect on other contracts of the Project.
17. Review of Schedule of Valve Completion Prior to Pay Request Application.
18. Construction Schedule.
19. Field Surveying Activities; completed and impending.
20. Critical/long-lead items.
21. Establish testing protocols and procedures for correcting and documenting construction or nonconformance.

22. Discuss liquidated damages.
23. Conduct a site inspection to discuss work areas, stockpile areas, laydown areas, access roads, haul roads, and related items.
24. Other business.

F. The Contractor shall attend construction progress meetings and shall study previous meeting minutes and current agenda items, in order to be prepared to discuss pertinent topics regarding progress of the work.

G. The Contractor is to provide a current submittal log at each progress meeting in accordance with Section 01340.

1.04 DAILY PROGRESS MEETINGS

A. An informal progress meeting is recommended daily before the start of work. At a minimum, the lead CQAM Monitor and Site Supervisor will attend this meeting. This meeting is intended to accomplish the following:

1. Discuss problems and resolutions.
2. Review test data.
3. Discuss the Construction Contractor's personnel and equipment assignments for the day.
4. Review the previous day's activities and accomplishments.
5. Resolve outstanding problems or disputes.

1.05 OTHER MEETINGS

A. As required, special meetings will be held to discuss problems or non-conformance issues. At a minimum, County staff, Project Manager, CQAM Monitors, and Construction Contractor will attend this meeting. If the problem requires a design modification and subsequent change order, the Design Engineer should also be present. The Project Manager will document the meeting.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01310

PROGRESS SCHEDULE AND REPORT

PART 1 – GENERAL

1.01 DECRIPTION OF WORK

A. A Progress Schedule shall be submitted to the County for approval within ten (10) calendar days after Notice to Proceed. The schedule shall include sequence and dates of construction operations for all major stages of work, order and delivery of materials and equipment, and an estimated time of completion. Changes in the approved schedule will not be allowed without written order. If the construction progress does not adhere to the schedule, as approved or revised, measures shall be taken to make up for lost time so completion of the work is in accordance with the schedule.

B. Procedures for preparation and submittal of construction progress schedules and periodical updating.

1.02 FORMAT

A. Progress schedules shall be accomplished by a program, which develops a Critical Path giving data similar and equivalent to PRIMAVERA "Sure Trak" or Microsoft Project.

B. Content: Identify for each major and minor construction stage, portion of work or operation, with initial start dates and durations. The critical path shall be indicated on the network together with the cumulative number of calendar days to complete the project.

C. Sequence of Listing: The chronological order of the start of each item of work.

D. Cost Data: Include a cost estimate for each activity, based on and compatible with the project Bid Quantity line items.

E. Scale and Spacing: To provide for notations and revisions.

F. Sheet Size: Minimum 11 x 17 inches.

1.03 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction including dewatering, ECW installation, excavation, fill, Landfill Gas Header System installation, liner subgrade completion, liner component installations, leachate pump station, force main, electrical conduit, substantial completion, final completion, County holidays, and any weekdays the Contractor will not be scheduled to work.

B. Each event or note of the network shall be uniquely numbered and each activity shall be labeled with a suitable description together with an estimate of the number of working days required for the activity.

C. With the approved network, the Contractor shall submit two (2) copies of each of two (2) different tabulations giving the type of information: Starting Node, Ending Node, Duration in working days, Description, Earliest Start, Earliest Finish, Latest Start, Latest Finish, Total Float, Free Float.

D. One tabulation shall be a listing of activities in order of ascending starting node numbers. If there is more than one activity with the same starting node number, than all such activities shall be listed in order of ascending ending node numbers. The second tabulation shall be a listing of all activities in order of ascending "latest starts" as related to the start of the Project. If there is more than one activity with the same "latest start," all such activities shall be listed in order of ascending node numbers.

E. Show accumulated percentage of completion of each item, and total percentage of work completed, as of the first day of each month.

F. Computer services, if used to process the tabulation, shall be furnished by the Contractor.

1.04 REVISIONS TO SCHEDULES

A. Indicate progress of each activity to date of submittal, and projected completion date of each activity.

B. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.

C. Provide narrative report to define problem areas, anticipated delays, and impact on schedule. Report corrective action taken, or proposed, and its effect, including effect of changes on schedule of separate contractors.

D. If in the opinion of the Engineer, the Contractor falls behind in scheduled progress, the Contractor shall take steps as required to improve their progress and shall submit their revised network diagram, tabulations, and operational plans to demonstrate the manner in which the lost progress will be regained, all without any time loss or additional cost to the County.

E. Lack of satisfactory progress, as adjusted by the Engineer, shall be considered grounds for the withholding of payment until necessary changes have been made.

F. If the Contractor fails to meet scheduled milestones, the County may request weekly schedule updates.

1.05 SUBMITTALS

A. Submit preliminary outline schedules within 10 days after Effective Date of the Agreement for coordination with work of separate contracts. After review, submit detailed schedules within 10 days, modified to accommodate revisions recommended by the County.

B. Submit revised progress schedules and progress site photographs with each application for payment.

C. Submit number of opaque reproductions, which Contractor requires, plus three copies retained by the County.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01340

SHOP DRAWINGS, WORKING DRAWINGS, AND SAMPLES

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall submit to the Engineer for review and approval, such working drawings, shop drawings, test reports and data on materials, material samples, materials list, certificates and affidavits as required for proper control of work, including but not limited to those working drawings, shop drawings, data and samples for materials and equipment specified elsewhere in the Specifications and in the Contract Drawings.

B. Within ten (10) calendar days after the Effective Date of the Agreement, the Contractor shall submit to the Engineer a complete materials list of preliminary data on items for which Shop Drawings are to be submitted. Included in this materials list shall be the names of all proposed suppliers furnishing specified items. Review of this list by the Engineer shall in no way expressed or implied relieve the Contractor from submitting complete Shop Drawings and providing materials fully in accordance with the Specifications.

C. The Contractor shall maintain an accurate updated submittal log and will bring this log to each scheduled progress meeting with the County and the Engineer. This log shall include the following items:

1. Submittal-Description and Number assigned.
2. Date submitted to Engineer.
3. Date returned to Contractor (from Engineer).
4. Status of Submittal (Reviewed with No Comments, Reviewed with Comments as Noted, Not Reviewed, Rejected - Contractor must Revise and Resubmit).
5. Date of Resubmittal and Return (as applicable).
6. Projected date of delivery to site.
7. Specification Section.
8. Drawings Sheet Number.

D. All Shop Drawings shall include a filled-out form provided in Exhibit 1 – Construction Documents.

1.02 CONTRACTOR'S RESPONSIBILITY

A. The Contractor shall check all drawings, data, and samples prepared by or for him/her before submitting them to the Engineer for review. Each and every copy of the drawings and data shall bear Contractor's stamp and signature showing that they have been so checked and by affixing the stamp that they comply to the Contract Documents unless exceptions are given. Shop drawings submitted to the Engineer without the Contractor's stamp and signature will be returned to the Contractor for conformance with this requirement. Shop drawings shall indicate any deviations in the submittal from requirements of the Contract Documents. If the Contractor takes exception to the specifications, the Contractor shall note the exception in the letter of transmittal to the Engineer. Shop drawing submittals shall not be used as a vehicle for requesting approval of substitute or alternative materials.

B. The Contractor shall stamp each shop drawing with a standard stamp as required by the General and Supplementary Conditions of the contract. The stamp will verify the Contractor has reviewed the information included in the shop drawing. In addition, the stamp will note any variation from the Contract Documents. The Contractor's stamp shall be submitted to the Engineer for acceptance 14 days prior to construction or submittal of shop drawings. The Engineer will only review shop drawings which have an Engineer-accepted stamp.

C. The Contractor shall determine and verify:

1. Field measurements.
2. Field construction criteria.
3. Catalog numbers and similar data.
4. Conformance with Specifications.
5. Conformance with drawings and details.

D. At the beginning of the project, the Contractor shall furnish the Engineer a schedule of Shop Drawings submittals fixing the respective dates for the submission of shop and working drawings, the beginning of manufacture, testing and installation of materials. This schedule shall indicate those that are critical to the progress schedule.

E. The Contractor shall not begin any work covered by a drawing, data, or a sample returned for correction until a revision or correction thereof has been reviewed and returned by the Engineer, with no exceptions.

F. The Contractor shall submit to the Engineer all drawings and schedules sufficiently in advance of construction requirements to provide no less than thirty (30) calendar days for checking and appropriate action from the time the Engineer receives them. No extension of contract time will be authorized because of failure to transmit submittals to the engineer sufficiently in advance of the work to permit processing.

G. All submittals shall be accompanied by a transmittal letter prepared in duplicate containing the following information:

1. Date.
2. Project Title and Number.
3. Contractor's name and address.
4. The number of each Shop Drawing, Product Data, and Sample submitted.
5. Notification of deviations from Contract Documents.
6. Submittal Log Number conforming to Specification Section Numbers.

H. The Contractor shall submit an electronic copy of descriptive or product data submittals to complement shop drawings for the Engineer. All blueprint shop drawings shall be submitted as electronic files in AutoCAD® or PDF format. The Engineer will review the blueprints and return to the Contractor the set of marked-up drawings with appropriate review comments. All blueprint shop drawings, when practical, shall be 24 inch by 36 inch in size.

I. The Contractor shall be responsible for and bear all costs of damages, which may result from the ordering of any material or from proceeding with any part of work prior to the completion of the review by Engineer of the necessary shop drawings.

1.03 ENGINEER'S REVIEW OF SHOP DRAWINGS

A. The Engineer's review of drawings, data and samples submitted by the Contractor will include only general conformity with the design concept of the Project and with the information given in the contract documents. The Engineer's review and exceptions, if any, will not constitute approval of dimensions, quantities, and details of the material or item shown.

B. The review of drawings and schedules will be general, and shall not be construed:

1. as permitting any departure from the Contract requirements;
2. as relieving the Contractor of responsibility for any errors, including details, dimensions, and materials;
3. as approving departures from details furnished by the Engineer, except as otherwise provided herein.

C. If the drawings or schedules as submitted describe variations per paragraph (1.04 E), and show a departure from the Contract requirements which Engineer finds to be in the interest of the County and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the reviewed drawings without noting an exception.

D. When reviewed by the Engineer, each of the Shop Drawings will be identified as having received such review, being so stamped and dated. Shop Drawings stamped "REVISE AND RESUBMIT" and with required corrections shown will be returned to the Contractor for correction and resubmittal.

E. Resubmittals will be handled in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than corrections requested by the Engineer on previous submissions. The Contractor shall make any corrections required by the Engineer.

F. If the Contractor considers any correction indicated on the drawings to constitute a change to the Contract Drawings or Specifications, the Contractor shall give written notice thereof to the Engineer.

G. Shop drawings and submittal data shall be reviewed by the Engineer for each original submittal and first and second resubmittal; thereafter review time for subsequent resubmittals shall be charged to the Contractor.

H. When the Shop Drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

I. No partial submittals will be reviewed. Submittals not complete will be returned to the Contractor for resubmittal. Make all submittals in groups containing all associated items as indicated in specific Specifications Sections. All drawings, schematics, supplier's product data, certifications and other shop drawing submittals required shall be submitted at one time as a package to facilitate interface checking.

1.04 SHOP DRAWINGS

A. When used in the Contract Documents, the term "Shop Drawings" shall be considered to mean Contractor's plans for materials, which become an integral part of the Project. These drawings shall be complete and detailed. Shop Drawings shall consist of setting and schedule drawings and supplier's scale drawings. Descriptive literature, and performance and test data, shall be considered only as supportive to required Shop Drawings as defined above.

B. Supplier's diagrams, illustrations, and other standard descriptive data shall be clearly marked to identify pertinent materials, product, or models. Delete information, which is not applicable to the work by striking or cross-hatching.

C. Drawings and schedules shall be checked and coordinated with the work of all trades involved before they are submitted for review by the Engineer and shall bear the Contractor's stamp of approval as evidence of such checking and coordination. Drawings or schedules submitted without this stamp of approval shall be returned to the Contractor for resubmission.

D. Each Shop Drawing shall have a blank area 3-1/2 inches by 3-1/2 inches, located adjacent to the title block. The title block shall display the following:

1. Project Title and Number.
2. Name of project material.
3. Number and title of the shop drawing.
4. Date of shop drawing or revision.
5. Name of Contractor and subcontractor submitting drawing.
6. Name of Supplier.
7. Separate detailer when pertinent.
8. Specification title and number.
9. Specification Section.
10. Application Contract Drawing Number.

E. If drawings show variations from Contract requirements for any reason, the Contractor shall describe such variations in his letter of transmittal. If acceptable, proper adjustment in the Contract shall be implemented where appropriate. If the Contractor fails to describe such variations, they shall not be relieved of the responsibility for executing the work in accordance with the Contract.

F. Data on materials and include, without limitation, materials lists, catalog data sheets, cuts, materials of construction and similar descriptive material. Materials lists shall give, for each item thereon, the name and location of the supplier, trade name, catalog reference, size, and all other pertinent data.

G. All suppliers who proposed to furnish products shall submit an installation list to the Engineer along with the required shop drawings. The installation list shall include at least five (5) installations where identical material has been installed and has been in operation for a period of at least one (1) year.

H. Only the Engineer will utilize the color "red" in marking shop drawing submittals.

1.05 WORKING DRAWINGS

A. When used in the Contract Documents, the term "working drawings" shall be considered to mean the Contractor's plan for temporary structures such as support of open cut excavation, utilities, ground water control systems, falsework and any other work as may be required for construction but is not an integral part of the Project.

B. Copies of working drawings as noted in paragraph 1.05 A. above shall be submitted to the Engineer for information only, not review, where required by the Contract Documents or requested by the Engineer, and shall be submitted at least thirty (30) calendar days (unless otherwise specified by the Engineer) in advance of their being required for work.

C. Working drawings shall be signed by a registered Professional Engineer, currently licensed to practice in the State of Florida and shall convey, or be accompanied by, calculation or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use. Review of working drawings by the Engineer will not relieve the Contractor in any way from his responsibility with regard to the fulfillment of the terms of the Contract. The Contractor assumes all risks of error; the County and Engineer shall have no responsibility therefor.

D. Submittals that relate to the means, methods, techniques, sequencing, procedures, or safety programs of the contractor will be received by the Engineer for information only. A review of the information will not be conducted. These submittals that will not be reviewed include:

1. Fit-up of parts,
2. Shoring and bracing,
3. Constructability tolerances,
4. Field measurements,
5. De-watering plans, except with respect to the requirements of the technical specification, and
6. False work forming plans.

1.06 SAMPLES

A. The Contractor shall furnish, for the approval of the Engineer, samples required by the Contract Documents or requested by the Engineer. Samples shall be delivered to the Engineer as specified or directed. The Contractor shall prepay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in work until after review by the Engineer and required corrections are made.

B. Samples shall be of sufficient size and quantity to clearly illustrate the functional characteristics of the product. A minimum of two samples of each item shall be submitted.

C. Each sample shall have a label indicating:

1. Name of Project.
2. Name of Contractor and Subcontractor.
3. Material Represented.
4. Place of Origin.
5. Name of Producer and Brand (if any).
6. Location in Project.

D. The Contractor shall prepare a transmittal letter in triplicate for each shipment of samples containing the information required in paragraph 1.06 B. above. He shall enclose a copy of this letter with the shipment and send a copy of this letter to the Engineer. Review of a sample shall be only for the characteristics or use on the project and shall not be construed to change or modify any Contract requirements.

E. Samples not destroyed in testing shall be sent to the Engineer or stored at the site of the work. Materials incorporated in work shall match the Engineer reviewed samples. Samples, which failed testing, will be returned to the Contractor at his expense, if so requested at time of submission.

1.07 CERTIFICATES AND AFFIDAVITS

A. Where specified in the Contract Documents that a certificate or affidavit be submitted to the Engineer for a particular product or product component, such submittals shall be made in accordance with the following:

1. For Installation: A certificate of compliance shall indicate that the material has been properly installed in compliance with supplier's instructions. The supplier's representative shall provide the certificate.

B. Each certificate shall include a sworn statement by an official of the company originating the certificate attesting to the truth and accuracy of all information contained in the certificate. If such attestation of truth and accuracy cannot be included in the certificate itself, it must be provided as an affidavit accompanying the certificate.

1.08 ALTERNATIVES TO SPECIFIED PRODUCTS

A. The Contract Documents may indicate the name of a trade name or a material to be used in the Contract. Reference made to a particular product of the supplier is made to identify a particular design, quality, construction, arrangement, or style.

B. Where the Contractor proposes to use a substitute product for that specified, complete information on such substitute product including all necessary redesign of the material or any other part of the Contract requiring modification as a result of the use of the requested substitute shall be submitted to the Engineer, for review. All such redesign and all new drawings and detailing required as a result thereof shall be prepared by the Contractor at his own expense, including regulatory permit acquisition for the modifications. Requests for additional money for such substitution will not be considered.

C. If the Contractor proposes to provide products as "equals" to those specified, it shall be his responsibility to furnish complete, specific, detailed information to the Engineer from the supplier of the product he proposes to provide in which the requirements of the Contract Documents are shown to be met. This shall consist of a point-by-point comparison of the Contract requirements with the product proposed to be provided. The burden of responsibility in furnishing this information is with the Contractor. If incomplete or irrelevant data is submitted as evidence of compliance with this subparagraph, the request for approval to provide this specific substitute product will be denied and no further submission will be considered.

1.09 MISCELLANEOUS DATA

A. Any other submittals required by these Specifications but not directly addressed under this Section shall be submitted in accordance with the requirements for the shop drawings.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01370

SCHEDULE OF VALUES

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Submit to the County a Schedule of Values allocated to the various portions of the Work (lump sum items) at the Pre-Construction meeting, and as otherwise specified or requested to be submitted earlier as evidence of the Apparent Low Bidder's qualifications.
2. Upon request of the Engineer or County, support the values with data, which will substantiate their correctness including the cost of material, labor, and O&P.
3. The Schedule of Values shall establish the actual value of the component parts of the Work to be completed and shall be used as the basis of the Contractor's Application for Payment.

B. Related Requirements Described Elsewhere:

1. General and Supplementary Conditions of the Construction Contract
2. Measurement and Payment: Section 01025.
3. Application for Payment: Section 01027.

1.02 FORM AND CONTENT OF SCHEDULE OF VALUES

A. The schedule of values shall be typed on an 8-1/2-inch x 11-inch white paper. Standard construction forms and computer format in MS-Excel spreadsheet will be considered acceptable by the County. Identify schedule with:

1. Title of project, location, County, Bid Number
2. Engineer and Engineer's project number
3. Name and address of Contractor
4. Date of submission

B. The schedule shall be organized based on the categories included in the Bid Proposal.

C. Schedule shall list the installed value of the component parts of the Work in sufficient detail to serve as a basis for computing item prices for progress payments during construction.

D. Identify each line item with the number and title of the respective major section of the specifications.

E. For each major line item, list sub-values of major products or operations under the item.

F. The total sum of all lump sum values listed in the schedule shall equal the total contract lump sum.

1.03 REVIEW AND RESUBMITTAL

A. After review by Engineer, revise and resubmit Schedule of Values as required.

B. Resubmit revised Schedule in same manner as previously submitted schedule.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 – GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. Contractor furnished materials and equipment shall be new and shall not have been in service at any other installation unless otherwise provided. It shall conform to applicable specifications approved in writing by the Engineer.

B. Fabricated and manufactured products shall be designed, fabricated, and assembled in accordance with the best engineering and shop practices. Like parts of duplicate units shall be manufactured to standard sizes and gages to be interchangeable.

C. Two or more items of the same kind shall be identical, by the same manufacturer.

D. Products shall be suitable for project service conditions.

E. Equipment dimensions, sizes, and capacities shown or specified shall be adhered to unless variations are specifically approved in writing.

F. Equipment and material shall not be used for any purpose other than that for which it is specified or designed.

G. Where equipment or material is specifically shown or specified to be reused in the work, special care shall be used in removal, handling, storage, and reinstallation, to assure proper function in the completed work.

H. Contractor shall arrange for transportation, storage, and handling of products that require off-site storage, restoration, or renovation.

I. Installation of all work shall comply with manufacturer's printed instructions. Contractor shall obtain and distribute copies of the manufacturer's instructions to the parties involved in the installation, including two copies to the Engineer. Also, a set of instructions shall be available at the job site during installation and until completion. All equipment and products shall be handled, installed, connected, cleaned, conditioned, and adjusted in accordance with the manufacturer's instructions and specified instructions. Should specified requirements or job conditions conflict with the manufacturer's instructions, these conflicts shall be called to the Engineer's attention for review and revised instructions.

J. All materials and equipment, which are furnished and/or installed by the Contractor, shall be guaranteed. The guarantee shall be against manufacturing and/or design inadequacies, materials and workmanship not in conformity with the paragraph above, hidden damage, improper assembly, failure of device and/or components, excessive leakage or other circumstances which would cause the equipment to fail under normal design and/or specific operating conditions for a period of two years or a longer period as may be shown and/or specified from the date of acceptance of the equipment by the County. If a piece of equipment, device, or component shall fail within the above specified term of the guarantee shall be replaced and installed with reasonable promptness by the Contractor without cost to the County.

K. Rotating machinery shall be designed and fabricated to provide satisfactory operation without excessive wear and without excessive maintenance during its operating life. Rotating parts shall be statically and dynamically balanced and shall operate without excessive vibration.

L. Screens, guards, or cages shall be provided for all exposed, rotating, or moving parts in accordance with accepted practices of applicable governmental agencies.

M. Each major component of equipment shall have the manufacturer's name, catalog and/or model number, and serial number on stainless steel or weather resistant plate securely attached to the item of equipment.

1.02 TRANSPORTATION AND HANDLING

A. Equipment and materials shall be loaded and unloaded by methods affording adequate protection against damage. Precaution shall be taken to prevent injury to the equipment or materials during transportation and handling. Suitable equipment will be used, and the material or equipment shall be under control at all times. Under no condition shall the material or equipment be dropped, bumped, or dragged. When a crane is used, a suitable hook or lift sling shall be used. The crane shall be placed so that all lifting is done in a vertical plane.

B. Equipment and material shall be delivered to the job site by means that will adequately support it and not subject it to undue stress.

1.03 STORAGE AND PROTECTION

A. All equipment, products, and materials shall be stored in accordance with the manufacturer's instructions, with seals and labels intact and legible. Humidity and temperature shall be maintained within the ranges required by the manufacturer's instructions. Products subject to damage by the elements shall be stored in weather-tight enclosures. Fabricated products shall be stored above the ground on blocking or skids. Products that are subject to deteriorations shall be covered with impervious coatings with adequate ventilation to avoid condensation. Loose granular materials shall be stored in a well-drained area on solid surfaces to prevent mixing with foreign matter.

B. Storage shall be arranged in such a manner to provide easy access for inspection. Periodic inspections shall be made of all stored products to assure that they are maintained under specified conditions, and free from damage or deterioration.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01610

TRANSPORTATION AND HANDLING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

Contractor shall provide transportation of all equipment, materials and products furnished under these Contract Documents to the Work site. In addition, Contractor shall provide preparation for shipment and storage, unloading, handling and re-handling, short-term storage, extended storage, preparation for installation and all other work and incidental items necessary or convenient to Contractor for the satisfactory prosecution and completion of the Work. Contractor shall provide a "Competent Person" to implement, supervise, and inspect all Work.

1.02 TRANSPORTATION

A. All equipment shall be suitably boxed, crated or otherwise protected during transportation.

B. All equipment shall be shipped and delivered in the largest assembled sections practical or permitted by carrier regulations to minimize the number of field connections.

C. Small items and appurtenances such as gages, valves, switches, instruments and probes which could be damaged during shipment shall be removed from the equipment prior to shipment, packaged and shipped separately. All openings shall be plugged or sealed to prevent the entrance of water or dirt.

D. Contractor shall comply with all federal, state, and local Laws and Regulations regarding packaging and transporting samples and materials containing hazardous materials.

1.03 HANDLING

A. All equipment, materials and products shall be carefully handled to prevent damage or excessive deflections during unloading or transportation. All equipment, materials and products damaged during transportation or handling shall be repaired or replaced by Contractor at no additional cost to County prior to being incorporated into the Work.

B. Lifting and handling drawings and instructions furnished by the manufacturer or supplier shall be strictly followed. Eyebolts or lifting lugs furnished on the equipment shall be used in handling the equipment. Shafts and operating mechanisms shall not be used as lifting points. Spreader bars or lifting beams shall be used when the distance between lifting points exceeds that permitted by standard industry practice. Slings and chains shall be padded as required to prevent damage to protective coatings and finishes.

C. Under no circumstances shall equipment or products such as pipe, structural steel, casting, reinforcement, lumber, piles, poles, etc., be thrown or rolled off of trucks onto the ground.

D. Nonmetallic items shall be handled using nonmetallic slings or straps unless adequately padded to prevent damage.

1.04 UNLOADING AND PLACEMENT OF EQUIPMENT

A. The Contractor shall provide all labor, materials and equipment, including cranes, needed to unload and place the equipment. The Contractor shall unload and install in accordance with the Equipment Vendor's written instructions.

B. The Contractor and Engineer shall inspect the equipment prior to unloading and installation or storage at the Site. The Contractor and Engineer shall properly document the observance of any damaged items and notify the Equipment Vendor prior to the continuing of installation of the equipment.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01611

STORAGE AND PROTECTION

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

This section includes the storage of materials and equipment. Contractor shall provide a "Competent Person" to implement, supervise and inspect all Work.

1.02 RELATED SECTIONS

A. Shop Drawings, Working Drawings, and Samples - Section 01340

B. Transportation and Handling - Section 01610

1.03 STORAGE OF PRODUCTS

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate-controlled enclosures.

B. For exterior storage of fabricated products, place on supports, so not to rest on ground surface.

C. All materials shall be stored on-Site unless Contractor provides suitable reasons, as approved by Engineer, why on-site storage is not adequate. Contractor shall provide Engineer with access to off-site storage locations.

D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

E. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

G. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

1.04 PROTECTION OF PRODUCTS

A. Use all means necessary to protect the materials, equipment, and products of every section before, during, and after installation and to protect the installed work and materials of all other trades**.**

B. All materials shall be delivered, stored, and handled to prevent the inclusion of foreign materials and damage by water, breakage, vandalism, or other causes.

C. Substantial weather-tight storage sheds, with raised floors, shall be provided and maintained as may be required to adequately protect those materials and products stored on the Site which may require protection from damage by the elements.

D. Replacements: In the event of damage, immediately make all repairs and replacements necessary for the approval of Engineer and at no additional cost to County.

E. Equipment and products stored outdoors shall be supported above the ground on suitable wooden blocks or braces arranged to prevent excessive deflection or bending between supports. Items such as pipe, structural steel and sheet construction products shall be stored with one end elevated to facilitate drainage.

F. Unless otherwise permitted in writing by Engineer, building products and materials such as cement, grout, plaster, gypsumboard, particleboard, resilient flooring, acoustical tile, paneling, finish lumber, insulation, wiring, etc., shall be stored indoors in a dry location. Building products such as rough lumber, plywood, concrete block and structural tile may be stored outdoors under a properly secured waterproof covering.

