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DIVISION 1
GENERAL REQUIREMENTS

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SECTION 01100 SUMMARY OF WORK

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

Unless otherwise specified on the construction drawings or specifications (Contract Documents), all work and the quality of materials shall conform to the referenced sections of the Florida Department of Transportation (FDOT) “Standard Specifications for Road and Bridge Construction”, “Supplemental Specifications” and “Roadway and Traffic Design Standards”. Wherever references are made to other specifications, standards, or requirements, it shall be understood that the latest specifications, standards or requirements are intended and shall apply, except as otherwise specified or to the extent that said specifications, standards or requirements may be in conflict with applicable laws, ordinances, rules and regulations. Contractor shall retain on the job site copies of both standard FDOT documents. Basis of payment shall conform to Section 01200 of the General Requirements.

1.02 DESCRIPTION OF THE PROJECT

- A. The Work to be performed generally consists of the closure of the Leon County Class I Landfill Phases II-B, II-C II-D and Class III East, West and South landfills. The Class III South landfill is adjacent to the Class I II-D cell and will be included as part of the Class I final closure system, site access roads, stormwater drainage facilities, earthwork and installation of a passive gas extraction system in accordance with the Contract Documents.
- B. Work shall include all surveying and record drawings, as required by the Florida Department of Environmental Protection (DEP) and Leon County Development Support & Environmental Management Services.
 - 1. Testing shall be performed by Owner.
 - 2. Retest for failed tests shall be paid by Contractor and performed by Owner.
- C. All incidental, minor and miscellaneous items, Work, and materials not specified or shown, which are necessary to complete the indicated Work and to maintain and repair the Work, or which may be reasonably implied as included, shall be done and furnished by Contractor without extra charge to Owner.

1.03 DRAWINGS AND SPECIFICATIONS

- A. The drawings and specification divisions are an integrated part of the contract

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documents and, as such, will not stand alone if used independently as individual sections, divisions, or drawing sheets. The drawings and specifications establish minimum standards of quality for this project. Contractor shall take no advantage of any error or omission in the drawings or of any discrepancy between the drawings and/or specifications. In all cases of doubt as to the meaning of the drawings and specifications, the decision of the Engineer will be final and conclusive. Contractor shall notify Engineer upon discovery of any actual or perceived discrepancy in or between the drawings and specifications.

1.04 PERMITS AND REGULATING AGENCY APPROVALS

- A. Contractor's attention is drawn to the fact that certain permits and governmental agency approvals are required for various portions of the Work. The Owner has obtained a solid waste landfill closure construction permit from the FDEP and an environmental management permit (stormwater) from Leon County Development Support & Environmental Management. Copies of these permits are included in the Appendices. It shall be expressly understood that nothing in these contract documents shall lessen or modify any permit stipulation or condition of approval, and that it is the Contractor's responsibility to comply with all regulatory requirements affecting the Work, including any and all environmental requirements.
- B. Contractor shall be responsible for obtaining and complying with any and all local permits necessary to perform the Work. This shall include, but not be limited to: (i) sediment control permits and approved plans for off-site borrow pits or spoil areas; (ii) traffic and highway permits; and (iii) temporary building and/or electrical permits. The Contractor shall pay all costs and fees associated with obtaining the permits for which the Contractor is responsible.

1.05 CONSTRUCTION QUALITY ASSURANCE REQUIREMENTS

- A. All material incorporated into the Work shall be new and of the highest grade. All materials shall be handled and stored in accordance with manufacturer's recommendations.
- B. All Work will be monitored and tested by a Construction Quality Assurance (CQA) Consultant in accordance with the requirements of the CQA Plan.
- C. Contractor shall be aware of all testing activities outlined in the CQA Plan and shall account for these activities in the construction schedule.
- D. Contractor shall be responsible for cooperating with the CQA Consultant during all earthwork-related testing activities. Contractor shall provide equipment and labor to assist the CQA Consultant in sampling, if requested, and shall also provide access to all areas requiring testing. Contractor shall repair any damage to finished Work

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caused by the CQA Consultant's sampling or testing activities.

- E. Contractor shall be responsible for cooperating with the CQA Consultant during all geosynthetic-related testing activities. Contractor shall provide equipment and labor to assist the CQA Consultant in sampling, if requested, and shall also provide access to all areas requiring testing. Contractor shall repair any damage to finished Work caused by the CQA Consultant's sampling or testing activities.
- F. Contractor shall be responsible for surveying and geometric control of the Work.
- G. Contractor (and its subcontractors, suppliers, manufacturers, etc.) shall abide by all qualification requirements identified in the CQA Plan.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

3.01 WORKING HOURS

- A. In addition to any applicable local ordinances or state laws affecting hours of operation, Work under this contract shall not be performed on Sundays or on state and/or national holidays, except in time of emergency, and then only under written permission from the Owner who shall be the sole judge as to the urgency of that situation. Work shall be performed during weekdays and Saturdays, the workday shall be limited to daylight hours.
- B. Should the Contractor deem it necessary to work on Sundays, holidays, or beyond daylight hours in order to comply with his construction schedule or because of an emergency, the Contractor shall request permission of the Owner to do so. If, in the opinion of the Owner, the need is bona fide, he will authorize the Contractor to work such hours as may be necessary.
- C. If Contractor intends to install geomembrane between one hour before sunset and one hour after sunrise, Contractor shall notify Engineer and CQA Consultant in writing prior to the start of the Work. Contractor shall indicate additional precautions that shall be taken during these installation hours. Contractor's plan for installing geomembrane during these installation hours must be approved by Engineer and CQA Consultant before the start of the Work.
- D. No geomembrane repair, liner system construction, or earthwork construction, will be allowed between one hour before sunset and one hour after sunrise, unless approved by Engineer and CQA Consultant.

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- E. No surveying will be allowed between one hour before sunset and one hour after sunrise, unless approved by Engineer and CQA Consultant

3.02 REIMBURSEMENT FEES

The following rates shall be applied as Owner's reimbursement of Engineer's fee to be paid by Contractor for expenses defined in Supplemental Conditions SC-6.02.C, SC-6.05.A.2.f, SC-6.17.F.2, SC-9.06.B, and SC-13.03.A.

A.	Project Representative:	\$79/hr
B.	Construction Administrator:	\$141/hr
C.	Engineering Consultant:	\$191/hr
D.	Administrative Assistant:	\$51/hr

3.03 CONTRACTOR'S USE OF SITE

- A. Contractor's access to Owner's property is limited to the project Work area as identified in the Contract Documents to include:
- limits of disturbance of the landfill construction areas;
 - soil stockpile area;
 - equipment staging area; and
 - access roads.

3.04 PROTECTION OF EXISTING UTILITIES

- A. Contractor shall protect and/or support all existing utilities that are endangered by its operations and the cost for these activities will be taken to be included in the total contract price except as specified herein.
- B. Contractor shall submit to Owner for acceptance, complete details for each and every operation involving interruption of service of any existing utility, item of equipment, piping, building, structure, or similar existing items, a minimum of 14 days before said operation commences. Details shall include the proposed methods of construction, construction schedule, estimated times that items will be out of service, details of temporary bypass piping, bypass pumping equipment and controls, and other similar items deemed pertinent in the opinion of Owner. Contractor will not be permitted to commence said operations until acceptance is obtained from Owner.

3.05 PROTECTION OF WORK

- A. Contractor shall use all means necessary to protect all prior Work, including all materials and completed Work of other Sections.
- B. In the event of damage to Work performed by Contractor prior to Owner's

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acceptance of the Work, Contractor shall immediately make all repairs and replacements necessary, to the approval of the CQA Consultant and at no additional cost to Owner.

PART 4 ABBREVIATIONS

4.01 ORDINANCES, REGULATIONS, STANDARDS, AND CODES

Reference in the specifications to known standards, codes, specifications, etc., promulgated by professional or technical associations, institutions, and societies, is intended to mean the latest edition of each such standard adopted and published as of the date of the Invitation to Bid on this project except where otherwise specifically indicated. Each such standard referred to shall be considered a part of the specifications to the same extent as if reproduced herein in full. The following is a list of applicable documents that apply to this contract.

American Association of State Highway and Transportation Officials (AASHTO)
Formerly (AASHO)

American Concrete Institute (ACI)

American Institute of Steel Construction (AISC)

American Iron and Steel Institute (AISI)

American National Standards Institute (ANSI)

American Standards Association (ASA)

American Society of Mechanical Engineers (ASME)

American Society of Testing and Material (ASTM)

American Water Works Association (AWWA)

American Welding Society (AWS)

Anti-Friction Bearing Manufacturer's Association (AFBMA)

Building Officials and Code Administrators International, Inc. (BOCA)

Construction Specifications Institute (CSI)

Federal Specification (FS)

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Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, Latest English Edition (Standard Specifications)

FDOT Roadway and Traffic Design Standards Latest English Edition (FDOT Index)

National Bureau of Standards (NBS)

National Electrical Manufacturer's Association (NEMA)

National Fire Protection Association (NFPA)

Portland Cement Association (PCA)

Occupational Safety and Health Act (Public Law 91-596), U.S. Department of Labor (OSHA)

Steel Structures Painting Council (SSPC)

Southern Standard Building Code (SSBC)

Underwriters' Laboratories, Inc. (UL)

United States of America Standards Institute (USASI)

Regulations of Florida Industrial Commission Regarding Safety

All local, state, county, or municipal building codes requirements of the Owner's Insurance

PART 5 SAFETY

5.01 EXCAVATION

The attention of the Contractor is specifically directed to the excavation requirements in connection with the protection of all excavations and for the safety of all persons. Due to the character of the work, excavations for structures will, in places, be wide and deep; and the Contractor shall be required to keep all excavations protected at all times. When permitted to leave a trench open overnight, the Contractor shall, at his own expense, provide suitable and safe means for completely covering all open excavations and for accommodating travel when work is not in progress. Contractor shall use suitable and adequate barricades warning signs shall be located where required.

5.02 TRENCH SAFETY ACT

The Contractor shall comply with all of the requirements of the Florida Trench Safety Act (Act) (Chapter 90-96, Building Construction Standards, Chapter 553, laws of Florida). The Contractor

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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.

5.03 WORK IN AND AROUND LANDFILLS

All work shall be done in accordance with state and local requirements and the Occupational Safety and Health Act (OSHA) Safety and Health Standards, CFR 29, and shall conform to the Solid Waste Association of North America (SWANA), formerly GRCDA, National Landfill Gas Committee Health and Safety Guidelines and the Florida Department of Environmental Protection.

All applicable governmental regulations to ensure worker safety shall be followed. The Occupational Safety and Health Administration (OSHA) regulations for the Construction Industry (29 CFR 1926) shall be adhered to through all project phases. The Contractor shall be able to demonstrate compliance with applicable requirements of the following Standards for Construction:

Subpart C-General Safety and Health Provisions

- 1926.21 Safety training and education.
- 1926.28 Personal protective equipment.
- 1926.34 Means of egress.
- 1926.35 Employee emergency action plans.

Subpart D-Occupational Health and Environmental Controls

- 1926.50 Medical services and first aid.
- 1926.51 Sanitation.
- 1926.52 Occupational noise exposure.
- 1926.55 Gases, vapors, fumes, dusts, and mists.
- 1926.56 Illumination.
- 1926.57 Ventilation.
- 1926.59 Hazard communication.
- 1926.65 Hazardous waste operations and emergency response.

Subpart E-Personal Protective and Life Saving Equipment

- 1926.95 Criteria for personal protective equipment.
- 1926.96 Occupational foot protection.
- 1926.100 Head protection.
- 1926.101 Hearing protection.
- 1926.102 Eye and face protection.
- 1926.103 Respiratory protection.
- 1926.104 Safety belts, lifelines, and lanyards.

Subpart F-Fire Protection and Prevention

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- 1926.150 Fire protection.
- 1926.151 Fire prevention.
- 1926.154 Temporary heating devices.
- 1926.159 Employee alarm systems.

Subpart G-Signs, Signals, and Barricades

- 1926.200 Accident prevention signs and tags.
- 1926.201 Signaling.
- 1926.202 Barricades.

Subpart H-Materials Handling, Storage, Use, and Disposal

- 1926.251 Rigging equipment for material handling.
- 1926.252 Disposal of Waste Material

Subpart I-Tools-Hand and Power

Subpart J-Welding and Cutting

- 1926.352 Fire prevention.
- 1926.353 Ventilation and protection in welding, cutting, and heating.
- 1926.354 Welding, cutting, and heating in way of preservation coatings.

Subpart K-Electrical

Safety-Related Work Practices

- 1926.416 General requirements.
- 1926.417 Lockout and tagging of circuits.

Subpart L-Scaffolding

- 1926.451 Scaffolding.
- 1926.453 Manually propelled mobile ladder stands and scaffolds (towers).

Subpart M-Fall Protection

- 1926.502 Fall protection systems criteria and practices.
 - 1926.503 Training requirements.
- And Applicable Appendices.

Subpart N - Cranes, Derricks, Hoists, Elevators, and Conveyors

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Subpart O-Motor Vehicles, Mechanized Equipment, and Marine Operations

- 1926.600 Equipment.
- 1926.601 Motor vehicles.
- 1926.602 Material handling equipment.
- 1926.603 Pile driving equipment.

Subpart P-Excavations

- 1926.651 Specific excavation requirements.
- 1926.652 Requirements for protective systems.

And applicable Appendices

Subpart X-Stairways and Ladders

- 1926.1053 Ladders.
- 1926.1060 Training requirements.

And Appendix A to Subpart X-Ladders

Subpart Z-Toxic and Hazardous Substances

In addition to the OSHA Construction Industry Standards the Contractor shall also comply with the General Industry Occupational Safety and Health Standards contained in 29 CFR Part 1910, which have been identified as also applicable to construction work.

All employee training requirements of part 1910 and part 1926 of Title 29 of the Code of Federal Regulations shall apply. The Contractor shall provide proof of employee training prior to initiating work. No employees are to be assigned to the project without documentation that appropriate health and the individual has completed safety training.

The Contractor shall designate a Site Safety and Health Supervisor who has specific training, knowledge, and experience in the area of industrial health and safety. The Site Safety and Health Supervisor shall be responsible to the employer and has the authority and knowledge necessary to implement the site safety and health plan, maintain required records, and verify compliance with applicable safety and health requirements.

The Site Safety and Health Supervisor shall have the authority to immediately cease all operations in the event that any OSHA Regulation is violated, worker protection provisions are not properly executed, or if operations present imminent danger to employee and/or public safety. The Site Safety and Health Supervisor shall notify the Engineer immediately of such action.

END OF SECTION

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SECTION 01200 MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 INTENT

A completed, quality project, as intended by the general nature of the drawings and specifications, shall be produced whether or not any particular wording or direction is inadvertently omitted. Pay items listed on the Bid Form are for comparison of bids and may be used as a method of determining the value of work performed for partial payment requests.

1.02 LUMP SUM QUANTITIES

Contractor shall be solely responsible for determining the quantities of each lump sum pay item necessary to complete the Work as required by the Contract Documents. When lump sum items are broken into components, the sum of the components shall be the total Contract Price for the Work. The lump sum price stated on the Bid Form shall constitute full compensation for each pay item completed in accordance with the drawings and specifications. No other payments will be made to the Contractor except as specifically authorized by change order.

PART 2 PAY ITEM DESCRIPTIONS

2.01 LUMP SUM SCHEDULE

The descriptions provided in the following paragraphs are to be used by the Bidder in preparation of his bid proposal. They generally indicate how the major workscope items and their respective costs are to be separated into the line items listed in the Lump Sum Schedule. 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 costs within the most appropriate line item(s) of the Lump Sum Schedule. The following descriptions are ordered in the same numeric sequence of the Lump Sum Schedule.

Item 1 – Mobilization, Demobilization, Insurance, Bonds and General Conditions

This item shall include and cover the costs for performance of construction preparatory and overhead operations, including, but not limited to, movement of personnel and equipment to and from the site, establishment of Contractor's storage areas and field office(s), sanitary facilities, project administration and management, insurance, bonds, Owner and Engineer indemnification, temporary utilities, site health and safety, environmental protection, all necessary permits and fees related to construction, and all other similar activities and facilities necessary for execution of this project. This item shall not exceed 10% of the total contract amount. Contractor will be paid 70%

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of the lump sum price for this item upon completion of mobilization and general conditions. The remainder will be withheld from payment until the final invoice to ensure proper demobilization.

Item 2 – Surveying and Record Drawings

This item shall be prorated based on the actual work accomplished each month by a Florida licensed Surveyor. Contractor shall submit proof of project survey work through subcontractor invoices of survey work products. The price shall include and cover the furnishing of all labor, materials, tools, supervision, transportation, and equipment necessary to perform project surveying work as specified in the Contract Documents and CQA Plan for all portions of the project including establishing survey control points, providing survey control during construction, and providing partial and final as-built documentation according to the requirements of the Contract Documents and as required by FDEP.

Item 3 - Installation and Maintenance of Soil Erosion and Sedimentation Control Measures

This item shall be prorated based on the contract schedule as agreed between Owner and Contractor. The price shall include the furnishing, installation, maintenance, and removal of all material, labor, tools and equipment needed to construct and maintain the erosion and sedimentation control measures required to protect the Work and as specified in the Contract Documents. The price shall include all materials, labor and equipment necessary to maintain sediment and erosion control at the site including performing weekly inspections of construction areas, install silt fence, stone check dams and riprap, seeding and mulching of disturbed areas, cleaning sediment accumulated behind the silt fence as needed, construct additional storm water control measures other than specified in the drawings, daily maintenance of storm water controlling devices and sediment removal from the existing sediment ponds to the cleanout elevation.

Item 4 - Site Clearing and Grubbing and Removal of Existing Access Roads

This item shall be prorated based on actual work accomplished as documented by the Engineer and/or the Engineer's representative. The lump sum price shall include all materials, equipment, labor, transportation, and appurtenances required to clear and grub the site as specified in the Contract Documents including clearing and disposing of vegetation on-site, removing the existing on-site tack-on road and stockpiling material, removing rubbish and other objectionable material and disposing of the material on-site as directed by Owner, and all other activities necessary to prepare the project site for construction. No additional payment will be made for losses due to settlement, wastage, erosion, over- excavation, dewatering, waste excavation equipment breakdown, or protection of the Work.

Item 5 – Furnish and Install Intermediate Cover/Grading Layer and Terraces

This item shall be prorated based on actual work accomplished as documented by the Engineer and/or the Engineer's representative. The lump sum price shall include all equipment, labor, transportation and appurtenances required to install and grade intermediate cover to proposed

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grades; remove unsuitable overburden waste from the on-site stockpile; excavate and haul material from the on-site borrow source; remove oversize material per the specifications; remove rubbish and other objectionable material and disposing of the material on-site as directed by Owner; material placement and compaction as needed to achieve required grades; smooth rolling; quality control surveying; and all other activities necessary to prepare the intermediate cover for placement of geomembrane. No additional payment will be made for losses due to settlement, wastage, erosion, over-excavation, dewatering, anchor trenches, equipment breakdown, removal of over-burden from on-site borrow sources, terraces or protection of the Work. Unless Engineer has directed in writing that site grading shall vary from that indicated on the Drawings, the payment quantity will not exceed the estimate in the Bid Tab.

Item 6 – Bottom Liner Tie-in

This item shall be prorated based on actual work accomplished as documented by the Engineer and/or the Engineer's representative. The lump sum price shall include all materials, equipment, labor, testing, transportation, and appurtenances required to locate the tie-in location, construct closure tie-in to the existing bottom liner as shown on the Drawings, supply and install geotextile, toe drain aggregate, anchor trenches, structural fill, edge of liner markers and quality control surveying. No additional payment will be made for losses due to settlement, wastage, compaction, erosion, over-excavation, seaming, testing, necessary overlaps, pipe boots, replacement of damaged or rejected material, dewatering, equipment breakdown, repairs to existing bottom liner or protection of the Work.