G. Tarps and other coverings shall be supported above the stored equipment or materials on wooden strips to provide ventilation under the cover and minimize condensation. Tarps and covers shall be arranged to prevent ponding of water.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01700

CONTRACT CLOSEOUT

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work Comply with the requirements stated in Conditions of the Contract and in specifications for administrative procedures in closing out the work.

1.02 SUBSTANTIAL COMPLETION

A. When Contractor considers the Work as substantially complete and ready for its intended use, the following shall be submitted to the Engineer:

1. A written notice that the work is substantially complete.
2. All operations and maintenance manuals and instructions and spare parts required by the Contract Documents.
3. Test/adjust/balance records and reports.
4. Start-up performance report.
5. A list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice and verification that the information submitted above is complete, correct, and compliance with Construction Documents confirmed, County, Contractor, and Engineer shall schedule and make an inspection of the Work to determine the status of completion.

C. If Engineer does not consider the work substantially complete:

1. The Engineer will promptly notify the Contractor in writing, listing the reasons for determining that the work is not substantially complete.
2. Contractor shall remedy the deficiencies in the work and deliver a second written notice of substantial completion to the Engineer.
3. Engineer will reinspect the work.

D. When Engineer finds that the work is substantially complete, the Engineer will:

1. Prepare and deliver to County a tentative Certificate of Substantial Completion on the form provided herein, with a tentative list of items to be completed or corrected before Final Completion.
2. After consideration of any objections made by County as provided in the Conditions of the Contract, and when Engineer considers the work to be substantially complete, the Engineer will execute and deliver to County and Contractor a definite Certificate of Substantial Completion with a tentative list of items to be completed or corrected.

1.03 FINAL INSPECTION

A. When Contractor has completed the minor items in the list attached to the Certificate of Substantial Completion and considers the work to be complete, the Contractor shall submit to the Engineer:

1. A written notice of Final Completion.
2. Written certification that:
    a. The Contract Documents have been reviewed.
    b. The work has been inspected for compliance with the Contract Documents.
    c. The work has been completed in accordance with the Contract Documents and is ready for final inspection.

B. Engineer, Contractor, and County will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

C. Should the Engineer consider the work to be incomplete or defective:

1. Engineer will promptly notify the Contractor in writing, listing the incomplete or defective work.
2. Contractor shall take immediate steps to remedy the stated deficiencies and send a second written certification to the Engineer that the work is complete.
3. Engineer, Contractor, and County will reinspect the work.

D. After Contractor has completed all corrections to the satisfaction of the Engineer and County as verified by the Final Inspection and delivered all maintenance and operating instructions, schedules, warranties, guarantees, Bonds, certificates of inspection, Evidence of Payment and Release of Liens: In accordance with Conditions of the Contract, Consent of Surety to Final Payment, and record documents, all as required by the Contract Documents and acceptable to County and Engineer, the Engineer will execute and deliver to County and Contractor a Certificate of Final Completion and the Contractor may then submit an application for Final Payment.

1.04 REINSPECTION FEES

A. If the status of Completion of Work requires more than one re-inspection by the Engineer due to failure of the Work to comply with the Contractor's claims on initial inspection, the County will deduct from the final payment to the Contractor the amount of the Engineer’s compensation for additional re-inspection services.

1.05 STATEMENT OF ADJUSTMENT OF ACCOUNTS

A. Submit final statement reflecting adjustments to total Contract Price, indicating the following:

1. Original total Contract Price.
2. Previous change orders.
3. Changes under allowances.
4. Changes under unit prices.
5. Deductions for uncorrected Work.
6. Penalties and bonuses.

7. Deductions for liquidated damages.
8. Deductions for re-inspection fees.
9. Other adjustments to total Contract Price.
10. Total Contract Price as adjusted.
11. Previous payments.
12. Sum remaining due.

B. The Engineer will issue a final Change Order reflecting approved adjustments to the total Contract Price not previously made by change orders.

1.06 FINAL PAYMENT

A. Contractor shall follow the procedures for Final Payment found in the General Conditions of the Contract Documents.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. The Contractor shall maintain at the site one record copy of:

1. Drawings.
2. Project Manual.
3. Addenda.
4. Change orders and other modifications to Contract.
5. Project Manager field orders, written instructions or clarifications.
6. Approved submittals.
7. Field test records.
8. Construction photographs.
9. Associated permits.
10. Certificates of inspection and approvals.

1.02 SUBMITTALS

A. At Substantial Completion the Contractor shall:

1. Deliver three review sets of record documents to the Engineer. Each set of record documents shall consist of: one (1) set of: 1) 24 x 36-inch drawings, 2) copy of the Operation and Maintenance manual, and 3) copy of the vendor and material supply information. The Engineer shall comment and return to Contractor.

B. Accompany the submittals with a transmittal letter in duplicate, containing the following.

1. Date.
2. Project title and number.
3. Contractor's name and address.
4. Title of record document.
5. Signature of Contractor or authorized representative.

C. At County’s acceptance:

1. Upon receipt of Engineer's comments, Contractor shall deliver, within 30 days, to Engineer three (3) final and completed sets of Record Documents incorporating Engineer’s comments. Each set of final record documents shall consist of: 1) 24 x 36-inch drawings in both PDF and AutoCAD file formats, 2) copy of the Operation and Maintenance manual, 3) copy of the vendor and material supply information, 4) a USB flash drive containing the project information. Documents shall be sealed by a Professional Engineer registered in the State of Florida and any documents containing survey points must also be sealed by a Professional Land Surveyor registered in the State of Florida.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 MAINTENANCE OF RECORD DOCUMENTS AND SAMPLES

A. The Contractor shall:

1. Store documents and samples in Contractor's field office apart from documents used for construction.
   a. Provide files and racks for storage of documents.
   b. Provide secure storage space for storage of samples.
2. Maintain documents in clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
3. Make documents and samples available at all times for inspection by Engineer or County.

B. Failure to properly maintain record documents may be reason to delay a portion of progress payments until records comply with Contract Documents.

3.02 CONSTRUCTION PHOTOGRAPHS

A. The Contractor shall submit to the Engineer a Pre-Construction video of the proposed area of construction, construction staging area, and each proposed access to the construction area. Submittal shall be in a DVD format.

B. The Contractor shall provide a series of digital color photographs, in print form and USB flash drive (2 megapixel resolution or better), documenting all aspects of construction. Photographer shall have no copyrights and agree that the County and Engineer may reproduce and use the photos as needed. Record photographs shall be 4”x6”, printed in color two per 8.5”x11” page, with the following identified for each photograph:

- Project Name.
- Contractor's Name.
- Date and Time (digital on front side of photograph).
- Photograph file name.
- A detailed description identifying location and name of feature photographed.

C. The photographs shall detail each major stage of construction as follows:

1. Project site prior to Mobilization.
2. Regrading of the landfill surface.
3. Installation of stormwater piping.
4. Installation of closure liner.
5. Connection of closure liner to landfill bottom liner.
6. Installation of protective soil cover.
7. Installation of sod.
8. Damage and repair of any existing utilities, appurtenances, or liner.
9. Project site after Demobilization.

D. Photographs shall be taken weekly or during execution of individual work items, whichever is more frequent, beginning prior to the start of construction and continuing through the completion of all construction. Submittal of the above shall be with each application for payment and shall detail all of the construction which has taken place during the payment period.

3.03 RECORD DOCUMENTS

A. Label each document "PROJECT RECORD" in neat, large printed letters.

B. Maintain record set of Drawings and Specifications legibly annotated to show all changes are made during construction.

1. Graphically depict changes by modifying or adding to plans, details, sections, elevations, or schedules.
2. Make changes on each sheet affected by changes.

C. Record information concurrently with construction progress.

1. Do not conceal field work until required information is recorded.
2. Record changes made by Written Amendment, Field Order, Change Order or Work Directive Change.

D. Drawings:

1. Record drawings should include the following:
   a. Title Sheet (includes site location map, site address and phone number, and designer address and phone number)
   b. System Header Layout (as-builts)
   c. Record Construction Header Route Survey
   d. Condensate Pump Stations (as builts)
   e. Compressor, pad, electrical, and structure (as-builts)
   f. As-Built Typical Details

   Note: All record drawings are to show northing and easting in Florida State Plane East, and elevation in NGVD29, of all survey points taken.

E. General File Requirements:

1. A USB flash drive with the Project Documentation text data (where applicable) saved for Microsoft Office compatibility.
2. A USB flash drive with the Project Documentation photos saved in jpeg format.
3. A USB flash drive with both the PDFs and AutoCAD files, saved for version 2018 or later compatibility, for all record drawings including:
   a. 2-dimensional, 1:1 format.
   b. Existing survey reference points.
   c. Break lines that define all surface features.
   d. All data must be on accurate levels and have proper line weights.
   e. Contours and spot elevations must be at correct elevation.
4. All survey points taken shall include northing and easting in the Florida State Plane East, and elevation in NGVD29.

END OF SECTION

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SECTION 01740

WARRANTIES AND BONDS

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

A. Scope of Requirements:

1. Compile specified warranties and bonds as specified in these Specifications.
2. Co-execute submittals when so specified.
3. Review submittals to verify compliance with Contract Documents.
4. Submit to Engineer for review and transmittal to County.

B. Related Work Described Elsewhere:

1. General and Supplementary Conditions of the Construction Contract
2. Section 01600: Material and Equipment
3. Section 01700: Contract Closeout

1.02 SUBMITTAL REQUIREMENTS

A. Assemble warranties executed by each of the respective manufacturers, suppliers, and subcontractors.

B. Number of original signed copies required: Two each.

C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product of work item.
2. Firm, with name of principal, address, and telephone number.
3. Scope.
4. Date of beginning of warranty, bond, or service and maintenance contract.
5. Duration of warranty, bond, or service and maintenance contract.
6. Provide information for County's personnel:
   a. Proper procedure in case of failure.
   b. Instances that might affect the validity of warranty or bond.
7. Contractor, name of responsible principal, address, email, and telephone number.

D. Submittal of warranties, bonds, and service and maintenance contracts shall be included in submittals for review and before Final Completion with actual dates included.

1.03 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size 8-1/2 inches x 11 inches, punch sheets for standard three-post binder.
   a. Fold larger sheets to fit into binders.
2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS". List:
   a. Title of Project.
   b. Name of Contractor.

C. Binders: Commercial quality, three-post binder, with durable and cleanable plastic covers and maximum post width of two inches.

1.04 WARRANTY SUBMITTALS REQUIREMENTS

A. For all major pieces of equipment, submit a warranty from the equipment manufacturer. Manufacturer's warranty period shall be concurrent with Contractor's for one (1) year, unless otherwise specified, commencing at the date of final completion and acceptance by County.

B. County shall incur no labor or equipment cost during the guarantee period.

C. Guarantee shall cover all necessary labor, equipment and replacement parts resulting from faulty or inadequate design, improper assembly or erection, defective workmanship and materials, leakage, breakage or other failure of all equipment and components furnished by manufacturer.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 02220

EXCAVATION, BACKFILLING, AND COMPACTION

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included under this Section consists of furnishing all labor, materials, equipment and incidentals necessary to perform all excavation, removal of unsuitable material, backfill, fill and grading required to complete the work shown on the Drawings and specified herein. The work shall include, but not necessarily be limited to, all excavation and trenching; all backfilling; embankment and grading; ditch grading; and all related work such as sheeting, bracing, dewatering, all earthwork and all other requirements shown on the drawings and specified herein.

B. Definitions:

1. Maximum Density: Maximum weight in pounds per cubic foot of a specific material.
2. Optimum Moisture Content: The optimum moisture content shall be determined by ASTM D 698 (latest) specified to determine the maximum dry density for relative compaction. Field moisture content shall be determined on the basis of the fraction passing the 3/4-inch sieve.
3. Rock Excavation: Excavation of any hard-natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.
4. Unsuitable: Unsuitable materials are highly organic soil (peat or muck) classified as A-8 in accordance with AASHTO Designation M l45.

C. Plan for Earthwork:

1. The Contractor shall be responsible for having determined to his satisfaction, prior to the submission of his bid, the conformation of the ground, the character and quality of the substrata, the types and quantities of materials to be encountered, the nature of the groundwater conditions, the prosecution of the work, the general and local conditions and all other matters which can in any way affect the work under this Contract according to the General Conditions.
2. The Contractor shall utilize on-site soil borrow which meets the requirements of these specifications, drawings and contract documents for this project.
3. The work of this section shall include, but not necessarily be limited to excavating, hauling, backfilling, compaction, and grading of soil. The work will pertain all or in part to the construction of landfill entrance road, stormwater pond excavation, pipes, drainage ditches, and disposal of surplus materials. Contractor shall conform to the dimension lines, grades and sections specified on the Drawings.
4. The Contractor will furnish transportation if the offsite borrow source is not contiguous to the landfill property.

D. Trench Safety Act: The Contractor shall comply with all of the requirements of the Florida Trench Safety Act (Chapter 90-96, CS/CB 2626, Laws of Florida). The Contractor shall acknowledge that included in various items of his bid proposal and in the total bid price are costs for complying with the provisions of the Act. Additionally, the Contractor is required to break out the costs for complying with the Florida Trench Safety Act.

1.02 RELATED WORK

A. Section 02100 – Site Preparation
Section 02270 – Temporary Erosion Control
Section 02502 – Toe Drain
Section 02720 – Geotextile
Section 02740 – Composite Drainage Net
Section 02776 – Linear Low Density Polyethylene Geomembrane
Section 02930 - Sodding

1.03 APPLICABLE PUBLICATIONS

A. All publications and standard specifications referred to herein are the latest or current issue of that publication or specification as of the specification date.

1.04 QUALITY ASSURANCE

A. All earthwork and related installations shall be performed in accordance with the requirements of these Specifications.

B. Costs for pre-qualification testing of materials including onsite/offsite materials shall be paid by the County.

1.05 FEDERAL AND STATE REGULATORY REQUIREMENTS

A. All trench excavations which exceed 5 feet in depth shall comply with the applicable trench safety standards as stated in the OSHA excavation safety standards 29 CFR S.1926.650 Subpart P as regulated and administered by the Florida Department of Labor and Employment Security as the "Florida Trench Safety Act."

1.06 JOB CONDITIONS

A. If, in the opinion of the Engineer, conditions encountered during construction warrant a change in the elevations or in the depth of removal of unsuitable material from that indicated in the soils report, an adjustment will be made in the contract price, as provided in the General and Special Conditions.

1.07 PROTECTION

A. Pre-Construction Survey:

1. Prior to commencing excavation, backfill or dewatering, the Engineer and Contractor shall jointly conduct a survey of any existing structures which, in the opinion of the Engineer, may be subject to settlement or distress resulting from excavation or dewatering operations.

B. The Contractor shall install and maintain all erosion control features (i.e., silt fences around all areas downslope of soil disturbance, and wetland boundaries). Other areas which may require erosion protection or silt fences shall be identified by the Engineer during construction. Silt fences shall not be removed until the contained areas are covered with sod (exterior of containment berms) or other sufficient erosion control measures such as erosion matting, seeding/mulching and the Engineer determines that soils are adequately stable (not eroding).

1.08 SUBMITTALS

A. Submit to the Engineer for review the proposed methods of construction, including dewatering, excavation, filling, compaction and backfilling for the various portions of the work. Review shall be for method only. The Contractor shall remain responsible for the adequacy and safety of the methods.

PART 2 – PRODUCTS

2.01 MATERIALS

A. General:

1. All fill material from on and off-site sources shall be subject to review by the Engineer
2. All fill material shall be unfrozen and free of organic material, roots, trash, or other objectionable material. Excess or unsuitable material as designated by the Engineer shall be removed from the job site by the Contractor.

B. Clean Common Fill Material:

1. Clean common fill shall be sand not containing stones, rock, concrete, clods, or other rubble larger than 1/4 inch in diameter. It shall have physical properties which allow it to be easily spread and compacted. Material shall be free of solid waste and degradable organic material, as determined by the Engineer.
2. The Contractor shall utilize as much excavated material as possible for reuse in accordance with the contract drawings and specifications or as directed by the Engineer.
3. Materials excessively wet or dry are unsuitable. Allow such material to dry, or moisten, to bring material within plus 3 percent of optimum moisture content range for specified compaction.
4. The Engineer shall direct the Contractor on the type of material allowed in certain sections of the earthwork operations.

C. Structural Fill: Structural fill shall be well graded sand to gravelly sand having the following gradation:

U.S. Sieve Size	Percent Passing By Weight
1 - inch	100
No. 4	75-100
No. 40	15-80
No. 100	0-30
No. 200	0-10

Any soil material which does not meet the above requirement must be classified either SW, SP, SM, or SC, according to the Unified Soil Classification System, and must be evaluated and approved for use by a Florida registered Professional Engineer with primary expertise in geotechnical engineering. The Engineer must state any additional construction requirements to be performed in order for the soil to perform the project design requirements as structural fill.

D. Class I Soils[1]: Manufactured angular, granular material, 1/4 to 1/2 inches (6 to 12 mm) in size, including materials having significance such as crushed stone or rock, broken coral, or crushed shells. Sieve analysis for crushed stone is given below separately.

1. Crushed Stone: Crushed stone shall consist of clean mineral aggregate free from clay, loam or organic matter, conforming with ASTM C33 stone size No. 89 and with particle size limits as follows:

U.S. Sieve Size	Percent Passing By Weight
1/2	100
3/8	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 50	0-5

E. Class II Soils[2]:

1. GW: Well-graded gravels and gravel-sand mixtures, little or no fines. Fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.
2. GP: Poorly graded gravels and gravel-sand mixtures, little or no fines. Fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.
3. SW: Well-graded sands and gravelly sands, little or no fines. More than fifty (50) percent passes No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.
4. SP: Poorly graded sands and gravelly sands, little or no fines. More than fifty (50) percent passes No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.

F. Other Material: All other material, not specifically described, but required for proper completion of the work shall be selected by the Contractor and approved by the Engineer.

PART 3 – EXECUTION

3.01 FIELD QUALITY CONTROL

A. The minimum frequency of quality control testing is as provided in these specifications or as set during construction by the County. Frequency of testing for field Quality Control shall be the same as defined for conformance testing.

B. Sampling locations may be selected by the Engineer. If necessary, the location of routine in-place moisture content and dry density test shall be determined using a non-biased sampling plan.

C. An increased testing frequency shall be used at the discretion of the Engineer when visual observations of construction performance indicate a potential problem.

D. All perforations resulting from testing the subgrade or embankment shall be filled by the Contractor with soil compacted to the satisfaction of the Engineer.

[1] Soils defined as Class I soils are not defined in ASTM D2487.
[2] In accordance with ASTM D2487, less than 5 percent pass No. 200 sieve.

E. If a defective area is discovered in the earthwork, the Engineer will determine the extent and nature of the defect and notify the Contractor. If the defect is indicated by an unsatisfactory test result, the Engineer shall determine the extent of the defective area by additional tests, observations, a review of record, or other means. The Contractor shall be responsible for the cost of these additional tests. If the defect is related to material, and/or adverse site conditions, such as overly wet soils or surface desiccation, the Engineer shall define the limits and nature of the defect.

F. After determining the extent and nature of a defect, the Contractor shall correct the deficiency to the satisfaction of the Engineer. The cost of corrective actions shall be borne by the Contractor.

G. Additional testing shall be performed to verify that the defect has been corrected before any additional work is performed by the Contractor in the area of the deficiency. The Contractor shall be responsible for the cost of these additional tests.

3.02 PROTECTION

A. Sheeting and Bracing:

1. Furnish, put in place, and maintain sheeting and bracing as required to support the sides of excavations, to prevent movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures, and to protect workers from hazardous conditions or other damage. Such support shall consist of braced steel sheet piling, braced wood lagging and soldier beams or other approved methods. If the County is of the opinion that sufficient or proper supports have not been provided, he may order additional supports be installed at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids beside the sheeting, but if voids are formed, they shall be immediately filled and compacted. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill at no additional expense to the County.

2. The Contractor shall construct sheeting outside the neat lines of the foundation unless deemed desired otherwise for his method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall withstand all pressure to which the structure or trench will be subjected. Any deformation shall be corrected by the Contractor at his own expense so as to provide the necessary clearances and dimensions.

3. Where sheeting and bracing are required to support the sides of excavations for structures, the Contractor shall engage a Professional Geotechnical Engineer registered in the State of Florida to design the sheeting and bracing. The sheeting and bracing installed shall conform with the design, and certification of this shall be provided by the Professional Geotechnical Engineer.

4. The installation of sheeting, particularly by driving or vibrating, may cause distress to existing structures. The Contractor shall evaluate the potential for such distress and, if necessary, take all precautions to prevent distress of existing structures because of sheeting installation.

5. The Contractor shall leave in place to be embedded in the backfill, all sheeting and bracing not shown on the Drawings but which the County directs him in writing to leave in place at any time during the progress of the work for the purpose of preventing injury to structures, utilities, or property, whether public or private. The County may direct that timber used for sheeting and bracing be cut off at any specified elevation.

6. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction, or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted for that purpose, or otherwise directed by the County.

7. The right of the County to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue such orders, and his failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

8. No wood sheeting is to be withdrawn if driven below mid-diameter of any pipe, and under no circumstances shall any wood sheeting be cut off at a level lower than l foot above the top of any pipe.

B. Pumping and Drainage:

1. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. The Contractor shall submit to the Engineer for review a plan for dewatering systems prior to commencing work. The installed dewatering system shall be in conformity with the overall construction plan. The Contractor shall be required to monitor the performance of the dewatering systems during the progress of the work and require such modifications as may be required to assure that the systems are performing satisfactorily.

2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the bottom of the excavation and to preserve the integrity of adjacent structures.

3. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.

4. The Contractor shall take all additional precautions to prevent buoyant uplift of any structure during construction.

5. The conveying of dewatering liquids off site will not be allowed unless approval by the proper regulatory agencies is obtained. Dewatering liquids should be routed into the facility's stormwater management system, or other onsite storage area if approved by the County and Engineer. The Contractor shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and he shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored as directed by the County.

6. Flotation shall be prevented by the Contractor by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.

7. Removal of dewatering equipment shall be accomplished after the system is no longer required; the material and equipment constituting the system shall be removed by the Contractor.

8. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, etc. in order to prevent adverse effects on groundwater quality.

3.03 EXCAVATION

A. Excavating for Landfill Soil Liner Subgrade, and Structures and Utilities:

1. Excavation work shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards. Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms.
2. The landfill site shall be graded to drain as shown on the plans and will require the Contractor to excavate some portions of the site and to fill others. The Contractor shall provide a surveyor to determine excavation or fill required in the landfill area to meet the lines and grades presented on the plans.
3. Excavation shall be made to such dimensions as will give suitable room for bracing and supporting, for pumping and draining, and for all other work required.
    a. Excavation for precast or prefabricated structures shall be carried to an elevation of 2 feet lower than the proposed outside bottom of the structure to provide space for the structural backfill material.
    b. Excavation for structures constructed or cast-in-place in dewatered excavations shall be carried down to the bottom of the structure where dewatering methods are such that a dry excavation bottom is exposed and the naturally occurring material at this elevation leveled and left ready to receive construction.
4. Immediately document the location, elevation, size, material type, and function of all new subsurface installations and utilities encountered during the course of construction.
5. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Drawings and should anticipate the encounter of unknown obstructions during the course of the work.
6. Encounters with subsurface obstructions shall be hand excavated unless otherwise approved by County.
7. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. Subgrade soils which become soft, loose, "quick" or otherwise unsatisfactory for support of the proposed road and structures as a result of inadequate dewatering or other construction methods, shall be removed and replaced with Class I soils for pipes and structures, as required by the Engineer at the Contractor's expense. Placement and compaction of the replacement material shall conform to the requirements contained herein.
8. The bottom of excavations shall be rendered firm and dry before placing any soil, structure or pipe. Excavated material not suitable for backfill shall be removed from the work and stockpiled as directed by the County. The bedding schedule for pipes shall be as shown in Table 02220-B.
9. Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered.
10. All soil, structure and pipe locations and elevations as required herein must be permanently documented by the Contractor on the Record Drawings prior to the Engineer’s approval of the Application for Payment for that work.
11. All pavements shall be cut prior to removal, with saws or approved power tools.
12. All trenches opened during the day shall be closed at the end of the workday or safely secured.

3.04 REFUSE SURFACE GRADING AND REFUSE EXCAVATION

A. The topography shown on the Drawings was surveyed by County surveying staff on 2/11/2022. Before start of any waste excavations and initial grading for this project, the Contractor shall perform a special purpose survey of the disturbed area of the project site. The Contractor shall submit a Digital Terrain Model (DTM) format of the survey and calculated quantities to the Engineer to verify the Contractor's quantities.

B. The Contractor shall allow for settlements during construction, compactions, and the thickness of the fill layers above the refuse for the final cover system. The Contractor is to move the refuse from the cut areas to the fill areas within the project limits or within the landfill boundary as designated by the County. The Contractor shall smooth the graded surface and remove any sharp points before the placement of leveling course fill layer.

C. The Contractor shall sequence refuse surface grading and refuse excavation operations so that large excavated areas would not stay open and unprotected against rain storms and washouts. The Contractor shall protect the refuse grading areas and shall not leave solid waste exposed overnight per the County's Operation Plan. The Contractor shall coordinate transporting and placement of excess solid waste in the Class I landfill with the County.

D. It is advised that excavation may encounter materials normally disposed in Class I landfill, however, other waste such as concrete debris, trees, and stumps could be encountered during excavation. The Contractor shall be responsible to complete all excavations necessary for this project regardless of the type, nature, or condition of materials encountered. The Contractor shall perform excavations of every type of material encountered and remove all excess materials within the limits of the project, to the lines, grades and elevations shown, required, or as specified.

E. After grading, the refuse surface shall be compacted with at least three passes using the Contractor’s heavy equipment. All compaction shall be conducted parallel to the slope from the toe of the slope.

F. Excavation for minor reconstructing of ditches and channels shall be accomplished by cutting accurately to the cross sections, grades, and elevations shown. All waste materials in the sides and bottom of ditches and channels shall be trimmed and dressed or removed to conform to the slope, grade, and shape of the section indicated. Care shall be taken not to excavate the ditches below the grades shown. Excess open ditch excavation shall be backfilled with granular fill to existing grade at Contractor's sole expense.

G. Excavation shall be made to the grades on the Drawings and to such widths as will give suitable room for construction of the structures, for bracing and supporting, pumping and draining. The bottom of the excavations shall be rendered firm and dry and in all respects acceptable to the Engineer.

H. Any underlying lines, conduits, evidence of previous work, or natural condition discovered during the excavation that may affect the integrity of any foundation shall immediately be brought to the attention of the Engineer.

I. An imaginary 45-degree line extending downward and outward from the bottom comer of any existing foundation shall not intercept any intended excavation for adjacent foundations or utilities, unless authorized by the Engineer.

3.05 DRAINAGE

A. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed liner subgrade foundation condition or structure subgrade foundation condition. The dewatering method used shall prevent disturbance of earth below grade.

B. All water pumped or drained from the excavated area shall be disposed of in a suitable manner without undue interference with other work, without damage to surrounding property, and in accordance with pertinent rules and regulations.

C. No construction, including pipe laying, shall be allowed in water. Groundwater shall be maintained at least 12 inches below excavation except in borrow areas. The Contractor shall constantly guard against damage due to water and take full responsibility for all damage resulting from his failure to do so.

D. The Contractor will be required at his expense to excavate below grade and refill with approved fill material if the County determines that adequate drainage has not been provided.

3.06 UNDERCUT

A. If the bottom of any excavation is below that shown on the Drawings or specified because of Contractor error, convenience, or unsuitable subgrade due to the Contractor's excavation methods, refill to normal grade with fill at Contractor’s cost. Fill material and compaction method shall be as directed by the Engineer.

3.07 STABILIZATION

A. Subgrades for structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact.

B. Subgrades for structures or trench bottoms which are otherwise solid, but which become mucky on top due to construction operations, shall be reinforced with one or more layers of crushed rock or gravel. Not more than 1/2-inch depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon. The finished elevation of stabilized subgrades for structures shall not be above subgrade elevations shown on the Drawings.

C. All stabilization work shall be performed by and at the expense of the Contractor.

3.08 FILL AND COMPACTION

A. Materials:

1. To the maximum extent available, excess earth obtained from subgrade, structure, and trench excavation shall be used for the construction of fills and embankments.
2. Materials used as backfill shall be free from rocks or stones larger than 2 inches in their greatest dimension; brush, stumps, logs, roots, debris, and organic or other deleterious materials; and must be acceptable to the Engineer.

B. Placement and Compaction:

1. Degree of compaction: Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in AASHTO T180. Field verification will be obtained by the test procedure presented in AASHTO T191. The term "maximum density" shall mean the maximum density determined under AASHTO T180.
2. Backfill materials shall be placed in approximately horizontal layers not to exceed 8 inches in uncompacted thickness. Material deposited in piles or windrows by excavating and hauling equipment shall be spread and leveled before compaction.
3. Each layer of material being compacted shall have the best practicable uniform moisture content to ensure satisfactory compaction. The Contractor will be required to add water and harrow, disc, blade, or otherwise work the material in each layer to ensure uniform moisture content and adequate compaction. Each layer shall be thoroughly compacted by rolling or other method acceptable to the Engineer to the percent of maximum density at optimum moisture content as described in Table 02220-A and as determined by AASHTO T180, (latest).
4. Whenever a trench passes through a backfill or embankment, material shall be placed and compacted to an elevation 12 inches above the top of the pipe before the trench is excavated.

C. Compact and backfill excavations and construct embankments according to the schedule listed in Table 02220-A. Backfill schedule for pipes is listed in Table 02220-B. (AASHTO T180, (latest)).

D. Pipe shall be laid in open trenches unless otherwise indicated on the Drawings or elsewhere in the Contract Documents.

E. Excavations shall be backfilled to the original grade or as indicated on the Drawings. Deviation from this grade because of settling shall be corrected. Backfill operation shall be performed to comply with all rules and regulations and in such a manner that it does not create a nuisance or safety hazard.

Table 02220-A

COMPACTION AND BACKFILL SCHEDULE

Area	Material	Compaction
Perimeter road berms embankments, containment berms, and drainage conveyance berms not over the liner system	Common Fill (Para. 2.01 B)	8 inch lifts, compacted to 95% relative compaction. Fill should not be placed over any in-placed soils until those layers have been compacted to 95% relative compaction.
Beneath all structures, and foundations (minimum 2 foot depth)	Structural Fill (Para. 2.01 C)	8 inch lifts, compacted to 95% relative compaction. Fill should not be placed over any in-placed soils until those layers have been compacted to 95% relative compaction.
Beneath pavements not over liner system (minimum 2 foot depth and minimum distance of 2 feet outside the edge of pavement)	Structural Fill (Para. 2.01 C)	8 inch lifts, compacted to 98% relative compaction. Fill should not be placed over any in-placed soils until those layers have been compacted to 98% relative compaction.
Liner Subgrade/Leveling Course	Protective Cover Soil (Para. 2.01 G)	12-inch lifts, compacted to 95% relative compaction on slopes less than 6:1. On slopes steeper than 6:1, place in 12-inch lifts to 90% relative compaction.
Protective Cover Soil	Protective Cover Soil (Para. 2.01 G)	12-inch lifts, compacted to 95% relative compaction on slopes less than 6:1. On slopes steeper than 6:1, place in 12-inch lifts to 90% relative compaction.
From cleared existing surface to subgrade for paved and gravel roadway surfaces	Common Fill (Para. 2.01 B)	12 inch lifts, compacted to 95% relative compaction.
Disturbed area requiring seeding and mulching	Topsoil	See Section 02922.
Landfill Mound	Solid Waste (Para. 2.01 H)	12-inch lifts, compacted to 95% relative compaction on slopes less than 6:1. On slopes steeper than 6:1, place in 12-inch lifts to 90% relative compaction.

Table 02220-B

BACKFILL SCHEDULE FOR GRAVITY AND PRESSURE PIPING (Non-Perforated)

Pipe Material	Pipe Size	Trench Condition	Bedding Material	PIPE ENVELOPE PRIMARY ZONE Material	PRIMARY ZONE Depth	SECONDARY ZONE Material	SECONDARY ZONE Depth	Others
HDPE, PVC and other Plastic Pipe	>□6"	Normal[a]	Class II or Common Fill	Class II or Common Fill	0.7 O.D.	Class II or Common Fill	0.3 O.D.+12"	
		Special[b]	Class I	Class II or Common Fill	0.7 O.D.	Class II or Common Fill	0.3 O.D.+12"	
R.C.P.	<48"	Normal[a]	Class II or Common Fill	Class II or Common Fill	0.5 O.D.	Common Fill	-	
		Special[b]	Class I	Class II or Common Fill	0.5 O.D.	Common Fill	-	

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[a] Dry soils.

[b] Saturated soils.

[c] Outside Diameter of pipe = O.D.

Notes:

1. No special bedding shall be required in case of suitable undisturbed earth type trench bottom.
2. Bedding thickness shall be 12 inches unless specified otherwise.
3. The backfill shall be placed and compacted in 6-inch lifts for pipe envelope and in 12-inch lifts from secondary zone to grade. Common fill shall be used as final backfill material.
4. It is intended that additional excavation be conducted to remove unsuitable material below bedding level which prevents bedding compaction as required herein and replaces such materials with suitable materials. Over excavation, geotextile fabric, gravel blanket, granular fill and other acceptable stabilization method shall be placed within 4 feet of the bedding level or within 10 feet of the existing ground (whichever is greater depth) at no additional cost to the County. Construction required beyond these limits shall be executed in accordance with the General Conditions. When indicated on the Drawings, the Contractor shall remove unsuitable material below bedding level to the limits indicated and replace with coarse sand or other acceptable stabilization method up to the bedding level without any additional cost to the County.

F. Embankments shall be constructed true to lines, grades, and cross sections shown on the plans or ordered by the County. Embankments shall be placed in successive layers of not more than 12 inches in thickness, loose measure, for the full width of the embankment. As far as practicable, traffic over the work during the construction phase shall be distributed so as to cover the maximum surface area of each layer.

G. If the Contractor requests approval to backfill material utilizing lifts and/or methods other than those specified herein, such request shall be in writing to the Engineer. Approval will be considered only after the Contractor has performed tests, at the Contractor's expense, to identify the material used and density achieved throughout the backfill area utilizing the method of backfill requested. The Engineer's approval will be in writing.

H. Foundation Preparation

1. Backfilled areas shall be compacted in 8-inch layers to a density of not less than the percent of Modified Proctor maximum dry density as described in Table 02220-A for a depth of not less than 2-feet below the bottom of the foundations or concrete slabs to be not less than that depth indicated in Table 02220-A. Any unsuitable foundation material shall be removed and replaced with suitable material.
2. Slabs On Grade: Subgrades for concrete slabs shall be removed, backfilled, and compacted to the required grade. The top 2-feet of concrete slab subgrade in cut sections and all fill material shall be compacted in 8-inch layers to a density of not less than the percent of Modified Proctor maximum dry density as described in Table 02220-A.

3.09 TRENCH EXCAVATION

A. The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. Four hundred (400) feet shall be the maximum length of open trench on any line under construction. All trench excavation shall be open cut from the surface.

1. Alignment, Grade, and Minimum Cover: The alignment and grade or elevation of each pipeline shall be fixed and determined from offset stakes. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith, shall be in conformity with requirements of the section covering installation of pipe.
2. Where pipe grades or elevations are not definitely fixed by the contract drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe of 42 inches where in paved or graded streets where surface grades are definitely established and 36 inches in other locations. Greater pipe cover depths may be necessary on vertical curves or to provide necessary clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation.

B. Limiting Trench Widths:

1. Trenches shall be excavated to a width which will provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment. However, minimum permissible sidewall clearances between the installed pipe and each trench wall, expressed in inches, shall be as follows:

Pipe Size	Minimum Sidewall Clearance
60	24
54	21
48	19
36 or smaller	12

2. Stipulated minimum sidewall clearances are not minimum average clearances but are minimum clear distances which will be required.
3. Cutting trench banks on slopes to reduce earth load to prevent sliding and caving will be permitted only in areas where the increased trench width will not interface with surface features or encroach on right-of-way limits. Slopes shall not extend lower than 1 foot above the top of the pipe.

C. Mechanical Excavation:

1. The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, and other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.
2. Mechanical equipment used for trench excavation shall be of the type, design, and construction, and shall be so operated, that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical sidewalls are obtained at least from an elevation one foot above the top of the installed pipe to the bottom of the trench, and that trench alignment is such that pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

D. Pavement Cutting:

1. Cuts in concrete pavement, asphalt pavement, and asphalt base pavements shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be started with asphalt or concrete saw in a manner which will provide a clean groove for the full depth of pavement along each side of the trench and along the perimeter of cuts for structures.
2. Asphalt pavement and asphalt base pavement over trenches excavated for pipelines shall be removed so that a shoulder not less than 6 inches in width at any point is left between the cut edge of the pavement and the top edge of the trench. Trench width at the bottom shall not be greater than at the top and no undercutting will be permitted. Pavement cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the centerline of the trench.
3. Pavement removed for connections to existing lines or structures shall not be greater than necessary for the installation as determined by the Engineer.

E. Artificial Foundations in Trenches: Whenever so ordered by the Engineer, the Contractor shall excavate to such depth below grade as the Engineer may direct and the trench bottom shall be brought to grade with such material as the Engineer may order installed. All piling, concrete, or other foundations made necessary by unstable soil shall be installed as directed by the Engineer. Compensation for extra excavation and piling, concrete, or other foundations, except where provided by contract unit prices, shall be made in accordance with the contract provisions for extra work.

F. Bell Holes: Bell holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

3.10 TESTS

A. All tests required for preliminary review of materials shall be made by the County. Moisture-density (Proctor) tests and relative in place density tests on the materials, and all in-place field density tests, shall be made at the expense of the County.

B. The frequency for testing the density of placed material will be at a minimum rate of two tests per acre per lift, or as necessary.

C. Re-tests for failures will be at the cost of the Contractor.

3.11 DRAINAGE MAINTENANCE

A. Trenches across roadways, driveways, walks, or other trafficways adjacent to drainage ditches or water courses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the trafficway to prevent impounding water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by the Contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches. All material deposited in roadway ditches or other water courses crossed by the line of trench shall be removed immediately after backfilling is completed and the original sections, grades, and contours of ditches or water courses shall be restored. Surface drainage shall not be obstructed longer than necessary.

3.12 FINAL GRADING

A. After other outside work has been finished and backfilling completed and settled, all areas on the site of the work which are to be graded shall be brought to grade with the tolerance of $\pm$0.1 feet at the indicated elevations, slopes, and contours where seeding or sodding is not required or, where sodding is required within 2 inches of finished grade. Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and equivalent to hand work. All surfaces shall be graded to secure effective drainage. Unless otherwise shown, a slope of at least one percent shall be provided.

B. Grading and surfacing shall be completed to the satisfaction of the Engineer.

3.13 EXCESS EXCAVATED MATERIALS

A. Insofar as needed, suitable excavated materials shall be used in fills and embankments shown on the Drawings. All suitable excess excavated material shall be placed outside the limits of construction, in an area approved by the County.

B. The Contractor shall segregate different types of excavated materials (i.e. sands, clayey sands, clay) in the stockpile area. All debris, junk (such as broken pipe, or other discarded construction material), stones, logs, stumps, roots, and other unsuitable materials may be disposed of by the Contractor in the landfill, if approved by the County.

C. The Contractor shall slope and compact the stockpile with a light roller type vehicle to maintain stability.

D. The Contractor shall maintain proper soil and erosion control measures.

3.14 SETTLEMENT

A. The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within the correction period stipulated in the General Conditions.

B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from the Engineer or County.

END OF SECTION

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SECTION 02270

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor shall take every reasonable precaution throughout construction to prevent the erosion of soil and the sedimentation of streams, bays, storm systems, or other water impoundments, ground surfaces, or other property as required by federal, state, and local regulations.

B. The Work specified in this Section consists of furnishing all necessary labor, equipment, material and transportation necessary to provide temporary and permanent erosion and sediment control as required by appropriate government agency permits, as shown on the Drawings and as required so as to prevent pollution of water detrimental effects of public or private property adjacent to the project and damage to work on the project.

C. For any excavation, the Contractor shall include temporary controls for stormwater runoff and erosion control in full conformance with all existing facility permits and/or applicable regulations. Facility's current permits will be supplied at pre-construction meeting.

D. The Contractor shall provide protective covering for disturbed areas upon suspension or completion of land-disturbing activities. Permanent vegetation shall be established at the earliest practicable time. Temporary and permanent erosion control measures shall be coordinated to ensure economical, effective, and continuous erosion and siltation control throughout the construction and post-construction period.

E. The Contractor shall prepare and submit a site-specific Temporary Erosion and Sediment Control Plan.

1.02 RELATED WORK

A. Section 01340 - Shop Drawings, Working Drawings, and Samples
B. Section 02930 - Sodding

1.03 SUBMITTALS

A. Temporary Erosion and Sediment Control Plan – The Contractor shall prepare and submit a site-specific Temporary Erosion and Sediment Control Plan for review and approval as part of the Shop Drawing process. The Plan should provide at least the following information:
   a. Contractor Contact Information: Name, address, and telephone number;
   b. Project Description: A brief description of the nature and purpose of the land disturbing activity;
   c. Existing Site Conditions: A description of the existing topography, vegetation, drainage, and any wetlands on the site;
   d. Adjacent Areas: A description of neighboring areas identifying land uses, streams, lakes, wetlands, roads, and other features which might be affected by the land disturbance.

e. Erosion and Sediment Control Measures: A description of the methods which will be used to control erosion and sediment on the site;

f. Project Schedule: A specified schedule indicating the anticipated starting and completion dates of the site grading and/or construction sequence including the date of anticipated installation and removal of erosion and sediment control measures and the period during which each area will be exposed prior to the completion of temporary erosion and sediment control measures;

g. Temporary Stabilization: A brief description of how to stabilize soil stockpiled areas or other disturbed areas that will be left untouched for a period of more than 30 days.

h. Permanent Stabilization: A brief description, including specifications, of how the site will be stabilized after construction is completed;

i. Stormwater Management Considerations: Explain how stormwater runoff from and through the site will be handled during construction and include a description of the post-construction stormwater quality control measures to be included as a part of the site development;

j. Maintenance: A schedule of regular inspections during construction, a plan for the repair of erosion and sediment control structures as necessary, and a description of proposed routine maintenance;

k. Site Plan: Include a site plan showing the following:

1. Location of any existing structures or hydrologic features on the site;
2. Location of all structures or natural features on the land adjacent to the site and within a minimum of 100 feet;
3. Location of all proposed structures and development on the site;
4. Identification of areas which are to be disturbed during construction;
5. Identification of areas designated for topsoil and subsoil storage;
6. Identification of areas designated for equipment, fuel, lubricants, chemical and waste storage;
7. Location of temporary roads designated for use during the construction period;
8. Location of all drainage features, paved areas, planting, temporary or permanent soil erosion control measures, or other features to be constructed in connection with, or as a part of, the proposed Work; and
9. Other information or data as may be reasonably required by the County.

B. Submit shop drawings of all proposed erosion control measures including but not limited to silt fence, enviro-fence, sandbagging, and floating silt barriers for approval prior to construction. Hay bales are not to be used.

1.04 REGULATORY REQUIREMENTS

A. The Contractor shall prevent damage to properties outside the construction limits from siltation due to construction of the project and assume all responsibilities to the affected property owners for correction of damages which may occur. Erosion control measures shall be performed conforming to the requirements of and in accordance with plans approved by applicable state and local agencies and as specified by the erosion-control portion shown on the Drawings and as required by these Specifications. The Contractor shall not allow mud and debris to accumulate in the roads or enter drainage ditches, canals, or waterways. Should the Contractor pump water from excavations during construction, appropriate siltation preventative measures shall be taken before the pumped water is discharged into any drainage ditch, canal, or waterway.

1.05 PRACTICES

The Contractor shall adhere to the following:

A. Avoid dumping soil or sediment into any stream bed, pond, ditch, or watercourse.

B. Maintain an undisturbed vegetative buffer where possible between a natural watercourse and trenching and grading operations.

C. Avoid equipment crossings of streams, creeks, and ditches where practicable.

D. Sufficient precautions shall be taken during construction to prevent the run-off of polluting substances such as silt, clay, fuels, oils, bituminous, solid waste, or other polluting materials harmful to humans, fish, or other life, into the supplies and surface waters of the site. Control measures must be adequate to assure that turbidity in the receiving water will not be increased more than 29 nephelometric turbidity units (NTU). Erosion evident within the limits of construction or other areas affected by the Contractor shall be the responsibility of the Contractor during the full term of the contract and for the full one (1) year guarantee period. Areas subject to erosion during this time shall be fully restored to original or design conditions within 10 days of notice to the Contractor.

1.06 EROSION AND SEDIMENT-CONTROL DEVICES AND FEATURES

A. The Contractor shall construct all devices (silt fences, retention areas, etc.) for sediment control at the locations required to protect federal, state, and local water bodies and water courses and drainage systems before beginning to excavate the site. All devices shall be properly maintained in place until a structure or paving makes the device unnecessary or until directed to permanently remove the device.

B. The Contractor shall use mulch to temporarily stabilize areas subject to excessive erosion and to protect seed beds after planting where required.

C. Filter fabric or other approved methods shall be placed and secured over the grates of each existing inlet, grating, or storm pipe opening near the area of excavation to prevent silt and debris from entering the storm systems.

D. The Contractor shall use silt fences, and floating turbidity barriers as shown on the Erosion Control Plan or as directed by the County or County's Representative to restrict movement of sediment from the site.

E. The Contractor shall establish vegetative cover on all unpaved areas disturbed by the work.

1.07 START OF WORK

A. Prior to starting, field survey and stake the limits of construction.

B. Obtain the County's Representative's approval of the field survey.

C. Install all silt fence, enviro-fence, and any other temporary erosion controls required by the Control Documents and Erosion Control Plan along the limits of construction as indicated on the Drawings. Hay bales are not to be used.

D. Initiate clearing and grubbing operations.

PART 2 – PRODUCTS

2.01 GENERAL

A. Open-mesh biodegradable mulching cloth.

B. Fertilizer shall be 10-10-10 grade or equivalent.

C. Lime shall be Dolomitic Agricultural Ground limestone, in accordance with Florida Department of Transportation (FDOT) Section 982.

D. Grass shall be in accordance with Section 02930, Sodding.

E. Silt fence shall consist of non-biodegradable filter fabric (Trevira, Mirafi, etc.), in accordance with FDOT Section 985, FDOT Standard Index 102, Type III, wired to galvanized wire mesh fencing and supported by wood or metal posts.

F. Floating or staked turbidity barriers as specified in FDOT Section 985 and FDOT Standard Index 103, Type I.

G. Erosion Stone: FDOT Section 530

1. Sand-Cement Riprap.
2. Concrete Block.
3. Rubble 20 to 300 pounds each.

H. Filter Fabric for placing under Riprap shall meet the requirements of FDOT Section 985.

I. If hydroseeding is required, then the straw shall be provided in accordance with FDOT Section 104.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install temporary erosion and sediment control items prior to clearing and commencing earthwork.

3.02 PROTECTION

A. Stabilization of Denuded Areas: No disturbed area may be denuded for more than 30 calendar days (excluding rights-of-way), unless otherwise authorized by the County. During construction, denuded areas shall be covered by mulches such as straw, hay, filter, seed and mulch, sod or some other permanent vegetation. Within 60 calendar days after final grade is established on any portion of a project site, that portion of the site shall be provided with established permanent soil stabilization measures per the original site plan, whether by impervious surface or landscaping.

B. Protection and Stabilization of Stockpiles: Fill material stockpiles shall be protected at all times by on-site drainage controls which prevent erosion of the stockpiled material. Control of dust from such stockpiles may be required, depending upon their location and the expected length of time the stockpiles will be present. In no case shall an unstabilized stockpile remain after 30 calendar days.

C. Protection of Existing Storm Sewer Systems: During construction, all storm sewer inlets shall be protected by approved sediment traps such as secured sod, stone, etc., which shall be maintained and modified as required by construction progress, and which must be approved by the County.

D. Sediment Trapping Measures: Sediment basins and traps, perimeter berms, filter fences, berms, sediment barriers, vegetative buffers and other measures intended to trap sediment and/or prevent the transportation of sediment onto adjacent properties, or into existing waterbodies, must be installed, constructed or, in case of vegetative buffers, protected from disturbance, as a first step in the land alteration process.

E. Swales and Ditches: All swales and ditches leading from the site shall be sodded within three (3) days of excavation. All other interior swales, etc., including detention areas will be sodded prior to issuance of a Certification of Occupancy.

F. Underground Utility Construction: The construction of underground utility lines and other structures shall be done in accordance with the following standards:

1. No more than 500 lineal feet of trench shall be open at any time;
2. Wherever consistent with safety and space consideration, excavated material shall be cast to the uphill side of trenches. Trench material shall not be cast into or onto the slope of any stream, channel, road ditch or waterway.

3.03 REMOVAL OF TEMPORARY EROSION CONTROL FEATURES

A. In general, remove or incorporate into the soil any temporary erosion control features existing at the time of construction of the permanent erosion control features in such a manner that there will be no detrimental effect. All erosion-control devices in seeded areas shall be left in place until the grass is established.

B. The Contractor shall clean up all areas at the completion of the project.

3.04 MAINTENANCE OF EROSION CONTROL FEATURES

A. The Contractor shall maintain all temporary and permanent erosion-control measures in functioning order. Temporary structures shall be maintained until such time as vegetation is firmly established and grassed areas shall be maintained until completion of the project. Areas which fail to show a suitable stand of grass or which are damaged by erosion shall be immediately repaired. No additional payment will be made to the Contractor for re-establishing erosion-control devices, which may become damaged, destroyed, or otherwise rendered unsuitable for their intended function during the construction of the project.

3.05 PROTECTION DURING SUSPENSION OF CONTRACT TIME

A. In the event that it is necessary that the construction operations be suspended for any appreciable length of time, shape the top of the earthwork in such a manner as to permit runoff of rainwater and construct earth berms along the tope edges of embankments to intercept runoff water. Provide temporary slope drains to carry runoff from cuts and embankments which are located in the vicinity of rivers, streams, canals, lakes, and impoundments. Should such preventive measures fail, immediately take such other action as necessary to effectively prevent erosion and siltation.

3.06 SURFACE WATER MANAGEMENT, STORMWATER RUNOFF CONTROL AND EROSION CONTROL

A. The Contractor shall be responsible for all runoff control efforts, including without limitation providing protection of areas receiving runoff, in accordance with any applicable regulations, codes, plans and permits.

B. The Contractor shall furnish, install and maintain, at no additional cost to the County, all necessary surface protection such as temporary retention basins, silt screens, diapers, jute mesh, filter fabric, sandbags, etc., for turbidity control and to prevent erosion and surface degradation.

END OF SECTION

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SECTION 02310

GROUT FILLED FABRIC REVETMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required to perform all operations in connection with the installation of the proposed, fabric formed concrete lining in accordance with the lines, grades, design and dimensions shown on the Contract Drawings and as specified herein.

B. The work shall consist of installing a non-reinforced concrete mat lining, by positioning a specially woven double-layer synthetic fabric form on the surface to be protected and filling it up with a pumpable fine aggregate fiber mesh concrete (structural grout) in such a way as to form a stable mat of required thickness, weight and configuration.

PART 2 – PRODUCTS

2.01 FINE AGGREGATE FIBER MESH CONCRETE

A. Fine aggregate concrete shall consist of a mixture of fiber mesh cement, fine aggregate (sand), and water so proportioned and mixed as to provide a pumpable grout Pozzolan and grout fluidifier conforming to these specifications may be used at the option of the Contractor. The mix shall exhibit a compressive strength of 2,500 psi at 28 days when made and tested in accordance with ASTM C-31 and C-39.

B. Portland cement shall conform to ASTM C-150, Type I or Type II. The average compressive strength of concrete test cylinders shall be 20% higher at 7 days than that of comparison test cylinders made in accordance with ASTM C-31, and not less than 2,500 psi at 28 days.

C. Fine aggregate shall conform to ASTM C-33, except as to grading. Aggregate grading shall be reasonably consistent and shall be well graded from the maximum.

D. Water for mixing shall be clean and free from injurious amounts of oil, acid, salt, alkali, organic matter or other deleterious substances.

E. Pozzolan, if used, shall conform to ASTM C-350.

2.02 FABRIC FORM

A. The fabric form shall be 8-inch Filter Point Mat (FPM) as manufactured by Construction Techniques, or approved equal. Each layer of fabric shall meet or exceed the statistical mean (average) results as shown below:

PROPERTY	TEST METHOD VALUES	UNIT	MIN.
Physical:			
Composition			Nylon
Weight (double-layer)	ASTM D-3776-9	oz/yd	12
Thickness (single-layer)	ASTMD-1777-75	mils	25
Mill Width		in	75
Mechanical:			
Grab Tensile Strength	ASTM D-1682-75	lbs	
Warp			90
Fill			90
Grab Tensile Elongation	ASTM D-4632	%	
Warp		%	15
Fill		%	15
Trapezoid Tear Strength	ASTM D-4533		
Warp		lbs/in	60
Fill		lb/in	40
Puncture Strength	ASTM D-3737	lb	80
Break Strength-Warp	ASTM D-3787	%	80
Hydraulic:			
Water Flow Rate	ASTM D-4491	gal/min/sf	90
Permittivity (k/l) (Two Layers)	ASTM D-4491	1/sec	0.28

The Contractor shall furnish the Engineer, in duplicate, manufacturer's certified test results showing values obtained when the above physical properties were tested or compliance with the Specifications.