Item 7 - Furnish and Install 40-mil Textured LLDPE Geomembrane

This item shall be prorated based on actual work accomplished as documented by the Engineer and/or the Engineer's representative. The lump sum price shall include all materials, equipment, labor, transportation, testing, surveying and appurtenances required to furnish and install the textured geomembrane as described in the Contract Documents and to the dimensions shown on the Drawings. No additional payment will be made for losses due to settlement, wastage, necessary overlaps, seaming, testing, anchor trench, replacement of rejected or damaged materials, dewatering, booting into pipe penetrations through the cover repairs or protection of the Work.

Item 8 - Furnish and Install Geocomposite

This item shall be prorated based on actual work accomplished as documented by the Engineer and/or Engineer's representative. The lump sum price shall include all materials (including but not limited to the ties and thread), equipment, labor, transportation, testing, and all else required to furnish and install the geocomposite as described in the Contract Documents and to the dimensions shown on the Drawings. No additional payment will be made for losses due to settlement, wastage, necessary overlaps, seaming, joining, testing, anchor trench, pipe boots, replacement of rejected or damaged materials, dewatering or protection of the Work.

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Item 9 – Install Protective Soil

This item shall be prorated based on actual work accomplished as documented by the Engineer and/or Engineer's representative. The lump sum price shall include all equipment, labor, testing, transportation, and all else required to remove unsuitable overburden waste from the on-site stockpile, excavate and haul material from the on-site stockpile and install the protective fill as described in the Contract Documents and as shown on the Drawings including material placement and compaction. No additional payment will be made for losses due to settlement, wastage, compaction, erosion, over- excavation, replacement of rejected material, dewatering, removal of over-burden from on-site borrow sources, equipment breakdown, or protection of the Work.

Item 10 – Install Vegetative Topsoil

This item shall be prorated based on actual work accomplished as documented by the Engineer and/or Engineer's representative. The lump sum price shall include all equipment, labor, testing, transportation, and appurtenances required to remove unsuitable overburden waste from the on-site borrow source, mix the on-site topsoil with yard waste/mulch, strip, excavate and haul material from the on-site stockpile and install the vegetative soil as described in the Contract Documents and as shown on the Drawings including material placement and grading from the on-site stockpiles as shown in the Drawings. No additional payment will be made for losses due to settlement, wastage, compaction, erosion, over-excavation, replacement of rejected material, dewatering, removal of over-burden from on-site borrow sources, equipment breakdown, or protection of the Work.

Item 11 - Furnish and Install Sodding

This item shall be prorated based on actual work accomplished as documented by the Engineer and/or Engineer's representative. The lump sum price shall include all materials, equipment, labor, testing, transportation, and all else required to install sodding as described in Section 02485 and Drawings.

Item 12 - Furnish and Install Hydroseeding

This item shall be prorated based on actual work accomplished as documented by the Engineer and/or Engineer's representative. The lump sum price shall include all materials, equipment, labor, testing, transportation, and all else required to install hydroseeding as described in Section 02486 and Drawings.

Item 13 - Furnish and Install Fabric Formed Concrete Downchute System

This item shall be prorated based on actual work accomplished as documented by the Engineer and/or Engineer's representative. The price shall include all materials, equipment, labor, transportation, and appurtenances required to furnish and install the fabric formed concrete downchute system as specified in Section 02095 and to the dimensions shown on the Drawings. No

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additional payment will be made for losses due to settlement, wastage, compaction, over-excavation, replacement of rejected material, dewatering, changes in material suppliers, equipment breakdown, or protection of the Work. No payment will be made for temporary drainage channels, sumps, basins, or any other interim measures needed to control stormwater, erosion, sedimentation, or the like, or for other measures to protect the Work.

Item 14 - Furnish and Install Terrace Swale Underdrain System

This item shall be prorated based on actual work accomplished as documented by the Engineer and/or Engineer's representative. The price shall include all materials, equipment, labor, transportation, and all else required to furnish and install the terrace underdrain system as specified and to the dimensions shown on the Drawings including: installation of the perforated twelve-inch plastic pipe, aggregate and woven geotextile separation layer at the specified locations and slopes. No additional payment will be made for losses due to wastage replacement of rejected material, connecting to downrain pipes or protection of the Work. No payment will be made for temporary drainage channels, sumps, basins, or any other interim measures needed to control stormwater, erosion, sedimentation, or the like, surveying, or for other measures to protect the Work.

Item 15 – Install Permanent Access Road

This item shall be prorated based on actual work accomplished as documented by the Engineer and/or Engineer's representative. The lump sum price shall include all materials, equipment, labor, testing, transportation, and all else required to install pavement on the tack-on access roads as shown on the Drawings including: removal of unsuitable overburden waste from the on-site stockpile, excavating and hauling material for structural fill and stabilized subgrade from the on-site stockpile, furnishing aggregate, limerock basecourse, asphalt concrete pavement, drainage channel, finish grading of shoulders and quality control surveying. No additional payment will be made for losses due to settlement, repairs, compaction, erosion, testing, removal of over- burden from on-site borrow sources, necessary overlaps/tie-ins, replacement of damaged or rejected work, or protection of the Work.

Item 16 – Install Perimeter Channels and Stormwater Management Improvements

Payment of the lump sum price listed in the Bid Tab for this Item will be prorated based on actual work accomplished as documented by the Engineer. This Work shall consist of furnishing all equipment, materials, labor, and appurtenances necessary to install the perimeter channels, and stormwater management system improvements as shown on the Drawings and in accordance with the technical Specifications. This work shall include, but not be limited to grading of the perimeter channels and stormwater ponds to the specified drainage slopes and elevations, excavation and other foundation preparation, backfill and compaction to design grades, quality control surveying and dewatering. The lump sum proposed shall be full compensation for performing the Work required. Payment will be on a lump sum basis, wherein no measurement will be made. Payments for this lump sum item will be made based on the value of materials furnished or services and work completed using estimates provided by Contractor and approved by Engineer.

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Item 17 – Existing Gas Extraction Wells & Drains Extension

Payment of the lump sum price listed in the Bid Tab for this Item will be prorated based on actual work accomplished as documented by the Engineer. This shall consist of furnishing and installing all necessary materials, equipment, and labor and services to extend the existing gas extraction wells and all appurtenances, quality control surveying, and all other work required for a complete and acceptable connection according to the Drawings and Specifications for this project. Payments for this lump sum item will be made based on the value of the services and work completed by Contractor and approved by Engineer.

Item 18 – Installation of Passive Gas Wells

Payment of the lump sum price listed in the Bid Tab for this Item will be prorated based on actual work accomplished as documented by the Engineer. This shall consist of furnishing and installing all necessary materials, equipment, and labor and services to install the landfill gas piping including excavation, trenching, backfilling, soil compaction, fittings, piping, pipe location markings, testing incidentals, quality control surveying, and all other work required for a complete and acceptable installation according to the Drawings and Specifications for this project. Payments for this lump sum item will be made based on the value of the services and work completed provided by Contractor and approved by Engineer.

Item 19 – Existing Leachate Collection System Clean Out Extension

Payment of the lump sum price listed in the Bid Tab for this Item will be prorated based on actual work accomplished as documented by the Engineer. This shall consist of furnishing and installing all necessary materials, equipment, and labor and services to extend the existing leachate collection clean out system and all appurtenances, quality control surveying, and all other work required for a complete and acceptable connection according to the Drawings and Specifications for this project. Payments for this lump sum item will be made based on the value of the services and work completed by Contractor and approved by Engineer.

Item 20 – Retaining Wall Systems

Payment of the lump sum price listed in the Bid Tab for this Item will be prorated based on actual work accomplished as documented by the Engineer. This shall consist of furnishing and installing all necessary materials, equipment, labor and services for permanent retaining wall systems in accordance with the lines, grades, design, and dimensions shown in the Drawings and Specification. Excavation, backfilling, soil compaction required specifically for wall construction, backfill reinforcement, leveling pad, footings, copings, fabric material, horizontal joint materials, alignment pins, repairs, testing incidentals, quality control surveying, and all other work is included in this bid item as required for a complete and acceptable installation according to the Drawings and Specifications. Payments for this lump sum item will be made based on the value of the services and work completed by Contractor and approved by Engineer.

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Item 21 – Owner Contingency Allowance

This Bid Tab item shall be used for payment of additional Work, directed by the Engineer and authorized by the Owner that is not included in the other Bid Items on the Bid Form. The Owner Contingency Allowance, or portion thereof, shall not be paid to the Contractor except for additional Work ordered in writing by the Engineer. A cost proposal shall be prepared by the Contractor for each proposed additional Work directive in accordance with the General and Supplemental Conditions. The total amount, if any, of Owner Contingency Allowance funds to be paid to the Contractor shall be the total amount agreed to, approved and ordered performed, which shall not necessarily be the total amount in the Bid.

Item 22 – Boring Refusal Unit Cost

Payment will be made at the unit price per linear foot listed in the Bid Tab for this item. The unit price shall consist of all necessary materials, equipment, and labor necessary to relocate the boring equipment and drilling the relocated passive gas well borehole in the event the original borehole location cannot be penetrated. Engineer approval is required prior to original well drilling location abandonment.

END OF SECTION

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SECTION 01300 CONTRACT ADMINISTRATION

PART 1 GENERAL

1.01 CORRESPONDENCE

All correspondence to Engineer, plus copy to Owner, shall be submitted in original plus two copies, unless otherwise specified.

1.02 CONSTRUCTION ADMINISTRATION FORMS

Contractor shall use the construction administration forms provided at the end of this Section for submittals, request for information, proposed contract modifications, payment and change order request, etc.

PART 2 PROGRESS MEETINGS AND SCHEDULE

2.01 PRECONSTRUCTION MEETING

- A. Owner will schedule a preconstruction meeting at the Project site or other convenient location prior to commencement of construction activities. The meeting will be conducted to review responsibilities and personnel assignments.
- B. Attendees: Owner, Engineer, CQA Consultant, and Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with, and authorized to, conclude matters relating to the Work.
- C. Agenda: The agenda for the meeting will be developed by OWNER/ENGINEER and should include items of significance that could affect progress including such topics as:
 - 1. Tentative construction schedule.
 - 2. Critical work sequencing.
 - 3. Designation of responsible personnel.
 - 4. Construction quality control requirements.
 - 5. Construction quality assurance (CQA) procedures and protocols.
 - 6. Procedures for processing field decisions and Change Orders.
 - 7. Procedures for processing Applications for Payment.
 - 8. Distribution of Contract Documents.
 - 9. Submittal of shop drawings, product data, and samples.
 - 10. Preparation of record documents.

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11. Use of the premises including traffic controls.
12. Office, work and storage areas.
13. Equipment deliveries and priorities.
14. Safety procedures.
15. First aid.
16. Security.
17. Housekeeping.
18. Working hours.
19. Erosion and Sediment Control Requirements
20. Stop work orders and related regulatory compliance matters

2.02 PROGRESS MEETINGS

- A. Progress meetings will be conducted by CQA Consultant at the Project site on a routine basis (i.e. weekly) but may change depending on construction activities. CQA Consultant will notify the Owner and Contractor of scheduled meeting dates. The dates of the meetings should be coordinated with preparation of application for payment requests.
- B. In addition to CQA Consultant, the Owner, and Contractor, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the project and authorized to conclude matters relating to progress.
- C. No later than 5 working days after each progress meeting date, CQA Consultant will distribute copies of minutes of the meeting to each party present and to other parties who should have been present. The minutes will include a brief summary, in narrative or bulleted form, of progress since the previous meeting.

2.03 PROBLEM OR WORK DEFICIENCY MEETING

- A. A special meeting shall be held when and if a problem or deficiency is present or likely to occur. At a minimum, the meeting shall be attended by Owner, Engineer, CQA Consultant, Contractor, and any affected subcontractors. The purpose of the meeting shall be to define and resolve the problem or work deficiency.
- B. The meeting shall be documented by CQA Consultant and minutes shall be transmitted by CQA Consultant to the meeting attendees and others as appropriate.

2.04 PROGRESS SCHEDULES

- A. Format: Contractor shall prepare schedules as a time scale logic diagram and bar chart, unless otherwise approved by Engineer. Each major portion of work or

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operation shall be clearly identified and tied by logical sequence to the shop drawing schedule and schedule of values. All schedules shall be prepared and submitted on 11-inch by 17-inch paper.

- B. Content: Contractor shall show complete sequence of construction by activity, with dates for beginning and completion of each element of construction and provide sub-schedules to define critical portions of entire schedule. Schedules shall also show accumulated percentage of completion of each item, and total percentage of work completed, as of the first day of each month.
- C. Revisions To Schedules: Contractor shall indicate progress of each activity to date of submittal, and projected completion date of each activity. Revised schedules shall identify activities modified since previous submittal, major changes in scope, and other identifiable changes. Contractor shall also provide narrative report to define problem areas, anticipated delays, and impact on schedule. Report corrective action taken, or proposed, and its effect, including effect schedule changes on other contractors.
- D. Submittals: Contractor shall furnish Engineer four (4) copies of revised progress schedules with each Application for Payment in addition to the number required by Owner.

PART 3 SHOP DRAWINGS AND SUBMITTALS

3.01 GENERAL

- A. Shop Drawings are generally defined as all drawings, diagrams, illustrations, brochures, schedules, and other data that are prepared by Contractor, a subcontractor, manufacturer, fabricator, supplier, or distributor, which illustrate how specific portions of the Work shall be fabricated or installed.
- B. All Shop Drawings shall conform to the Contract Documents. All Shop Drawings shall be to scale, shall be accurate and distinct, and shall give all dimensions required for the fabrication, installation, and incorporation of the specified items in the Work. Wherever the location of any of the materials, equipment, accessories, and appurtenances is not shown on the Drawings, Contractor shall furnish prints of Shop Drawings for the purpose of giving the exact location in plan and in elevation of the said materials, equipment, accessories, and appurtenances.
- C. A Shop Drawing submittal schedule is included at the end of this Section for the Contractor's information. Within 10 days of the Notice of Agreement, Contractor shall submit an updated list to Engineer of all submittals that will be made and the dates that they will be submitted, subject to approval of Engineer. The approved list

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will be used by Engineer and Contractor throughout the project to communicate submittal requirements and responsibilities.

- D. Contractor shall furnish Engineer four (4) copies of all required shop drawings for review. Contractor shall call to Owner's and Engineer's attention, in writing, any deviations that the Shop Drawings may have from the requirements of the Drawings and Specifications. Shop Drawings for a particular component shall be submitted complete at least 21 days prior to the anticipated date of furnishing or installation of the particular component, unless an alternative schedule is given elsewhere in the Specifications. Shop Drawings will be reviewed and 1 copy of the reviewed drawings will be returned to Contractor within 10 days unless otherwise indicated.
- E. Contractor shall not fabricate related work, except at his own risk, until approved by Engineer.
- F. All Shop Drawings shall be labeled as specified below:
 - 1. Project Name, Contract Number and description of item.
 - 2. Submittal Numbering: Shop Drawings shall be numbered sequentially in order of original submission. Resubmittals shall include the original submittal number and shall be lettered sequentially (A, B, C, etc...). Contractor shall maintain the submittal log in current and correct condition.

3.02 COMPLIANCE TO SPECIFICATIONS

Shop drawings and submittals shall accurately and completely indicate compliance with every aspect of the drawings and/or specifications relating to the respective items. Contractor shall enumerate in the submittal and associated transmittal correspondence, each and every feature specifically addressed in the respective drawings and/or specifications, and he shall call out and completely describe any exceptions to the drawings and/or specifications which he wishes to have accepted. Failure to completely identify the submitted item's compliance or exception to specified features will be grounds for automatic rejection of the submittal. Engineer's review or acceptance of any submittal, which contains a deviation(s) from the drawings and/or specifications not clearly and specifically called out and described in the submittal and associated transmittal correspondence shall not constitute approval of that portion(s) of the submittal containing the deviation(s). Should Contractor prepare, and Engineer accept, any deviation to the drawings and/or specifications, all necessary design, equipment, installation modifications and additional cost of same shall be the sole responsibility of Contractor.

3.03 MATERIALS AND EQUIPMENT

Materials and equipment are specified by a single or by multiple manufacturers to indicate quality, material, and type of construction desired. Manufacturer's product as shown on the drawings has been used as basis for design; it shall be Contractor's responsibility to ascertain that alternate

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manufacturer's products meet detailed specifications and that size and arrangement of equipment is suitable for installation.

3.04 REQUESTS FOR SUBSTITUTION

- A. All requests for substitution shall clearly and specifically indicate any and all differences or omissions between the products specified as basis of design and the product proposed for substitution. Data shall include but not be limited to differences as follows for both the specified and substituted products:
1. Principle of operation
 2. Materials of construction or finishes
 3. Thickness or gauge of materials
 4. Weight of item
 5. Deleted features or items
 6. Added features or items
 7. Changes in other work caused by the substitution
- B. Substitute Methods or Procedures: If a specific means, method, technique, sequence, or procedure of construction is shown or indicated in and expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer and Owner. Contractor shall submit sufficient information to allow Engineer and Owner, in Engineer and Owner's sole discretion, to determine that substitute proposed is equivalent to that expressly called for by the Contract Documents.
- C. Contractor shall submit, in writing, his request before 30 days of proposed use for permission to make a substitution and shall furnish full information as to costs of the item, material or procedure specified and the item or material to be substituted therefore. Such information shall be in such form and detail as to permit Owner to check, to its satisfaction, the costs involved. Upon acceptance of the substitution, when the cost thereof is greater or less, Engineer will authorize, in writing, the proper credits to be allowed Owner, or the proper additional payments to be made to Contractor. Payment adjustments shall represent the difference between the net cost to Contractor of the accepted substituted item or material and the price at which he could have obtained the lowest priced items or material specified. The decisions of Engineer as to the proper credits to be allowed to Owner, or proper payments to be made to Contractor, or substitutions to be allowed, shall be final.
- D. Special Guarantee: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

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- E. Engineer's Cost Reimbursement: Engineer will record time required by Engineer and Engineer's Consultants in evaluating substitute proposed or submitted by Contractor pursuant to this Section and in making changes in the Documents (or in the provision of any other direct contract with Owner for work on the Project) occasioned thereby. Whether or not Engineer approves a substitute item submitted by Contractor, Contractor shall reimburse Owner for the charges of Engineer and Engineer's Consultants for evaluating each such proposed substitute.
- F. An offer of a substitute material or method by Contractor, not specified herein, will raise the presumption that it is for the purpose of saving money. If, in such case, the article or material is accepted, Owner shall be given credit as follows: the difference in the net cost to Contractor of the article or material submitted and the price at which it could have obtained the lowest priced article or material specified. For convenience in checking the credit, Contractor shall submit these figures with each substitute submittal, and no materials or methods will be considered without such figures.
- G. If, subsequent to award of the Contract, it becomes necessary because of the inability of Contractor to obtain any items or material as specified or the equal thereof, within a reasonable time frame, and could possibly cause future delays in the project, Engineer, at his discretion, may authorize use of substitute items or materials of the same, greater, or less cost than those specified. The review procedures shall be the same and as Engineer may decide is appropriate under the circumstances.

3.05 ENGINEER'S RIGHTS

If the substitution contains differences or omissions not specifically called to the attention of Engineer, Engineer reserves the right to require equal or similar features to be added to the substituted product at Contractor's expense.

3.06 ACCEPTANCE

Before delivery of materials and equipment, certified copies of all test reports specified in the individual sections of the specifications or referenced standards shall be submitted for approval.

3.07 CERTIFICATE OF COMPLIANCE

Contractor shall submit certification from the manufacturer attesting that materials and equipment to be furnished for the Project comply with the requirements of the specifications and of the referenced standards. Preprinted certifications will not be acceptable; certifications shall be original. The certification shall not contain statements that could be interpreted to imply that the product does not meet all requirements specified; such as, "as good as," "achieve the same end use and results as materials formulated in accordance with the referenced publications," or "equal or exceed the service and performance of the specified material." The certification shall simply state that the product conforms to the requirements specified.