B. Fabric form fabric shall consist of double-layer woven fabric joined together by spaced interwoven filter points to produce a mat with a finished average thickness of 8-inches, and a nominal weight of 90 lbs./sq. ft. Nominal density of fabric shall be at least 2.0 lb/ft^2. Material shall be 100% nylon, industrial grade. No carpet or staple yams will be allowed. The filter points shall be on approximately 8-inch centers. The filter points shall relieve hydrostatic uplift pressure and provide a deeply cobbled surface appearance.

C. Individual mill width rolls of fabric form shall be a minimum width of 80 inches. Mill width rolls shall be cut to the length required, and the two layers of fabric separately jointed bottom edge to bottom edge, and top edge to top edge by means of sewing thread, to form multiple mill width panels. All factory-sewn seams shall be downward facing. The grab tensile strength of all sewn seams shall not be less than 150 lbs. /in. when tested in accordance with ASTM D-1682-75.

D. Grout stops shall be installed at predetermined, mill width, intervals to regulate the flow of fine aggregate concrete.

E. Immediately following receipt of fabric forms to the job site, forms should be inspected and stored in a clean dry area where they will not be subject to mechanical damage, exposure to moisture, or direct sunlight.

2.03 FABRIC FILTER

A. The fabric filter underlayment material shall be an 8 ounce per square yard, non-woven geotextile and shall be furnished by a single geotextile manufacturer.

B. Unless otherwise noted on the drawings, geotextile manufacturer shall furnish materials whose minimum average roll values for geotextile materials, as defined by the Federal Highway Administration (FHA), Task Force 25 Guidelines shall meet or exceed the criteria listed below under Geotextile Properties. The geotextiles provided by the supplier shall meet or exceed the property values specified and shall be stock products.

C. The non-woven material shall be comprised of yarns of polypropylene or polyester fibers, oriented into a stable network by needle punching which retains its structure during handling, placement, and long-term service. Geotextiles shall be capable of withstanding direct exposure to sunlight for thirty (30) days with no measurable deterioration and shall be mildew and rot resistant, and be insect and rodent resistant.

REQUIRED PROPERTY VALUES NONWOVEN FABRIC FILTER

Property	Units	Value [1]	Test
Mass per unit area	oz/sy	8	ASTM D 5261
Trapezoidal tear strength[2]	lb	80	ASTM D 4533
Resistance Range	pH	2-12	-
U.V. Resistance Strength Retained	%	70	ASTM D 4355

[1]All values specified are minimums unless otherwise noted.

[2]Values represent minimum average roll values (for this parameter) as defined by the Federal Highway Administration

PART 3 – EXECUTION

3.01 SITE PREPARATION

A. Area on which fabric forms are to be placed shall be constructed to the lines and grades shown on the Contract Drawings. Where such areas are below the allowable grades, they shall be brought to grade by placing compacted layers of granular fill material. Suitable material shall be placed in 8-inch lifts compacted to 95 percent of maximum modified proctor as determined by ASTM D1557, or as specified by Engineer. All obstructions such as roots and projecting stones shall be removed.

B. Excavation and preparation of anchor trenches, terminal trenches, and toe trenches or aprons shall be done in accordance with the manufacturer's recommendations.

C. Immediately prior to placing the fabric forms, the prepared area shall be inspected by the Engineer and no forms shall be placed thereon, until the area has been approved.

3.02 FABRIC FORM PLACEMENT

A. Installation should be accomplished during dry weather and surface conditions.

B. Place fabric immediately following reaching of final grade elevations and/or at berm or terrace grading and placement of filter fabric.

C. Fabric is to be continuous across the channel or spillway.

D. Provide anchor trench to the dimensions shown on the Drawing.

E. Fabric form panels shall be placed within the limits shown on the Contract Drawings.

F. Fabric forms shall be placed over filter fabric as specified herein and shown on drawings.

G. Adjacent fabric form panels shall be joined before fine aggregate concrete injection, by field sewing or zippering the two bottom layers of fabric together and shall be downward facing except with the approval of the Engineer.

H. When conventional joining of panels is impractical, or when called for on Contract Drawings, adjacent top panels may be overlapped a minimum of 2-feet pending approval by the Engineer. In no case shall simple butt joints between panels be permitted.

I. Lap joints and expansion joints shall be provided at intervals recommended by the manufacturer.

J. Immediately prior to injection of fine aggregate concrete, the assembled fabric form panels shall be inspected by the Engineer and no fine aggregate concrete shall be pumped therein until the fabric seams and panel connections have been approved.

K. The Contractor shall provide a 6-inch turndown to anchor the grout filled fabric revetment (GFFR) blanket in place.

3.03 FINE AGGREGATE CONCRETE PLACEMENT

A. Following panel placement, small slits shall be cut in the top layer of the fabric form to allow for the insertion of the injection pipe. Fine aggregate concrete shall be injected between the top and bottom layers of fabric, filling the panel to the recommended thickness and configuration.

B. Fine aggregate concrete shall be injected in such a way that excessive pressure on the fabric form and cold joints is avoided. Care shall be taken so not to over fill the fabric form enough to cause bursting of the fabric form.

C. Holes in the fabric left by the removal of the injection pipe shall be temporarily closed by inserting a piece of burlap or similar material. The burlap shall be removed when the concrete is no longer fluid and the concrete surface at the hole has hardened. The concrete at the hole shall be smoothed by hand. Foot traffic on the filled mat shall be restricted to an absolute minimum for one hour after pumping.

D. Upon completion of the fine aggregate concrete placement, all the anchor trenches, terminal trenches, and toe trenches shall be backfilled, compacted, and protected as specified or as required by the drawings.

3.04 CLEANING

Filter points shall be inspected and clean of any dirt, excess grout, or any other type of blockage that could prevent the relief of hydrostatic uplift pressure before final acceptance by the County.

END OF SECTION

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SECTION 02502

TOE DRAIN

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Scope of Work: Furnish all labor, materials, equipment, and incidentals required for the installation and construction of the solid wall and perforated PVC drain piping and discharge at the locations depicted on the Drawings, or as required by the Contract Documents, all PVC Piping, fittings, and appurtenances.

B. General Design: The equipment and materials specified herein are intended to be standard types of PVC pipe and fittings for use in transporting water and stormwater.

C. Related Requirements:

1. Section 01340: Shop Drawings
2. Section 02220: Excavation, Backfilling, and Compaction
3. Section 02720: Geotextile

D. The below-listed standards are adopted by reference as applicable:

1.	ASTM D1598	*Time-to-Failure of Plastic Pipe Under Constant Internal Pressure
2.	ASTM D1599	*Short-Time Rupture Strength of Plastic Pipe, Tubing and Fittings
3.	ASTM D1784	*Rigid Poly(Vinyl Chloride) (PVC) Compounds And Chlorinated Poly. (Vinyl Chloride) (CPVC) Compounds
4.	ASTM D1785	*Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120
5.	ASTM D2241	*Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
6.	ASTM D2321	*Underground Installation of Flexible Thermoplastic Sewer Pipe
7.	ASTM D2412	*External Loading Properties of Plastic Pipe By Parallel-Plate Loading
8.	ASTM D2444	*Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)
9.	ASTM D2466	*Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
10.	ASTM D2467	*Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings Schedule 80
11.	ASTM D2564	*Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
12.	ASTM D2774	*Underground Installation of Thermoplastic Pressure Piping
13.	ASTM D2855	*Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
14.	ASTM D3034	*Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
15.	ASTM D3139	*Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
16.	ASTM D3212	*Joints for Drain and Sewer Plastic Pipe Using Flexible Elastomeric Seals
17.	ASTM F477	*Elastomeric Seals (Gaskets) for Joining Plastic Pipe

*American National Standards

1.02 QUALITY ASSURANCE

A. Qualifications: All of the PVC pipe and fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

B. PVC pipe shall be manufactured by CertainTeed, Diamond Plastics, Eslon, J-M Pipe, North American Pipe Corp., or equal.

C. PVC compounds shall be Class 12454A or 12454B in accordance with ASTM D1784. The manufacturer(s) of pipe supplied for this project shall provide a compliance statement for this and all other qualifications required by this specification as applicable.

1. Cell Classification Tests (ASTM D1784)
2. Hydrostatic Design Stress Testing (ASTM D2837)
3. Quick Burst Testing (ASTM D1599)
4. Pipe Impact Testing (ASTM D2444)
5. Pipe Stiffness Testing and Flattening Testing (ASTM D2412)
6. Sustained Pressure Testing (ASTM D1598 and ASTM D2241)
7. Hydrostatic Proof Testing (ANSI/AW WA C900)

D. The manufacturer(s) of pipe shall provide a written warranty for their products.

1.03 SUBMITTALS

A. Within 14 days after execution of the Contract, the Contractor shall submit a list of materials, names of manufacturers, and dates of delivery of materials to the project site.

B. Shop and Layout Drawings

1. Submit complete shop drawings detailing all of the technical and dimensional data of material to be furnished.
2. Submit layout drawings including fitting and joint layouts. Layout drawings shall be prepared to an appropriate scale with dimensioning.

C. Submit Manufacturer Certifications, Compliance Statements, and warranties as required by these specifications.

D. Submit Florida Licensed Surveyor Certified As-built drawings of drain piping with verified vertical and horizontal data as required by these specifications.

E. Submit documentation for all tests required by these specifications.

PART 2 – PRODUCTS

2.01 PVC PIPE FOR PERIMETER TOE DRAIN

A. PVC pipe and fittings are specified in Part 3. Toe drain pipe shall be 6-inch nominal diameter, perforated, schedule 80 PVC drainage pipe. Toe drain discharge pipe shall be 6-inch nominal diameter non-perforated Schedule 80 PVC. Fittings and joints for PVC toe drain system pipe shall be Schedule 80 socket type, secured by solvent cement.

B. Non-perforated pipe shall have the following properties at 73 degrees F.

1. Tensile Strength min. 7,000 psi
2. Modules of Elasticity in Tension 400,000 psi
3. Izod Impact Strength 0.65
4. Cell Designation 12454-A or 12454-B

C. Pipe shall be PVC drainage pipe meeting AASHTO M278. Joints shall be socket welded using PVC solvent cement.

D. PVC pipe used for perforated toe drain shall be Schedule 80.

E. Perforations shall be 1/4-inch holes at 3-inch O.C. spacing. Holes shall be evenly spaced at 120 degrees with one line of holes placed at the pipe bottom as illustrated in the Construction Drawings.

F. Solid wall pipe shall be Schedule 80.

G. Fittings shall be Schedule 80.

H. Pipe shall be supplied in lengths not exceeding a nominal 20 feet.

2.02 FILTRATION GEOTEXTILE

A. Filtration 8 ounce geotextile as specified in Section 02720 shall be used to wrap the required drainage layer material for the toe drain system in accordance with the plans. Overlap edges of filtration geotextile a minimum of 24 inches.

2.03 DRAINAGE LAYER MATERIAL

A. Drainage layer material surrounding toe drains shall be non-calcareous, FDOT or AASHTO approved No. 57 stone or rounded river rock as specified in Section 02220.

2.04 OTHER MATERIALS

A. See Drawings and details for information related to the pipe penetration through the liner material, concrete pad, wire mesh materials, and any other incidentals.

PART 3 – EXECUTION

3.01 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Delivery and storage of the materials shall be in accordance with manufacturer recommendations and ANSUAW WA C605.

B. Handling: Care shall be taken in loading, transporting, and unloading to prevent damage to the pipe. The pipe shall not be rolled off the carrier or dropped. Unloading shall be done by lifting by hand or with a forklift or crane. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective.

C. If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the County. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.

3.02 INSTALLATION

A. Below-grade PVC pipe shall be installed in accordance with requirements of ANSI/AWWA C-605, manufacturer recommendations, and ASTM D2321.

B. Pipes shall be laid to the lines and grades shown on the Drawings with a minimum of 2.0 feet of cover from proposed finished grades. Pipes shall be laid at a constant slope between elevations specified. Pipe joints may be deflected to a maximum of 75 percent of manufacturer recommendations to establish alignment, slope and grade, except for gravity sewers which shall be surveyed straight to the required grade. Pipe trenching, bedding, and backfill shall be in accordance with Section 02220 and the Drawings.

C. All field cutting of pipe shall be performed in accordance with the requirements of ANSLAW WA C605 and the manufacturer's recommendations.

D. Pipe joints and fittings shall be socket type. Fittings and couplings shall be joined to PVC by solvent cement.

3.03 TOE DRAIN LINE FITTING INSTALLATION

A. Use standard fitting specified under Paragraph 2.01 to complete connections where required and in conformance with ANSI/ASTM F449.

3.04 TOE DRAIN PIPE BACKFILL

A. Place the toe drain pipe, stone, filter fabric, seal the liner penetration with a GCL material as shown in the Drawings before placing General Backfill over the pipe envelope. Toe drain backfill shall be placed in such a manner that displacement of the underdrain line will not occur and that the filter after backfilling shall meet the requirements of these Specifications. It is especially important that the first lift of backfill be placed with a minimum of disturbance of the drain line. The first lift of the General Backfill material shall be placed immediately following the placement of the drain line, drain gravel, and filtration geotextile. The remaining backfill shall be placed as soon as practical. In no event shall it be left open overnight.

3.05 CLEANING

A. At the conclusion of the work, the Contractor shall thoroughly clean the new pipelines by flushing with water or other means to remove all dirt, stones, or other material that may have entered the line during the construction period. The Contractor shall pay for and provide all water, pumps, piping, and related equipment required for cleaning at no additional cost to the County.

3.06 CORRECTION OF NON-CONFORMING WORK

A. All non-conforming work shall be repaired or replaced by the Contractor at no additional expense to the County. Non-conforming work shall be defined as the failure to adhere to any specific or implied directive of these specifications and/or the Drawings including, but not limited to, pipe not laid straight, hue to the lines and grades as shown on the Drawings, damaged or unacceptable materials, excessive misalignment or diameter ring deflection in the pipe due to bedding, backfilling, or installation, visible or detectible leakage, and failure to pass a specified test or inspection.

END OF SECTION

SECTION 02630

STORM DRAINAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes storm drainage system.

1.02 QUALITY ASSURANCE

A. Compliance: Comply with Florida Department of Environmental Protection (FDEP) and local government regulations pertaining to storm drainage systems.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic structures in direct sunlight.

B. Do not store plastic pipe or fittings in direct sunlight.

C. Protect pipe, pipe fittings, and seals from dirt and damage.

D. Handle precast concrete manholes and other structures according to manufacturer's rigging instructions.

PART 2 - PRODUCTS

2.01 PIPES AND FITTINGS

A. Reinforced Concrete Pipe:

1. Pipe: ASTM C 76, Class III unless indicated otherwise on Drawings.
2. Gaskets: ASTM C 443; rubber compression gaskets installed in accordance with manufacturer's published instructions.

B. Polyvinyl Chloride (PVC) Pipe:

1. Pipe: ASTM D 3034, SDR 35 Rated.
   a. Continuously mark pipe with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification.
2. Joints: ASTM D 3034, Table 2; integrally molded bell ends with factory supplied elastomeric gaskets and lubricant.

C. High Density Polyethylene (HDPE) Pipe:

1. Pipe Material: ASTM D3350 minimum cell classification 335420C; or STM 1248 Type III, Class C, Category 4, Grade P33.
2. Pipe, Joints, and Fittings:
   12- to 36-inches: AASHTO M294 Type S
   42- and 48-inches: AASHTO MP6-95

2.02 SPECIAL PIPE COUPLINGS AND FITTINGS

A. Sleeve-Type Pipe Couplings: Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined, for non-pressure joints.

1. Sleeves for Concrete Pipe: ASTM C 443, rubber.
2. Sleeves for Cast-Iron Soil Pipe: ASTM C 564, rubber.
3. Sleeves for Plastic Pipe: ASTM F 477, elastomeric seal.
4. Sleeves for Dissimilar Pipes: Compatible with pipe materials being joined.
5. Bands: Stainless steel, at least one at each pipe insert.

B. Gasket-Type Pipe Couplings: Rubber or elastomeric compression gasket, made to match outside diameter of smaller pipe and inside diameter or hub of adjoining larger pipe, for non-pressure joints.

1. Gaskets for Concrete Pipe: ASTM C 443, rubber.
2. Gaskets for Cast-Iron Soil Pipe: ASTM C 564, rubber.
3. Gaskets for Plastic Pipe: ASTM F 477, elastomeric seal.
4. Gaskets for Dissimilar Pipes: Compatible with pipe materials being joined.

C. Internal, Expansion-Type Pipe Couplings: Stainless-steel expansion band with ethylene-propylene-diene-monomer (EPDM), rubber-compound sealing sleeve, made to match inside diameter of pipes for non-pressure joints. Use nitrile rubber-compound sealing sleeve for fluids containing oil or gasoline.

2.03 MANHOLES AND CATCH BASINS

A. Precast Concrete Manholes and Catch Basins: Precast, reinforced concrete, with provision for rubber gasket joints. For manholes, comply with ASTM C 478. For catch basins, comply with ASTM C 858.

1. Gaskets: ASTM C 443, rubber.
2. Grade Rings: Include two (2) or three (3) reinforced-concrete rings, of 6- to 9-inch total thickness, that match a 24-inch-diameter frame and cover.
3. Steps: Fiberglass, individual steps, or ladder. Include a width that allows a worker to place both feet on one step and is designed to prevent lateral slippage off the step. Cast steps or anchor ladder into base, riser, and top section sidewalls at 12- to 16-inch intervals. Omit steps for manholes less than 60 inches deep.
4. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
5. Additional requirements, manholes:
    a. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having a separate base slab or base section with integral floor.
    b. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth required.
    c. Top Section: Eccentric cone type. Top of cone of size that matches grade rings.

B. Brick Manholes: Brick and mortar.

1. Base, Channel, and Bench: Concrete.
2. Wall: ASTM C 32, Grade MS, manhole brick; 8-inch minimum thickness and an inside diameter of 48 inches with tapered top for a 24-inch frame and cover. Include 12-inch minimum wall thickness for section of manhole deeper than 96 inches.
    a. Option: ASTM C 139, concrete masonry units may be used instead of brick.
3. Mortar and Parging: ASTM C 270, Type S, using ASTM C 150, Type II, Portland cement, 1/2-inch minimum thickness on exterior surface.
4. Steps: Fiberglass, individual steps, or ladder. Include a width that allows a worker to place both feet on one step and is designed to prevent lateral slippage off the step. Cast steps or anchor ladder into sidewalls at 12- to 16-inch intervals. Omit steps for manholes less than 60 inches deep.

C. Cast-in-Place Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top, designed according to ASTM C 857 for loading.

1. Steps: Fiberglass, individual steps, or ladder. Include a width that allows a worker to place both feet on one step and is designed to prevent lateral slippage off the step. Cast steps or anchor ladder into sidewalls at 12- to 16-inch intervals. Omit steps for manholes less than 60 inches deep.

D. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, heavy-duty ductile iron.

1. Manhole Covers: 24-inch inside diameter by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter cover. Include indented top design with lettering, STORM SEWER, cast into cover.
2. Square Drainage Frames and Grates: Include 24-by-24-inch minimum flat grate with small square or short-slotted drainage openings.
3. Round Drainage Frames and Grates: 24-inch inside diameter by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter flat grate having small square or short-slotted drainage openings.

2.04 FRAMES AND GRATES

A. Frames and Grates: ASTM A 536, Grade 60-40-18, heavy-duty ductile iron, frames and flat grates, of dimensions according to authority standards. Include small square or short-slotted drainage openings in grates.

2.05 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Structures: Portland-cement design mix, 4000 psi minimum, with 0.45 maximum water-cement ratio.
   1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
   2. Reinforcement Bars: ASTM A 615, Grade 60, deformed steel.

C. Ballast and Pipe Supports: Portland-cement design mix, 3000 psi minimum, with 0.58 maximum water-cement ratio.
   1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
   2. Reinforcement Bars: ASTM A 615, Grade 60, deformed steel.

2.06 OUTFALLS

A. Construct headwall, apron, and tapered sides of cast-in-place, reinforced concrete.

B. Riprap: Broken stone, irregular size and shape, weighing 15 to 50 pounds each.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Install piping beginning at low point of systems, true to grades and alignment with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

B. Use manholes for changes in direction, except where fittings are indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.

C. Use proper size increasers, reducers, and couplings, where different sizes or materials of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

D. Install gravity-flow-systems piping at constant slope between points and elevations. Install straight piping runs at constant slope.

E. Install drainage piping pitched down in direction of flow, at minimum slope of 1 percent and 36-inch minimum cover, unless otherwise indicated.

F. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

G. Set tops of frames and covers flush with finished surface where manholes occur in pavements. Set tops 3 inches above finished surface elsewhere, except where otherwise indicated.

3.02 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. General: Join and install pipe and fittings according to the following.

B. Ductile-Iron Pipe with Ductile-Iron or Cast-Iron Fittings: With push-on-joint, rubber gaskets according to AWWA C600.

C. Install with top surfaces of components, except piping, flush with final finished surface.

D. Corrugated-Steel Pipe: Join and install according to ASTM A 798. Use soil tight joints made with coupling bands and gaskets.

E. Corrugated-Aluminum Pipe: Join and install according to ASTM B 788. Use soil tight joints made with coupling bands and gaskets, except where other joints are indicated.

F. Polyethylene (PE) Plastic Pipe and Fittings: As follows:

1. Join pipe, tubing, and fittings with couplings for soiltight joints according to AASHTO "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4 "Joint Properties" and manufacturer's written instructions.
2. Join pipe, tubing, and gasketed fittings with elastomeric seals for watertight joints according to ASTM D 2321 and manufacturer's written instructions.
3. Install according to ASTM D 2321 and manufacturer's written instructions.

G. Concrete Pipe and Fittings: Install according to ACPA "Concrete Pipe Handbook," with ASTM C 443, rubber gaskets.

H. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and fit both systems' materials and dimensions.

3.03 SPECIAL PIPE COUPLING AND FITTING APPLICATIONS

A. Special Pipe Couplings: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

1. Use the following pipe couplings for non-pressure applications:
   a. Strait-pattern, sleeve type to join piping, of same size, with small difference in outside diameters.
   b. Increaser/reducer-pattern, sleeve type to join piping of different sizes.
   c. Gasket type to join piping of different sizes where annular space between smaller piping outside diameter and larger piping inside diameter permits installation.
   d. Internal-expansion type to join piping with same inside diameter.

3.04 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318, ACI 350R.

3.05 TAP CONNECTIONS

A. Make connections to existing piping and underground structures so finished work conforms as nearly as practical to requirements specified for new work.

B. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap, with not less than 6 inches of 3000-psi, 28-day, compressive-strength concrete.

C. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.06 FIELD QUALITY CONTROL

A. Clear interior of piping and structures of dirt and superfluous material as the work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.
2. Place plug in end of incomplete piping at end of day and whenever work stops.
3. Flush piping between manholes and other structures, if required by authorities having jurisdiction, to remove collected debris.

B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of the Project.

1. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visual between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of a ball or cylinder of a size not less than 92.5 percent of piping diameter.
   c. Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.

2. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
3. Re-inspect and repeat procedure until results are satisfactory.

END OF SECTION

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SECTION 02720

GEOTEXTILE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Furnish all transportation, labor, materials, tools, installation equipment and supervision necessary for the manufacturing, testing, storage, delivery, and installation of a non-woven needle-punched geotextile as a component of the liner system for the Landfill, as herein specified and as shown on the drawings.
2. The installation of geotextile shall be performed in conjunction with other work as follows:
   a. Leachate collection laterals.
   b. Toe drain.

B. Related Work Described Elsewhere:

1. Section 01340 - Shop Drawings, Working Drawings, And Samples
2. Section 02220 - Excavation, Backfilling and Compaction
4. Section 02502 - Toe Drain
5. Section 02740 - Bonded Composite Drainage Net
6. Section 02772 - Geosynthetic Clay Liner
7. Section 02776 – Linear Low Density Polyethylene (LLDPE) Geomembrane

1.02 APPLICABLE STANDARDS OR REFERENCES

1. ASTM D4439 - Standard Terminology for Geosynthetics.
2. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
3. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
4. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
5. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile.
6. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
7. ASTM D5261 - Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

1.03 QUALIFICATIONS

A. The Contractor shall provide the services of a geotextile system manufacturer who shall meet the following qualifications. The Contractor shall accept and retain full responsibility for all materials and installation and shall be held responsible for any defects in the completed geotextile system(s).

B. Manufacturer Qualifications: Prequalified manufacturer shall be a company, corporation, or firm regularly engaged in the development and manufacture of geotextile with a history of successful production for a minimum period of five (5) years. The manufacturer shall have supplied

geotextile to a minimum of six (6) projects during the past five (5) years of similar size and scope totaling a minimum of ten million (10,000,000) square feet. Projects shall be considered similar only if the manufacturer had total responsibility for geotextile manufacture and the installed system has successfully fulfilled its primary function for a minimum of two (2) years.

C. Manufacturer to furnish complete laboratory analysis of the material to the Certifying Engineer for review for compliance with the specifications prior to delivery of this material to the job site. The laboratory analysis shall be submitted as a Shop Drawing in accordance with Section 01340 of the specifications and as noted herein.

D. Installer Qualifications: The installation shall be installed by the manufacturer of the material or by an approved installer certified by the manufacturer. The installer shall have installed a minimum of 2,000,000 square feet of geotextile in the last five (5) years. The installer shall have worked in a similar capacity on at least three (3) projects similar in complexity to the project described in the Contract Documents and within at least 750,000 square feet of geotextile installation on each project. The installation supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.

1.04 SUBMITTALS

A. Shop Drawings: The Contractor shall submit to the Certifying Engineer, for approval, information on the following;

1. Within 10 days (10) calendar days after the Notice to Proceed date:
    a. Geotextile Manufacturer's name, address, contact, and location where the geotextile product is to be produced.
    b. Geotextile Manufacturer's Qualifications as required under Article 1.03.
    c. Warranty (Materials) meeting the requirements of Article 1.06 of this Section.
    d. Quality Control Certificates
    e. The Manufacturer’s material properties sheets (cut sheets) of proposed geotextile product(s) meeting the requirements listed in the Article 2.
    f. The Manufacturer’s written instructions for storing, handling, installing, seaming, and repairing the proposed geotextile, including recommendations for handling equipment (model number and load capacity).
    g. Geotextile Accessories
    h. Resumes of Installation Personnel
    i. Certificate from the geotextile manufacturer that the installer is qualified to install their product.

B. Detailed informational requirements for the shop drawing submittals are described within this specification section. The Contractor shall be required to submit and receive approval from the Certifying Engineer for all submittals described within this specification section.

C. Geotextile Installer’s Information:

1. The Contractor shall submit the Installer’s Information as part of the Pre-Qualification of Construction Bidders prior to Award and at least 30 days before geotextile is scheduled to be installed.
2. Installer’s name and address and primary contact.
3. The Installer’s written procedures manual.

1.05 CERTIFICATION

A. Prior to installation of the geotextile, the manufacturer shall provide the Engineer with two (2) original signature copies of a notarized certification signed by an authorized Corporate Officer of the manufacturer indicating that the product meets the required specifications and listing:

1. The manufacturer's certified minimum property values of the geotextile and the tests used to determine those properties.