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PART 4 PHOTOGRAPHIC RECORD

4.01 GENERAL

Contractor shall employ a competent photographer to take construction record photographs during the Work.

4.02 REQUIRED PHOTOGRAPHS

- A. Provide photographs of at least twelve (12) views of the Project site taken prior to any construction and prior to each scheduled Application for Payment.
- B. Provide up to twelve (12) additional photographs of views randomly selected by Owner's and Contractor's representative, taken prior to any construction and prior to each scheduled Application for Payment. Provide two (2) prints, 8-inch by 10-inch, color, double-weight paper, smooth glossy finish of each photograph. Include a CD or thumb drive containing the images in .jpeg format, if using digital photos.
- C. In addition to other photos, a narrated video recording of at least fifteen (15) minutes shall be taken prior to construction and at the time of Substantial Completion.
- D. In addition to the photos accompanying Application for Payment, Contractor shall provide photographs to be taken for unusual conditions during construction. The photographs shall show pertinent physical features of construction. Two (2) 8-inch by 10-inch prints of all pictures shall be submitted.
- E. All prints shall be captioned on the face of the print with the Project name and number, date and pertinent information describing the view.

4.03 SUBMITTALS

Contractor shall furnish Engineer with required photographs to accompany each Application for Payment.

PART 5 APPLICATION FOR PAYMENT

5.01 GENERAL

- A. Contractor shall furnish engineer four (4) copies of application for payment. Each application for payment shall be consistent with previous applications and payments as certified by Engineer and/or Engineer's Representative and paid for by Owner. One copy shall include waivers of lien and similar attachments if required.

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- B. Payment Application Times: Progress payments shall be submitted to the Engineer by the 25th of each month. The period covered by each Application for Payment is one month, ending on the last day of the month.
- C. Application Preparation: Contractor shall complete every entry on the form. Notarize and execute by a 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 Contractor's Construction Schedule. Use updated schedules if revisions were made.
 - 2. Include amounts of Change Orders issued before the last day of construction period covered by payment application.

5.02 INITIAL APPLICATION FOR PAYMENT

- A. Contractor shall provide the following prior to the first Application for Payment:
 - 1. List of Subcontractors
 - 2. Schedule of Values
 - 3. Contractors Construction Schedule
 - 4. Products list
 - 5. Submittals Schedule

5.03 APPLICATION FOR PAYMENT AT SUBSTANTIAL COMPLETION

After issuing the Certificate of Substantial Completion, Contractor shall submit an Application for Payment showing 100% completion for portion of the Work claimed as substantially complete.

5.04 APPLICATION FOR FINAL PAYMENT

Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted including but not limited to the following:

- A. Evidence of completion of Project closeout documents.
- B. Warranty certificates for products and completed operations where required and proof that taxes, fees and similar obligations were paid.
- C. Updated final statement, accounting for final changes to the Contract amount.
- D. Contractor's Affidavit of Payment of Debts and Claims.
- E. Contractor's Affidavit of Release of Liens.
- F. Consent of Surety to Final Payment.
- G. Evidence that claims have been settled.
- H. Final meter readings for utilities and similar data as of established Substantial Completion date or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

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- I. Final liquidated damages settlement statement.

PART 6 SURVEYING AND RECORD DOCUMENTS

6.01 SURVEYING

- A. Owner shall provide engineering surveys for construction to establish control points that, in Owner's judgment, are necessary to enable Contractor to proceed with the Work. The Contractor shall establish the location of all the Work from control points that are shown on the Drawings, or furnished by the Engineer after the award of the Contract, or as modified by the Engineer.
- B. Contractor shall employ a Florida Registered Land Surveyor to layout the Work, establish benchmarks and control points. Contractor shall have the responsibility to carefully preserve the benchmarks, existing or new control points, property markers, monuments and stakes. In the case of destruction thereof, Contractor shall replace and reestablish at his own cost all such damaged markers.
- C. The Surveyor shall, prior to start of construction, perform a preconstruction survey in order to verify all grades, lines, levels and dimensions as shown on the drawings and shall report any errors or inconsistencies to the Engineer in writing within seven (7) days before commencing of the Work. Failure to notify Engineer prior to commencing of Work will be construed as Contractor's acceptance of the survey data presented in the Construction Drawings.
- D. CADD Requirements for Survey: Contractor shall provide Engineer a complete record survey in AutoCAD Version 2007 or later format upon completion of the Work. No additional compensation will be allowed for Contractor to provide record survey. No other CADD software or format will be accepted. It is the Contractor's sole responsibility to ensure the record survey conforms to the following CADD requirements:
 1. Survey shall be submitted to Engineer on CD or thumb drive. Each CD or thumb drive shall be clearly labeled with the appropriate project number, client name, date, and file names included on each CD or thumb drive. If files are compressed, a description of the compression software must be included along with a copy of the appropriate uncompressing software.
 2. All systems must be put on separate layers with an appropriate layer name. The colors and line types of the appropriate existing layers shall be adhered to when creating new layers.
 3. Contractor shall supply five (5) full sets of the record survey on opaque bond paper.

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6.02 LAYOUT AND LEVELS

- A. Contractor shall layout the features and structures as shown on the Drawings, and shall be responsible for any damage caused the Owner due to incorrect laying out of the Work.
- B. The Surveyor shall locate and clearly mark in the field all property boundaries within 100 feet of the work area. The Surveyor shall submit to Engineer a description of the evidence and procedures used to locate the property boundary or boundaries. The Surveyor shall immediately notify Owner and Engineer of any discrepancy between the boundary location shown on the Drawings and the location indicated by the evidence and procedures used by the Surveyor.
- C. The Surveyor shall maintain lines and levels, layout, and locate the Work utilizing recognized engineering survey practices. The survey shall be based on horizontal and vertical datum used in Contract Drawings. A complete and accurate log of control and survey work must be maintained. The Surveyor shall establish a 50 foot by 50 foot survey grid or grade breaks whichever is closer for construction and “as-built” documentation. All survey control points shown on the Drawings shall be included in the Surveyor’s documentation. Within seven (7) days after completion of each of the following phases of construction, the Contractor shall prepare and deliver to the Engineer five (5) copies to review that all dimensions, elevation grades, slopes and contours [one foot (1') contour interval] were constructed in accordance with the Contract Documents to include but not be limited to:
 - 1. Elevation of subgrade showing terraces, roads and channels prior to geosynthetic installation;
 - 2. Edge of liner markers, and the location of the anchor trenches and dimensions;
 - 3. Elevations of the centerline, bottom width and top width of the down drain pipes;
 - 4. The surface and limits of geomembrane, including locations of seam samples, major repairs and edge of liner;
 - 5. Improvements to landfill gas collection network including vertical extraction wells;
 - 6. Locations and invert elevations related to gas piping and structures;
 - 7. Center line and width of the roads;
 - 8. Elevations of stormwater piping including inverts of inlets, control structures and culverts;
 - 9. Existing bottom liner tie-in;
 - 10. Topsoil elevation, showing road, terraces and channels; and
 - 11. Pavement.

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- D. Both existing below grade utilities unearthed by the Contractor and above grade and below grade new construction shall be surveyed by the Contractor. The following are the minimum requirements for said survey:
1. Where below grade existing utilities are encountered, Surveyor shall record their location both horizontally and vertically. If a length of utility is unearthed, that utility shall be located horizontally and vertically at each end of the excavated length at a minimum. Additionally, if in that length there are any appurtenances, changes in direction, or changes in elevation encountered; those points shall also be surveyed horizontally and vertically.
 2. All new construction shall be surveyed. Survey of new below grade utilities shall meet the requirements of existing below grade utilities listed above. Additionally, new below grade utilities shall be located by survey at a maximum of every 50 feet along straight runs. All above grade features shall be located both horizontally and vertically.
- E. Just prior to installation of the landfill gas extraction system improvements, the Surveyor shall locate the proposed vertical wells, remote wellheads, and access points. The Surveyor will provide the Engineer the coordinates and elevations of these features at least 7 days prior to beginning gas system construction to ensure locations and make adjustments to the locations and well schedule, as necessary.

6.03 TOLERANCES

- A. Construction tolerances shall be within 0.01 ft unless otherwise specified in the Drawings or Specifications.
- B. Landfill gas collection pipes and toe drain pipes shall meet the minimum slopes defined on the Contract Drawings.
- C. No surveying will be allowed between one hour before sunset and one hour after sunrise, unless approved by Engineer and the CQA Consultant.
- D. Contractor shall be aware of the surveying activities and shall account for them in the construction schedule.
- E. Proposed modifications to stormwater management system shall meet the invert elevations and minimum slopes defined on the Contract Drawings.

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6.04 RECORD DRAWINGS

- A. Maintenance: Contractor shall label and file record documents and samples in accordance with the corresponding specification section number. Each document shall be labeled "PROJECT RECORD" in neat, large, printed letters. Record documents shall be maintained in a clean, dry, and legible condition. Record documents shall not be used for construction purposes.
- B. Recording: Contractor shall record construction information as follows:
1. Record and update daily "record" information from field notes and on set of opaque drawings, provided by Owner and to the satisfaction of Engineer. This working set of Record drawings shall be made available to the Engineer upon request.
 2. Provide felt tip marking pens, maintaining separate colors for each major system, for recording information.
 3. Record information concurrently (daily) with construction progress. Work shall not be concealed until required information is recorded.
- C. CADD Requirements for Record Drawings: Contractor shall provide Engineer a complete set of record drawings in AutoCAD Version 2007 or later format upon completion of the Work. No additional compensation will be allowed for Contractor to provide the record drawings. Contractor shall utilize the AutoCAD drawings furnished by Engineer for this purpose. As-Built drawings must be submitted in the AutoCAD format of the complete contract drawing set. No other CAD software or format will be accepted. It is Contractor's sole responsibility to ensure the record drawings conform to the following CAD requirements:
1. Drawings shall be submitted to Engineer on CD or thumb drive. Each CD or thumb drive shall be clearly labeled with the appropriate project number, client name, date, and file names included on each CD. If files are compressed, a description of the compression software must be included along with a copy of the appropriate uncompressing software.
 2. All changes to drawings must be done in accordance with the appropriate scale of the revised drawing and shall be delineated by placing a "cloud" around the areas revised and adding a revision triangle indicating the appropriate revision number.
 3. Each drawing must have the revision block completed to indicate the revision number, date, and initials of the person revising the drawing. The description

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of the revision must say "Record Drawing." This procedure must be followed for every drawing even when no changes are made to the drawing.

4. All revisions to drawings must be put on separate layers with the layer names prefixed "record" followed by the appropriate existing layer name. The colors and line types of the appropriate existing layers shall be adhered to when creating new layers.
 5. Contractor shall supply five full sets of record drawings on opaque bond paper.
- D. Record Drawings: The construction drawings shall be marked, and the marks shall be incorporated into the electronic drawings, to reflect:
1. Edge of bottom liner tie-in.
 2. Stormwater collection system inverts and locations.
 3. Measured horizontal and vertical locations of underground utilities and appurtenances referenced to permanent surface improvements.
 4. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of construction.
 5. Field changes of dimension and detail.
 6. Changes made by Modifications.
 7. Details not on original construction drawings.

6.05 SUBMITTALS

- A. At Contract closeout, Contractor shall transmit Record Documents and samples with cover letter to Engineer, listing:
1. Date.
 2. Project title and number.
 3. Contractor's name, address, and telephone number.
 4. Number and title of each Record Document.
 5. Signature of Contractor or authorized representative.

END OF SECTION

Attachment B - Technical Specifications



Locklear & Associates, Inc.
4140 NW 37th Place, Suite A
Gainesville, Florida 32606
PH: 352-672-6867
FX: 352-692-5390
www.locklearconsulting.com

PARTIAL PAYMENT APPLICATION

Partial Payment No.: _____
Date: _____
Period Covered: _____

Project Name: _____
Owner Project Number: _____
L&A Project Number: _____

Owner: _____
Address: _____
City: _____
State: _____
PH: _____

Engineer: _____
Address: _____
City: _____
State: _____
PH: _____

Contractor: _____
Address: _____
City: _____
State: _____
PH: _____

Contract Information:

Bids Received: _____
Contract Date: _____
Notice to Proceed: _____
Calendar Days to Complete: _____
Original Completion Date: _____
*Days Extended to date: _____
New Completion Date: _____

Original Contract Sum: \$ _____
Revised Contract Sum: \$ _____
*Adjustments to Date: \$ _____
Percent Complete: (\$) _____ %
Percent Complete: _____ %

*See applicable Change Order or Supplementary Agreement for approved changes to Contract sum and time.

Summary of Job Status:

Total Work Completed: \$ _____
Material Stored on Site: \$ _____
Subtotal: \$ _____
Less Liquidated Damages: \$ _____
Subtotal: \$ _____
Less Retainage (10%): \$ _____
Subtotal: \$ _____
Less Previous Payments: \$ _____
Amount Due This Period: \$ _____

As authorized agent for the Contractor, I, the undersigned, hereby certify that to the best of my knowledge and belief, this is a true and correct statement of work performed and materials delivered. I further certify that the Contractor has good title for all materials delivered under this Partial Estimate and there are no vendor's liens, mechanic's liens, or rights to liens (time) against this job, and that all previous Partial Payments received under this Contract have been applied to discharge in full all of the Contractor's obligations reflected in prior Partial Payment requests, and that hourly wages paid to all employees on this project for the period of this estimate are in accordance with the wage scale determination contained in the Contract Documents.

APPROVED FOR PAYMENT:

Signature (Contractor) Signature (Engineer) Signature (Owner)
Date Date Date

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Gainesville, Florida 32606
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www.locklearconsulting.com

SHOP DRAWING / SUBMITTAL CONTROL FORM

Project Name:
Owner Project Number:
L&A Project Number:

Owner:
Address:
City:
State:
PH:

Engineer:
Address:
City:
State:
PH:

Contractor:
Address:
City:
State:
PH:

CONTRACTOR INFORMATION:

Submittal Number:
Submittal Date:
[] ORIGINAL SUBMITTAL [] RESUBMITTAL [] SUPPLEMENT [] INFO ONLY

SPECIFICATION SECTION AND SUBSECTION NUMBER:
DESCRIPTION:
MANUFACTURED BY:
INSTALLATION BY:

ENGINEER INFORMATION:

No. of Copies Received:
No. of Copies Returned:

Table with 4 columns: ACTIVITY, DATE, PERSON, COMMENT. Rows for RECEIVED and RETURNED.

STATUS:
[] NO EXCEPTIONS TAKEN [] MAKE CORRECTIONS AS NOTED
[] AMEND AND RESUBMIT [] REJECTED SEE COMMENTS

COMMENTS:

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Locklear & Associates, Inc.
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REQUEST FOR INFORMATION (RFI)

Project Name:
Owner Project Number:
L&A Project Number:

Owner:
Address:
City:
State:
PH:

Engineer:
Address:
City:
State:
PH:

Contractor:
Address:
City:
State:
PH:

TO:

DATE:

CONTRACT DOCUMENT REFERENCE(S):

DESCRIPTION OF REQUEST:

- Information
Clarification
Interpretation

is requested for the items described below or in the attached:

Multiple horizontal lines for describing the request items.

Your response is requested by Date

Signature

TO:

DATE:

FROM:

RESPONSE TO THIS REQUEST IS DESCRIBED BELOW:

Multiple horizontal lines for describing the response.

Signature Date

Attachment:



Locklear & Associates, Inc.
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Gainesville, Florida 32606
PH: 352-672-6867
FX: 352-692-5390
www.locklearconsulting.com

PROPOSED CONTRACT MODIFICATION (PCM)

Project Name:
Owner Project Number:
L&A Project Number:

Owner:
Address:
City:
State:
PH:

Engineer:
Address:
City:
State:
PH:

Contractor:
Address:
City:
State:
PH:

TO:

DATE:

Please submit your proposal for an equitable adjustment in the contract amount and/or performance time in accordance with the following:

CONTRACT DOCUMENT REFERENCE(S):

DESCRIPTION OF MODIFICATION:

REASON FOR MODIFICATION:

WORK DIRECTIVE:

- Proceed with the work immediately
Do not proceed with the work until a change order is issued.

Your response is requested by

xc:

Signature Date



Locklear & Associates, Inc.
4140 NW 37th Place, Suite A
Gainesville, Florida 32606
PH: 352-672-6867
FX: 352-692-5390
www.locklearconsulting.com

NOTICE OF NONCOMPLIANCE (NON)

Project Name:
Owner Project Number:
L&A Project Number:

Owner:
Address:
City:
State:
PH:

Engineer:
Address:
City:
State:
PH:

Contractor:
Address:
City:
State:
PH:

TO:

DATE:
TIME:

NONCOMPLIANCE OBSERVATION:

DETAILS OF OBSERVATION:

REFERENCE TO CONTRACT DOCUMENTS:

Your response to this notice is required by the close of business on the day following the date of issuance.

Receipt of the above notice of noncompliance is hereby acknowledged by:

Contractor Date

Resident Project Representative Date

Attachment B - Technical Specifications



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 Gainesville, Florida 32606
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CONSTRUCTION CONTRACT CHANGE ORDER

Change Order Number: _____	Owner: _____
Project Name: _____	Address: _____
Owner Project Number: _____	City: _____
L&A Project Number: _____	State: _____
	PH: _____
Engineer: _____	Contractor: _____
Address: _____	Address: _____
City: _____	City: _____
State: _____	State: _____
PH: _____	PH: _____

Description of Change (Attach additional sheets if required)	<u>Decrease In</u>	<u>Increase In</u>

<u>Contract Time*</u>	<u>Days</u>	<u>Date</u>	<u>Contract Amount*</u>
Notice to Proceed:			Change Order Subtotal: \$ _____
Original Contract Time:			Add: \$ _____
Present Contract Time:			<Deduct>: \$ _____
This Change: Add/Deduct			Net: \$ _____
New Contract Time:			Original Contract Sum: \$ _____
Substantial Completion:			Present Contract Sum: \$ _____
Final Completion:			New Contract Sum: \$ _____

*Reflects Change Order No's 1 thru _____

This Change Order is an amendment to the Contract Agreement between Contractor and the Owner, and all contract provisions shall apply unless specifically exempted. The amount and time change designated are the maximum agreed to by both the Owner and the Contractor for this change. In consideration of the foregoing adjustments in contract time and contract amount, the Contractor hereby releases Owner from all claims, demands or causes of action arising out of the transactions, events and occurrences giving rise to this Change Order. This written Change Order is the entire agreement between Owner and Contractor with respect to this Change Order. No other agreements or modifications shall apply to this Contract amendment unless expressly provided herein. This Change Order represents final action relating to this Change Order

AGREED:

This Change Order is not valid unless signed by Owner, Engineer and Contractor.

_____	_____	_____
Signature (Contractor)	Signature (Engineer)	Signature (Owner)
_____	_____	_____
Date	Date	Date

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CERTIFICATE OF SUBSTANTIAL COMPLETION

Project Name:
Owner Project Number:
L&A Project Number:

Owner:
Address:
City:
State:
PH:

Engineer:
Address:
City:
State:
PH:

Contractor:
Address:
City:
State:
PH:

Description of Work:
Date of Substantial Completion:

The Work performed under this Contract has been reviewed and found to be substantially complete. The Date of Substantial Completion of the Project or portion thereof designated above is hereby established as also the date of commencement of applicable warranties required by the Contract Documents.

The Date of Substantial Completion of a project or specified part of a project is the date accepted by the Owner, that the construction is sufficiently completed, in accordance with the Contract Documents, so that the project or specified part can be utilized for the intended purpose.

A list of items to be completed or corrected, prepared by the Contractor and verified and amended by the Construction Engineer and the Owner is attached. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all work in accordance with the Contract Documents.

The Contractor will complete or correct the work on the list of items attached hereto within 15 days from the Date of Substantial Completion.