2. The manufacturer's available production capacity and projected delivery dates for this project.

B. Installation: The Contractor shall be responsible for transportation, field handling, storing, deploying, seaming, temporary restraining (against wind), anchoring and other site aspects of the geotextiles. The Contractor shall be trained and qualified to install geotextile and shall be approved and/or licensed by the manufacturer. The Contractor's qualifications will require the County's acceptance.

C. Manufacturer's Quality Control (MQC): See Article 2.05 of this Section.

D. Construction Quality Control (CQC): During construction, the Contractor shall submit CQC documentation weekly:

1. Material delivery report.
2. Rejected material removal report.
3. Records of daily installation, including roll numbers placed.
4. Records of daily personnel activity.
5. Meeting reports.
6. Updated record drawings.

1.06 WARRANTY

A. The Contractor shall guarantee the materials of all products supplied, on a prorated basis, as part of this work for a minimum period of five (5) years following final acceptance of the geotextile installation by the County.

B. Unless otherwise stated in this specification, the Contractor shall guarantee the workmanship of all services supplied as part of this work for a minimum period of two (2) years following acceptance by the County. The Contractor shall repair or replace, at no additional expense to County or CQA Manager, any defective work which fails to meet the design requirements. Repair or replacement of such defective work shall be completed within thirty (30) calendar days of notification by the County.

C. Warranty conditions, for the materials and workmanship, proposed by the Manufacturer/Fabricator concerning limits of liability shall be evaluated upon receipt by the County and must be acceptable to the County prior to installation of the Geotextile. Proposed Warranty conditions shall be submitted to the Certifying Engineer within twenty-one (21) contract days after award of contract for review and approval.

1.07 QUALITY ASSURANCE

A. MQC and CQC are the responsibility of the Contractor. and are performed by the Manufacturer and Installer to document that the material and installation are in accordance with this Specification. The Installer's CQC representative will be responsible for CQC in accordance with the submitted CQC Plan, which is independent of CQA.

B. The County will engage and pay for the services of an Engineer and/or CQA Consultant. The County will engage and pay for the services of an independent CQA Laboratory for monitoring the quality and installation of the geotextile. The Manufacturer, Installer, and Contractor must help the County and the Engineer with product sampling for CQA testing by providing samples, personnel, and equipment, as necessary. CQA tests will be the measure of the acceptance of material. The Contractor will be responsible for the cost of retesting should the CQA tests fail. The retests will be paid by the County and reimbursed by the Contractor.

PART 2 - PRODUCTS

2.01 GEOTEXTILES

A. General Requirements:

1. Unless otherwise noted on the drawings, geotextile manufacturers shall furnish materials whose minimum average roll values for geotextile materials, as defined by the Federal Highway Administration (FHWA), Task Force 25 Guidelines shall meet or exceed the criteria listed below under Geotextile Properties. The geotextiles provided by the supplier shall meet or exceed the property values specified and shall be stock products.
2. The non-woven material shall be comprised of yarns of polypropylene or polyester fibers, oriented into a stable network by needle-punching which retains its structure during handling, placement, and long-term service. Geotextiles shall be capable of withstanding direct exposure to sunlight for 30 days with no measurable deterioration. The geotextiles shall be inert to commonly encountered chemicals, hydrocarbons, mildew and rot resistant, and be insect and rodent resistant.
3. During shipment and storage, the geotextile shall be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions. During storage, the geotextile shall be raised off the floor/ground. The manufacturers shall furnish complete written instructions for the storage, handling and installation of the geotextile in compliance with this Specification and the conditions of the warranty.

B. Labeling:

1. Geotextiles shall be supplied in rolls wrapped in impermeable and opaque protective covers. Geotextile and rolls shall be marked or tagged with the following information:
   a. Manufacturer's name.
   b. Product identification.
   c. Lot number.
   d. Roll number.
   e. Roll dimensions.
   f. Mass expressed in oz/yd^2.

C. Manufacturers:

1. The geotextile shall be manufactured by SKAPS, Solmax, or approved equal.

2.02 NONWOVEN GEOTEXTILE FOR SEPARATION

A. Products composed of nonwoven polypropylene or polyester filaments that maintain their structure during handling, placement, and long-term service.

B. Resistant to soil chemicals, landfill gas, and leachate.

C. New product made from virgin materials.

D. Geotextile used for separation conforming to the minimum property values in Table 02720-A.

2.03 NONWOVEN GEOTEXTILE FOR GEOMEMBRANE PROTECTION (CUSHION)

A. Products composed of nonwoven polypropylene or polyester filaments that maintain their structure during handling, placement, and long-term service.

B. Resistant to soil chemicals, landfill gas, and leachate.

C. New product made from virgin materials.

2.04 TRANSPORTATION, HANDLING, AND STORAGE

A. Transportation, handling, storage, and care of the geotextile materials prior to storage at the site are the responsibility of the Manufacturer.

2.05 MANUFACTURING QUALITY CONTROL

A. Geotextiles:

1. The geotextile shall be manufactured with a high degree of quality control and shall contain no needles from the manufacturing process. In most cases, however, sampling can be carried out on sacrificial portions of the material. Consequently, repair of sampled locations should not be required as long as the rest of requirements are met in this Specification. The following criteria are necessary for these components.
2. Rolls:
   a. All materials shall be tested, at a minimum, once every lot or once every 90,000 square feet, whichever is least, to evaluate the pertinent characteristics for quality control. This testing shall be performed and certified by the Manufacturer to show that the material samples meet the specifications described herein. Samples not satisfying the specifications shall result in the rejection of the applicable rolls. At the County's discretion and expense, additional testing of individual rolls may be performed to more closely identify the non-complying rolls and/or to qualify individual rolls. The following manufacturing quality control at the above frequency shall be performed:

Test	Method
Mass per unit area	ASTM D 5261
Grab Strength	ASTM D 4632
Tear Strength	ASTM D 4533
Puncture Strength	ASTM D 4833
Apparent Opening Size	ASTM D 4751
Permittivity	ASTM D 4491

b. The Manufacturer shall provide to the CQA Manager the geotextile manufacturer's certification on the quality of the rolls of geotextiles. As a minimum, the certifications shall include quality control certificates for each shift's production and shall be signed by responsible parties employed by the manufacturer (such as the production manager), shall be notarized and supplied to the CQA Manager.

c. The quality control certificate shall include:
   i. Roll numbers and identification.
   ii. Sampling procedures.
   iii. Results of quality control tests, including a description of test methods used.

B. Conformance Testing: Samples may be collected at the manufacturer's factory or upon delivery to the site, samples of all geotextile materials shall be removed by the CQA Manager and sent to the County's independent specified laboratory (approved by Certifying Engineer) for testing to ensure conformance to these specifications. Conformance tests by independent laboratory will be at County's expense. The Contractor shall be responsible for payment of any failed conformance tests. Samples shall be selected by the CQA Manager in accordance with these specifications and with the CQA Plan. The CQA Manager may increase the frequency of sampling at his discretion in the event that test results are negative. Any materials whose sample minimum average roll values do not meet these specifications shall be rejected and replaced, at the cost of the Manufacturer. The Contractor shall be responsible for the safe storage of rolls at the jobsite.

PART 3 - EXECUTION

3.01 INSTALLATION OF GEOTEXTILES

A. Handling and Placement: The Installer shall handle all geotextiles in such a manner as to ensure they are not damaged in any way, and the following shall be complied with:

1. In the presence of wind, geotextiles shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain until replaced with earth cover material.
2. Geotextiles shall be cut using a tool capable of obtaining a clean cut, unstressed sample. If in place, special care must be taken to protect other materials from damage which could be caused by the cutting of the geotextiles.
3. During placement, care shall be taken not to entrap in the geotextile stones, excessive dust, or moisture that could damage the liner, generate clogging of drains or filters, or hamper subsequent seaming. At no time during geotextile placement shall any vehicle be allowed directly on the exposed geotextile.

4. An examination of the geotextile over the entire surface, after installation, shall be conducted to ensure that no potentially harmful foreign objects, such as needles, are present. Any foreign objects so encountered shall be removed by the installer or the geotextile shall be replaced.
5. If white colored geotextile is used, precautions shall be taken against "snow blindness" of personnel.

B. Overlaps:

1. Geotextile shall be overlapped by at least 12 inches.

C. Repair:

1. Any holes or tears in the geotextile shall be repaired as follows:
   a. A patch made from the same geotextile shall be thermally bonded into place with a 12-inch overlap in all directions. Should any tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced.
2. Care shall be taken to remove any soil or other material which may have penetrated the torn geotextile.

3.02 PLACEMENT OF SOIL MATERIALS

A. The Contractor shall place all soil materials located on top of a geotextile, in such a manner as to ensure:

1. No damage of the geotextile.
2. Minimal slippage of the geotextile on underlying layers.
3. No excess tensile stresses in the geotextile.

B. Care shall be taken during filling operations to ensure that the geotextile is not damaged by earth-moving or other equipment. Any damage to the geotextile caused by the Contractors equipment shall be repaired at no cost to the County.

C. Upon completion of the covering operation, the cover material shall be smoothed to the required elevation ± 0.1 feet.

D. Upon completion of the covering operation, the Contractor shall certify the following to the County:

1. The geotextile was constructed in accordance with the approved project plans and specifications.
2. The cover material meets all requirements with the approved project plans and specifications. The geotextile has not been damaged during the covering operation or construction.

3.03 ACCEPTANCE

A. The Contractor retains ownership and responsibility until acceptance by County.

B. The County accepts geotextile when:

1. The installation is complete.
2. All required documentation from the Manufacturer, Installer, and Contractor has been received and accepted.
3. Conformance test reports verifying material properties have been received and accepted.
4. The Engineer has completed Final Inspection and any noted defects have been repaired.

Table 02720-A

REQUIRED PROPERTY VALUES NONWOVEN GEOTEXTILE FOR SEPARATION

Property	Qualifier	Units	Specified Values	Test Method
Type				
Nonwoven needle punched				(-)
Polymer composition	minimum	%	95 polypropylene or Polyester by weight	(-)
Mass per unit area	minimum	oz/yd^2	8 (70 US Sieve)	ASTM D 5261
Thickness		mil	80	ASTM D 5199
Filter Requirements				
Apparent Opening Size (O_{95})	maximum	mm	0.18 (80 US Sieve)	ASTM D 4751
Permittivity	minimum	sec^{-1}	1.0	ASTM D 4491
Mechanical Requirements[1]				
Grab strength	minimum	lb	200	ASTM D 4632[2]
Tear strength	minimum	lb	80	ASTM D 4533[3]
CBR Puncture strength	minimum	lb	500	ASTM D 6241
Resistance Range		pH	2-12	-
U.V. Resistance		% Strength Retained	70	ASTM D 4355

Notes:

(1) All values represent minimum average roll values.
(2) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
(3) Minimum value measured in machine and cross machine direction.

TABLE 02720-B GEOTEXTILE QUALITY CERTIFICATION
Section 02720 Geotextile

Property	Qualifier	Test Designation	MQC Test Frequency	CQA Test Frequency
Mass Per Unit Area	Minimum	ASTM D5261	Once per every lot or once every 90,000 square feet, whichever is least	1 per 100,000 ft^2
Grab Strength	Minimum	ASTM D4632	Once per every lot or once every 90,000 square feet, whichever is least	1 per 100,000 ft^2
Tear Strength	Minimum	ASTM D4533	Once per every lot or once every 90,000 square feet, whichever is least	1 per 100,000 ft^2
CDR Puncture Strength	Minimum	ASTM D6241	Once per every lot or once every 90,000 square feet, whichever is least	1 per 100,000 ft^2
Apparent Opening Size	Minimum	ASTM D4751	Once per every lot or once every 90,000 square feet, whichever is least	1 per 100,000 ft^2
Permittivity	Minimum	ASTM D4491	Once per every lot or once every 90,000 square feet, whichever is least	1 per 100,000 ft^2
Thickness	Minimum	ASTM D5199	Once per every lot or once every 90,000 square feet, whichever is least	1 per 100,000 ft^2

END OF SECTION

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SECTION 02740

BONDED COMPOSITE DRAINAGE NET

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Furnish all transportation, labor, materials, tools, and supervision necessary for the manufacturing, storage, delivery, installation, and testing of a primary and secondary composite drainage net (CDN) as part of the landfill liner system, as herein specified and as shown on the Drawings.
2. The installation of CDN shall be performed in conjunction with other work as follows:
   a. Landfill liner system including site preparation, GCL, textured High Density Polyethylene (HDPE) geomembrane, leachate collection lateral, drainage sand, protective cover soils, and other landfill liner system component installations as shown on the Drawings.

B. Related Work Described Elsewhere:

1. Section 01340 - Shop Drawings, Working Drawings, And Samples
2. Section 02220 - Excavation, Backfilling and Compaction
3. Section 02720 - Geotextile
4. Section 02772 - Geosynthetic Clay Liner
6. Section 02776 – Linear Low Density Polyethylene (LLDPE) Geomembrane

1.02 APPLICABLE STANDARDS OR REFERENCES

1. ASTM D751 - Standard Test Methods for Coated Fabrics.
2. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
3. ASTM D1238 - Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
4. ASTM D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique.
5. ASTM D1557 - Standard Test Method for Moisture Content Penetration Resistance Relationships of Fine-Grained Soils.
6. ASTM D1603 - Standard Test Method for Carbon Black Content in Olefin Plastics.
7. ASTM D3786 - Standard Test Method for Bursting Strength of Textile Fabrics—Diaphragm Bursting Strength Tester Method.
8. ASTM D4218 - Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.
9. ASTM D4354 - Standard Practice for Sampling of Geosynthetics for Testing.
10. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
11. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
12. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

13. ASTM D4716 - Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
14. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile.
15. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
16. ASTM D5199 - Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.
17. ASTM D5261 - Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
18. ASTM D5321 - Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.
19. ASTM D6141 - Standard Guide for Screening Clay Portion of Geosynthetic Clay Liner (GCL) for Chemical Compatibility to Liquids.
20. ASTM D7361 - Standard Test Method for Accelerated Compressive Creep of Geosynthetic Materials Based on Time-Temperature Superposition Using the Stepped Isothermal Method.

1.03 QUALIFICATIONS

A. Manufacturer Qualifications: Pre-qualified Manufacturer shall be a company, corporation, or firm regularly engaged in the development and manufacture of CDN with a history of successful production for a minimum period of five (5) years. The Manufacturer shall have manufactured a minimum of 10 million (10,000,000) square feet. Manufacturer shall provide written verification of Manufacturer's experience in the form of Shop Drawing for review and acceptance prior to installation.

B. Manufacturer to furnish complete laboratory analysis of the material to the Certifying Engineer for review for compliance with the specifications prior to delivery of this material to the job site. The laboratory analysis shall be submitted as a Shop Drawing in accordance with Section 01340 of the specifications and as noted herein.

C. Installer Qualifications: The installation shall be installed by the manufacturer of the material or by an approved installer certified by the manufacturer. The installer shall have installed a minimum of 10,000,000 square feet of geocomposite in the last five (5) years. The installer shall have worked in a similar capacity on at least 3 projects similar in complexity to the project described in the Contract Documents and within at least 750,000 square feet of CDN installation on each project. The installation supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.

1.04 SUBMITTALS

A. Shop Drawings: The Contractor shall submit to the Certifying Engineer, for approval, information on the following;

1. Within 10 days (10) calendar days after the Notice to Proceed date:
    a. CDN Manufacturer's name, address, contact, and location where the CDN product is to be produced.
    b. CDN Manufacturer's Qualifications as required under Article 1.02A of this Section.
    c. Warranty (Materials) meeting the requirements of Article 1.06 of this Section.
    d. CDN Resin Information & Quality Control Certificates.
    e. CDN Manufacturer Material Information & Quality Control Certificates.
    f. The Manufacturer’s material properties sheets (cut sheets) of proposed CDN product meeting the requirements listed in the Article 2.

g. The Manufacturer's written instructions for storing, handling, installing, seaming, and repairing the proposed CDN, including recommendations for handling equipment (model number and load capacity).
h. The Manufacturer's quality control (MQC) plan, including examples of CDN certification documents, name and address of the quality control testing laboratory, quality control laboratory certification, examples of retesting notification, and documentation.
i. CDN Accessories.
j. Resumes of Installation Personnel.
k. Certificate from the CDN manufacturer that the installer is qualified to install their product.

B. Detailed informational requirements for the shop drawing submittals are described within this specification section. The Contractor shall be required to submit and receive approval from the Certifying Engineer for all submittals described within this specification section.

C. CDN Installer's Information:

1. The Contractor shall submit the Installer's Information as part of the Pre-Qualification of Construction Bidders prior to Award and at least 30 days before CDN is scheduled to be installed.
2. Installer's name and address and primary contact.
3. CQC plan including but not limited to the following:
   a. Description of a. seaming equipment and techniques.
   b. Description of methods for repairing panels.
   c. Description of method for removing rejected materials.
   d. Proposed staffing.
   e. Proposed equipment.
   f. Complete set of forms to be used for recording installation QC data, including but not limited to daily record documents.
4. The Installer's written procedures manual.

1.05 CERTIFICATION

A. Prior to installation of the CDN, the manufacturer shall provide the Engineer with two (2) original signature copies of a notarized certification signed by an authorized Corporate Officer of the manufacturer indicating that the product meets the required specifications.

B. Product Acceptance Testing:

1. After the Engineer's review and approval of the Manufacturer's Information and, representative samples of the CDN product intended for this project and manufactured at the same plant that will produce the product for this project, shall be sampled and sent directly to the Engineer's selected laboratory for the Product Acceptance Testing.

2. The Engineer's acceptance of the CDN product will depend on the results of the Product Acceptance testing. Product Acceptance test results shall be submitted to the Engineer 21 days before shipping the CDN. The CDN shall not be shipped before review and acceptance of the Product Acceptance Test results.

3. Samples shall be sent to the Product Acceptance Laboratory unless otherwise noted. The sample package should include a cover letter referencing the project location, project number, Manufacturer, date of sampling, lot and roll number, and MQC test data documented for the particular production run from which the sample was taken. This submittal shall conform to the requirements of Section 01340 - Shop Drawings, Working Drawings, And Samples. The Contractor shall bear the cost of all shipping samples to the Engineer's selected laboratory.

4. CDN Samples: The Manufacturer shall package and ship two 3-foot-long-by-the-width-of-roll samples for laboratory testing. The samples shall be packaged securely for shipping to prevent damage, bentonite loss, and hydration. Each sample shall be clearly marked with lot and roll number and date of sampling as the machine direction on the sample. The Contractor shall submit MQC data for the roll sampled with the test results.

5. The Independent Laboratory will be conducting Interface Direct Shear Strength Testing in accordance with ASTM D5321 and Rule 62-701.400(3)(d)7, FAC.

6. If the results of any test do not conform to the requirements of this Specification, the Engineer may elect to retest from the same roll of product or reject the roll. If retesting, the Engineer will notify the Contractor that a retest is planned. Retesting results shall be reported within 7-days of retesting. If the retest does not conform to the requirements of this Specification, the product shall be rejected, and the Contractor must submit pre-construction submittals pertaining to the new product so the Engineer's selected laboratory can perform the Project Acceptance Tests for the new product. Contractor shall pay for any failed tests.

C. The Manufacturer shall provide the Engineer or other designated party, the QA/QC certifications for each shipment of CDN. The certification shall be signed by a responsible party employed by the manufacturer such as the QA/QC Manager, Production Manager, or Technical Services Manager. The QA/QC certifications shall include:

1. CDN lot and roll numbers (with corresponding shipping information).
2. Manufacturer's test data for raw materials used in CDN production, including, at a minimum, mass/area data and tensile test data.
3. Manufacturer's test data for finished CND product.

D. Manufacturer's Quality Control (MQC): See Article 2.03A of this Section.

E. Construction Quality Control (CQC): During construction, the Contractor shall submit CQC documentation weekly:

1. Material delivery report.
2. Rejected material removal report.
3. Records of daily installation, including roll numbers placed.
4. Records of daily personnel activity.
5. Meeting reports.
6. Updated record drawings.

1.06 WARRANTY

A. The Contractor shall guarantee the materials of all products supplied, on a prorated basis, as part of this work for a minimum period of five (5) years following final acceptance of the CDN installation by the County.

B. Unless otherwise stated in this specification, the Contractor shall guarantee the workmanship of all services supplied as part of this work for a minimum period of two (2) years following acceptance by the County. The Contractor shall repair or replace, at no additional expense to County or CQA Manager, any defective work which fails to meet the design requirements. Repair or replacement of such defective work shall be completed within thirty (30) calendar days of notification by the County.

C. Warranty conditions, for the materials and workmanship, proposed by the Manufacturer/Fabricator concerning limits of liability shall be evaluated upon receipt by the County and must be acceptable to the County prior to installation of the CDN. Proposed Warranty conditions shall be submitted to the Certifying Engineer within 21 contract days after award of contract for review and approval.

1.07 QUALITY ASSURANCE

A. MQC and CQC are the responsibility of the Contractor, and are performed by the Manufacturer and Installer to document that the material and installation are in accordance with this Specification. The Installer's CQC representative will be responsible for CQC in accordance with the submitted CQC Plan, which is independent of CQA.

B. The County will engage and pay for the services of an Engineer and/or CQA Consultant. The County will engage and pay for the services of an independent CQA Laboratory for monitoring the quality and installation of the CDN. The Manufacturer, Installer, and Contractor must help the County and the Engineer with product sampling for CQA testing by providing samples, personnel, and equipment, as necessary. CQA tests will be the measure of the acceptance of material. The Contractor will be responsible for the cost of retesting should the CQA tests fail. The retests will be paid by the County and reimbursed by the Contractor.

PART 2 – PRODUCTS

2.01 COMPOSITE DRAINAGE NET

A. General Requirements:

1. The CDN shall consist of a non-woven geotextile bonded to both sides of a high-density polyethylene geonet. The bonding process shall be heat bond and shall not introduce adhesives or other foreign products.
2. The CDN's provided by the supplier shall meet or exceed the property values specified and shall be stock products; i.e., except when specifically authorized, the supplier shall not furnish products specifically manufactured to meet the specifications of this Project.
3. The non-woven geotextile shall be comprised of yarns of polypropylene or polyester fibers, oriented into a stable network by needle punching. The geotextile shall be capable of withstanding direct exposure to sunlight for thirty (30) days with no measurable deterioration.

4. Products shall be chemically compatible with the leachate from a typical Class I landfill in Florida; and inert to commonly encountered chemicals, hydrocarbons, and mildew and rot resistant. The product shall conform to the properties of Table 02740-1.
5. During shipment and storage, the CDN's shall be wrapped in opaque wrapping and shall be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions. During storage, the CDN shall be raised off the floor/ground. The Manufacturer shall provide complete written instructions for the storage, handling, and installation of the CDN in compliance with this Specification and the conditions of the warranty prior to installation.

B. Labeling: CDN's shall be supplied in rolls marked or tagged with the following information:

1. Manufacturer's name.
2. Product identification.
3. Lot number.
4. Roll number.
5. Roll dimensions.

C. Manufacturers: The CDN shall be manufactured by The Tensar Corporation, Solmax, or approved equal.

2.02 TRANSPORTATION, HANDLING AND STORAGE

A. Transportation, handling, storage, and care of the CDN's prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall be liable for all damages to the materials incurred prior to final acceptance of the geosynthetic liner system by the County.

2.03 MANUFACTURING QUALITY CONTROL

A. The CDN and its components shall be manufactured with a high degree of quality control. In most cases, however, sampling can be carried out on sacrificial portions of the material. Consequently, repair of sampled locations should not be required as long as the rest of requirements are met in this Specification. The following criteria are necessary for these components.

B. Rolls:

1. All materials shall be tested, at a minimum, once every lot or once every 90,000 square feet, whichever is least, to evaluate the pertinent characteristics for quality control, as listed below. This testing shall be performed and certified in writing by the Manufacturer to show that the material samples meet the specifications described herein. Samples not satisfying the specifications shall result in the rejection of the applicable rolls. At the County's discretion and expense, additional testing of individual rolls may be performed to more closely identify the noncomplying rolls and/or to qualify individual rolls.

Test	Method
Mass per unit area	ASTM D 5261
Grab strength	ASTM D 4632
Puncture strength	ASTM D 4833

2. Perform manufacturing quality control tests on the geotextile, at a minimum frequency of one test per 100,000 square feet to demonstrate that its apparent opening size (per ASTM D 4751) and permittivity (per ASTM D 4491) conform to the values specified in Table 02740-1.
3. Perform manufacturing quality control tests to demonstrate that the geonet drainage core properties conform to the values specified in Table 02740-1. Perform as a minimum, the following manufacturing quality control tests at a minimum frequency of once per 100,000 square feet:

Test	Method
Polymer density	ASTM D 1505
Carbon black	ASTM D 1603

4. Perform manufacturing quality control tests, at a minimum frequency of once per 100,000 square feet, to demonstrate that the geocomposite drainage layers conform to the hydraulic transmissivity (per ASTM D 4716) and laminated strength (per ASTM D4632) requirements of Table 02740-1.
5. The Manufacturer shall provide to the CQA Manager the CDN manufacturer's certification on the quality of the rolls of CDN. As a minimum, the certifications shall include quality control certificates for each shift's production and shall be signed by responsible parties employed by the manufacturer (such as the production manager), and shall be notarized and supplied to the CQA Manager.

6. The quality control certificate shall include:
   a. Roll numbers and identification.
   b. Sampling procedures.
   c. Results of quality control tests, including a description of test methods used.

C. Conformance Testing: samples of all CDN's materials shall be removed by the CQA Manager at the site or the manufacturer’s factory and sent to an independent specified laboratory (approved by the Certifying Engineer) for testing to ensure specification conformance. Samples shall be selected by the CQA Manager in accordance with these specifications and with the CQA Plan. The CQA Manager may increase sampling frequency in the event that test results are negative. Materials whose sample minimum average roll values do not meet these specifications shall be rejected and replaced, at no cost to the County. The Contractor shall be responsible for inspection of rolls at the job-site for proper storage.

Table 02740 – 1

REQUIRED PROPERTY VALUES FOR COMPOSITE DRAINAGE NETS

Property	Qualifier	Units	Specified Values[1]	Test Method
Geonet Core[2]				
Specific Gravity	minimum	g/cm^3	0.94	ASTM D 792/1505
Carbon Black	range	%	2-3	ASTM D 1603/4218
Geotextile				
Type	range	none	Needle punched nonwoven	--
Polymer composition	minimum	%	95 polyester or polypropylene	--
Mass per unit area	minimum	oz/sy	8.0	ASTM D 5261
Grab Tensile Strength	minimum	lbs	150	ASTM D 4632
AOS	maximum	mm	0^{95} - ≤ 0.21 (70 US Sieve)	ASTM D 4751
Permittivity	minimum	sec^{-1}	1.0	ASTM D 4491
CDR Puncture strength	minimum	lb	400	ASTM D 6241
Geocomposite				
Ply Adhesion	minimum	lbs/in	1	ASTM D 7005
Transmissivity[3,5,6,7]	minimum	$m^3/sec\text{-}m$	$1.79x10^{-3}$	ASTM D 4716

1 Values are minimum average roll values.
2 Values are values of geonet prior to bonding.
3 At a gradient of 0.33, normal load of 350 psf, seating time of 24 hours.
4 Test cross-section (top to bottom) drainage sand, geocomposite, and textured geomembrane.
5 Reported results shall be an average of three (3) test specimens tested by an independent GAI-accredited laboratory.
6 Normal loads – 125 psf, 250 psf, and 375 psf.
7 Transmissivity based on protective cover hydraulic conductivity of 1.00×10^{-4} cm/s. See Table 02740-2

Table 02740 – 2

REQUIRED TRANSMISSIVITY OF COMPOSITE DRAINAGE NET VERSUS HYDRAULIC CONDUCTIVITY OF THE PROTECTIVE COVER[7]

HYDRAULIC CONDUCTIVITY (cm/sec)	CDN TRANSMISSIVITY ($m^3/sec\text{-}m$)
1.00E-03	$1.79x10^{-2}$
8.00E-04	$1.43x10^{-2}$
6.00E-04	$1.08x10^{-2}$
4.00E-04	$7.17x10^{-3}$
2.00E-04	$3.59x10^{-3}$
1.00E-04	$1.79x10^{-3}$
8.00E-05	$1.43x10^{-3}$
6.00E-05	$1.08x10^{-3}$
4.00E-05	$7.17x10^{-4}$
2.00E-05	$3.59x10^{-4}$
1.00E-05	$1.79x10^{-4}$

7 Hydraulic conductivity test (ASTM D 5084) at 90% Standard Proctor

PART 3 – EXECUTION

3.01 INSTALLATION OF COMPOSITE DRAINAGE NETS (CDN)

A. Before installing the geocomposite, the Contractor shall examine the underlying construction for conformance with Specifications. Verify the following:

1. Underlying installations are complete, installed as designed, and Record Documentation has been obtained.
2. There is no debris, excessive dust, or rocks on the geomembrane in the area where the geocomposite will be deployed.

B. Installation shall be by the manufacturer's recommendations unless otherwise specified below.

C. Handling and Placement: The Contractor shall handle all CDN's in such a manner as to ensure the CDN's are not damaged in any way, and the following shall be complied with:

1. All seams shall run parallel to the line of the slope. Seams shall be overlapped a minimum of 4 inches and secured by plastic ties every 5 feet and 6 inches along the ends. Tying material shall be white or yellow for easy inspection. Metallic material shall not be allowed. The geotextile shall then be overlapped and sewn.
2. On slopes, the CDN's shall be secured and rolled down the slope in such a manner as to continually keep the CDN sheet in tension. If necessary, the CDN shall be positioned by hand after being unrolled to minimize wrinkles.
3. When the CDN must be cut to fit and/or maintain seams parallel to the line of slope, the geotextile will be cut as required and the drainage net tied as described. A cap, using the same type of geotextile extending 12-inches from the seam, shall be thermally bonded over the seam.
4. In the presence of wind, all CDN's shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain until replaced with cover material.
5. The Contractor shall take any necessary precautions to prevent damage to underlying layers during placement of the CDN.
6. During placement of CDN's, care shall be taken not to entrap dirt or excessive dust in the CDN that could cause clogging of the drainage system, and/or stones that could damage the adjacent liner system components. If dirt or excessive dust is entrapped in the CDN, it should be hosed clean prior to placement of the next material on top. In this regard, care should be taken with the handling of sandbags, to prevent rupture or damage of the sandbag.
7. Direction of Flow: The direction of flow for the CDN within the cell is downslope to the anchor trench.

D. Seams and Overlaps:

1. On slopes steeper than 10 horizontal to 1 vertical, geotextiles component of CDN shall be continuously sewn (i.e., spot sewing is not allowed). Geotextiles shall be overlapped a minimum of 4 inches prior to seaming. Seams shall be double sewn with parallel stitching. The seams shall meet the same tensile strength requirements as required for the fabric in the direction perpendicular to the seam. No horizontal seams shall be allowed on side slopes.

2. On bottoms and slopes flatter than 10 horizontal/1 vertical, geotextiles shall also be continuously sewn, but may be single sewn.
3. The Contractor shall pay particular attention at seams to ensure that no earth cover material could be inadvertently inserted between the overlaps of the geotextile.
4. Sewing shall be done using polymeric thread with chemical resistant properties, durability and strength equal to or exceeding those of the geotextile.
5. Geonet component of the CDN shall be bound with plastic ties at a spacing of 1 per 5 feet on slopes flatter than 10 horizontal/vertical (10H:IV), 1 per 2 feet on slopes greater than 10H:IV, and 1 per 6 inches at the bounding of the end of one roll of CDN to another. All repairs will require ties at 1 per 6 inches.

E. Repair: Any holes or tears in the CDN shall be repaired by placing a patch extending 2 feet beyond edges of the hole or tear. The patch shall be secured to the original CDN by tying every 6 inches with accepted tying devices. If the hole or tear width across the roll is more than 50 percent the width of the roll, the damaged area shall be cut out and the two portions of the CDN shall be joined as indicated.

3.02 GEOMEMBRANE PLACED OVER COMPOSITE DRAINAGE NET

A. When placing other geosynthetics over the geocomposite ensure the following:

1. No damage occurs to the geocomposite.
2. The CDN does not slip on the underlying geosynthetics.
3. There are no excessive tensile stresses in the CDN.

3.03 DRAINAGE SAND/PROTECTIVE COVER SOILS OVER COMPOSITE DRAINAGE NET

A. Care shall be taken during filling operations to ensure that the CDN system is not damaged by earth-moving or other equipment. Any damage to the CDN caused by the Contractor's equipment shall be repaired at no cost to the County or CQA Manager.

B. Unless otherwise specified by the CQA Manager, all lifts of soil material placed over the CDN shall be in conformance with the following guidelines:

MAXIMUM ALLOWABLE EQUIPMENT GROUND PRESSURE (LBS/SQUARE INCH)	THICKNESS OF OVERLYING COVER MATERIAL (INCHES)
<5	12
5 - 10	18
10 - 20	24
>20	36

C. Geosynthetics shall be covered as soon as practical, but at least within thirty (30) days of deployment unless accepted by the County and the CQA Manager.

D. On side slopes steeper than 10 horizontal to 1 vertical, soil cover shall be placed beginning at the bottom of the slope and extending upward.

3.04 ACCEPTANCE

A. The Contractor retains ownership and responsibility for geocomposite until acceptance by County.

B. The County accepts geocomposite when:

1. The installation is complete.
2. All required documentation from the Manufacturer, Installer, and Contractor has been received and accepted.
3. Conformance test reports verifying material properties have been received and accepted.
4. The Engineer has completed Final Inspection and any noted defects have been repaired.

END OF SECTION

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SECTION 02772

GEOSYNTHETIC CLAY LINER

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Furnish all labor, transportation, materials, supervision, administration, management, and quality control necessary for the manufacturing, storage, and delivery of reinforced geosynthetic clay liner (GCL), as herein specified and as shown on the Drawings. The supply of these materials shall be in strict accordance with the Engineer's Specifications and Drawings and the manufacturer's instructions.
2. The installation of the GCL shall be performed in conjunction with work by others, including excavation, subgrade preparation, LFG piping, storm drainage systems, and placement of protective cover soil.
3. All work shall be performed in strict accordance with the lines, grades, cross-sections, and dimensions as shown on the Drawings.

B. Related Work Described Elsewhere:

1. Section 02220: Excavation, Backfilling and Compaction
2. Section 02740: Bonded Composite Drainage Net

1.02 APPLICABLE STANDARDS OR REFERENCES

1. GRI-GCL3, "Test Methods, Required Properties, and Testing Frequencies of Geosynthetic Clay Liners".
2. ASTM D 3776, "Weight (Mass) Per Unit Area of Woven Fabrics".
3. ASTM D 4632, “Test Method for Grab Breaking Load and Elongation of Geotextiles”.
4. ASTM D 4833, "Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products".
5. ASTM D 4873, "Guide for Identification, Storage and Handling of Geotextiles".
6. ASTM D 5890, "Swell Index Test".
7. ASTM D 5891, "Fluid Loss of Bentonite Clays".
8. ASTM D 5993, “Standard Test Method for Measuring Mass per Unit Area of Geosynthetic Clay Liners”.
9. ASTM D 6496, “Test Method for Determining Average Bonding Peel Strength Between the Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners”.
10. ASTM D 6768, “Test Method for Tensile Strength of Geosynthetic Clay Liners”.

1.03 QUALIFICATIONS

A. GCL Manufacturer Qualifications:

1. Qualified GCL manufacturers shall be a company, corporation, or firm regularly engaged in the development and manufacture of GCL's with a history of successful production of GCL's for a minimum period of three (3) years. The GCL manufacturer must have produced at least 10 million square feet of GCL.
2. The manufacturer shall have successfully supplied GCL for a minimum of six (6) projects during the last three (3) years of similar size and scope totaling to a minimum of 10 million square feet of installed GCL. Projects shall be considered similar only if the manufacturer had total manufacturing responsibility of the GCL production and the installed GCL has successfully fulfilled its primary function for a minimum of two (2) years. The manufacturer shall submit written information as follows:
   a. Name of location of project and date of installation;
   b. Contact name and phone number for each project; and
   c. GCL type and surface area installed.

B. GCL Installer Qualification:

The GCL Installer must either have installed at least 1 million square feet of GCL, or must provide to the Engineer satisfactory evidence, through similar experience in the installation of other types of geosynthetics, that the GCL will be installed satisfactorily. The installer shall submit written information as follows:

1. Name of location of project and date of installation;
2. Contact name and phone number for each project; and
3. GCL type and surface area installed.

1.04 SUBMITTALS

A. Shop Drawings: The Manufacturer shall submit to the Engineer, for acceptance, information on the following:

1. At least seven (7) calendar days prior to the GCL installation:
   a. GCL Manufacturer's Qualifications
   b. Warranty (Materials)
   c. GCL Manufacturer's Material Information Certification and Quality Control Certificates
2. During Installation:
   a. Panel installation under conditions outside of the accepted weather conditions, if any.
   b. Proposals for night operations (if proposed).
3. If during GCL installation, additional material or labor is required; (Note materials or labor shall not be used until the proper documentation is received and accepted by the Engineer). Documentation shall include the following:
   a. GCL Manufacturer's Material Information and Quality Control Certificates with notarized certification
   b. GCL Accessories
   c. Resumes of installation personnel
   d. Panel Layout(s) and Details

4. After completion of installation:
    a. Record (As-Built) Drawings
    b. Contractors' Written Certification
    c. Warranties (Materials and Workmanship)

B. Detailed informational requirements for the Shop Drawing submittals are described within this Specification section. The Contractor shall be required to submit and receive acceptance from the Engineer for all submittals described within this Specification section prior to beginning GCL construction.

1.05 CERTIFICATION

A. Prior to installation of the GCL, the manufacturer shall provide the Engineer with two (2) original signature copies of a notarized certification signed by an authorized Corporate Officer of the manufacturer indicating that the product meets the required specifications.

B. The Contractor shall submit to the Engineer a physical sample of the GCL used in the final construction. The samples shall be labeled with manufacturer's name, product identification, lot number, and roll number.

C. The Manufacturer shall provide the Engineer or other designated party, the QA/QC certifications for each shipment of GCL. The certification shall be signed by a responsible party employed by the manufacturer such as the QA/QC Manager, Production Manager, or Technical Services Manager. The QA/QC certifications shall include:

1. GCL lot and roll numbers (with corresponding shipping information).
2. Manufacturer's test data for raw materials used in GCL production, including, at a minimum, mass/area data and tensile test data.
3. Manufacturer's test data for finished GCL product, including at a minimum, clay mass/area data and tensile testing data.
4. Certificates of analysis for the bentonite clay used in GCL production.

1.06 WARRANTIES

A. Unless otherwise stated in this specification, the Manufacturer shall guarantee the materials of all products supplied on a prorated basis as a part of this work for a minimum period of twenty-five (25) years following Final Acceptance by the County. The Manufacturer shall repair or replace at no additional expense to County or Engineer, any defective materials or products which fail to meet the design requirements. Repair or replacement of such defective material and/or products shall be completed within thirty (30) calendar days of notification by the County.

B. Unless otherwise stated in this specification, the Contractor shall guarantee the workmanship of all services supplied as part of this work for a minimum period of two (2) years following acceptance by the County. The Contractor shall repair or replace, at no additional expense to County or Engineer, any defective work which fails to meet the design requirements. Repair or replacement of such defective work shall be completed within thirty (30) calendar days of notification by the County.

C. Warranty conditions proposed by the manufacturer/installer concerning limits of liability will be evaluated upon receipt and must be acceptable to the County prior to installation of the GCL. Proposed Warranty Conditions shall be submitted to the Engineer within twenty-one (21) contract days after Award of Contract for review and acceptance.

PART 2 – PRODUCTS

2.01 GCL - MATERIALS

A. The GCL shall be a factory manufactured hydraulic barrier consisting of sodium bentonite clay supported by geotextiles which are held together by needling. The GCL shall have the properties necessary to achieve compliance with the requirements in this section. The GCL shall be Bentomat ST, as manufactured by CETCO, Arlington Heights, IL; Bentofix NSL, as manufactured by GSE, Houston, TX; or accepted equals, if it can be documented that these materials meet or exceed these specifications.

2.02 GCL MANUFACTURING

A. GCL Manufacturing Quality Control

1. Rolls manufactured with inclusions, bubbles, or not complying with the specifications shall be rejected and not delivered to the Project.
2. The GCL shall be tested for the material to be delivered and installed on this project. The GCL shall be tested for the parameters and requirements listed in GRI-GCL3. This testing shall be performed by the manufacturer or the manufacturer's certified testing laboratory. Samples which do not satisfy the Contract Specifications shall be cause to reject applicable rolls. If a GCL sample fails to meet specifications, subsequent tests shall be performed at random on additional GCL samples produced from the same batch to determine whether all rolls produced from the same batch shall be regarded as unsatisfactory and therefore, rejected. This additional testing, at the manufacturer's discretion and expense, may be performed to more closely identify the rolls which do not comply with the specifications.
3. The tests specified in GRI-GCL3 shall be performed by the manufacturer or manufacturer's testing laboratory for the material to be delivered and installed on this Project. The test results shall be recorded on each of the Quality Control Certificates.
4. Exception to GRI-GCL3, the permeability test shall be performed at 2 psi maximum effective stress.
5. Samples shall be taken across the entire width of the rolls. The averaged test results of the GCL samples shall meet or exceed the Specifications. Certifications of the test results obtained shall be provided to the Engineer and recorded on the Quality Control Certificates.
6. The manufacturer shall submit two (2) original signature copies of the Quality Control Certificates on company letterhead, and shall be signed by responsible parties employed by the manufacturer or independent laboratory (such as the Production Manager). The Quality Control certificates shall include:
   a. GCL Roll Number, identification and type; and
   b. Results of Quality Control tests, including description of test methods used.

2.03 GCL DIMENSIONS AND IDENTIFICATION

A. An overlap or lapline shall be printed ten (10) inches from both edges of the upper geotextile component of the GCL as a means for providing quality assurance of the overlap. Lines shall be printed in easily visible, non-toxic, waterproof ink.

B. GCL's shall be supplied in rolls, marked, tagged, and bagged in U.V. resistant packaging. Prior to shipment, the GCL manufacturer shall affix a label to each roll identifying the following characteristics:

1. Manufacturer's name and address
2. Product identification (code number, name and type)
3. Lot number
4. Roll number
5. Roll dimensions (length and width)
6. Total roll weight

2.04 GCL - SHIPPING, HANDLING, AND STORAGE

A. The manufacturer assumes responsibility for initial loading and shipping of the GCL. Unloading, on-site handling, and storage are the responsibility of the Contractor. The requirements of ASTM D 5888 shall be followed.

B. A visual inspection of each roll should be made as it is unloaded by the CQA monitor to identify if any packaging has been damaged. Rolls with damaged packaging should be marked and set aside for further inspection. The packaging should be repaired prior to being placed in storage.

C. The party responsible for unloading the GCL should contact the manufacturer prior to shipment to ascertain the appropriateness of the proposed unloading methods and equipment to be utilized.

D. Storage of the GCL rolls shall be in accordance to the manufacturer's recommendations. A dedicated storage area shall be selected at the job site that is away form high traffic areas and is level, dry, and well-drained.

E. Rolls should be stored in a manner that prevents sliding or rolling from the stacks and may be accomplished by the use of chock blocks or by use of the dunnage shipped between rolls. Rolls should be stacked at a height no higher than that at which the lifting apparatus can be safely handled (typically no higher than three).

F. All stored GCL materials and the accessory bentonite must be covered with a plastic sheet or tarpaulin until their installation. The area shall be protected from precipitation and the direct heat of the sun, especially when stored for a long period of time.

PART 3 – EXECUTION

3.01 SUBGRADE PREPARATION

A. Refer to Contract Specification Section 02220: Excavation, Backfilling, and Compaction for subgrade preparation requirements.

B. The project CQA personnel shall certify acceptance of the subgrade before GCL placement and ensure that no potentially harmful objects are present, e.g., stones, cutting blades, small tools, sandbags, etc.

C. It shall be the Contractor's responsibility thereafter to indicate to the Engineer any change in the condition of the subgrade that could cause the subgrade to be out of compliance with any of the requirements listed in A and B above.

D. At the top of sloped areas of the job site, an anchor trench for the GCL shall be excavated in accordance with the Drawings. The trench shall be excavated and accepted by CQA personnel prior to GCL placement. No loose soil shall be allowed at the bottom of the trench, and no sharp corners or protrusions shall exist anywhere within the trench.

3.02 GCL PLACEMENT

A. Placement of the geocomposite drainage net and cover soil shall proceed rapidly to limit exposure of the GCL to the environment. The installed GCL should be covered with soil by the end of the working day. Any deviations from these procedures must be reviewed and accepted by the Engineer.

B. Placement of the GCL shall be conducted in accordance with the manufacturer's recommendations and with the direction provided herein. Any deviations from these procedures must be reviewed and accepted by the Engineer prior to construction.

C. The use of equipment capable of freely suspending the GCL roll is required. A spreader bar and core pipe are also required for supporting the roll and allowing it to unroll freely. The core bar and spreader bar shall not bend or flex excessively when a full roll is lifted.

D. The Contractor shall unwrap, install, and have CQA inspected only as much GCL in one working day as can be covered with earthen backfill or a geomembrane. In no case shall the GCL be exposed to the elements at the end of the day. Any leading edge of panels left uncovered shall be protected at the end of the working day with a waterproof sheet which is adequately secured with sandbags, soil, or other ballast.

E. Should any lead edge or area of overlaps become prematurely hydrated, then the area shall be allowed to dehydrate before any overlapping is allowed in the affected area.

3.03 GCL PANEL SEAMING

A. A minimum 10-inch overlap should exist at longitudinal seam locations. The end seams shall be at least 24 inches. The lap line and match lines printed on the panels shall be used to assist in obtaining this overlap. The edges of the GCL panels should be adjusted to smooth out any wrinkles, creases, or "fishmouths" in order to maximize contact with the underlying panel.

B. All GCL seams shall be formed by executing a bentonite-enhanced overlap to ensure that a continuous seal is achieved between panels. After the overlying panel is placed, its edge shall be pulled back to expose the overlap zone. Any soil or debris present in the overlap zone or entrapped in the geotextiles shall be removed. A fillet of granular bentonite shall then be poured in a continuous manner along the overlap zone (between the edge of the panel and the 10-inch), at a rate of at least one-quarter pound per lineal foot. The use of a watering can or line chalker is recommended to improve the uniformity and consistency of the bentonite enhancement. CQA for this process shall be conducted in accordance with the manufacturer's CQA plan.

C. On gently sloping areas (less than 10H:1V) where seams may be placed across the slope, overlaps should be "shingled" so as to prevent flow into the seam.

D. Trimming of the GCL shall be done with great care so that fugitive clay particles do not come in contact with drainage materials such as geonets, geocomposites, or natural drainage materials.

3.04 DAMAGE REPAIR

A. Any damage in the form of cuts, rips, or tears in the GCL shall be identified and repaired by the installer before backfilling by cutting a patch from unused GCL and placing it over the affected area.

B. The damaged area should be removed of all dirt and debris. A patch of GCL shall be cut to fit over the damaged area and to extend at least 12 inches in all directions around it. Granular bentonite shall then be placed around the perimeter of the affected area at the rate of one-quarter pound per lineal foot, and the patch shall be placed over the damaged area. An epoxy-based adhesive shall be used to keep the patch in position during backfill operations. These repair patches shall not be stapled or nailed in place.

C. Any damage to the material due to penetration by foreign objects or distress from rough subgrade shall, as directed by the Engineer, be replaced or covered with an additional layer of GCL of the proper size.

3.05 DETAIL WORK

A. Detail work, defined as the work necessary to seal the liner to pipe penetrations, foundation walls, drainage structures, spillways, and other appurtenances, shall be performed as recommended by the GCL manufacturer.

B. For any penetrations or structures the liner will contact, a small notch shall be cut along the edge of the area. The liner shall be brought up to the appurtenance and trimmed to fit snugly. The Contractor shall then hand apply and compact a pure bead of bentonite into half of the notch. The liner shall then be inserted into the notch, with the remaining area in the notch filled with bentonite.

3.06 PLACEMENT OF OVERLYING MATERIALS

A. The GCL shall be covered with the required cover material of soil, gravel, or another geosynthetic before a rainfall or moisture event occurs.

B. The GCL should not be covered before observation and acceptance by the CQA personnel.

C. If the cover material is soil or gravel, a minimum thickness of 24 inches shall be placed over the GCL. The soil cover shall be free of sharp-edged stones greater than 3/8 inches in size. The use of calcareous cover material shall be prohibited.

D. Soil cover shall be placed with low ground pressure equipment. A minimum thickness of 24 inches of cover shall be kept between heavy equipment and the GCL at all times, except when final-grading. No vehicles should be driven directly on the GCL until the proper thickness of cover has been placed. Care should be taken to avoid damaging the GCL by making sharp turns or pivots with equipment.

E. When covering GCL installed on sloped areas steeper than 8H:1V, the cover should be pushed upslope to minimize tension on the GCL.

F. Any leading edge of panels left uncovered shall be protected at the end of the working day with a waterproof sheet which is adequately secured with sandbags or other ballast.

3.07 INSPECTION OR TESTING

A. Upon completion of the work, all overlapping of the GCL liner shall be inspected to insure a ten (10)-inch overlap exists. In addition, the liner shall be inspected for any tears or punctures and repaired or replaced as deemed necessary by the Engineer.

B. The CQA personnel will collect samples for testing by the County in accordance with the project's CQA plan.

PART 4 – FINAL ACCEPTANCE

4.01 GCL ACCEPTANCE

A. The Contractor shall retain all ownership and responsibility for the GCL in the lining system until Final Acceptance by the County. Full compensation for the GCL installation shall not occur until the GCL lining system is accepted by the County. The County will accept the GCL system when:

1. The entire GCL installation is completed.
2. All documentation of installation is completed.
3. Verification of the adequacy of all field seams and repairs, including associated testing, is complete.
4. Written certification documents have been received and accepted by the Engineer. Certification documents include:
   a) Final acceptance of all required submittals by the Engineer.
   b) The cover material meets all requirements of the accepted project plans and specifications. The GCL has not been damaged during the covering operation or associated construction.
   c) Receipt of the GCL warranties.

4.02 RECORD (AS-BUILT) DRAWINGS

A. The Contractor shall submit a Record Panel Layout and related installation details of the actual GCL lining system:

1. The record panel layout shall be drawn, using applicable drafting standards, to the same scale indicated on the drawings for easy comparison. The record panel layout shall be on the installer's letterhead.
2. The record panel layout shall indicate installed field panel and seam numbering, configuration and dimensions, GCL penetrations, access roads, and berms. The record panel layout drawing(s) shall indicate individual panel dimensions and estimated installed square footage.
3. The locations of destructive samples with the correct corresponding sample number shall be located on the record panel layout.

4. The record panel layout shall have surveyed locations of the limits of GCL deployment.
5. The Installer shall submit detail drawings, using applicable drafting standards, of record (as-built) GCL penetrations details, and connection details, etc.

B. The Contractor shall submit a Record Survey of spot elevations (grade shots) of the GCL elevations of the installed lining system:

1. The record panel layout shall be drawn, using applicable drafting standards, to the same scale indicated on the Drawings for easy comparison.
2. The surveyor shall sign and seal the spot elevation survey.
3. The spot elevations (grade shots) shall be taken at every 50-foot grid increment marker. The drawing shall indicate the design elevation prior to installation and the installed elevation at each survey point.

END OF SECTION

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SECTION 02776

LINEAR LOW DENSITY POLYETHYLENE (LLDPE) GEOMEMBRANE

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work shall include furnishing and installing all materials, manufacturer's quality control and quality assurance, installer's quality control, warranties, transportation and storage, supervision, geomembrane accessories and installation equipment necessary for the installation of a geomembrane landfill cap, as herein specified. The supply and installation of these materials shall be in strict accordance with the Engineer's and be subject to the terms and conditions therein.

B. The installation of the geomembrane shall be preformed in conjunction with other work, including but not limited to, placement of geocomposite drainage net and cover soils.

C. Applicable Standards: All geomembrane material supplied as part of this Work shall be tasked as described in GRI-GM17 and GRI-GM19, and in the applicable American Standards and Test Methods (ASTM).

1.02 DEFINITIONS AND RESPONSIBILITY

A. Geomembrane shall be strictly defined to be linear low density polyethylene (LLDPE) in this specification section.

B. Manufacturer Qualifications:

1. Qualified Manufacturer shall be a company, corporation, or firm regularly engaged in the development and manufacture of geomembrane liners with a history of successful production of geomembrane for a minimum period of five (5) years. The geomembrane rolls shall be manufactured by a single Manufacturer. The Manufacturer shall submit written information as follows:
    a) Information on plant size (square feet of geomembrane produced daily), number of shifts, and capacity of each shift.
    b) Daily production quantity shall be sufficient to meet the demands of the project schedule for this project.
    c) Quality Control procedures (manual) for production. The manual shall define sampling procedures, test frequencies and methods. The Manufacturer shall, at a minimum, comply with the quality control specification for this project.
    d) Statement from the Manufacturer stating the manufacturing quality control measures specified for this project will be followed and the manufactured geomembrane products will meet or exceed the product specifications for this project.
2. The Manufacturer shall have successfully supplied geomembrane liner for a minimum of six (6) projects, during the last five (5) years, of similar size and scope totaling to a minimum of ten (10) million square feet of installed geomembrane. Projects shall be considered similar only if the Manufacturer had total manufacturing responsibility for geomembrane production and the installed geomembrane has successfully fulfilled its primary function for a minimum of two (2) years. The Manufacturer shall submit written information as follows;

a) Name and location of project and date of installation.
b) Contact name and phone number for each project.
c) Geomembrane thickness and surface area geomembrane installed.