Contractor Signature Date

Engineer Signature Date

Owner Signature Date

Comments:

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CERTIFICATE OF GUARANTEE

Project Name:
Owner Project Number:
L&A Project Number:

Owner:
Address:
City:
State:
PH:

Engineer:
Address:
City:
State:
PH:

Contractor:
Address:
City:
State:
PH:

Description of Work:

The Work under the Contract, except as expressly excluded, and all of its subcontracts, severally and collectively, whether herein stipulated in each case or not, shall be guaranteed against faulty workmanship and/or material as specified below from date of acceptance of the work.

Neither the Certificate of Substantial Completion, Final Certificate of Payment, nor any provision in the Contract Documents, nor partial or entire use or occupancy of the premises by the Owner shall constitute an acceptance of work, materials, or equipment not performed or installed in accordance with the Contract Documents, or relieve the Contractor or his Sureties of liability in respect to any warranties or responsibility for faulty materials or workmanship.

The Contractor shall guarantee all materials and equipment furnished and work performed for a period of one (1) year from the date of Substantial Completion. The Contractor warrants and guarantees for a period of one (1) year from the date of Substantial Completion of the system that the completed system is free from all defects due to faulty materials or workmanship and the Contractor shall promptly make such corrections as may be necessary by reason of such defects, including the repairs of any damage to other parts of the system resulting from such defects with reasonable promptness.

Contractor Signature Date

Engineer Signature Date

Owner Signature Date

Attachment B - Technical Specifications

SECTION 01500 TEMPORARY FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 RESPONSIBILITY

- A. This section specifies the minimum requirements for temporary facilities, utilities, and controls required to provide an adequate and safe work site at every stage during construction of the project. The Contractor is solely responsible for the requirements set forth in this section.

1.02 STANDARDS

- A. In addition to compliance with all governing regulations and standards, and/or rules and recommendations of franchised utility companies, comply with specific requirements indicated and with applicable local industry standards for construction work. Whenever Owner's facility standards are more stringent, the Owner's facility standards shall apply. Obtain inspections and permits as required.

1.03 ONSITE TEMPORARY

- A. Except as otherwise indicated, the Contractor may, at his option, furnish stand-alone utility plants to provide needed services, in lieu of connected services from available public utilities, provided such stand-alone plant facilities comply with all governing regulations. The Contractor will, prior to availability of temporary utility services, provide trucked-in/trucked-out containerized or unitized services for start up of construction operations at the site.

1.04 COSTS

- A. Except as otherwise indicated, the costs of providing and using temporary utility services are included in the contract sum.

1.05 JOB CONDITIONS

- A. Ten (10) days prior to the installation of temporary facilities, Contractor shall submit copies of any permits required for temporary facilities. All permits shall be posted as required by applicable regulations for such facilities.

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PART 2 TEMPORARY FACILITIES

2.01 GENERAL

A. The types of utility services required for general temporary use at the project site include the following (other specific services may be required for specific construction methods of operations):

1. Electrical Power Service
2. Water Service (potable for certain uses)
3. Sanitary
4. Storm Sewer or Open Drainage/Run-off Control
5. Gas (fuel) Service
6. Telephone Service

2.02 TEMPORARY ELECTRICITY

A. The Contractor shall make the necessary applications and arrangements and pay all fees and charges for electrical energy for power and light necessary for proper completion of the work and during its entire progress up to time of final acceptance by the Owner. The Contractor shall provide and pay for all temporary switches, connections, and meters.

2.03 TEMPORARY WATER

A. The Contractor shall make all necessary application and arrangements, and pay all fees and charges for water necessary for the proper completion of the project up to the time of final acceptance. The Contractor shall provide and pay for any temporary piping and connections.

2.04 TEMPORARY SANITARY FACILITIES

A. The Contractor shall provide adequate sanitary facilities for the use of those employed on the work. Such facilities shall be made available when the first employees arrive on the site of the work, shall be properly secluded from public observation, and shall be constructed and maintained during the progress of the work in suitable numbers and at such points and in such manner as may be required or approved.

2.05 CLEANLINESS OF FACILITIES

A. The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. He shall rigorously prohibit the

Attachment B - Technical Specifications

committing of nuisances on the site of the work, on the lands of the Owner, or on adjacent property.

2.06 RELOCATION

- A. Should a change in location of a temporary facility be necessary in order to promote progress of the Work, Contractor shall remove and relocate such items as directed without additional cost to Owner.

2.07 TERMINATION AND REMOVAL

- A. The Contractor shall, at the time the need for a temporary utility service has ended, or has been replaced by use of permanent services, or not later than the time of final completion, promptly remove the installation, unless requested by the Engineer to retain it for a longer period. Any work which may have been delayed or affected by the installation and use of the temporary utility, including repairs to construction and grades and restoration and cleaning of exposed surfaces shall be completed at this time. Replace any work damaged beyond acceptable restoration.

PART 3 TEMPORARY CONTROLS

3.01 NOISE CONTROL

- A. The Contractor shall provide adequate protection against objectionable noise levels caused by the operation of construction equipment.

3.02 DUST CONTROL

- A. The Contractor shall provide for adequate protection against raising objectionable dust clouds caused by moving construction equipment, high winds, clearing or grubbing, grading, fill placement, travel or any other cause. Contractor shall apply water or use other methods to keep dust in the air to a minimum, subject to the approval of Owner.

3.03 WATER CONTROL

- A. The Contractor shall provide for satisfactory disposal of surplus water and shall submit a plan to the Engineer for his review prior to initiation and implementation of the plan. Prior approval shall be obtained from the proper authorities for the use of public or private lands or facilities for such disposal.

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3.04 POLLUTION CONTROL

- A. The Contractor shall provide for adequate protection against polluting any public or private lands, lakes, ponds, rivers, streams, creeks, and other such areas by the disposal of surplus material in the form of solids, liquids, gases, or from any other cause.

3.05 ADVERSE IMPACT

- A. The Contractor shall evaluate and assess the impact of any adverse effects on the natural environment which may result from construction operations and shall operate to minimize pollution of air, ground, or surface waters vegetation, and afford the neighboring community the maximum protection during and up to completion of the construction project.

3.06 STREAMS, LAKES, AND OTHER BODIES OF WATER

- A. The Contractor shall take sufficient precautions to prevent pollution of streams, lakes, and reservoirs with fuels, oils, bitumens, calcium chloride, or other harmful materials. He shall conduct and schedule his operations so as to avoid or otherwise prevent pollution of siltation of streams, lakes, and reservoirs and to avoid interference with movement of migratory fish.

3.07 CHEMICALS

- A. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, 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.

3.08 EROSION CONTROL

- A. The Contractor shall not expose, by construction operations, a larger area of erosive land at any one time than the minimum necessary for efficient construction operations, and the duration of exposure of the uncompleted construction to the elements shall be as short as practicable. Erosion control features shall be constructed concurrently with other work and at the earliest practicable time.

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3.09 FIRE PREVENTION CONTROL

- A. Contractor shall take all precautions necessary to prevent fires and explosions. Contractor is hereby advised that flammable and explosive gases are naturally generated at the existing landfill.
- B. Fuel for cutting and heating torches shall be contained in containers approved by the Underwriter's Laboratory.
- C. Contractor shall furnish and maintain a 20-pound maximum capacity dry chemical type fire extinguisher in the immediate vicinity of the Work when welding tools or torches of any type are in use.
- D. No smoking or open flame is permitted on landfill areas.

PART 4 STORAGE FACILITIES

4.01 GENERAL

- A. All products, materials, and equipment shall be stored in accordance with the manufacturer's instructions, with seals and labels intact and legible. Products subject to damage by the elements shall be stored in the weathertight enclosures. Temperature and humidity shall be maintained within the ranges required by the manufacturer's instructions. Fabricated products shall be stored above the ground on blocking or skids. Products which are subject to deterioration 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. Any products which will come in contact with potable water shall be stored off the ground so as to prevent contamination.

4.02 INSPECTION

- A. 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.

4.03 TEMPORARY PROTECTION

- A. After installation, Contractor shall provide substantial coverings as necessary to installed products to protect from damage from traffic and subsequent construction operations. Coverings shall be removed when no longer needed.

PART 5 PRESERVATION OF PROPERTY

5.01 ADJACENT TO WORK

- A. Preserve from damage all property along the line of the work, or which is in the vicinity of or in any wise affected by the work, the removal or destruction of which is not called for by the plans. Wherever such property is damaged due to the activities of the Contractor, it shall be immediately restored to its original condition by the Contractor at no cost to the Owner.

5.02 REMEDY BY OWNER

- A. In case of failure on the part of the Contractor to restore such property, or make good such damage or injury, the Owner may, after 48-hours notice to the Contractor, proceed to repair, rebuild or otherwise restore such property as may be deemed necessary and the cost thereof will be deducted from any monies due or which may become due to the Contractor under this contract.

5.03 SECURITY AND PROTECTION FROM DAMAGE

- A. The Contractor shall be responsible for the protection of property, in the areas in the vicinity of the project; and for the protection of his equipment, supplies, materials and work, against any damage resulting from the elements, such as flooding, by rainstorm, wind damage, or other precautions against any such damage occurrence, and shall be responsible for damage resulting from same. The Contractor shall provide adequate drainage facilities, tie-downs, or other protection, throughout the contract period, for the protection of his, the Owner's, and other properties from such damage.
- B. The types of temporary security and protection provisions required may include, but are not limited to, fire protection, barricades, warning signs/lights, building enclosure/lockup, personnel security program (theft prevention), environmental protection, and similar provisions intended to minimize property losses, personal injuries and claims for damages at project site.
- C. Fire Extinguishers: Provide types, sizes, numbers and locations as would be reasonably effective in extinguishing fires during early stages, by personnel at project site. Provide Type A extinguishers at locations of low-potential for either electrical or grease/oil/flammable liquids fires, provide Type ABC dry chemical extinguishers at other locations; comply with recommendations of NFPA No. 10. Post warning and quick response instructions at each extinguisher location, and instruct all personnel at project sites at time of their first arrival, on proper use of extinguishers and other available facilities at project site. Post local fire department call number on each telephone instrument at project site.

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PART 6 TRAFFIC REGULATION

6.01 GENERAL

- A. Signs, marking barricades and procedures, shall conform to the requirements of the Florida Department of Transportation Manual on Traffic Controls and Safe Practices for Street and Highway Construction, Maintenance, and Utility Operations.
- B. Use of existing site access roads will be permitted to Contractor's personnel who lawfully frequent the site.
- C. Existing roads shall be kept open by Contractor for the passage of vehicular traffic and pedestrians during the construction period unless otherwise approved by Owner. Routes of ingress and egress to the location of the Work shall be clearly marked by Contractor and approved by Owner before use by Contractor.
- D. Control and maintain traffic within the project area. Supply traffic control personnel if directed by Engineer. Provide signs, signals, barricades, lights and personnel to regulate all traffic and to warn vehicles and personnel of hazards. Such Work shall conform to the requirements of authorities having jurisdiction and as required by Owner.
- E. Construct and maintain temporary roads required for excavation operations, fill hauling operations, and disposal of excavated material.
- F. Provide for access by emergency traffic, such as police, fire, and disaster units at all times. Contractor shall be liable for damages resulting from failure to provide such access.
- G. Contractor is responsible for providing security at any construction entrances to the facility.

6.02 SIGNAGE

- A. The Contractor shall provide and maintain adequate barricades around open excavations.

6.03 REMOVAL OF SIGNAGE

- A. On completion of work, the Contractor shall remove all debris, excess materials, barricades, and temporary work leaving walkways and road clear of obstructions.

END OF SECTION

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SECTION 01590 FIELD OFFICES

PART 1 GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

- A. Promptly after starting work, the Contractor shall provide a field office for his use. The Contractor shall maintain the office until the completion of the work to be done under this Contract. The Contractor's field office shall be the size required for his use plus adequate space to hold project meetings (minimum seating - 6).
- B. The Contractor shall provide and maintain in the vicinity of the Work site a suitable all-year-round air-conditioned office with minimum width of twelve (12) feet and having not less than one hundred forty (140) square feet for the exclusive use of the CQA Consultant. The office shall have a lockable exterior door and a minimum of one (1) operable window at each exterior wall.
- C. The Contractor shall furnish, install, and maintain storage and work sheds as needed or required for the construction. Should the construction site change, field offices, storage, and work sheds shall be moved to a convenient location at the new site.
- D. The Contractor shall be responsible for obtaining all permits required to install and maintain the field offices.
- E. The Contractor's Field Office is not compulsory. In the event the Contractor does not bring a field office, the Contractor will not be allowed to share any facilities with the CQA Consultant.

PART 2 MISCELLANEOUS

2.01 CONSTRUCTION FIELD OFFICE

- A. The Contractor shall provide, at minimum, in the construction field office:
 - 1. Electric lights (50 foot candles at desk top height) and power supply outlets.
 - 2. Two private telephone lines with a facsimile/answering machine.
 - 3. Acceptable toilet facilities.

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4. Water cooler, bottled water and paper cups for the duration of the Contract Period.
5. Table for viewing Project Drawings.
6. Two (2) office desks with drawers and two (2) swivel chairs.
7. Suitable file cabinet(s) containing a copy of the complete project records.
8. Standard Office Supplies.
9. Air Conditioning and Heating System.
10. One (1) dry chemical fire extinguisher mounted on wall per NFPA-#10.
11. One (1) First Aid Kit for ten (10) people (wall mounted).

PART 3 INSTALLATION

The field office shall be installed on a clean, graded, well-drained area of suitable size. Installation of the field office shall meet all local building codes and ordinances. Where no such apply, the Contractor shall as a minimum install the structure on a level foundation and secure it against 100 mph winds. Office shall be provided with structurally sound and safe steps and landings for each door. Office shall be designated a “No Smoking Area.”

PART 4 REMOVAL AT COMPLETION OF CONTRACT

On the completion of the contract, the Contractor shall remove the office, storage, sheds and all such temporary facilities from the site at a time discussed in paragraph 1.0 of this section. Remove foundations and debris, grade site to required elevations, grass disturbed area, and clean and remove trash and debris.

END OF SECTION

Attachment B - Technical Specifications

SECTION 01600 MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 NEW MATERIALS AND EQUIPMENT

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

1.02 STANDARD SIZE AND GAUGES

Manufactured and fabricated 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 gauges to be interchangeable.

1.03 INTERCHANGEABILITY

Quantities of items that are identical shall be by the same manufacturer.

1.04 SUITABILITY OF USE

Products shall be suitable for service conditions.

1.05 MATCH SPECIFICATIONS

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

1.06 USE INTENDED

Material and equipment shall not be used for any purpose other than that for which it is designed or is specified.

1.07 EXISTING EQUIPMENT

Where material or equipment 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.

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1.08 OFF-SITE STORAGE AND TRANSPORTATION

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

1.09 SALVAGED MATERIALS

In the absence of special provisions to the contrary, salvaged materials, equipment, or supplies that occur are the property of the Owner and shall be cleaned and stored as directed by the Engineer. Surplus excavated materials become the property of the Contractor and shall be disposed of by him.

1.10 MANUFACTURER'S INSTRUCTIONS

The installation of all Work shall comply with manufacturer's printed instructions. Contractor shall obtain and distribute copies of such instructions to parties involved in the installation including two copies to the Engineer. One complete set of instructions shall be maintained at the job site during installation and until completion. All products and equipment shall be handled, installed, connected, cleaned, conditioned, and adjusted in accordance with the manufacturer's instructions and specified requirements. Should job conditions or specified requirements conflict with manufacturer's instructions, such conflicts shall be called to the Engineer's attention for resolution and revised instructions.

1.11 EQUIPMENT GUARANTEE

All mechanical and electrical equipment, together with devices of whatever nature and all components, 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, improper assembly, hidden damage, failure of devices 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 one year or such longer period as may be shown and/or specified from and after the date of acceptance of the equipment by the Owner. Each piece of equipment, device, or component which 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 Owner. Failure of the Contractor to provide timely repairs as specified herein shall result in a claim being issued by the Owner against either the Contractor's Performance and Payment Bond or Maintenance Bond.

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1.12 OPERATING CHARACTERISTICS

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.

1.13 LUBRICATION SYSTEM

The minimum design criteria for lubrication of moving parts of the equipment shall include one week of continuous operation during which no lubricants shall be added to the system. The system shall be designed to receive lubricants whether in operation or shut down, and shall not leak or waste lubricants under either condition. The manufacturer's recommendations of grade and quality and a supply of the lubricants so recommended in quantities sufficient to conduct start up and testing operations shall be furnished with the equipment.

1.14 SAFETY REQUIREMENTS

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

1.15 NAMEPLATES

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

PART 2 TRANSPORTATION AND HANDLING

2.01 LOADING - UNLOADING

Materials and equipment shall be loaded and unloaded by methods affording adequate protection against damage. Every precaution shall be taken to prevent injury to the material or equipment during transportation and handling. Suitable power 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 so placed that all lifting is done in a vertical plane. Materials or equipment skid loaded, palletized, or handled on skidways shall not be skidded or rolled against material or equipment already unloaded.

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2.02 TRANSPORTATION

- A. Material and equipment shall be delivered to the job site by means that will adequately support it and not subject it to undue stresses. Material and equipment damaged or injured in the process of transportation unloading or handling shall be rejected and immediately removed from the site.
- B. All trucks bringing to or removing from the site, earth, loose materials or debris shall be loaded in a manner to prevent dropping of materials on streets.
- C. At all points, where trucks leave the project site and enter adjacent paved streets, Contractor shall maintain a crew to prevent any mud from being carried onto such adjacent paved streets.
- D. Earth, loose materials or debris deposited on the streets due to contract trucking activities shall be removed daily.
- E. All trucks entering or leaving the project shall be covered by a tarp.

PART 3 STORAGE

3.01 DELIVERY OF MATERIALS

The Contractor shall coordinate the delivery of all materials, including those furnished by the Owner (if any). He shall be responsible for the proper transport, handling, and storage of all materials, and they shall be protected to ensure their expected performance. Delivery schedules shall be coordinated by the Contractor, in advance, such that timely prosecution of the work will be effected.

3.02 STORAGE SPACE

Outside storage space for materials and equipment shall be available at the Owner's site. The Contractor shall be responsible for keeping the areas used for storage neat and orderly and shall install such security equipment as he deems necessary to safeguard his tools, equipment, and materials.

END OF SECTION

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SECTION 01710 FINAL CLEANING

PART 1 DESCRIPTION OF REQUIREMENTS

1.01 GENERAL

The Contractor shall execute cleaning during progress of the work and at the completion of the work as required by General Conditions.

1.02 ENVIRONMENTAL CONCERNS

Cleaning and disposal operations shall comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2 MATERIALS

A. The Contractor shall:

1. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
2. Use only those cleaning materials and methods recommended by manufacturer of the surfaces recommended by manufacturer of the surface material to be cleaned.
3. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 DURING CONSTRUCTION

A. The Contractor shall:

1. Execute periodic cleaning to keep the work, the site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris.
2. Clean-up shall be performed as required to prevent accidents to personnel, protect all Work in place, and to effect completion of the project in an orderly manner.
3. Construction clean-up shall consist of but not be limited to the removal of all mud, oil, grease, sand, gravel, dirt, trash, scrap, debris, and excess

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materials, from any floor space or walking surface, that may cause the tripping or sliding of Workmen, ladders, or equipment. Particular attention shall be given to the removal of water from floor areas where electrical power tools are to be used and to the prevention of stains on concrete which will be exposed in the finish Work.

4. Provide onsite containers for the collection of waste materials, debris, and rubbish.
5. Remove waste materials, debris, and rubbish from the site periodically and dispose of at legal areas away from the site.
6. Burning of waste material will not be permitted.

PART 4 DUST CONTROL

A. The Contractor shall:

1. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.
2. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.

PART 5 FINAL CLEANING

A. The Contractor shall:

1. Employ skilled workmen for final cleaning.
2. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces.
3. Broom clean exterior paved surface; rake clean other surfaces of the grounds.
4. Prior to final completion or Owner occupancy, Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces, and all work areas, to verify that the entire work is clean.

END OF SECTION

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SECTION 01770 CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 CLOSEOUT PROCEDURES

- A. Contractor shall submit written certification before final payment that Contract Documents have been reviewed, work has been inspected, and that work is complete, in accordance with Contract Documents, and ready for Engineer's and Owner's substantial and final inspection.
- B. Contractor shall provide "as-built" documentation, all submittals of these Specifications, and any other submittals required by governing or other authorities to Engineer and Owner.
- C. Contractor shall submit final Application for Payment identifying total adjusted Contract Sum (adjusted, if appropriate), previous payments, and sum remaining due.

1.02 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following and list items below that are incomplete in request:
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list and reasons why the Work is not complete.
 - 2. Provide Owner with an explanation of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications and similar documentation.
 - 4. Terminate and remove temporary facilities from project site.
 - 5. Complete final cleaning requirements.
- B. Inspection: Contractor shall submit in writing a request for inspection for Substantial Completion. After inspection, Engineer will prepare a list of deficiencies (punch list) if any, required for certification of substantial completion. Items identified by the Contractor and/or Engineer must be completed before the Certificate of Substantial Completion will be issued.

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1. Results of completed inspection will form the basis of requirements for Final Completion.
- C. Reinspection: Contractor shall request reinspection once all deficient items have been verified to be complete or corrected by Engineer and/or Engineer's Representative.

1.03 FINAL COMPLETION

- A. Contractor shall submit in writing certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected as part of substantial completion. The certified copy of the inspection list shall state that each item has been completed or otherwise resolved for final approval and acceptance.
- B. Inspection: Contractor shall submit in writing a request for inspection for Final Completion and acceptance. Upon receipt of request, Engineer will either proceed with inspection or notify the Contractor of outstanding items required for final completion in accordance with the Contract Documents. Engineer will prepare a final Certificate for Payment after inspection or notify Contractor of outstanding items that must be completed or corrected prior to issuance of final certification.
- C. Reinspection: Contractor shall request reinspection once outstanding items have been verified to be complete or corrected by Engineer and/or Engineer's Representative.

1.04 PROJECT RECORD DOCUMENTS

- A. Contractor shall maintain on site, one set of the following Project Record Documents:
1. Red-line drawings.
 2. Specifications.
 3. CQA Plan.
 4. Addenda.
 5. Change Orders, Field Orders, and other modifications to the Contract.
 6. Approved Shop Drawings.
 7. Product data and samples.
 8. As-built documentation and record drawings.
 9. Other approved documents submitted by Contractor in compliance with these Specifications.

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- B. Contractor shall store Project Record Documents separate from documents used for construction in fireproof files.
- C. Contractor shall record information concurrent with construction progress.
- D. Contractor shall legibly mark each project record document and shop drawing item to record actual construction, including:
 - 1. Field changes of dimension and detail; and
 - 2. Details not on original Drawings.
- E. Contractor shall submit a complete copy of the Project Record Documents identified in the Contract Documents to Owner with claim for final Application for Payment.

1.05 WARRANTIES

- A. Submit written warranties for designated portions of the Work where commencement of warranties other than date of substantial completion is indicated.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1.06 GUARANTEES

Contractor shall guarantee all of the Work included in this Contract for a period specified in the front-end contract documents:

- A. Against all faulty or imperfect materials and against all imperfect, careless, or unskilled workmanship on the part of Contractor, its subcontractors, suppliers, or component manufacturers.
- B. The entire Work and each and every part thereof shall operate, with normal care and attention, in a satisfactory and efficient manner, and in accordance with the requirements of the Specifications.
- C. Contractor agrees to replace with proper workmanship and materials, and to re-execute, correct, or repair without cost to Owner, Work that may be found to be improper or imperfect or that does not operate in satisfactory manner or fails to perform as specified.
- D. The guarantee obligations assumed by Contractor under the Specifications shall not be held or taken to be in any way impaired because of the Specifications,

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indication or approval by or on behalf of Owner of any articles, materials, means, combinations or things used or to be used in the construction, performance, and completion of the Work or any part thereof.

- E. No use or acceptance by Owner of the Work specified herein, or any part thereof, nor any repairs, adjustments, replacements, or corrections made by Owner due to Contractor's failure to comply with any of its obligations under the Specifications shall impair in any way the guarantee obligations assumed by Contractor under the Contract Documents.
- F. If these contract documents include warranty periods for products, installation and other Work that exceed the guarantee period, these items' warranty periods shall not be superseded by the warranty period.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

3.01 FINAL CLEANING

- A. Upon completion of work, and prior to final inspection, Contractor shall remove all of its equipment, signs, facilities, construction materials, and trash, and shall perform any other reasonable cleanup activities requested by Owner. All disturbed areas shall be revegetated, restored, or otherwise put into a condition satisfactory to Owner. Revegetation shall be carried out in accordance with the Specifications.
- B. Conduct cleaning and waste removal operations in accordance with local laws and ordinances and federal and local environmental and antipollution regulations.
- C. Contractor shall comply with health and safety standards during cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems.

END OF SECTION

DIVISION 2
SITE CONSTRUCTION

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SECTION 02020 ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.01 WORK INCLUDED

This section covers the work necessary to provide and maintain environmental protection.

1.02 RELATED WORK

- A. Section 01500, Temporary Facilities and Controls
- B. Section 02220, Earthwork
- C. Section 02270, Soil Erosion and Sedimentation Control
- D. Section 02485, Sodding
- E. Section 02486, Hydroseeding

1.03 REFERENCED STANDARDS

The publications listed below form a part of this specification as if incorporated herein except as modified herein to the extent referenced. Referenced standards and recommended practices referred to herein shall be the latest edition of any such document.

- A. Environmental Protection Agency (EPA) Regulations:
 - 1. 40 CFR 112 Oil Pollution Prevention.
 - 2. 40 CFR 122 National Pollutant Discharge Elimination System (NPDES).
 - 3. 40 CFR 261 Identification and Listing of Hazardous Waste.
 - 4. 40 CFR 403 General Pretreatment Regulations for Existing and New Sources of Pollution.
 - 5. PL 96-510 Comprehensive Environmental Response Compensation and Liability Act of 1980.
- B. Florida Department of Transportation (DOT) Regulations:
 - 1. 49 CFR 171 Hazardous Materials - General Information, Regulations, and Definitions.

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2. 49 CFR 172 Hazardous Materials Tables, Hazardous Materials Communications, Requirements, and Emergency Response Information Requirements.

1.04 SUBMITTALS

- A. The Contractor shall be responsible for the preparation and submission of an environmental protection plan before commencing work. The environmental protection plan shall include, but not be limited to, discussion of the items referenced in Section 3.0.
- B. The Contractor shall be required to submit a copy of the obtained NPDES - Construction Activity Permit as soon as it becomes available.

1.05 GENERAL REQUIREMENTS

- A. The Contractor shall provide and maintain environmental protection during the life of the work as defined herein and in accordance with the Contractor's NPDES - Construction Activity Permit. Environmental protection shall be provided to correct conditions that develop during the construction of permanent or temporary environmental protection features or that are required to control pollution that develops during normal construction practices. The Contractor's operations shall comply with all federal, state, and local regulations pertaining to water, air, solid waste, hazardous waste substances, asbestos and asbestos material, oily substances, and noise pollution.

1.06 DEFINITIONS OF CONTAMINANTS

- A. Asbestos and Asbestos Material: Asbestos means actinolite, amphibole, amosite, anthophyllite, chrysotile, crocidolite, and tremolite. Asbestos material means asbestos or any material containing asbestos (such as asbestos waste, scrap, debris bags, containers, equipment, and asbestos contaminated clothing consigned for disposal).
- B. Debris: Includes both combustible and noncombustible wastes such as ashes, waste materials that result from construction or maintenance and repair work, leaves, and tree trimmings.
- C. Hazardous Material: As defined in United States (U.S.) Florida Department of Transportation (DOT) 49 Code of Federal Regulations (CFR) 171 and listed in U.S. DOT 49 CFR 172.
- D. Hazardous Substance: As defined in Public Law 96-510 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

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- E. Hazardous Waste: As defined in EPA 40 CFR 261 and/or appropriate state regulations.
- F. Oily Substance: Includes petroleum products and bituminous materials.
- G. Rubbish: A variety of combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.
- H. Sanitary Wastes:
 - Sewage - That which is considered domestic sanitary sewage.
 - Garbage - Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.
- I. Sediment: Soil and other debris that has been eroded and transported by runoff water or wind.
- J. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, residential, and agricultural operations and from community activities.
- K. Waste fill (refuse and fill): Any combination of solid waste, garbage, rubbish and debris that has been previously landfilled for final disposal.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

3.01 PROTECTION OF NATURAL RESOURCES

- A. General: It is intended that the natural resources within the project boundaries and outside the limits of permanent work performed be preserved in their existing condition or be restored to an equivalent or improved condition, as determined by the Engineer, upon completion of the work. The Contractor shall confine his construction activities to areas defined by the Work Schedule, Drawings, and these Specifications.
- B. Land Resources: Except in areas indicated to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy trees or shrubs. No ropes, cables, or guys shall be fastened to or attached to any existing trees for anchorage unless specifically authorized by the Engineer. Where such special emergency use is

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permitted, the Contractor shall be responsible for any damage resulting from such use.

1. The Contractor shall include in the environmental protection plan the steps for protecting existing trees which are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. Rocks that are displaced into uncleared areas shall be removed and disposed of by the Contractor.
2. Repair or Restoration: All trees or other landscape features scarred or damaged by the Contractor's equipment or operations shall be repaired and/or restored to their original condition at the Contractor's expense. The Engineer shall approve the repair and/or restoration prior to its initiation and upon completion.
3. Temporary Construction: The Contractor shall completely remove all temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and all other vestiges. Temporary roads, parking areas, and similar temporary use areas shall be graded in conformance with surrounding areas and shall be tilled and seeded, unless within areas specified to be otherwise landscaped or developed. Seeding shall include, but not be limited to, topsoil, nutriment, and maintenance as necessary to establish a suitable stand of grass and shall be in accordance with Section 02485, Grassing.

C. Water Resources

1. All work under this contract shall be performed in such a manner that any adverse environmental impact to water resources, where applicable, is reduced to a level that is acceptable to the applicable environmental agencies and the Owner.
2. Oily and Hazardous Substances: Special measures shall be taken at all times to prevent oily and/or other hazardous substances including soil sterilent materials from entering the ground, drainage areas, or bodies of water. Environmental requirements applicable to the prevention of oil spill are contained in EPA 40 CFR 112.

D. Fish and Wildlife Resources: The Contractor shall at all times perform all work and take such steps required to prevent any interference or disturbance to fish and wildlife. The Contractor will not be permitted to alter water flows or otherwise significantly disturb native habitat adjacent to the project area which are critical to fish and wildlife, except as may be indicated or specified.

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- E. Historical and Archaeological Resources: All items having any apparent historical or archaeological interest which are discovered in the course of any construction activities shall be carefully preserved and reported immediately to the Owner and the Engineer for determination of actions to be taken.

3.02 EROSION AND SEDIMENT CONTROL MEASURES

- A. Burn-Off: Burn-off of ground cover will not be permitted without prior approval of the Engineer and the necessary regulatory permits. The Contractor is responsible for obtaining all required permits prior to burning. The Contractor is also responsible for impacts to public safety, including traffic safety, from the burn event (smoke, etc.).
- B. Reduction of Exposure of Unprotected Erodible Soils: Earthwork brought to final grade shall be finished immediately as indicated and specified. Where side and back slopes shall be protected immediately upon completion of rough grading. All earthwork shall be planned and conducted in such a manner as to minimize the duration of exposure of unprotected soils.
- C. Temporary Protection of Erodible Soils: Such methods as may be necessary shall be used to prevent erosion and control sedimentation effectively, including, but not limited to, the following:
 - 1. Mechanical Retardation and Control of Runoff: The rate of runoff from the construction site shall be mechanically retarded and controlled. This includes construction of diversion ditches, benches, and berms to retard and divert runoff to protected drainage courses.
 - 2. Vegetation and Mulch: If necessary to prevent erosion, temporary protection shall be provided on all side and back slopes as soon as rough grading is completed or sufficient soil is exposed to require protection. Such protection shall be by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Slopes too steep for stabilization by other means shall be stabilized by hydroseeding, mulching anchored in place, covering by anchored netting, sodding, or such combination of these and other methods as may be necessary for effective erosion control.
- D. The Contractor shall provide temporary protection of erodible soils in the landfill cell area, excavations, and existing swales. Protection shall include, but not limited to, the use of silt fences, haybales, etc.

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3.03 CONTROL AND DISPOSAL OF SOLID, HAZARDOUS, AND SANITARY WASTES

- A. General: Wastes generated by the Contractor shall be picked up and placed in containers provided by the Contractor which are emptied on a regular schedule at the expense of the Contractor. All handling and disposal shall be so conducted as to prevent contamination of the site and any other areas. Upon completion, the areas shall be left clean and natural looking. All signs of temporary construction and activities incidental to construction of the required permanent work shall be completely removed.
- B. Disposal of Rubbish and Debris: The Contractor shall dispose of all waste in a manner that complies with federal, state, and local requirements. The Contractor shall have a copy of state and/or local permit or license which reflects such agency's approval and his compliance with their solid waste disposal regulations. All waste material generated by the Contractor, with the exception of waste fill excavated as part of earthwork operations, shall be disposed of at a permitted disposal facility at the expense of the Contractor. The permit or license and the location of the disposal area used by the Contractor shall be provided to the Engineer prior to transportation and disposal of any material by the Contractor.

All waste fill excavated by the Contractor as part of earthwork operations shall be disposed of on site within lined Cell III-A or III-B as directed by the Owner. Excavated waste fill shall not be stockpiled with excavated earth fill.

- C. Sewage, Odor, and Pest Control: Sewage shall be disposed of through connection to municipal, district, or station sanitary sewerage systems. No substances shall be disposed of to a sewerage system which will interfere with treatment plant operation, in accordance with EPA 40 CFR 403. Where such systems are not available, chemical toilets or comparably effective units shall be used with wastes periodically emptied into municipal, district, or station sanitary sewerage systems. Provisions shall be made for pest control and elimination of odors.
- D. Hazardous Waste: Hazardous waste shall be handled, stored, manifested, and disposed of in accordance with federal, state, and local regulations. All hazardous waste generated from an activity must be identified as being generated under the activity "EPA Hazardous Waste Generator Number" for manifesting purposes.

3.04 DUST CONTROL

Dust shall be minimized at all times, including but not limited to, nonworking hours, weekends, and holidays. Soil at the site, haul roads, and other areas disturbed by the Contractor's operations shall be wetted or treated by other approved means, as necessary, to control dust.

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3.05 NOISE

The maximum use shall be made of “low-noise-emission products” as certified by the EPA when available. No blasting or use of explosives will be permitted.

END OF SECTION

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SECTION 02095 FABRIC FORMED CONCRETE

PART 1 GENERAL

1.01 SCOPE OF WORK

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

1.02 DESCRIPTION

The work shall consist of installing an unreinforced concrete lining by positioning specially woven, double layer synthetic forms on the surface to be protected and filling them with a pumpable fine aggregate concrete (structural grout) in such a manner as to form a stable lining of required thickness, weight and configuration.

1.03 REFERENCED STANDARDS

A. American Society for Testing and Materials (ASTM)

ASTM D 5261 Test Method for Measuring Mass per Unit Area of Geotextiles

ASTM D 5199 Test Method for Measuring Nominal Thickness of Geosynthetics

ASTM D 4595 Test Method for Tensile Properties of Geotextiles by the Wide Width Strip Method

ASTM D 4632 Test Method for Breaking Load and Elongation of Geotextiles

ASTM D 4533 Standard Test Method for Trapezoidal Tearing Strength of Geotextiles

ASTM D 4751 Test Method for Determining Apparent Opening Size for a Geotextile

ASTM D 4491 Standard Test Methods for Water Permeability of Geotextiles by Permittivity

ASTM D 4759 Standard Practice for Determining the Specification Conformance of Geosynthetics

ASTM D 4354 Standard Practice for Sampling of Geosynthetics for Testing

ASTM D 4884 Standard Test Method for Strength of Sewn or Bonded Seams of Geotextiles

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ASTM D 4873 Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples

ASTM C 939 Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)

ASTM C 31 Standard Practice for Making and Curing Concrete Test Specimens in the Field

ASTM C 39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

ASTM C 150 Standard Specification for Portland Cement

ASTM C 33 Standard Specification for Concrete Aggregates

ASTM C 618 Standard Specification for Coal Fly Ash and Calcined Natural Pozzolan for Use in Concrete

ASTM C 494 Standard Specification for Chemical Admixtures for Concrete

ASTM C 260 Standard Specification for Air-Entraining Admixtures for Concrete

1.04 SUBMITTALS

- A. The Contractor shall submit to the Engineer all manufacturers' full-scale flume hydraulic testing and calculations in support of the proposed fabric formed concrete lining system and geotextile.
- B. The Contractor shall furnish the manufacturer's certificates of compliance for the fabric formed concrete lining. The Contractor shall also furnish the manufacturer's specifications, literature, shop drawings for the layout of the lining, and any recommendations, if applicable, that are specifically related to the project.
- C. Alternative materials may be considered. Such materials must be pre-approved in writing by the Engineer prior to the bid date. Alternative material packages must be submitted to the Engineer a minimum of fifteen (15) days prior to the bid date. Submittal packages must include, as a minimum, the following:
 - 1. Full-scale laboratory testing and associated engineering calculations quantifying the hydraulic capacity of the proposed fabric formed concrete lining system in similar conditions to the specified project.
 - 2. Material testing reports prepared by a certified geotextile laboratory attesting to the alternative material's compliance with this Specification.

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TABLE 02095-1 FILTER POINT (FP) CONCRETE LININGS

<u>Physical Properties</u>	Value
Average Thickness (in)	3
Mass Per Unit Area (lb/ft ²)	34
Filter Point Spacing (in)	6
Area Per Filter Point (in ²)	2
Perimeter Per Filter Point (in)	6.5
<u>Hydraulic Design Properties</u>	
Shear Resistance (lb/ft ²)	15

PART 2 PRODUCT

2.01 FABRIC FORMED CONCRETE LINING

Fabric formed concrete lining(s) shall be Filter Point (FP) type and shall meet or exceed the minimum property values listed in Table 02095-1.

2.02 FABRIC FORMS

- A. The fabric forms for casting the concrete lining(s) shall be as HYDROTEX® Filter Point or approved equal. The fabric forms shall be composed of synthetic yarns formed into a woven fabric. Each layer of fabric shall conform to the physical, mechanical and hydraulic requirements listed in Table 02095-2. The fabric forms shall be free of defects or flaws which significantly affect their physical, mechanical, or hydraulic properties.

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Table 02095-2 FILTER POINT (FP) FABRIC

	Test Method	Units	Values
Physical Properties			
Composition of Yarns			Polyester
Mass Per Unit Area (double-layer)	ASTM D 5261	oz/yd ² (g/m ²)	11.3 (319)
Thickness	ASTM D 5199	mils (mm)	25 (0.6)
Mill Width		in (m)	83 (2.1)
Mechanical Properties			
Wide-Width Strip Tensile Strength	ASTM D 4595		
MD		lbs (kN/m)	295 (51.7)
TD		lbs (kN/m)	269 (45.7)
Elongation at Break	ASTM D 4595		
MD		%	13
TD		%	13
Grab Tensile Strength	ASTM D 4632		
MD		lbs/in	310 (54.3)
TD		lbs/in	228 (39.9)
Elongation at Break	ASTM D 4632		
MD		%	23
TD		%	20
Trapezoidal Tear Strength	ASTM D 4533		
MD		lbs (N)	125 (556)
TD		lbs (N)	105 (467)
Hydraulic Properties			
Apparent Opening Size (AOS)	ASTM D 4751	US Standard Sieve (mm)	16 (1.18)
Permittivity	ASTM D 4491	sec ⁻¹	2.4
Flow Rate	ASTM D 4491	gal/min/ft ² (l/min/m ²)	180 (7330)
Flow Rate through Filter Point	ASTM D 4491	gal/min/ft ² (l/min/m ²)	7 (285)

Notes:

1. Conformance of fabric to specification property requirements shall be based on ASTM D 4759, "Standard Practice for Determining the Specification Conformance of Geosynthetics."
2. All numerical values represent minimum average roll values (i.e., average of test results from any sample roll in a lot shall meet or exceed the minimum values). Lots shall be sampled according to ASTM D 4354, "Standard Practice for Sampling of Geosynthetics for Testing."