C. Installer Qualifications:

1. Qualified Installer shall be a company, Corporation, or firm regularly engaged in the deployment and installation of geomembrane liners with a successful history of a minimum of three (3) years. The geomembrane shall be installed by a single installer. The Installer shall submit written information as follows:
   a) Copy of installer's letter of approval by the manufacturer and/or fabricator, or license.
   b) Corporate background and information.
   c) Information on equipment and personnel.
   d) Average daily production anticipated. Daily installation quantity shall be sufficient to meet the demands of the project schedule for this project.
   e) Quality Control procedures (manual) for field installation. The Installer shall, at a minimum, comply with the specifications for this project.

   Quality Assurance/Quality Control Field Program: The QA/QC program shall provide for recording all inspection and testing of all work items to ensure conformance to applicable specifications and drawings with respect to materials, workmanship, construction, functional performance and identification. This program shall be subject to acceptance by the Engineer.
2. The Installer shall have successfully installed geomembrane products for at least six (6) projects, during the last five (5) years, of similar size and function totaling a minimum of ten (10) million square feet of installed geomembrane. Projects shall be considered similar only if the Installer had total installation responsibility for geomembrane installation and the installed geomembrane has successfully fulfilled its primary function for a minimum of two (2) years. The Installer shall submit written information as follows:
   a) Name and purpose of facility, location of project, and date of installation.
   b) Name of owner, project manager, designer, manufacturer, and name of contact at the facility who can discuss the project.
   c) Name and qualifications of the supervisor(s) of the installer's crew(s).
   d) Geomembrane thickness and surface area geomembrane installed.
   e) Duration of installation.
3. Duration of the installation, the General Contractor shall be responsible for the timely submission of:
   - The installer's quality control documentation.
   - The installer's subgrade acceptance certificates for each area to be covered by the lining system, signed by the installer.
4. Resume of the qualifications of the "master seamer" to be assigned to this project. All personnel performing seaming operations shall be qualified by experience or by successfully passing seaming tests. At least one seamer shall have experience seaming a minimum of 1,000,000 linear feet of liner seams using the same type of seaming apparatus to be used for this project. No seaming shall be carried out without the presence of the "master seamer."

1.03 SUBMITTALS

A. SHOP DRAWINGS: The Contractor shall submit to the Engineer, for approval, information on the following;

1. Twenty-one (21) contract days prior to the geomembrane installation;

a) Manufacturer's Qualifications
b) Installer’s Qualifications
c) Special Guaranties
d) Geomembrane Resin Information & Quality Control Certificates
e) Geomembrane Manufacturer Material Information & Quality Control Certificates
f) Geomembrane Accessories
g) Resumes of Installation Personnel
h) Panel layout and details
i) Certificate from the geomembrane manufacturer that the installer is qualified to install their product
j) Certification that the geomembrane produced for this project is chemically compatible with leachate and landfill gas from a typical sanitary landfill.

2. Contract Closeout Submittals:

a) Geomembrane installer’s certification of subsurface acceptability (attached)
b) Geomembrane installer’s Certificate of Proper Installation (attached)
c) Record Documents: Include panel and sheet numbers, seaming equipment and operator identification, temperature and speed setting of equipment, date seamed, identity and location of each repair, cap strip, penetration, boot and sample taken from installed geomembrane testing
d) Special guarantee(s).

B. Detailed informational requirements for the shop drawing submittals are described within this specification section. The Contractor shall be required to submit and receive approval from the Engineer for all submittals described within this specification section.

1.04 SPECIAL GUARANTEE

A. Provide manufacturer’s extended warranty, with County named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the manufacturer’s option replacement of geomembrane specified in this Section found defective during periods below, commencing on the date of Substantial Completion.

1. Guaranty geomembrane against manufacturing defects, deterioration of geomembrane due to ozone, ultraviolet, and other exposure to the elements for a period of five (5) years.

B. Provide evidence of Geomembrane Installer’s extended warranty in the form of a Surety Bond to the General Contractor registered with the Clerk of the Court, with Contractor and the County named as beneficiaries, as special guarantee. Special guarantee shall provide for correction, or at the option of the County, removal and replacement of Work specified in this Specification section found defective during periods below, commencing on the date of Substantial Completion.

1. Guaranty geomembrane against defects resulting from installation for a period of two (2) years.

C. Provide Contractor's extended warranty in the form of a Surety Bond registered with the Clerk of the Court, with County named as beneficiary as special guarantee. Special guarantee shall provide for correction, or at the option of the County, removal and replacement of Work specified in this Specification section found defective during periods below, commencing on the date of Substantial Completion.

1. Guaranty geomembrane against defects resulting from installation of the Barrier Layer (geomembrane liner) and the Protective Cover for a period of two (2) years.

1.05 RELATED WORK

Section 02220 - Excavation, Backfilling, and Compaction
Section 02560 – Composite Drainage Net (CDN)

PART 2 – PRODUCTS

2.01 GEOMEMBRANE RESIN RAW MATERIALS

A. The geomembrane shall be manufactured from virgin, first-quality polyethylene resin that shall meet the standard specification GRI GM17.

B. At the Engineer's discretion, additional conformance sampling may be conducted. If the results of the Manufacturer and Engineer differ, the testing shall be repeated by the Engineer and the Manufacturer shall be allowed to monitor the testing. The latter of the tests will prevail, provided that the applicable test methods have been followed. The additional tests shall be at no cost to the County or Engineer if it is determined that the specifications have not been complied with.

C. The Manufacturer shall submit written documentation on the geomembrane raw materials and resin batches;

1. Resin supplier's name, plant location or identification, and production date(s) of resin.
2. Copies of Quality Control Certificates, issued on company letterhead and shall be signed by responsible parties, employed by the manufacturer, supplier, or independent laboratory (such as the production manager), with test results conducted by the manufacturer or resin production plant.
3. The manufacturer shall submit written documentation that no reclaimed or reworked polymer was added to the resin during the geomembrane manufacturing process to be used for this project.
4. The manufacturer shall submit written documentation correlating each individual geomembrane roll delivered to the project to the respective resin batches.

2.02 GEOMEMBRANE MANUFACTURING

A. The geomembrane for this project shall consist of a 40-mil LLDPE sheet and shall meet the standard specification GRI GM17, at a minimum. In addition, the geomembrane shall:

1. Contain no more than one (1) percent, by weight, additives, fillers, or extenders. (Note Carbon Black not included in this limitation)
2. Be free of striations, folds, crimps, roughness, pinholes, or bubbles on the surface.
3. Be produced so as to be free of holes, blisters, undispersed raw materials, or any sign or contamination by foreign materials.
4. Be manufactured in a single layer, i.e., thinner layers shall not be welded together to produce the final required thickness.
5. Have any factory seams whose shear strengths during testing are in conformance with the seam strengths specified in method GRI GM19.
6. Be subjected to continuous spark testing by the manufacturer at the factory with no defects found.

B. Geomembrane Manufacturing Quality Control;

1. The carbon black shall be added to the pure polyethylene resin as part of the roll manufacturing process.
2. Rolls manufactured with inclusions, bubbles, or not complying with the specifications shall be rejected and not delivered to the project. Geomembrane thickness shall be monitored continuously during manufacturing. No geomembrane shall be accepted which fails to meet minimum specified thickness.
3. Samples shall be taken across the entire width of the rolls and shall not include the first 3 feet. The averaged test results of the geomembrane samples shall meet or exceed the specifications. Certifications of the test results obtained shall be provided to the Engineer and recorded on the Quality Control Certificates.
4. The Manufacturer shall submit the Quality Control Certificates, on company letterhead, and shall be signed by responsible parties, employed by the manufacturer or independent laboratory (such as the production manager). The Quality Control Certificates shall include;
   a) Geomembrane Roll Number and resin batch identification
   b) Results of Quality Control tests, including description of test methods used.

2.03 ACCESSORY MATERIALS

A. Accessory materials used for seaming sheets, sealing around pipes and geomembrane penetrations and other installation-related applications shall be submitted to the Engineer for approval.

B. Metal batten strips, clamps, bands shall be a grade of 316 stainless steel. Fastening hardware, i.e., nuts, bolts, washers, screws, etc., shall also be a grade 316 stainless steel. The batten strip shall be 2 inches wide by 1/4 inch thick.

C. Two (2) inch wide by 1/4 inch thick closed-cell, neoprene sponge shall be used around the geomembrane penetration.

D. All geomembrane penetrations shall be sealed in such a manner, approved by the Engineer, as to provide a leak-proof seal around the penetrations.

PART 3 – TRANSPORTATION, HANDLING, STORAGE, EQUIPMENT

3.01 DESCRIPTION

A. The Contractor shall provide transportation, labor, and handling for delivery of the geomembrane to the project location. Special transportation or handling requirements required for the geomembrane shall be provided by the Contractor. The geomembrane shall be unloaded in the presence of the installer and/or representative of the County.

B. The equipment for transportation, handling, loading and unloading the geomembrane shall be of sufficient size and capacity to safely and efficiently handle to geomembrane materials. The type, size, and capacity shall be according to Manufacturer/ Installer requirements.

C. The Contractor shall provide all equipment and labor necessary for the loading, unloading, and handling of the geomembrane. The Contractor shall inspect the delivered materials for damage. Repairs, if approved by the Engineer, to damaged materials caused by transportation or handling of the geomembrane shall be at no additional cost to the County. Excessively damaged materials shall be rejected and replaced by the Contractor at no additional cost to the County.

D. The materials shall be unloaded by the Contractor in areas designated by the County. If the County has not specified a storage area, the Contractor shall determine an area for storage of the materials to meet the project schedule requirements. In any case the materials shall not be stored or unloaded in areas which will impair the operations of the landfill facility or be deleterious to the materials.

E. Storage and protection requirements of the materials shall be provided by the Contractor. Storage requirements for the materials shall be specified by the Manufacturer/Fabricator/Installer. Protection shall be provided from puncture, cutting, ultraviolet radiation, precipitation, dirt or other damaging or deleterious conditions.

F. The Contractor shall provide equipment and labor necessary for installation of geomembrane.

PART 4 – GEOMEMBRANE MATERIAL ACCEPTABILITY

4.01 ON-SITE INSPECTION AND CONFORMANCE TESTING

A. Upon delivery to the project site, the geomembrane material shall be inspected by the Contractor, Installer, and Engineer or County's Representative to confirm that proper labeling, transportation, handling, and storage procedures are followed. Damaged materials will be identified and repaired or rejected at the discretion of the Engineer or County's Representative. Materials to be repaired will be repaired following the repair specifications established for this project. Repairs will be at no additional cost to the County. Rejected materials will be identified and removed from the project site at no additional cost to the County. No material shall be off-loaded without the supervision of the Engineer or County’s Representative.

B. Upon delivery to the project site, the geomembrane shall be randomly sampled, by the Engineer or County's Representative, every 100,000 square feet of material to be installed. The on-site conformance sampling shall insure compliance with the specifications established for this project. This initial on-site conformance testing shall be at the County's expense.

C. Samples shall be taken across the entire width of the rolls and shall not include the first 3-feet. The averaged test results of the geomembrane samples shall meet or exceed the contract specifications.

D. Samples which do not satisfy the contract specifications shall be cause to reject applicable rolls. If a geomembrane sample fails to meet specifications, subsequent tests shall be performed at random on additional geomembrane samples produced from the same resin batch to determine whether all rolls produced from the same batch shall be regarded as unsatisfactory and therefore rejected. This additional testing, at no additional cost to the County, may be performed to more closely identify the rolls which do not comply with the specifications. Rejected rolls will not be installed and shall be removed from the project site at no additional cost to the County.

4.02 GEOMEMBRANE MATERIAL ACCEPTABILITY

Geomembrane materials shall be accepted, by the Engineer, for installation only upon receipt and approval of the following:

1. Information received and approved, by the Engineer, regarding resin quality control for delivered materials.
2. Information received and approved, by the Engineer, regarding geomembrane manufacturing quality control for delivered materials.
3. Approved repair methods established for damaged materials.
4. Interface shear strength of the actual components shall pass the design requirements after tested with method ASTM D5321 or an equivalent test method. (Interface friction angle (secant angle) of 26 degrees at loads 125 psf, 250 psf and 375 psf.)

PART 5 – GEOMEMBRANE INSTALLATION

5.01 ENGINEER'S FULL TIME CONSTRUCTION QUALITY ASSURANCE MONITOR

A. The Engineer's full time Construction Quality Assurance (CQA) Monitor shall observe a maximum of two (2) geomembrane seaming crews. If the Contractor and/or subcontractors chose to utilize more than two (2) seaming crews simultaneously, then additional full time CQA Monitor(s) will be required. Compensation for additional CQA Monitors shall be at $75.00/hour and deducted from the Contract as part of the final change order. One (1) seaming crew is defined as follows:

(2) two personnel operating fusion welding machines;
(1) one personnel operating an extrusion welding machine;
(1) one personnel performing air test on seams;
(1) one personnel vacuum box testing

B. The additional full time Resident Inspector(s) are in addition to the two required technicians.

5.02 EXECUTION

A. The Installer shall submit information, prior to installation, on the following;

1. All personnel performing supervisory and seaming operations shall be qualified by experience or certification. The Installer shall submit written information as follows:

a) Resumes of personnel performing the installation shall be submitted to the Engineer for approval. At least one seamer shall have experience seaming a minimum of 1,000,000 lineal feet of seam using the same type of seaming apparatus to be use on this project. The most experienced seamer shall provide direct supervision, as required, over the less experienced seamers. No field seaming shall take place without the Installer's site supervisor or foreman being present.

b) Resume(s) of supervisory personnel supervising the installation shall be submitted to the Engineer for approval. At least one supervisor shall have installation experience of a minimum of three (3) million square feet of similar geomembrane and experience using the same type of seaming apparatus to be use on this project.

2. The Installer shall submit a Panel Layout and related installation details:

a) The panel layout shall be drawn, using applicable drafting standards, to the same scale indicated on the Engineer's Drawings for easy comparison. The panel layout shall be on the installer's letterhead.

b) The panel layout shall indicate panel configuration, numbering, and dimensions, geomembrane penetrations, access roads, and berms. Factory seams shall be differentiated from field seams (if any). The layout drawing(s) shall indicate individual panel dimensions, estimated waste quantities, estimated installed square footage.

c) The Installer shall submit drawings, using applicable drafting standards, detailing geomembrane details and cross sections showing seam overlaps for extrusion and fusion welds, geomembrane penetrations, booting details, geomembrane connection details and be sufficient in detail for construction.

3. Documentation shall be submitted, from the Installer, that the extrudate rods are from similar resin materials as the geomembrane resin specified for this project.

B. Earthwork

1. Geomembrane Subgrade Preparation: The Contractor shall be responsible for preparation the low permeability soil. Foreign objects such as rocks, sticks, glass, sharp objects, stones larger than 1/4-inch in diameter and any other harmful materials shall be removed from the surface of the geomembrane subgrade. Soil at the surface of the subgrade shall be graded to a smooth, even surface to ensure that the area is free of irregularities, loose earth and abrupt changes in grade. Perimeter anchor trenches shall be excavated to the lines and width shown on the plans prior to geosynthetic placement. All visible vegetation shall be removed. The Installer shall be responsible for inspection of the subgrade surface suitability in writing to the Contractor and Engineer prior to beginning geomembrane installation. This certification of acceptance shall be given to the Engineer, by the Contractor, prior to commencing geomembrane installation in the area being considered. Special care should be taken to maintain the prepared soil surface. Any damage to the subgrade caused by installation activities shall be repaired at the Contractor's expense.

2. All required survey information and geotechnical testing shall be collected, reviewed, and accepted by the Engineer prior geomembrane deployment.

3. The subgrade shall also be inspected by the Installer and Engineer or County's Representative prior to geomembrane deployment. The Installer and Engineer or County's Representative shall certify the acceptability of the geomembrane's subgrade. Rejected and unacceptable areas of the geomembrane's subgrade shall be repaired and reinspected before any geomembrane is deployed over this area.

4. Anchor Trench: The anchor trench shall be excavated prior to geomembrane installation to the lines and grades shown on the drawings. The trench shall have the configuration as shown on the drawings. No loose soil shall be allowed beneath the geomembrane. The anchor trench shall be backfilled and compacted. Care shall be taken to prevent any damage to the geomembrane when backfilling the trenches. Slightly rounded corners shall be provided in the trench where the geomembrane turns down into the trench so as to avoid sharp bends in the geomembrane. The geomembrane shall be welded the entire length of the panel including through the entire dimensions of the trench.

C. Geomembrane Deployment

1. Layout Drawings: The Installer shall have received a set of layout and detail drawing submittal approved by the Engineer. If the Installer changes the configuration of the geomembrane or details, as shown on the approved submittals, due to field conditions, the Installer shall request prior approval by the Engineer. The layout drawings, as modified and/or approved by the Engineer shall become part of these specifications.
2. Limits of Geosynthetic Deployment: The limits of geosynthetic deployment shall have the configuration as shown on the Drawings. The limits shall be surveyed and clearly identified, i.e stacked, to the Installer. Any deviations from the limits defined in the Drawings shall be approved by the Engineer and recorded on the Record (As-Built) panel layout.
3. Panel Identification for Field deployment: Each panel shall be given an "identification code" (number or letter-number) consistent with the layout plan. The panel identification code shall be related, through a table or chart, to the original resin, and the constituent rolls and factory panels.
4. Field Panel Placement:
   a) Location: Field panels shall be installed as approved or modified at the location and positions indicated in the layout drawings. Instructions on the boxes or wrapping containing the geomembrane materials shall be followed to assure that the rolls and/or factory panels are unrolled and/or unfolded in the proper direction for seaming.
   b) Installation Schedule: Field panels may be installed using any one of the following schedules:
      1) All field panels shall be placed prior to field seaming (in order to protect the subgrade from erosion by rain).
      2) Field panels shall be placed one at a time and each field panel shall be seamed immediately after its placement (in order to minimize the number of unseamed field panels exposed to wind).
      3) Any combination of the above.
   c) Weather Conditions: Geomembrane placement shall not proceed at an ambient temperature below 40^{o}F, unless otherwise authorized in writing by the Engineer. Geomembrane placement shall not be done during any precipitation, in the presence of excessive moisture (e.g., fog, dew), in an area of pond water, or in the presence of excessive winds.
   d) Method of Placement: The Contractor shall ensure that:
      1) No equipment used shall damage the geomembrane by handling, trafficking, leakage of hydrocarbons or other means;
      2) No personnel working on the geomembrane shall smoke, wear damaging shoes, or engage in other activities which could damage the geomembrane;

3) The method used to unroll the panels shall not cause scratches, wrinkles, or crimps in the geomembrane and shall not damage the supporting soil;

4) The prepared surface underlying the geomembrane must not be allowed to deteriorate after acceptance, and must remain acceptable up to the time of geomembrane placement;

5) Adequate temporary loading and/or anchoring (e.g., sand bags, tires), not likely to damage the geomembrane, shall be placed to prevent uplift by wind (in case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels);

6) Geomembrane panels shall be positioned in a slackened condition so that they will conform to subgrade irregularities without being stretched taut when covered with fill. Geomembrane panels shall be positioned such that excessive wrinkling does not occur at the overlaps where field seaming is to be completed; and

7) Direct contact with the geomembrane shall be minimized; i.e., the geomembrane in excessively high pedestrian traffic areas shall be protected by geotextiles, extra geomembrane, or other suitable materials.

e) Damage: Any field panel or portion thereof which becomes seriously damaged (torn, twisted or crimped) shall be replaced by the Contractor at no cost to the County. Damaged panels or portions of damaged panels which have been rejected shall be removed from the work area.

D. Field Seaming:

1. Seam Layout: In general, seams shall be oriented parallel to the line of maximum slope, i.e., oriented along, not across, the slope. In corners and odd-shaped geometric locations, the number of field seams shall be minimized. No horizontal seams, (oriented parallel to the toe of slope) shall be permitted on sideslopes greater than 5(H):1(V) unless approved by the Engineer. No seams shall be located in the areas of potential stress concentrations.

2. Geomembrane will have field seams whose shear strengths during testing are in conformance with the seam strengths specified in method GRI GM19.

3. Requirements of Personnel: All personnel performing seaming operations shall be qualified as previously indicated.

4. Overlapping and Temporary Bonding:

a) The panels of geomembrane shall be overlapped by a minimum of 3-inches for extrusion welding, 5-inches for fusion welding, and 5-inches for double wedge fusion welding, but in any event, sufficient overlap shall be provided to allow peel tests to be performed on the seam.

b) The procedure used to temporarily bond adjacent panels together shall not damage the geomembrane; in particular, the temperature of the air at the nozzle of any spot welding apparatus shall be controlled such that the geomembrane is not damaged.

c) No solvent or adhesive shall be used unless the product is approved in writing by the Engineer (samples shall be submitted to the Engineer for testing and evaluation).

5. Seam Preparation:
   a) Prior to seaming, the seam area shall be clean and free of moisture, dust, dirt, debris of any kind, and foreign material.
   b) If seam overlap grinding is required, the process shall be completed according to the geomembrane Installer's instructions within one hour of the seaming operation and in a way that does not damage the geomembrane. The roughness of the grinding paper shall not exceed 80 grit.
   c) Seams shall be aligned with the fewest possible number of wrinkles and no "fishmouths".

6. Seaming Equipment and Products: Approved processes for field seaming are extrusion welding and fusion welding (hot air excluded). Only apparatus which have been specifically approved by make and model shall be used. Proposed alternate processes shall be documented and submitted for approval prior to any seaming being performed. Seam welding equipment shall be equipped with adequate temperature gauges to assure that proper seaming temperatures are maintained. Temperature gauges will be monitored, and readings recorded every four hours by the geomembrane Installer.
   a) Extrusion Process: The Installer shall provide documentation, for approval to the Engineer, on the welding apparatus planned to be used at the site prior to any geomembrane seaming work. The Installer shall provide documentation regarding the extrudate to the Engineer and shall certify that the extrudate is compatible with the specifications, and in any event is comprised of the same resins as the geomembrane sheeting. The geomembrane Installer shall maintain at least one spare operable seaming apparatus on site. Equipment used for seaming shall not damage the geomembrane, and the geomembrane shall be especially protected from damage in areas of heavy pedestrian or other traffic. The extruder shall be purged prior to beginning a seam until all heat-degraded extrudate has been removed from the barrel. Whenever the extruder is stopped, the barrel shall be purged of all heat degraded extrudate. The electric generator shall be placed on a protective base such that no damage occurs to the geomembrane. Similarly, a protective insulation plate or fabric shall be placed beneath the hot welding apparatus after usage.
   b) Fusion Process: The Installer shall provide documentation, or approval to the Engineer, on the welding apparatus planned to be used at the site prior to any geomembrane seaming work. The fusion-welding apparatus must be automated vehicular-mounted devices. The fusion-welding apparatus shall be equipped with gauges giving the applicable temperatures and pressures. The geomembrane Installer shall maintain at least one spare operable seaming apparatus on site. Equipment used for seaming shall not damage the geomembrane, and the geomembrane shall be protected from damage in heavily trafficked areas. For cross seams associated with fusion welding, the edge of the cross seams shall be ground to a smooth incline (top and bottom) prior to welding. The electric generator shall be placed on a protective base such that no damage occurs to the geomembrane. Similarly, a protective insulating plate or fabric shall be placed beneath the hot welding apparatus after usage. A movable protective layer may be used directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture

between the sheets. The double wedge fusion welding apparatus must be a self-propelled unit containing a high-temperature split wedge used to melt the plastic along the weld lines on the overlapped panels. The geomembrane panels are then squeezed together by pressure rollers so that the two sheets fuse together. The temperature, pressure and welding speed are independently adjustable so that consistently high quality seams are produced. The split wedge system produces two fusion weld lines separated by an unwelded channel.

7. Weather Conditions for Seaming:
   a) Unless authorized in writing by the Engineer, no seaming shall be attempted at ambient temperatures below 40°F or above 104°F. At ambient temperatures between 40°F and 50°F, seaming shall be allowed if the geomembrane is preheated by either sun or hot air device, and if there is no excessive cooling resulting from wind. At ambient temperatures above 50°F, no preheating shall be required. In all cases, the geomembrane shall be dry, clean and protected from wind damage.
   b) If the geomembrane Installer wishes to use methods which may allow seaming at ambient temperatures below 40°F or above 104°F, he shall demonstrate by seaming and testing trial seams under actual field conditions and he shall certify in writing that the seam so produced under these conditions is equivalent to those produced under normally approved conditions, and that the overall geomembrane's physical and chemical properties will not fall below the material and seam specifications for this project. In addition, an addendum to the contract between the County and the Contractor is required which specifically states that the seaming procedure does not cause any physical or chemical modification to the geomembrane that will generate any short- or long-term damage to the geomembrane.
   c) All seaming operations shall cease upon the presence of any precipitation (i.e., drizzle, sprinkle, etc.)
8. Trial Seams:
   a) Trial seams shall be made on fragment pieces of geomembrane to verify that seaming conditions are adequate. Such trial seams shall be made at the beginning of each seaming period, and at least once each four hours, for each seaming apparatus used that day. Also, each seamer shall make at least one trial seam each day. Trial seams shall be made under the same conditions as actual seams.

      The trial seam sample shall be at least 3 feet long by 1-foot wide (after seaming) with the seam centered lengthwise. Seam overlap shall be as previously indicated.
   b) Two adjoining specimens, each 1-inch wide, shall be cut from the trial seam sample by the geomembrane Installer. The specimens shall be tested respectively in shear and peel using a field tensiometer, and shall not fail the seam specifications established for this project. If a specimen fails, the entire operation shall be repeated. If the additional specimen fails, the seaming apparatus or seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful trial welds are achieved.
   c) After completion of the above described tests, the remaining portion of the trial seam sample can be discarded. Alternatively, the remaining portion of the trial seam can be subjected to destructive

testing. If a trial seam sample fails a test, then a destructive test seam sample shall be taken from the seams completed by the seamer during the shift related to the considered trial seam. These samples shall be forwarded to the Engineer and, if they fail the tests, the procedure indicated in Section 5.03 (D) 11 shall apply. The conditions of this paragraph shall be considered as met for a given seam if a destructive seam test sample has already been taken from the considered seam(s).

9. General Seaming Procedures: The general seaming procedure used by the geomembrane Installer shall be as follows:
   a) For fusion welding, a movable protective layer of plastic may be placed directly below each overlap of geomembrane that is to be seamed. This is to prevent any moisture build-up between the sheets to be welded.
   b) Seaming shall extend the entire length of the panels, including seams within the anchor trench.
   c) If required, a firm substrate shall be provided by using a flat board, a conveyor belt, or similar hard surface directly under the seam overlap to achieve proper support.
   d) If seaming operations are carried out at night, written approval, by the Engineer, shall be required 24 hours in advance of the intended night operation. Adequate illumination shall be provided. If during the course of the night operations, the Engineer or County's Representative decide the illumination is inadequate, proper illumination shall be provided or night operations shall be ceased. Contract specifications for placing and seaming the geomembrane shall apply to the night operations.
   e) Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch of the same geomembrane extending a minimum of 6 inches beyond the cut in all directions.
   f) The seam bond strength shall be greater than or equal to the sheet.
   g) A width of 1-foot along the edge, and between the surfaces to be welded, of the liner hall be cleaned to remove all extraneous materials (i.e., sand, silt, oily films, water, etc.) which could be detrimental to the seaming process. The extraneous materials shall be wiped, brushed, or blown from the area to be welded.