- B. Fabric forms shall consist of double-layer woven fabric joined together by spaced, interwoven filter points to form a concrete lining with a deeply cobbled surface appearance. Filter points shall be formed by interweaving the double-layer fabric to form water permeable drains and attachment points for the control of concrete lining thickness. The interweaving of the fabric layers shall form an area of double density, high strength, single-layer fabric with area and perimeter given in Table 02095-1.

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- C. All seams sewn in the factory shall be not less than 100 lbf/in when tested in accordance with ASTM D 4884. All sewn seams and zipper attachments shall be made using a double line of U.S. Federal Standard Type 401 stitch.
- D. Baffles shall be installed at predetermined mill width intervals to regulate the distance of lateral flow of fine aggregate concrete. The baffle material shall be nonwoven filter fabric. The grab tensile strength of the filter fabric shall be not less than 90 lbf (400 N) when tested in accordance with ASTM D 4632.
- E. The fabric forms shall be kept dry and wrapped such that they are protected from the elements during shipping and storage. If stored outdoors, they shall be elevated and protected with a waterproof cover that is opaque to ultraviolet light. The fabric forms shall be labeled as per ASTM D 4873, "Standard Guide for Identification, Storage and Handling of Geosynthetic Rolls and Samples."
- F. The Contractor shall submit a manufacturer's certificate that the supplied fabric forms meet the criteria of these Specifications, as measured in full accordance with the test methods and standards referenced herein. The certificates shall include the following information about each fabric form delivered:
 - 1. Manufacturer's name and current address; full product name
 - 2. Style and product code number; form number(s)
 - 3. Composition of yarns
 - 4. Manufacturer's certification statement

2.03 FINE AGGREGATE CONCRETE

- A. Fine aggregate concrete shall consist of a proportioned mixture of Portland cement, fine aggregate (sand) and water. The consistency of the fine aggregate concrete delivered to the concrete pump shall meet manufacturer specifications. The mix shall exhibit a compressive strength of 2,000 lb/in² (13.8 MPa) 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.
- C. Fine aggregate shall conform to ASTM C 33, except as to grading. Aggregate grading shall be reasonably consistent and shall not exceed the maximum size which can be conveniently handled with available pumping equipment.
- 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 618, Class C, F or N.

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- F. Plasticizing and air entraining admixtures, if used, shall conform to ASTM C 494 and ASTM C 260, respectively.

2.04 FILTER FABRICS

- A. The geotextile filter fabrics shall be composed of synthetic fibers or yarns formed into a nonwoven or woven fabric. Fibers and yarns used in the manufacture of filter fabrics shall be composed of at least 85% by weight of polypropylene, polyester or polyethylene. The materials shall conform to the physical requirements listed in Table 02095-3. The geotextile shall be free of defects or flaws which significantly affect its mechanical or hydraulic properties.
- B. The geotextile filter fabric must be permitted to function properly by allowing relief of hydrostatic pressure; therefore fine soil particles shall not be allowed to clog the geotextile.
- C. The geotextile filter fabric shall be kept dry and wrapped such that they are protected from the elements during shipping and storage. If stored outdoors, they shall be elevated and protected with a waterproof cover that is opaque to ultraviolet light. The fabric forms shall be labeled as per ASTM D 4873, “Standard Guide for Identification, Storage and Handling of Geosynthetic Rolls and Samples.”

TABLE 02095-3 FILTER FABRIC

	Test Method	Units	Values
Mechanical Properties			
Grab Tensile Strength	ASTM D 4632	lbf/in	90 (in any principal direction)
Elongation at Break	ASTM D 4632	%	50 max. (in any principal direction)
Trapezoidal Tear Strength	ASTM D 4533	lbf/in	40 (in any principal direction)
Puncture Strength	ASTM D 4833	lbs	55 (in any principal direction)
CBR Puncture Strength	ASTM D 6241	lbs	250 (in any principal direction)
Hydraulic Properties			
Apparent Opening Size (AOS)	ASTM D 4751	US Sieve	60 max.
Permittivity	ASTM D 4491	sec ⁻¹	1.0
Flow Rate	ASTM D 4491	gal/min/ft ²	50

Notes:

- Conformance of fabric to specification property requirements shall be based on ASTM D 4759, “Standard Practice for Determining the Specification Conformance of Geosynthetics.”

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PART 3 EXECUTION

3.01 SITE PREPARATION

- A. Areas on which fabric forms are to be placed shall be constructed to the lines, grades, contours, and dimensions shown on the Contract Drawings. All obstructions such as roots and projecting stones shall be removed. Where such areas are below the allowable grades, they shall be brought to grade by placing compacted layers of clean fill. Soft and otherwise unsuitable subgrade soils shall be identified, excavated and replaced with select materials in accordance with the Contract Specifications.
- B. Excavation and preparation of aprons as well as anchor, terminal or toe trenches shall be done in accordance with the lines, grades, contours, and dimensions shown on the Contract Drawings.
- C. Immediately prior to placing the fabric forms, the prepared area shall be inspected by the CQA Consultant, and no forms shall be placed thereon until the area has been approved.

3.02 FABRIC FORM PLACEMENT

- A. A filter fabric shall be placed on the graded surface approved by the CQA Consultant.
- B. Fabric forms shall be placed over the filter fabric and within the limits shown on the Contract Drawings. Anchoring of the fabric forms shall be accomplished through the use of anchor, terminal and toe trenches.
- C. Adjacent fabric forms shall be joined before filling with fine aggregate concrete by field sewing or zipping the two bottom layers of fabric together and the two top layers of fabric together.
- D. When conventional joining of fabric forms is impractical or where called for on the Contract Drawings, adjacent forms may be overlapped a minimum of 3 ft (1 m) to form a lap joint, pending approval by the Engineer. Based on the predominant flow direction, the downstream edge of the form shall overlap the upstream edge of the next form. In no case shall simple butt joints between forms be permitted.
- E. Immediately prior to filling with fine aggregate concrete, the assembled fabric forms shall be inspected by the CQA Consultant, and no fine aggregate concrete shall be pumped therein until the fabric seams have been approved. At no time

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shall the unfilled fabric forms be exposed to ultraviolet light (including direct sunlight) for a period exceeding five days.

3.03 FINE AGGREGATE CONCRETE PLACEMENT

- A. Following the placement of the fabric forms, small slits shall be cut in the top layer of the fabric form to allow the insertion of the filling pipe at the end of the fine aggregate concrete pump hose. These slits shall be of the minimum length to allow proper insertion of the filling pipe. Fine aggregate concrete shall be pumped between the top and bottom layers of fabric, filling the forms to the recommended thickness and configuration.
- B. Fine aggregate concrete shall be pumped in such a manner that excessive pressure on the fabric forms and cold joints are avoided. A cold joint is defined as one in which the pumping of the fine aggregate concrete into a given form is discontinued or interrupted for an interval of forty-five or more minutes.
- C. Holes in the fabric forms left by the removal of the filling pipe shall be temporarily closed by inserting a piece of nonwoven fabric or similar material. The nonwoven fabric shall be removed when the concrete is no longer fluid and the concrete surface at the hole shall be cleaned and smoothed by hand. Foot traffic on the filled form shall not be allowed for one hour after filling.
- D. After the fine aggregate concrete has set, all anchor, terminal and toe trenches shall be backfilled and compacted.

END OF SECTION

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SECTION 02120 PAVING AND SURFACING

PART 1 GENERAL

1.01 SCOPE OF WORK

This Work shall consist of furnishing all labor, materials, tools, testing and equipment necessary to install and construct all road base coarse and bituminous asphaltic paving.

1.02 RELATED WORK

- A. Section 02220 - Earthwork
- B. Section 02270 - Erosion and Sedimentation Control

1.03 SUBMITTALS

Furnish certification from concrete, bituminous and aggregate producers attesting that materials conform to the requirements of the latest edition of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction (FDOT Specifications) and latest edition of the FDOT Flexible Pavement Manual.

1.04 CONSTRUCTION QUALITY ASSURANCE

- A. Source Quality Control:
 - 1. Use materials conforming to requirements of the latest FDOT Specifications Section 334 and the latest workbook for revisions.
 - 2. Use products of a bituminous asphalt concrete producer regularly engaged in production of bituminous asphalt concrete conforming to the standards referenced herein.
 - 3. Maintain quality of work by using products of a qualified bituminous concrete producer and qualified plant operating workmen.

- B. Construction Quality Assurance (CQA)

Testing will be conducted by the Contractor for Quality Control for verification to determine compliance with the specified degree of compaction and moisture content in accordance with FDOT Specification Section 200-6.4. for subbase and FDOT Specification Section 160-7 for subgrade. Testing will be performed according to requirements outlined in FDOT Standard Specifications for Road and Bridge Construction Section 330.

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C. Referenced Standards:

1. ASTM International (ASTM):
 - a. D1557, Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.5-kg) Rammer and 18-in (457-mm) Drop
 - b. D2922, Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
 - c. D3017, Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
 - d. D946, Penetration-Graded Asphalt Cement for Use in Pavement Construction
2. Florida Department of Transportation
3. Asphalt Institute
 - a. MS-2, Mix Design Methods for Asphalt Concrete and Other Hot Mix Types
 - b. MS-3, Asphalt Plant Manual
 - c. MS-8, Asphalt Paving Manual
 - d. MS-19, Basic Asphalt Emulsion Manual

PART 2 PRODUCTS

2.01 MATERIALS

All materials shall conform to the latest edition of the Florida Department of Transportation Flexible Pavement Design Manual and as indicated on the Contract Drawings.

- A. Aggregate Road Base: Aggregate road base shall be limerock, 3/4-inch maximum grading conforming to FDOT Section 911.
- B. Liquid Asphalt: Liquid asphalt for tack coats base shall be Type RS-1 or RS-2 and shall comply with FDOT Section 300. Liquid asphalt for prime coats on the aggregate road base shall be Type RC-70 or RC-250 and shall comply with FDOT Section 300.
- C. Asphalt Concrete: Asphalt concrete shall be Superpave SP-12.5, Traffic Level C in accordance with FDOT Section 334.
- D. Traffic line paint shall be a white latex traffic paint 21209 by Glidden, Vin-L-Stripe acrylic epoxy traffic paint W-801 by Dunn-Edwards, or equal.

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PART 3 EXECUTION

3.01 PAVEMENT REMOVAL

A. General:

1. Cut any existing pavement to neat lines at the tie in of the proposed road to existing paved perimeter road.
2. Remove pavement to final pavement restoration pay-line widths as shown on the Drawings.
3. If pavement is removed or disturbed for a greater width without written authorization of the Engineer, the Owner will require the Contractor to replace such pavement without compensation.

- B. At joints between existing pavements and new paving work, a PG binder tack coat material shall be applied for adequate bonding.

3.02 AGGREGATE BASE PLACEMENT

- A. Subgrade: Areas to be improved shall be graded and well-compacted in accordance with paragraph 02200-3.06. Where indicated on the plans, the subgrade shall be treated with a stabilizing material (if necessary) for Type B stabilization (LBR 40) in accordance with FDOT Section 160.
- B. Aggregate Road Base: Placing of aggregate road base shall comply with FDOT Section 200. The aggregate road base shall be placed in multiple lifts. Relative compaction of each lift shall be a minimum of 98 percent of the maximum dry density as determined using methods set forth in ASTM D1557.
- C. Primed Aggregate Road Base: The aggregate road base shall be given a prime coat with liquid asphalt as specified and in conformance with FDOT Section 300.
- D. Prime coat shall be applied to the aggregate base prior to the placement of asphalt concrete pavement. The material shall be applied at a rate of no less than 0.15 gallons per square yard. Any prime coat material that has not penetrated the aggregate road base shall be “blotted” with clean dry silica sand.

3.03 ASPHALT CONCRETE PAVEMENT

Placement of asphalt concrete pavement shall comply with Leon County Standards and FDOT Specification Section 330. Berms shall be shaped and compacted with an extrusion machine. The asphalt mixture may include up to 30% recycled asphalt (maximum).

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A. Cleaning and Base: Before any bituminous material is applied, all loose material, dust, and foreign material which would prevent proper bond with existing surface shall be removed for the full width of the application. Particular care shall be taken to clean the outer edges of the strip to be treated in order to insure that the prime or tack coat will adhere. Where the prime or tack coat is applied adjacent to curb and gutter or valley gutter, such concrete surfaces are to be protected and kept free of bituminous material.

B. Preparation

1. Primer: The surface to be primed shall be clean and free of standing water. For limerock road bases, the glazed finish shall have been removed leaving a granular or porous condition that will allow free penetration of bituminous material. The temperature of the prime material shall be between 100 degrees F and 150 degrees F. The actual temperature will be that which will insure uniform distribution. The amount of bituminous material applied shall be not less than 0.10 gallon per square yard for limerock base and not less than 0.15 gallon per for sand clay, soil cement, or shell base.

A light uniform application of clean sand shall be applied prior to opening the primed base to traffic, in which case the sand shall be rolled with a traffic roller. If warranted by traffic conditions, the application shall be made only on one-half of the width of the base at one time, care being taken to secure the correct amount of bituminous material at the joint. The base shall be sufficiently moist in order to obtain maximum penetration of the asphalt.

2. Tack Coat: Where a bituminous surface is to be laid a tack coat shall be applied as herein specified. On newly constructed base courses the application of the tack coat shall follow the application of the prime coat, immediately prior to placing the wearing surface. The tack coat shall be applied with a pressure distributor. The bituminous material shall be heated to a suitable consistency as designed. The bituminous material shall be applied at the rate between 0.02 gallon and 0.08 gallon per square yard. The tack coat shall be applied sufficiently in advance of the laying of the wearing surface to permit drying but shall not be applied so far in advance or over such an area as to lose its adhesiveness as a result of being covered with dust or other foreign material and shall be kept free from traffic until the wearing surface is laid.
3. Seal Coat: Apply seal coat to surface course in accordance with AI MS-19 and FDOT standards.

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3.04 INSTALLATION OF PAVEMENT OVER TACK-ON ACCESS ROAD

A. General:

1. Backfill and compact the road surface using structural fill per the grading requirement shown on the drawings and requirements Section 02220-Earthwork.
2. The Contractor shall install pavement sections over the compacted structural fill to the dimensions shown in the drawings. Extreme caution shall be taken to avoid any damage to the geomembrane during placement and compaction. Contractor shall repair all damage areas of the geomembrane at no additional cost to the Owner.
3. Method of preparing and placing mixture, compaction and protection of in-place bituminous concrete for pavement shall comply with this Section.
4. Location of types and thicknesses of replacement pavements are as indicated on the Drawings.

3.05 CLEAN UP AND MAINTENANCE

- A. Immediately after placement, protect pavement from mechanical injury for 3 days.
- B. During construction, surfaces of all areas including, but not limited to, roads shall be maintained on a daily basis to produce a safe, desirable, and convenient condition.
 1. Roads shall be swept and flushed after backfilling, and re-cleaned as dust, mud, stones and debris caused by the work, or related to the work again accumulates.
 2. Failure of the Contractor to perform this work shall be cause for the Engineer to order the work to be done by others, and backcharge all costs to the Contractor.
- C. Repair or Correction of Unsatisfactory Conditions: All unsatisfactory conditions, as determined by the Engineer, resulting from the work shall be corrected.
- D. Any subnormal or dangerous condition caused by the work, on any surface, shall be repaired or corrected within two hours of observance or notification of its existence. If repairs or corrections are not made within this period, the Owner shall cause to have the work completed with the resulting cost subtracted from the

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Contractor's next monthly payment request. Any such costs shall be deemed a reduction in the total amount due the Contractor under the contract and no subsequent reimbursement shall be made to the Contractor by the Owner for these costs.

END OF SECTION

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SECTION 02130 PASSIVE GAS WELLS and EXTRACTION SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The Contractor shall provide all labor, equipment, materials, and appurtenances necessary to drill, install, and complete landfill passive gas collection wells as specified herein and as indicated on the Drawings. In addition, raising existing LFG wells and well heads to extend above the proposed closure cap.

There are thirty-six (36) passive gas wells to be located, drilled, installed, and completed for the Project. The perforated and solid pipe, bentonite seals, stone, and soil backfill packs for the passive wells shall be set at depths shown on the Plans or as designated in the field by the Engineer.

- B. There are twenty-seven (27) existing vertical active gas collection wells will need to be extended upward due to the additional height of the closure layers. Well modification to include but not be limited to: extension of above ground well casing, extension of lateral piping, removal and repositioning of landfill gas wellhead and flexible tubing, installation of liner boot, replacement of well tags, well protection and restoration to provide full function of the wellhead. Existing wellhead to be reused, unless otherwise directed by the Engineer.

There are ten (10) existing vertical active gas collection drains will need to be extended upward due to the additional height of the closure layers. Modifications include, but not limited to: extension of the drain casing, installation of the liner boot, and restoration of the drain covers, pipes, etc.

- C. It is expected that combustible, asphixiant, and hazardous gases will be venting from boreholes drilled to install extraction wells. The Contractor's bid price shall include provision for all equipment and procedures necessary to safely install wells under this condition. All work shall be performed by qualified workers in accordance with the best standards and practices available.
- D. Upon completion of each passive gas well or any exposed waste materials, Contractor is responsible for relocating all construction and drilling waste materials in low areas of the Class I landfill footprint requiring fill. Excavated refuse must be removed immediately prior to any rain event to prevent stormwater from contacting the refuse.

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1.02 RELATED WORK

- A. Section 02200, Earthwork
- B. Section 15060, HDPE Pipe and Pipe Fittings

1.03 CONSTRUCTION QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates
 - b. C702, Standard Practice for Reducing Field Samples of Aggregate to Testing Size
 - c. D2487, Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
 - d. D2487, Standard Practice for Description and Identification for Soils (Visual-Manual Procedure)
 - e. D2922, Standard Test Methods for Density of Soil and Soil-Aggregate In- Place by Nuclear Methods (Shallow Depth)
 - f. D3042, Standard Test Method for Insoluble Residue in Carbonate Aggregates.
 - g. D4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
 - h. D1693 - Test Method for Environmental Stress Cracking of Ethylene Plastics.
 - i. D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
 - j. D2513, Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
 - k. D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter - Controlled Polyethylene Pipe and Tubing.
 - l. D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
 - m. D3350 - Specification for Polyethylene Plastic Pipe and Fittings Material.
 - n. D421, Standard Practice for Dry Preparation of Soil Samples for Particle- Size Analysis and Determination of Soil Constants.
 - o. D422, Standard Test Method for Particle-Size Analysis of Soils.
 - p. D4220, Standard Practices for Preserving and Transporting Soil Samples.
 - q. F480, Standard Specification for Thermoplastic Water Well Casing Pipe and Couplings Made in Standard Dimension Ratio (SDR).
 - r. F1248 - Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe.

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B. Qualifications:

1. The driller and installer of the landfill passive gas wells shall have completed at least one hundred (100) successful vertical landfill gas wells of similar type and depth as the passive gas wells proposed for the this Project within the last two (2) years.
2. All landfill gas wells and modifications to the wells shall be installed under the direction of a Civil Engineer, or Engineering Geologist, or Geologist retained by the Contractor. All final gas well drilling logs and construction diagrams of the modifications to the wells shall be signed by a registered professional or person of responsible charge, also retained by the Contractor. Field supervision of drilling, logging and installation activities shall be performed by trained, experienced technical personnel.

C. Miscellaneous

1. Contractor's personnel Health and Safety Plan (HASP) shall be available for informational purposes.
2. Retain a professional experienced in installation of landfill gas wells to be responsible for observing and documenting information related to all installation activities.
3. Inspect well materials for cleanliness, deformations, and imperfections, and to ensure conformance with specifications prior to use.

1.04 SUBMITTALS

- A. The Contractor shall prepare and submit to the Engineer, for review and approval, Certificates of Compliance on materials furnished, and manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, and inspection of pipe and appurtenances furnished.
- B. The Contractor shall submit a HASP specific for this Project. The submittal is for information purposes only and to demonstrate the Contractor and Installer have developed a site specific HASP for the work to be accomplished. The HASP is not for review or approval of the Engineer, the adequacy of the HASP is the fill responsibility of the Contractor and Installer before any construction starts.
- C. The Contractor shall prepare and submit to the Engineer for review and approval Shop Drawings showing dimensions, materials, and manufacturer's information for backfill materials, pipe, pipe perforations, fittings, bentonite, and wellhead components.

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- D. One week prior to well drilling, Contractor shall submit an example well boring log and construction log. The example log shall be completed with all of the required descriptions and pertinent information required under Part 3.3 of this Section.
- E. At least two weeks prior to construction, the Contractor shall submit to the Engineer for review and approval, results of the sieve analysis and calcium carbonate content for the stone backfill, samples of all well backfill materials (if requested), the name of the vendor(s) and source of materials furnished.
- F. At the end of each day, Contractor shall provide the Engineer copies of the handwritten well boring and completion logs for each well drilled on that day. Information to be included on the well logs is listed in Part 3.3 of this Section.
- G. Final boring logs, based on field information shall be typewritten and submitted with the Record Documents.
- H. As-Built drawings shall be submitted to the Engineer including, northing, easting and elevation data for all required points of the gas collection system in the state plane coordinate system. Top of casing and ground surface elevation shall be surveyed for all well points.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers of HDPE casing, screen, protective casing and accessories are acceptable:
 - 1. See Section 15060.

2.02 MATERIALS

- A. Well Casing as specified in Section 15060:
 - 1. 6 inch nominal diameter.
 - 2. ASTM D1248.
 - 3. High Density Polyethylene Pipe (HDPE) PE 3408 SDR 11 or approved equal with ASTM D3350 Cell Classification 345434C.
- B. Well Screen:
 - 1. Same material and dimensions as casing.
 - 2. 3/4 inch diameter perforation
 - 3. Holes to be factory installed. No holes or slots to be installed in the field.

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4. 20 foot lengths or as needed. Field cutting will be allowed as long as cuts are clean, perpendicular to the pipe, and do not affect the integrity of the well screen.
- C. HDPE Jointing:
1. All joints shall be butt fused per ASTM D3261.
 2. Bottom cap of screen shall be butt fused per ASTM D3261.
- D. Filter Pack as specified in Section 02220:
1. Clean washed, non-calcareous gravel with no fines.
 2. 1-inch to 3-inch diameter size so as not to impair flow to perforations/slots.
- E. Bentonite Seal:
1. Pellet or chip form of sodium bentonite that shall consist of clay greater than 85% sodium montmorillonite, without additives.
 2. Bentonite shall be hydrated per manufacturer's instructions prior to backfilling with soil. Bentonite shall be hydrated in 6-inch lifts as per Paragraph 3.2.C.15 of this Section.
 3. Under no circumstances will the use of granular bentonite be permitted.
- F. Backfill Material:
1. Soil backfill material shall be granular material free of clay, sticks, roots and organics.
- G. Top and Bottom Cap:
1. Bottom end cap shall be HDPE butt fused per ASTM D3261 methods.
 2. Contractor shall supply HDPE cap, with at least nine (9) ½-in dia holes drilled into the cap, with at least three (3) set screws to secure the cap to the elbow as per Project Drawings and Specifications.
- H. Geocomposite:
1. 6 oz geotextile bonded to geocomposite

PART 3 EXECUTION

3.01 PREPARATION

- A. All materials necessary to complete the installation of the gas well drilling, and modifications to the existing extraction system shall be on-site prior to drilling start-up.
- B. Contractor shall follow his Health and Safety Plan at all times.

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1. The Contractor is advised that the 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.
 2. The Contractor shall perform all work in a fire -safe manner. He shall supply and maintain, on the site, adequate firefighting equipment capable of extinguishing incipient fires. The Contractor shall develop and maintain, for the duration of the Contract, a safety program 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 United States Occupational Safety and Health Administration (OSHA), in accordance with 29 CFR t910, 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. 24 1) 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.
 3. The duty of the Engineer or the Owner 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 other construction safety program based on all applicable federal, state, and local codes, ordinances, and regulations.
 4. Payment for complying with the additional Safety Requirements for Construction on the work shall be included in the Contract lump sum price, and no separate payment will be made therefore.
- C. The Contractor shall survey and stake the well locations prior to drilling. Well layout surveying shall be done by a Florida Licensed Professional Surveyor. Contractor shall notify the Engineer of any discrepancies between the elevations shown on the drawings and actual field measurement elevations, and any other conflicts that may be evident.
- D. Contractor shall supply surveyed ground elevations to Engineer electronically in AutoCAD format so that the design depths may be confirmed at least one week prior to drilling.
- E. Well locations must be approved and may be adjusted by the Engineer prior to beginning drilling. Final well schedule to be used for construction of the vertical

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wells will be provided by the Engineer after reviewing the survey provided by the Contractor.

3.02 INSTALLATION OF PASSIVE GAS WELLS

A. General:

1. All passive gas wells will be installed in the general locations shown in the Contract Drawings. The well schedule shows the estimated design depths of the wells along with the associated screen lengths. All field changes regarding the locations, depth, or dimensions specified in the Contract Drawings shall be approved by the Engineer and documented in the record drawings by the Contractor.
2. The Contractor shall provide at all times a thoroughly experienced, competent driller during all operations at the drill site.

B. Well Hole Construction:

1. Drill wells using a minimum 36 in. OD core-grab bucket auger. Alternate drilling methods shall be pre-approved by the Engineer.
2. If a layer of coarse drainage sand or the liner is encountered while boring, drilling shall immediately cease and the Engineer shall be contacted immediately.
3. All gas well borings shall extend to the depth indicated in the plans. Under no circumstances, are the drilling depths from the well schedule on the Plans to be exceeded unless approved by the Engineer in advance.
 - a. Wet Borings:
 - (1) The Engineer shall be notified of wet boring conditions.
 - (2) If water is encountered in a boring, the Contractor may be directed by the Engineer to drill beyond the point at which it was encountered. If wet conditions remain the boring may be terminated if agreed upon by the Engineer and the length of perforated pipe adjusted by the Engineer. If wet conditions cease (e.g. due to perched water layer), then drilling will continue to the design depth.
 - (3) If water is encountered in a boring, the Engineer may decrease the well depth and length of perforated pipe, or relocate the well.
 - b. Abandoned Borings
 - (1) If in the opinion of the Engineer, the borehole has not reached a sufficient depth to function as an effective

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extraction well, the Contractor shall abandon this borehole by backfilling it with cuttings removed during drilling. Soil shall be backfilled and compacted to ground surface. Contractor shall supply additional soil backfill to refill any settlement within the abandoned borehole, as approved by the Owner and Engineer.

- (2) If cuttings are unsuitable as backfill (for example, box springs, tires, etc.) the Contractor shall use soil backfill material.
 - (3) Compensation for abandoned borings shall be at the unit price for boring refusal.
- c. As soon as drilling is completed, a safety screen shall be placed over the top of the bore. This screen shall stay in place until backfilling is within 4 feet of the surface. Safety screen size should be large enough to accommodate all backfill materials and any tools used during backfill yet not large enough for any human to accidentally fall through.
- d. All bore holes that are not completed at the end of the day are to be covered with a metal well cover capable of preventing any persons from falling into the hole. The hole must then be covered with a piece of plywood to substantially cover the entire hole. Soil must be placed on top of the plywood to completely cover the plywood to further prevent gas emissions. Substitute safety measure may be used if approved by the Engineer.

C. Well Installation:

1. Contractor shall fabricate the well casings in accordance with Project Drawings and Specifications. The well casing shall be perforated in accordance with the Details and Specifications. Well casings shall be capped at the end and welded at the surface prior to installation to prevent backfill material from entering the pipe.
2. No pressure tests are required for the collection well casings.
3. Measure depth of boring. The bore for the well shall be straight and the well pipe shall be installed in the center of the borehole. The well depth shall be measured from ground surface (note elevation on the well boring log) at the time of the boring to the bottom of the borehole with no obstruction. Total depth shall be adjusted for final surface elevations based upon the Plans and final total depth noted on the well boring logs.

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4. Connect the well screen and a sufficient length of well casing including bottom plug or cap.
5. Place 6-feet of gravel filter pack in the bottom of the boring prior to installing well casing.
6. In no instance, drive or force well into position. The Contractor shall take all necessary precautions to maintain the well pipe vertically plumb during the entire backfill operation of the borehole to the satisfaction of the Engineer.
7. If the pipe is installed out of plumb, as determined by the Engineer, the Contractor, at his own expense shall correct the alignment.
8. Join screen and riser sections for a single interval by butt fusion methods per ASTM D3261 for HDPE.
9. Extend casing to no more than 4 feet above final cover surface elevation or as shown on the Plans.
10. 10. At the end of each day, Contractor shall cap the ends of all joined pipes longer than 20 feet to prevent entry by animals and debris.
11. Continue placement of gravel filter pack into the annulus between the well screen and the borehole wall until the filter pack is 24 inches minimum above the top of the well screen. All filter pack materials shall be placed by methods approved by Engineer. All gravel to be placed with a trimmie pipe uniformly around the well casing.
12. Take periodic depth soundings to monitor the level of the gravel filter pack and detect any bridging. Soundings shall be taken at no more than 5-foot intervals.
13. Place FDOT No. 89 pea gravel above gravel or as an alternative place a 6 ounce non-woven geotextile bonded Geocomposite ring or approved equal on top of the gravel filter. If Geocomposite ring or approved equal barrier used, contractor to ensure the alternative material is placed in a manner so it uniformly covers the gravel, with approval from the Engineer. All gravel to be placed with a trimmie pipe uniformly around the well casing.

Place a 2-foot minimum layer of bentonite chips on top of the pea gravel to the dimensions shown on the plans.
14. Place a 10-foot minimum soil plug on top of the bentonite chips to the dimensions shown on the plans.

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15. After ensuring that the casing is centered in the borehole, place 2 foot minimum bentonite seal on the soil plug in maximum 6-inch lifts.
 - a. Hydrate bentonite chips/pellet in the bore hole per supplier's recommendations for a minimum 1 hour after placement and prior to installing clean backfill. The bentonite must be thoroughly hydrated
 - b. Measure depth of bentonite seal after tamping each lift.
16. Install geomembrane boot around the well casing as show on the Drawings.
17. The grate over the borehole that is used to keep the well casing plumb shall not be removed until the borehole is backfilled to within 1 foot of ground surface and sufficiently compacted.

Complete passive well installation by welding pipe elbows and end cap with holes.
18. Collect and clean up drilling debris, cuttings around the work areas. Dispose in active landfill.
19. Mound shall be installed around the well riser to drain stormwater away from the well.
20. Contractor shall be responsible for any grading, leveling, towing and/or restoration that may be necessary for movement of the drill rig on the landfill property

D. Refuse Disposal:

1. Contractor shall dispose of cuttings at the working face of the landfill by the end of each working day. Excavated refuse must be removed immediately during any rain event to prevent stormwater from contacting the refuse.

E. Temporary Cap:

1. The Contractor shall temporarily cap the riser pipe of the vertical extraction well immediately after well pipe installation to prevent venting of LFG into the atmosphere. The Contractor shall remove this cap during the installation of the wellheads. Lag screws may be necessary to secure the cap due to the internal gas pressure within the well.

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F. Asbestos Handling:

1. If asbestos is encountered during drilling operations, the following waste handling procedures must be implemented:
 - a. If any waste appearing to possibly contain asbestos is uncovered, all asbestos handling procedures will be immediately placed into effect.
 - b. All persons within 25 feet of the drilling operations will be required to wear the appropriate respirators.
 - c. The use of Tyvek suits will be optional. However, if Tyvek suits are not worn, all employee uniforms must be laundered and the launderers notified of possible contamination with asbestos. All Tyvek suits will be considered to be contaminated with asbestos and will be disposed of accordingly.
 - d. A water truck equipped with the appropriate spraying equipment to keep the drill cuttings wet will be required at all times.
 - e. An area of appropriate size will be prepared to contain the cuttings by one of the following methods.
 - (1) A waste container lined with 6 mil polyethylene will be placed as close as reasonably possible to the well being drilled. A small area next to the drill rig where drill cuttings will be handled will also be lined with 6 mil polyethylene and covered with clean soil to protect the polyethylene. A small earthen berm will be made to help contain the cuttings and facilitate loading into the container. The polyethylene and soil cover will be considered to be part of the waste.
 - (2) An area next to the drill rig that is appropriately sized to accommodate all of the drill cuttings will be surrounded by a small soil berm approximately 30" high. This area will then be lined with 6 mil polyethylene and covered with clean soil to protect the polyethylene. This area will be positioned in a way such that all handling of cuttings will be in the protected area. The polyethylene and soil will be considered to be part of the waste.
 - f. All cuttings that are not already damp upon removal from the well bore will be immediately wetted.

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- g. After wetting, all cuttings will be immediately placed into the container or moved to a different part of the storage area (if needed).
- h. All cuttings will be kept damp and covered.
- i. After the container is filled, the well is completed, or at the end of the workday, a representative sample will be taken of the waste. The waste sample will be tested by a certified testing laboratory for asbestos using the polarizing light microscopy method. While waiting for the test results, all waste will be kept damp and covered.
- j. If test results indicate greater than one (1) percent asbestos, the waste will be handled and disposed as asbestos waste. This will include keeping the waste wetted and covered as it is transported to another portion of the landfill. If asbestos waste is handled, all equipment that contacted the waste must be decontaminated in an acceptable manner prior to leaving the landfill site.
- k. If test results indicate less than one (1) percent asbestos, the waste will be tested as normal MSW and disposed of at the normal working face of the landfill.
- l. An alternative to sampling and testing the waste will be to assume that the waste contains asbestos and to handle and dispose of accordingly.
- m. The cost of all laboratory testing will be the responsibility of the Contractor. The exact drilling procedure that will be followed must be included in the Contractor's Health and Safety Plan. Additionally, both the selected testing laboratory and testing protocol (should asbestos be encountered during drilling) must be submitted by the Contractor in writing and approved by the Owner prior to beginning any well drilling activities.
- n. Contractor shall be responsible for safely transporting asbestos to the active face for proper disposal as directed by the Owner. The Owner will not charge Contractor a tipping fee, but Contractor shall be responsible for all other costs.

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G. Settlement

1. Any settlement around the completed wells, or over abandoned boreholes, shall be backfilled within 3 weeks after placement of backfill from the level of the subsidence to 6 inches above existing grade with the appropriate cover materials.

H. Obstruction

1. If there is a drilling obstruction encountered in the landfill that, despite the best reasonable efforts of the Contractor, cannot be penetrated, the Contractor shall request relief from the Owner or Engineer from completion of the well. The Owner or Engineer shall be the sole authority for deciding on one of the following:
 - a. Additional drilling efforts are needed at no additional compensation.
 - b. The hole shall be abandoned. The Contractor shall backfill the well to the predrilled condition or to the satisfaction of the OWNER or Engineer. The Contractor shall be compensated for the drilling and backfilling of the well, but not its completion.
 - c. The well shall be accepted at the obstructed depth. The well shall be completed at this new depth. Compensation shall be for the modified footage of the well.

3.03 MODIFICATION TO EXISTING LFG EXTRACTION WELLS AND SYSTEM

- A. General: The existing LFG Extraction well casings, piping, wellhead, drains, and other landfill gas appurtenances are to be extended to the wellhead and top of the drains are a minimum of four (4) feet above the final grade at each location.
- B. Wellhead Installation:
 1. Wellheads shall be removed from the existing wells. Installed in accordance with manufacturer's recommendations. Pipe sections of the wellhead shall be air-tight. Any leaks shall be repaired by Contractor at no additional cost to the Owner.
 2. Install flexible hose so that hose has no sags, as show on the Plans. However, flexible hose shall not be taut. Provide enough slack to accommodate minor pipe settlement, as approved by the Engineer.
 3. Wellhead to lateral connection shall be made with a 2 inch flexible hose fastened with stainless steel pipe clamps (or equal).

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3.04 FIELD QUALITY CONTROL

- A. Submit the following to the Engineer after each day's work.
- B. Project Record Documents:
 - 1. Daily driller's report: During the drilling of the well, maintain daily driller's report that includes:
 - a. Date
 - b. Location
 - c. Boring Identification Number
 - d. Weather Conditions
 - e. Daily Activities
 - f. Equipment Used
 - g. Materials Used
 - h. Well construction (materials used, type, quantity, etc.)
 - i. The number of feet drilled.
 - j. The number of hours on the job (rig time, down time, stand-by, etc.).
 - k. Names of contract personnel on the job.
 - l. The foot of casing set.
 - m. Other pertinent data as may be requested by the Engineer.
 - 2. Driller's log: During the drilling of the well, prepare and maintain a complete log that includes:
 - a. Logger's Name
 - b. Date
 - c. Location
 - d. Boring Identification Number
 - e. Equipment Used
 - f. Drill Crew
 - g. Time
 - h. The reference point for all depth measurements.
 - i. The depth at which each soil to refuse change occurs.
 - j. The thickness of each soil or refuse stratum.
 - k. The depth at which the leachate is encountered, if applicable.
 - l. Depth to refuse and depth of undisturbed soil.
 - m. Visual description of refuse at 5-foot intervals:

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- (1) Type of waste encountered including the estimated percentage of the following components (by volume) on visual inspection:
 - (a) Plastic/Cardboard
 - (b) Plastic
 - (c) Yard waste
 - (d) Construction debris
 - (e) Textiles
 - (f) Tires
 - (g) Sludge
 - (h) Dirt
 - (2) Temperature of excavated refuse.
 - n. Depth of location of any lost drilling material, tools, or any other unusual occurrences.
 - o. The total depth of completed extraction well.
 - p. The total depth of boring.
 - q. Well screen interval.
 - r. Solid pipe casing interval.
 - s. Length of above ground riser stick-up pipe.
 - t. Gravel filter pack depth interval.
 - u. Bentonite seal depth interval.
3. Typed final copies of the well logs shall be submitted with the Record Drawings. Handwritten logs will not be acceptable for submittal with the Record Drawings.

END OF SECTION

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SECTION 02220 EARTHWORK

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Contractor shall furnish all labor, materials, tools, supervision, transportation, and installation equipment necessary to perform all earthwork as specified in this section and as shown on the Drawings.
- B. Contractor shall perform earthwork activities in conjunction with the construction of other components of the Work.
- C. The Work of this section shall include, but not necessarily be limited to: removal of unsuitable overburden from on-site stockpiles, excavating soil, hauling, backfilling, compacting, and grading soil and aggregate materials. Work of this section may pertain in whole or in part to construction of the following: soil liner components of the final cover, anchor trenches, storm water cut-off berms, waste excavation and waste grading, placement of aggregate, and stockpiling of surplus material. The work of this section also includes any protection necessary to complete the Work.
- D. Earthwork shall conform to the dimensions, lines, grades, and sections indicated on the Drawings.