10. Non-Destructive Seam Continuity Testing:
   a) Concept: The geomembrane Installer shall non-destructively test all repairs and field seams over their full length using a vacuum test unit, air pressure (for double fusion seams only), or other approved method. Continuity testing shall be carried out as the seaming work progresses, not at the completion of all field seaming. Any required repairs shall be completed by the installer in accordance with Section 5.03 (D) 13. Test results shall be forwarded to the Engineer. The following procedures shall apply to locations where seams cannot be non-destructively tested:
      1) All such seams shall be cap-stripped with the same geomembrane.

2) If the seam is accessible to testing equipment prior to final installation, the seam shall be nondestructively tested prior to final installation.

3) If the seam cannot be tested prior to final installation, the seaming and cap-stripping operations shall be observed by the Engineer for uniformity and completeness.

b) Vacuum Testing:

1) The equipment shall be comprised of the following:

(a) A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, port hole or valve assembly, and a vacuum gauge.

(b) A steel or aluminum vacuum tank and pump assembly equipped with a pressure controller and pipe connections.

(c) A rubber pressure/vacuum hose with fittings and connections.

(d) A bucket, water and wide paint brush or mop.

(e) A soapy solution.

2) The following procedures shall be followed:

(a) Energize the vacuum pump and reduce the tank pressure to approximately 10 inches of mercury, i.e., 5 psi gauge. All gauges shall read zero (0) psi when the vacuum pump is not turned on. Gauges not reading zero (0) psi shall be replaced.

(b) Wet a strip of geomembrane approximately 4 inches by 24 inches with the soapy solution.

(c) Place the box over the wetted area.

(d) Close the bleed valve and open the vacuum valve.

(e) Ensure that a leak tight seal is created.

(f) For a period of not less than 15 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles, which would indicate defects in the geomembrane.

(g) If no bubble appears after 15 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 inches overlap, and repeat the process.

(h) All areas where soap bubbles appear shall be marked and repaired in accordance with Section 5.03 (D) 13.

c) Air Pressure Testing (For Double Fusion Seam Only): The following procedures are applicable to those processes which produce a double seam with an enclosed space.

1) The equipment shall be comprised of the following:

(a) An air pump (manual or motor driven) equipped with a pressure gauge capable of generating and sustaining a pressure between 25 and 30 psi and mounted on a cushion to protect the geomembrane. All gauges shall read zero (0) psi when the air pump is not turned on. Gauges not reading zero (0) psi shall be replaced.

(b) A rubber hose with fittings and connections.

(c) A sharp hollow needle, or other approved pressure feed device.

2) The following procedures shall be followed:
   (a) Seal both ends of the seam to be tested.
   (b) Insert needle or other approved pressure feed device into the tunnel created by the fusion weld.
   (c) Insert a protective cushion between the air pump and the geomembrane.
   (d) Energize the air pump to a pressure between 25 and 30 psi, close valve, and sustain pressure for approximately 5 minutes.
   (e) If loss of pressure exceeds 2 psi or does not stabilize, locate faulty area and repair in accordance with Section 5.03 (D) 13.
   (f) After a seam has passed a pressure test, release pressure at the end of seam that is opposite the air pump and pressure gauge assembly so as to ensure that the seam is continuous and has been completely tested.
   (g) Remove needle or other approved pressure feed device and repair in accordance with Section 5.03 (D) 13.

d) All field fabricated geomembrane penetration boots shall be non-destructively tested before the boot is installed. The boot and boot seams shall be non-destructively tested, in addition to visual inspection, using one of the following methods - hydraulically, air-pressure, or smoke. The Installer shall submit procedures for non-destructively testing field fabricated geomembrane penetration boots, for the Engineer's approval, prior to any geomembrane installation.

11. Destructive Testing:

a) Concept: Destructive seam tests shall be performed at selected locations by the Engineer. The purpose of these tests is to evaluate seam strength. Seam strength testing shall be done as the seaming work progresses, not at the completion of all field seaming.

b) Location and Frequency: Destructive test samples shall be collected initially at a minimum average frequency of one test location per 500 feet of seam length. The sampling frequency will be adjusted based on GRI-GM14 Standard Guide “Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes”. The Engineer reserves the right to increase the testing frequency should test results or seam conditions warrant. Test locations shall be determined during seaming, and may be prompted by suspicion of excess crystallinity, contamination, offset welds, or any other potential cause of imperfect welding. The Engineer shall choose the locations. The geomembrane Installer will not be informed in advance of the locations where the seam samples will be taken.

c) Sampling Procedure: Samples shall be cut by the geomembrane Installer at locations designated by the Engineer as the seaming progresses in order to obtain laboratory test results before the geomembrane is covered by another material. Each sample shall be numbered and the sample number and location identified on the Record (As-Built) panel layout drawing. A report completed by the installer's CQA personnel shall accompany each test strip listing the welder's number, date, time of day, welding machine's welding temperature, sheet temperature, sample location, and nominal thickness. All holes in the geomembrane resulting from the

destructive seam sampling shall be immediately repaired in accordance with the repair procedures described in Section 5.03 (D) 13. The continuity of the new seams in the repaired area shall be tested according to Section 5.03 (D) 10.

d) Size of Samples: The samples shall be 12 inches wide by 44 inches long with the seam centered lengthwise. One 1-inch wide strip shall be cut from each end of the sample and these shall be tested in the field by the Installer. The remaining sample shall be cut into three parts and distributed as follows:
   1) One portion to the Contractor for laboratory testing, 12 inches x 12 inches; and
   2) One portion for the Engineer for laboratory testing, 12 inches x 18 inches; and
   3) One portion to the Engineer for archive storage, 12 inches x 12 inches.

e) Field Testing: The two 1-inch wide strips shall be tested, by the Installer, in the field, by hand or tensiometer, for peel and shear respectively and shall not fail to meet the specifications established for this project. If any field test sample fails to pass, then the procedures outlined in 5.03 (D) 13 shall be followed.

f) Laboratory Testing: Testing by the Engineer will include "Seam Strength" and "Peel Adhesion". The minimum acceptable values to be obtained in these tests are those indicated in GRI-GM19. A total of five (5) specimens will be tested, from each sample, for each test method. Four (4) out of the five (5) specimens must pass for each test in order for the seam to pass destructive test. The results will not be averaged. Specimens will be selected alternately by test from the samples (i.e., peel, shear, peel, shear). The Engineer will provide test results to the Contractor no more than 24 hours after the samples are received at the laboratory. The only exception shall be weekends or official holidays. On weekends and holidays the laboratories are closed. Arrangements to schedule testing of destructive samples on weekends and holidays shall be approved by the Engineer 24 hours in advance. Additional costs for lab work on holidays or weekends shall be at no additional expense to the County.

g) Procedures for Destructive Test Failure: The following procedures shall apply whenever a sample fails the destructive test, whether the test is conducted by the Engineer's specified laboratory, the geomembrane Installer's laboratory, or by field tensiometer. The geomembrane Installer shall have two options, the cost of which shall be at no additional expense to the County:
   1) The geomembrane Installer can reconstruct the seam between any two passed test locations.
   2) The geomembrane Installer can trace the welding path to an intermediate location (at 10 feet) minimum from the location of the failed test in each direction) and take a specimen for an additional field test at each location. If these additional specimens pass the tests, then full laboratory destructive samples shall be taken. These additional tests shall be at the expense of the Contractor. If these laboratory samples pass the tests, then the seam shall be reconstructed between these locations. If either sample fails, then the process shall be repeated to establish the zone in which the seam should be

reconstructed. In any case, all acceptable seams must be bounded by two locations from which samples passing laboratory destructive tests have been taken. In cases exceeding 130 feet of reconstructed seam, a sample taken from within the reconstructed zone must pass destructive testing. Whenever a sample fails, additional testing may be required for seams that were welded by the same welder and/or welding apparatus or welded during the same time shift. Such additional testing shall be at the Contractor's expense.

12. Pipes Penetrating Geomembrane: All penetrations of leachate collection and stormwater piping shall be constructed according to the shop drawings approved by the Engineer before any installation.

13. Defects and Repairs:
    a) Identification: All seams and non-seam areas of the geomembrane will be examined for identification of defects, holes, blisters, undispersed raw materials and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of examination. The geomembrane surface shall be broomed or washed by the Contractor if the amount of dust or mud inhibits examination. The Contractor shall ensure that this examination of the geomembrane precedes any seaming of that section.
    b) Evaluation: Each suspect location both in seam and non-seam areas shall be nondestructively tested using the methods described in Section 5.03 (D) 10, as appropriate. Each location which fails the nondestructive testing shall be marked by the CQA monitor and repaired by the geomembrane Installer. Work shall not proceed with any materials which will cover locations which have been repaired until laboratory test results with passing values are available, non-destructive testing passed and the repair has been documented by the Engineer or County's Representative.
    c) Repair Procedures:
        1) Any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test, shall be repaired by the geomembrane Installer. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be agreed upon between the Engineer and the Installer. The procedures available include:
            (a) Patching: used to repair large holes, tears, undispersed raw materials, and contamination by foreign matter.
            (b) Grinding and rewelding: used to repair small sections of extruded seams.
            (c) Spot welding or seaming: used to repair small tears, pinholes, or other minor, localized flaws.
            (d) Capping: used to repair portions of failed seams, less than 5 feet in length. An extruded weld or fusion weld shall be permitted.
            (e) Topping: used to repair inadequate seams areas, which have an exposed edge, for lengths of seams under 5 feet in length. An extruded weld will be permitted along the outside edge.

(f) Removing the bad seam and replacing with a strip of new material welded into place. Used with large lengths of fusion seams (greater than 5 feet in length). The strip shall be additional geomembrane material which is fusion welded over the failed seam. The cap strip shall be air-tested and vacuum tested.

2) In addition, the following provisions shall be satisfied:

(a) Surfaces of the geomembrane which are to be repaired shall be abraded no more than one hour prior to the repair.

(b) All surfaces must be clean and dry at the time of repair.

(c) All seaming equipment used in repairing procedures must be approved.

(d) The repair procedures, materials, and techniques shall be approved in advance of the specific repair by the Engineer and Installer.

(e) Patches or caps shall extend at least 6 inches beyond the edge of the defect, and all corners of patches shall be rounded with a radius of at least 3 inches.

(f) The geomembrane below large caps should be appropriately cut to avoid water or gas collection between the two sheets.

d) Verification of Repairs: Each repair shall be identified, tested and logged. Each repair shall be nondestructively tested using the methods described in Section 5.03 (D) 10, as appropriate. Repairs which pass the nondestructive test shall be taken as an indication of an adequate repair. Large caps may be of sufficient extent to require destructive test sampling, at the discretion of the Engineer. Failed tests indicate that the repair shall be redone and retested until a passing test results. The Contractor shall not cover any portion of the geomembrane until the Installer and Engineer have completed the documentation of the repair.

e) Large Wrinkles: When seaming of the geomembrane is completed (or when seaming of a large area of the geomembrane is completed) and prior to placing overlying materials, the Engineer shall identify all excessive geomembrane wrinkles. The geomembrane Installer shall cut and reseam all wrinkles so identified. The seam, thus produced, shall be tested like any other seam.

f) Bridging or Induced Tension: Bridging is defined as areas where the geomembrane is not in contact with the subgrade due to a void in the subgrade or the sheet is pulled in tension so as to span over depressions in the subgrade. Areas likely to promote bridging, i.e., trenches, toe of slopes, etc., shall be loaded with sandbags after deployment and after seaming. Induced tension is stress introduced into the geomembrane during installation or covering. These areas will likely result in bridging. Areas bridging excessively shall be identified and repaired by either of the following methods:

1) The geomembrane shall be cut, by the Installer, so the tension is relieved and the geomembrane conforms to the subgrade contours. The cut geomembrane shall be repaired and tested according to the specifications regarding repairs and testing.

2) The geomembrane shall be cut, by the Installer, and subgrade material shall be added and placed, in accordance with the contract specifications, so as bring the geomembrane in contact with the subgrade. The cut geomembrane shall be repaired and tested according to the specifications regarding repairs and testing.

g) Repairs, test sample locations, and defects in the geomembrane shall be replaced at no additional cost to the County until final acceptance of the geomembrane lining system. Repairs shall only be made by qualified members of the Installer's organization or authorized personnel.

h) Wrinkles, gas bubbles, bridging, and inducing tension in the geomembrane system shall be avoided by the Contractor or subcontractors. Areas in the geomembrane which exhibit wrinkles, gas bubbles, bridging, and tension shall be repaired and documentation before any cover material is placed. These repairs will be at no additional cost to the County.

PART 6 – MATERIALS IN CONTACT WITH THE GEOMEMBRANE

6.01 GENERAL

A. General: The following provisions require the Contractor to take all necessary precautions so that the installation of materials does not damage the geomembrane. Installation on rough surfaces, such as concrete, shall be carefully performed to minimize damage. If approved, additional loosely placed geotextile or geomembrane sections, may be used by the Contractor as protection for the geomembrane.

B. Granular Materials: Placement of granular materials on the CDN shall not proceed at an ambient temperature below 40ºF (5ºC) or above 104ºF (40 degrees C), unless otherwise approved by the Engineer. Equipment used for placing granular material shall not be driven directly on the exposed geomembrane. A minimum thickness of 1-foot of granular material is specified between a light dozer (such as a wide pad caterpillar D-4 or lighter) and the geomembrane. The dozer movement shall be forward and backward, no turning will be allowed until a minimum of 2 feet of cover is placed above the geomembrane. All turning of equipment will be off the area underlain by geomembrane. A minimum thickness of 3 feet of granular material is specified between rubber-tired vehicles and the geomembrane. In areas of heavy traffic such as access ramps, granular material thickness should be at least 3 feet. In any case, the following table shall be complied with:

Equipment Ground Pressure	Minimum Lift Thickness
psi	inches
≤4	12
4-8	18
8-16	24
≥16	36

C. Concrete: Geotextile or excess geomembrane layers shall be used between concrete and the geomembrane as required. Construction methods used shall not damage the geomembrane.

PART 7 – FINAL ACCEPTANCE

7.01 GEOMEMBRANE ACCEPTANCE

The Contractor shall retain all ownership and responsibility for the geomembrane in the lining system until acceptance by the County. Full compensation for the geomembrane installation shall not occur until the geomembrane lining system is accepted by the County. The County will accept the geomembrane system when:

1. The entire geomembrane installation is completed.
2. All documentation of installation is completed, reviewed, and accepted by the County.
3. Verification of the adequacy of all field seams and repairs, including associated testing, is complete. This verification shall include field seams to existing geomembrane.
4. Written certification documents have been received and approved by the Engineer. Certifications documents include:
   a) Final approval of all required submittals by the Engineer.
   b) Record (As-Built) Drawings.
5. Upon completion of the covering operation, the Contractor shall certify the following to the County:
   a) The geomembrane has been constructed in accordance with the approved project plans and specifications.
   b) The cover material meets all requirements of the approved project plans and specifications. The geomembrane has not been damaged during the covering operation or construction.
   c) Receipt of the special guaranties.

7.02 RECORD (AS-BUILT) DRAWINGS

A. The Contractor shall submit a Record Panel Layout and related installation details of the actual geomembrane lining system:

1. The record panel layout shall be drawn, using applicable drafting standards, to the same scale indicated on the Engineer's Drawings for easy comparison. The record panel layout shall be on the installer's letterhead.
2. The record panel layout shall indicate installed field panel and seam numbering, configuration and dimensions, geomembrane penetrations, access roads, and berms. Factory seams shall be differentiated from field seams (if any). The record panel layout drawing(s) shall indicate individual panel dimensions and estimated installed square footage.
3. The locations of destructive samples with the correct corresponding sample number shall be located on the record panel layout.
4. The record panel layout shall have surveyed locations of the limits of geomembrane deployment.
5. The Installer shall submit detail drawings, using applicable drafting standards, of record (as-built) geomembrane penetrations details, booting details, and connection details, etc.

B. The Contractor shall submit a Record Survey of spot elevations (grade shots) of the geomembrane elevations of the installed lining system:

1. The record panel layout shall be drawn, using applicable drafting standards, to the same scale indicated on the Engineer's Drawings for easy comparison.
2. The surveyor shall sign and seal the spot elevation survey.
3. The spot elevations (grade shots) shall be taken at every 200 foot grid increment marker. The drawing shall indicate the design elevation prior to installation and the installed elevation at each survey point.
4. The elevations (grade shots) of the terrace cross-section shall also be taken at every 100 foot increments.

END OF SECTION

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MANUFACTURER'S CERTIFICATION
OF
SUBSURFACE ACCEPTABILITY

Project:_____ Contract No:_____

Date:_____

Partial:_____ Final:_____

Geomembrane Manufacturer_____for Lake County Phase III Ash/MSW Cell Closure, hereby certify that supporting surfaces are acceptable for installation of geomembrane, undersigned having personally inspected condition of constructed surfaces. This certification is for areas shown on Attachment Drawings or defined as follows:

_____

_____

_____

Condition of supporting surfaces in defined area meets or exceeds minimum requirements for installation of geomembrane and related products including, but not limited to, composite drainage nets, GCL, and protective soil cover.

Acceptance No.:_____ Area Accepted:_____S.F. Total Area Accepted to Date:_____S.F.

Geomembrane Representative

Signed:_____

_____
Position

Date:_____

General Contractor's Superintendent

Signed:_____

Subgrade surface noted above was observed and has been tested for compaction, as needed, and found to be in accordance with project requirements.

On-site Engineer's Field Representative

Signed:_____ Date:_____

On-site County Resident Project Representative

Signed:_____ Date:_____

HDPE MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

Contract Name: Lake County Phase III Ash/MSW Cell Closure

County: Lake County Solid Waste Division

Contractor: _____

Engineer: S2L, Incorporated

Material: Linear Low Density Polyethylene (LLDPE) Geomembrane

Specification Section No: 02776

I, the undersigned Manufacturer's Representative, hereby certify that I am:

1) A duly authorized representative of the Manufacturer.

2) Empowered by the Manufacturer to inspect and approve the installation and repair of the material(s) identified above.

3) Authorized to make recommendations required to assure that the installation and/or repair of the material(s) furnished by the Manufacturer are complete and functional, except as may be otherwise indicated herein.

I further certify that:

1) The above referenced material(s) was installed in accordance with the (i) County's plans and specification, (ii) Manufacturer's and Installer's Quality Assurance Programs, and (iii) Manufacturer's Pro-Rata Limited Installation Warranty.

2) All repairs to the above referenced material(s) performed by the Manufacturer and/or Installer prior to the Final Completion date of _____ were performed in accordance with the (i) County's plans and specification, (ii) Manufacturer's and Installer's Quality Assurance Programs, and (iii) Manufacturer's Special Guarantees and warranties.

3) All information contained herein is true and accurate.

Date:_____

Manufacturer: _____

Manufacturer's Authorized Representative: _____
(Authorized Signature)

_____
(Print Name)

SECTION 02930

SODDING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of sodding consists of supplying and placing sod in all areas where construction activity has disturbed the ground cover.

B. The sod work shall include, but not be limited to, supplying all labor, materials, and equipment necessary to perform sodding, fertilizing, watering, mowing, and cleanup.

1.02 QUALITY ASSURANCE

A. The Engineer reserves the right to test, reject, or accept all materials before application.

B. Sod shall be provided in accordance with Section 981-3, placed and maintained in accordance with Sections 570-3 and 570-4 of the Florida Department of Transportation (FDOT) – Standard Specifications for Road and Bridge Construction or as amended.

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver fertilizer in waterproof bags showing weight, chemical, analysis, and name of manufacturer.

B. The Contractor shall, at the time of delivery, furnish the Engineer invoices of all materials received in order that the minimum application rate of materials may be determined. Failure to supply invoices at the time of delivery will warrant that payment for those items be delayed until proper submittal of invoices is obtained, and the minimum application rates of material may be verified.

PART 2 – PRODUCTS

2.01 TOPSOIL

A. Material shall be fertile, natural soil, typical of the locality, free from MSW, stones (exceeding 2-inch in any dimension), roots or sticks (exceeding 1-inch diameter), clay, and weeds, and obtained from naturally well drained areas. It shall not be excessively acid or alkaline nor contain material harmful to plant growth. The material shall comply with the requirements of FDOT's Standard Specifications for Road and Bridge Construction, Section 987.

2.02 LIME

A. Composition: Ground limestone with not less than 85 percent total carbonate ASTM C602-90.

B. Gradation:
   1. Minimum 50 percent passing No. 100 sieve.
   2. Minimum 90 percent passing No. 20 sieve.
   3. Coarser material acceptable, provided rates of application are increased proportionately on basis of quantities passing No. 100 sieve.

2.03 SOD

A. Sod shall be Bahia with well matted roots. If pH of the topsoil exceeds the enclosed requirements, then a more pH tolerant sod may be substituted.

B. The sod shall be supplied in commercial size rolls.

C. The sod shall be sufficiently thick to secure a dense stand of live grass, with a minimum thickness of 2-inches. The sod shall be live, fresh, and uninjured at the time of planting. It shall have a soil mat of sufficient thickness adhering firmly to the roots to withstand all necessary handling. It shall be reasonably free of weeds and other grasses.

D. Sod shall be planted as soon as possible after being harvested and shall be shaded and kept moist from the time of harvesting until it is planted. No sod which has been cut for more than 72 hours may be used.

E. The source of the sod may be inspected and accepted by the Engineer prior to construction.

2.04 FERTILIZER

A. The material shall comply with the requirements of FDOT's Standard Specifications for Road and Bridge Construction, Section 982.

B. The fertilizer shall be a commercial granular type with a chemical designation of 12-8-8.

C. The numerical designations for fertilizer indicate the minimum percentages (respectively) of: (1) total nitrogen, (2) available phosphoric acid, and (3) water soluble potash, contained in the fertilizer.

1. At least 50 percent of the phosphoric acid shall be from a normal super phosphate or an equivalent source which will provide a minimum of two units of sulfur.
2. The amount of sulfur shall be indicated on the quantitative analysis card attached to each bag or container.

D. Commercial fertilizers shall comply with the State fertilizer laws.

E. Fertilizer may, at the discretion of the Engineer, upon satisfactory evidence of its feasibility from the manufacturer, be applied in liquid form.

2.05 WATER

A. The water used in the sodding operations may be obtained from any accepted spring, pond, lake, stream, or municipal water system. The Contractor may use water from the on-site stormwater pond.

B. The water shall be free of excess and harmful chemicals, acids, alkalies, or any substance which might be harmful to plant growth or obnoxious to traffic.

C. Salt water shall not be used.

D. Effluent water shall meet all Federal, State and local requirements.

PART 3 – EXECUTION

3.01 GENERAL

A. The order of work for sod installation shall be as follows:

1. Fine grading
2. Removal of debris
3. Placement of topsoil
4. Application of fertilizer
5. Placement of sod
6. Clean-up
7. Watering

3.02 SOIL MANIPULATION

A. All soil manipulation shall be done at right angles to the direction of the slope.

3.03 FINE GRADING

A. After removal of debris, fine grading shall be performed as required to bring all areas to receive sod to an acceptable smooth and finished grade. Areas to receive sod shall be fine graded by raking to eliminate wind rows, ridges, depressions, and other irregularities.

B. All sodded areas bordered by paving shall have a finished grade (top of the sod) that is 1/2-inch below the grade established by the adjacent paving. All sodded areas bordered by planting areas shall have a finished grade (top of the sod) that is 2 inches above the soil level in the adjacent planting bed.

3.04 REMOVAL OF DEBRIS

A. Areas to receive sod shall be cleaned of all stones larger than 1-inch in diameter, sticks, stumps, paper, glass, and other debris which might interfere with the placement of sod, growth of grass, or subsequent maintenance of sod area. All weeds shall be removed from areas to be sodded.

3.05 PLACEMENT OF TOPSOIL

A. Topsoil shall be placed to a minimum depth of 4.5 inches for sod. Testing needs to be conducted on the topsoil to determine the required prepartion prior to the placement of sod.

3.06 APPLICATION OF FERTILIZER

A. The fertilizer (and/or lime) shall be spread uniformly in one or more applications as specified below.

1. Test soil for pH which must be between 5.5 and 6.5 before installation of sod.
2. An initial application of 500 pounds per acre is required for fertilizer.
3. Lime shall be spread at a minimum uniform rate of 250 pounds per acre and thoroughly mixed with the soil to a depth of 4-inches. Additional lime may be required as determined by the pH tests. If pH is above the required limits, the Contractor shall apply a suitable soil amendment to bring the pH into compliance.

B. Fertilizing operations will not be permitted when wind velocities exceed 15 miles per hour.

3.07 PLACING OF SOD

A. Sod size shall be as previously specified. The setting of sod shall be staggered in such a manner as to avoid continuous seams. Sod shall be moist and shall be placed on a moist earth bed. Sod shall be carefully placed by hand, edge to edge, in rows at an oblique angle to the slope, commencing at the base of the area to be sodded and working upward. Sod shall be immediately pressed firmly into contact with the sod bed by rolling with a one-ton roller or any other Engineer accepted equipment. The rolling operation shall provide a true and even surface and insure knitting without displacement of sod or deformation of the surfaces. Sod located on slopes should be placed carefully enough so that rolling with a power roller is not necessary. Sod located around retention areas, along pavement areas, in swales or sideslopes may require staking. The repair of any erosion or sod relocation necessary prior to the sod becoming firmly rooted to the existing soil will be the responsibility of the Contractor. Stakes, if used, shall not interfere with the mowing of the lawn areas. All sod placed in areas with slopes steeper than 8:1 shall be staked.

B. The Contractor shall ensure that the finished grade of sod placed directly adjacent to buildings or other walls does not vary more than 1/2-inch from a 10-foot-long straight edge.

C. A letter of certification from the grassing contractor as to when the sod was cut, and what type, shall be provided to the Engineer upon delivery of the sod to the job site.

3.08 CLEAN UP

A. Upon completion of the work, all debris, fertilizer bags, pallets, etc. shall be removed from the site. Any paved areas including curbs and sidewalks shall be thoroughly swept.

3.09 WATERING

A. The sod shall be kept in a moist condition after planting and for the duration of the Contract (and in no case less than two weeks). The moistened condition shall extend to at least the full depth of the rooting zone.

3.10 MAINTENANCE

A. The Contractor shall, at his expense, maintain the planted areas in satisfactory condition until final acceptance. Such maintenance shall include watering, filling, leveling, and repairing any washed or eroded areas, and additional fertilizer and sod applied to areas where satisfactory stand of grass has not been achieved.

B. Immediately prior to final inspection, the Contractor shall mow the areas sodded under this Contract.

3.11 ACCEPTANCE

A. The Contractor shall schedule the laying of sod to allow the sod to be well established prior to the date of final completion. The County shall not accept the sod unless the roots have grown into the soil and the sod cannot be raised. The sod shall also show signs of health, good growth, and proper maintenance. The limits of sod placement shall be made to the satisfaction of the County.

END OF SECTION

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