1.02 RELATED WORK

- A. Section 02225, Trenching
- B. Section 02270, Soil Erosion and Sediment Control
- C. Section 02701, LLDPE Geomembrane Liner
- D. Section 02930, Geocomposite

1.03 DEFINITIONS

- A. "Relative compaction" is defined as the ratio, in percent, of the as-compacted field dry soil density to the laboratory maximum dry density as determined by the Modified Proctor Method, ASTM D 1557. Corrections for oversize material may be applied to either the as-compacted field dry density or the maximum dry density, as determined by the Engineer.
- B. "Optimum moisture content" is defined as the moisture content corresponding to the maximum dry density obtained by the Modified Proctor test, ASTM D 1557. Field moisture content shall be determined on the basis of the fraction passing the No. 4 sieve.

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- C. "Completed course" is defined as a course or layer that is complete and ready for testing and/or the next layer or phase of construction.
- D. "Clearing" shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring in the areas to be cleared.
- E. "Grubbing" shall consist of the removal and disposal of stumps, roots, and matted roots from the designated grubbing areas.

1.04 REFERENCED STANDARDS

- A. Reference standards and recommended practices referred to herein shall be the latest revision of any such document.
- B. Standards referenced herein are as listed below:

ASTM D 422 Particle Size - Analysis of Soils
ASTM D 448 Standard Sizes of Coarse Aggregate and Bridge Construction
ASTM D 1140 Amount of Material in Soils Finer than the No. 200 Sieve
ASTM D 1556 Density of Soil in Place by the Sand-Cone Method
ASTM D 1557 Modified Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 - lbf/ft)
ASTM D 1587 Thin-Walled Sampling of Soils
ASTM D 2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil Aggregate Mixtures
ASTM D 2434 Test Method for Permeability of Granular Soils (Constant Head)
ASTM D 2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2937 Density of Soil In Place by the Drive Cylinder Method
ASTM D 3017 Standard Test Method for Determining Soil Moisture by Nuclear Method
ASTM D 3282 Standard Practice of Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes
ASTM D 4220 Preserving and Transporting of Soil Samples
ASTM D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 5084 Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
AWPA C 1 All Timber Products - Preservative Treatment by Pressure Processes
EPA 9100 Saturated Hydraulic Conductivity, Saturated Leachate Conductivity, and Intrinsic Permeability

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Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction (Standard Specifications).
FDOT Roadway and Traffic Design Standards

1.05 SUBMITTALS

- A. At least 14 days prior to the start of any earthwork construction, Contractor shall submit to Engineer the following information and samples for each proposed soil for earthwork originating from off-site sources.
 - 1. The proposed material source or sources, including quarry/site name, location, and supplier's name of material, site contact name and telephone number.
 - 2. Laboratory test data in conformance with the requirements of paragraph 2.01 B.
 - 3. A 5-gallon bucket containing a material sample from each proposed source.
- B. If work is interrupted for reasons other than inclement weather, Contractor shall notify Owner and the CQA Officer a minimum of 24 hours prior to the resumption of Work.
- C. Contractor shall submit to Engineer a soil stockpiling plan 14 days prior to start of work.
- D. A record of existing conditions shall be submitted by the Contractor prior to the start of this work and shall include all structures and other facilities adjacent to areas of work. Such records shall contain the location of existing utilities, the elevation of the top of foundation walls, the location and extent of cracks and other damage, and a description of surface conditions that exist prior to the start of work. The records shall be verified by the Engineer prior to starting the work.
- E. Originals of manufacturer's catalog data sheets, operation instructions, and recommendations for proof-rolling, compaction, and earth moving equipment scheduled for use shall be submitted to the Engineer.

1.06 CONSTRUCTION QUALITY ASSURANCE, ACCEPTANCE AND TOLERANCES

- A. Prior to commencing any excavation or grading, the Contractor shall satisfy himself as to the accuracy of all survey data as indicated on the drawings and in the specifications and/or as provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the survey data, he shall immediately notify the Engineer that proper adjustments can be anticipated or ordered. Commencement by the Contractor of any excavation or grading shall be held as an acceptance of the survey data by him after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions, or inaccuracies of the survey data.

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- B. All material limits shall be constructed within a tolerance of ± 0.1 foot except where dimensions or grades are shown or specified as minimum.
- C. All grading shall be performed to strictly maintain slopes and drainage as shown on the drawings.
- D. Contractor shall be aware of the activities outlined in the CQA Plan and shall account for these activities in the construction schedule.
- E. Prior to placement of protective soil, Contractor shall construct a test pad. The test pad shall be a minimum of 50' x 100' in plan dimensions, shall be constructed within the waste boundaries of the appropriate closure area, and shall include underlying soil and geosynthetic layers per the required closure system. The test pad shall be complete after verification and demonstration of successful soil moisture conditioning, grade control, placement, compaction, permeability and testing of soil layers. Contractor shall demonstrate that selected methods for all work will be conducted without damage to underlying closure system geosynthetic components.

PART 2 PRODUCTS

2.01 GENERAL

- A. Earthen materials include structural fill, protective soil, aggregate, topsoil and intermediate cover soil.
- B. Contractor shall employ an independent geotechnical testing laboratory approved by Owner and Engineer to perform the prequalification tests (at a frequency of 1 set of tests with the exception that 3 sets of tests for the protective soils will be needed per borrow source or change in materials). Certification for all materials indicating that the material conforms to the specification requirements along with copies of the test results from the approved independent testing laboratory, shall be submitted to the Engineer for approval at least 10 days before the material is required for use. The Contractor shall coordinate material location and delivery with the testing agency and the Engineer. The Contractor shall notify the Engineer, in writing, a minimum of 24 hours prior to the time materials approval is required. The testing laboratory shall be certified and approved to do work with the Florida Department of Transportation. Prequalification testing is not required for Owner-supplied material.
- C. The Contractor shall provide certification that proposed material is clean and meets gradation and other parameters herein specified.
- D. The final approval of earthen materials shall be at the discretion of the CQA Officer and Engineer. No materials shall be delivered to the site or used in construction until the proposed source and materials tests have been tentatively accepted in writing by the Engineer.

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- E. The following prequalification tests shall be performed on the fill material by the Contractor's independent geotechnical laboratory:

Table 02220-1
Soil Qualification Testing For Material From Off-Site Sources

Material	Test	ASTM No.
Structural Fill	Standard Proctor	D 698
	Soil Classification (USCS Classification System)	D 2487
	Sieve Analysis	D 422
	Natural Moisture Content	D 2216
	Atterberg Limits	D 4318
	Consolidated – Undrained Triaxial Compression Test	D 4767
Intermediate Cover (Grading Layer)	Soil Classification	D 2487
	Sieve Analysis	D 422
	Atterberg Limits	D 4318
	Standard Proctor	D 698
Protective Soil	Soil Classification (USCS)	D 2487
	Sieve Analysis	D 422
	Atterberg Limits	D 4318
	Standard Proctor	D 698
	Permeability	D2434/D5084

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Material	Test	ASTM No.
Aggregates (FDOT 2, FDOT 57, Riprap, AASTO #3, Gabion Aggregate)	Classification	D 448
	Sieve Analysis	C 136
	Calcium Carbonate Content (only for aggregates used under final cover geomembrane, i.e. gas wells)	D 3042
	Resistance to Degradation (LA Abrasion)	C 535
Topsoil	Soil Classification (Classification according to USDA System)	D 2487
	Organic Content	FM 5-550
	pH	E 70
	Soluble Salts (Conductivity)	

- F. Classification tests for materials as specified herein shall be in accordance with ASTM D 2487 except for aggregates. Preparation and testing for classification purposes shall be by the wet method. Additional tests required as part of ASTM D 2487 shall be for water content (ASTM D 2216), Atterberg limits (ASTM D 4318), particle size (ASTM D 422), and percent fines (ASTM D 1140). These additional tests shall be performed concurrently with each application of ASTM D 2487. Classification tests on all materials as specified herein shall be made on samples of each material at its place of production prior to shipment. Classification tests in excess of those listed above may be required on the finished product if variation in gradation is apparent or if the material appears to depart from the specifications. Additional testing shall be as directed by the Engineer.

2.02 STRUCTURAL FILL

- A. Structural fill will be used to construct berms, track-on road and anchor trench backfill as shown on the Drawings. The structural fill will consist of relatively homogenous natural soils that are free of debris, foreign objects, organics and other deleterious materials. Structural fill shall be classified according to ASTM D 2487 as GP-GM, GW-GM, GM, GW, SW-SM, SW, SP-SM, SP, SC or SM and will have no particles or soil clods larger than 4 in. (100 mm).

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- B. The structural fill will be placed and compacted in lifts to the lines and grades shown on the Drawings. The compacted thickness of each lift will be 6 in. maximum (150 mm). Each lift will be compacted to at least 95 percent of the standard proctor maximum dry density (ASTM D698) within $\pm 4\%$ of optimum moisture content.

2.03 GRADING LAYER (SUBGRADE)

The Contractor shall excavate and/or fill the subgrade as required to achieve the subgrade elevations indicated on the drawings. Fill shall be placed in loose lifts not exceeding 12 inches and shall be compacted to at least 95% of the Modified Proctor (ASTM D 1557) maximum dry density, within $\pm 4\%$ of optimum moisture content. The compacted subgrade soil shall be relatively homogeneous, natural soils that are free of debris, foreign objects, excess silt and organics. Any subgrade areas that pump or rut shall be reworked or repaired to provide a stable subgrade.

2.04 PROTECTIVE SOIL

Protective soil layer shall be 18-in. thick and consist of relatively homogenous natural soils that are free of debris, foreign objects, excess silt, clay lumps, brush, roots, weeds, sharp materials, sticks, angular pieces or other deleterious materials. The soil shall have a maximum particle size of 3 in., and shall have at least 40 percent by weight of particles passing through the U.S. Standard No. 10 sieve. The soil shall be classified as a sandy loam, loam, sandy clay loam, silty clay loam, loamy sand, or silt loam as classified by the USDA Soil Classification System. The installed permeability shall be less than or equal to a range of 3×10^{-4} to 1×10^{-5} cm/s. Based on the prequalification testing, this permeability requirement can be met at 95% standard proctor compaction. Contractor is allowed to change the compaction requirement provided permeability requirement is met. However, compaction requirement shall not be lowered below 90% of Standard Proctor maximum dry density. Any laboratory testing fees associated with lowering compaction requirement shall be borne by the Contractor.

2.05 TOPSOIL

The topsoil shall be a 6-in. thick layer of soil capable of promoting the growth of vegetation. The topsoil shall be relatively homogenous natural soils that are free of debris, foreign objects, excess silt, clay lumps, brush, roots, weeds, or other deleterious materials. The topsoil shall have at least 75 percent by weight passing the U.S. Standard No. 4 (4.75 mm) sieve, and at least 60 percent by weight passing the U.S. Standard No. 10 (2 mm) sieve. For the portion passing the U.S. Standard No. 10 (2 mm) sieve, the material will be classified as sandy loam, loam, or silt loam in accordance with the USDA classification system. In addition, the topsoil shall have a pH in the range of 5.8 to 7; a minimum of 7 percent by weight of organic matter; and a maximum of 4 milliohms per centimeter of soluble salts. The material shall comply with the requirements of the latest edition of FDOT's Standard Specifications for Road and Bridge Construction, Section

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987 for Topsoil. If necessary, nutrients (including agricultural lime and fertilizer) shall be added to the topsoil to enhance its ability to promote vegetation growth.

2.06 AGGREGATES AND RIPRAP

- A. Aggregate shall consist of hard, strong, durable material free of any metal, roots, concrete, debris, organics, and other deleterious materials and coatings. Material shall be well rounded and shall not be limerock or other material that would react and/or break down when in contact with solid waste leachate. Gravel and drainage aggregates shall be used for the following components:
 - 1. Seep trenches (FDOT 57);
 - 2. Terrace swale (FDOT No. 3 or 4);
 - 3. Vertical Gas Extraction Wells (1-inch to 3-inch diameter aggregate)
 - 4. Toe of slope (FDOT No. 3 or 4);
 - 5. Riprap (FDOT 530-2.2.2 Ditch Lining Rubble, with no larger than 12-inch maximum size) and Erosion and sediment control, as needed.
- B. The aggregate shall have less than 5 percent loss of weight when tested in accordance with ASTM D3042. Do not place calcareous aggregate underneath the final cover, gas extraction wells or gas collection pipe trenches.
- C. Aggregate and riprap shall be of sound, hard and durable quality that will be free of open or incipient cracks, soft seams or other structural deficiencies. Aggregate shall have less than 5 percent loss when tested in accordance with ASTM C 3042. The maximum loss for aggregate shall be 15.0 percent when tested in accordance with ASTM C535 and 45% for riprap. It shall not contain any soapstone, shale, or other material that easily disintegrates.

2.07 EQUIPMENT

- A. Contractor shall only use equipment that has been approved for this work.
- B. Contractor shall furnish, operate, and maintain grading equipment as is necessary to produce uniform layers, sections, and smoothness of grade for compaction and drainage.
- C. Contractor shall furnish, operate, and maintain compaction equipment as necessary to produce the required in-place soil density and moisture content.
- D. Contractor shall furnish, operate and maintain tank trucks, pressure distributors, or other equipment designed to apply water uniformly and in controlled quantities to variable surface widths.

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- E. Contractor shall furnish, operate, and maintain soil spreading equipment that travels on the material being spread without traveling on the surface of the underlying compacted soil surface layer.
- F. Contractor shall furnish, operate, and maintain miscellaneous equipment such as scarifiers, disks, spring tooth or spike tooth harrows, earth hauling equipment, manual compaction equipment and other equipment, as necessary for construction of structural fill and intermediate cover soil.

PART 3 EXECUTION

3.01 EXCAVATION SAFETY AND LEGISLATION

- A. Protect bench marks and existing structures, roads, sidewalks, monitoring wells, piezometers, paving, and curbs against damage from equipment, vehicular or foot traffic, settlement, lateral movement, undermining, and washout.
- B. Install and maintain shoring, sheeting, bracing, and sloping necessary to support the sides of the excavation, to keep and to prevent any movement which may damage adjacent pavements, utilities, or structures; damage or delay the work; or endanger life and health. Install and maintain shoring, sheeting, bracing, and sloping as required by the Occupational Safety and Health Administration (OSHA) and other applicable governmental regulations and agencies.
- C. The Contractor shall be solely responsible for making all excavations in a safe manner. Excavations shall be barricaded and posted with warning signs for the safety of persons. Warning lights shall be provided during hours of darkness.
- D. Excavated materials suitable for backfill shall be piled in an orderly manner sufficiently distant from excavations to prevent overloading, slides, cave-ins, and obstruction of access ways and roadways.
- E. Underpin adjacent structure(s) which may be damaged by excavation work, including service lines.
- F. Notify Engineer of unexpected subsurface conditions and discontinue work in area until Engineer provides notification to resume work.
- G. Excavations shall be done in ways that will prevent surface and subsurface water from flowing into excavations and will also prevent flooding of the site and surrounding area.

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- H. Contractors shall familiarize themselves with, and comply with, all applicable codes, ordinances, and statutes, and bear sole responsibility for the penalties imposed for noncompliance.

3.02 TEMPORARY EROSION CONTROL

- A. Contractors shall familiarize themselves with, and comply with, all applicable codes, ordinances, and statutes, and bear sole responsibility for the penalties imposed for noncompliance.
- B. It is the Contractor's responsibility to provide temporary erosion control procedures to protect slopes and other areas from erosion. Measures such as straw bales, temporary slope flumes, or other methods shall be used to protect completed work from damage due to erosion. Damage to facilities under construction, including clay liner, shall be repaired at the Contractor's sole expense. Contractor shall submit a statement stating that they are aware of the nature of adjacent on-site activities and they have taken steps to protect their site from damage and that they will continue to maintain protection of their site as surrounding conditions change. Any conditions which the Contractor believes endangers their site and cannot be addressed by taking reasonable precautions should be immediately brought to the attention of the Engineer in writing.

3.03 LIMITS OF EXCAVATION

- A. Excavate to the depths and widths shown. Allow for working space, prepared subgrade requirements, and finish or other liner layers as shown or required.
- B. A scarifier or disk harrow shall be used to prepare the subgrade prior to compaction.
- C. Excavation carried below the grade lines shown or established by the Engineer shall be replaced with fill material in 12-inch lifts and compacted as specified herein. Cuts below grade shall be corrected by similarly cutting adjoining areas and creating a smooth transition. Correction of all overexcavated areas shall be at the Contractor's sole expense.
- D. Areas of unsuitable soils, established by the Engineer, shall be undercut to competent soils and replaced with fill material in 12-inch lifts and compacted as specified herein.

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3.04 REMOVAL OF WATER

- A. At all times during construction, Contractor shall provide and maintain proper equipment and facilities to remove all water entering the construction area so as to obtain satisfactory working conditions.
- B. Contractor shall be responsible for controlling surface runoff and run on around the construction area and to otherwise protect the Work and the property.
- C. DEWATERING (as required): Provide and maintain dewatering of all surface water and/or groundwater as required for excavation. Where groundwater is or is expected to be encountered during borrow area excavation, install a dewatering system to prevent softening and disturbance of excavation, allow borrow material to be excavated in the dry, and maintain a stable excavation. Soils and hydrogeologic information may be reviewed before beginning excavation to determine where groundwater is likely to be encountered during excavation. Employ a dewatering specialist for selecting/designing, monitoring, and operating the dewatering system as needed. Keep dewatering system in operation until borrow activities are completed. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction as approved by the Owner. Install groundwater monitoring points as necessary. Shut off dewatering system at such a rate so as to prevent a quick upsurge of water that might weaken the subgrade. Installation, start-up, monitoring maintenance, and shut-off of the dewatering system shall be at no additional cost to the Owner. Any dewatering from within the disposal footprint (within the limits of liner/waste) will be considered leachate and cannot be discharged to the stormwater system, but must be disposed appropriately as directed by the Owner, and at no additional cost to the Owner.

3.05 FAMILIARIZATION

- A. Prior to implementing any of the work described in this section, Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this section.
- B. The grades depicted in the construction documents may change by the time construction commences due to settlement. Settlement that occurs between the date of the Drawings and the date of Construction shall not be grounds for a 'Changed Condition', or a Change Order. Bidder/Contractor accepts these terms and conditions. Only in the event that the Contractor can demonstrate that there is more fill or excavation resulting from settlement needed to achieve design criteria will there be consideration of a Change Order.

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C. Inspection:

1. Prior to implementing any of the work in this section, Contractor shall carefully inspect the installed work of all other sections and verify that all work is complete to the point where the work of this section may properly commence without adverse impact.
2. If Contractor has any concerns regarding the installed work of other sections, it should notify Engineer in writing 48 hours prior to starting work. Failure to notify Engineer prior to earthwork operations will be construed as Contractor's acceptance of the related work of all other sections.

3.06 SITE PREPARATION

- A. Contractor shall install erosion and sediment controls, as shown on the Drawings, down-slope of each area to be disturbed prior to the beginning of work at each stage. Contractor shall maintain the erosion and sediment controls for the duration of construction and until the contained areas are successfully revegetated. Accumulated sediment shall be disposed of on-site by Contractor in a manner approved by Engineer.
- B. Diversion ditches, either permanent or temporary, shall be constructed in accordance with the Drawings, at a minimum, and as otherwise necessary to protect the Work and property. Contractor shall be responsible for constructing diversion ditches as required to divert run on around the construction area. The construction of temporary ditches not shown on the Drawings shall not be undertaken until Contractor's plan for construction of such ditches is accepted by Engineer, except as needed to protect the Work and property in urgent situations.
- C. All brush, vegetation, rubbish, and other objectionable material shall be removed from the construction area and disposed of in an area designated by Owner.
- D. Contractor shall scrape existing vegetation and stockpile at locations determined by the Owner.
- E. Contractor shall proof roll the liner construction area to identify and correct soft areas.

3.07 STOCKPILING

- A. Excavated materials will be classified during construction in the field for stockpiling purposes by the CQA Officer. Once classified, Contractor shall stockpile fill in accordance with the approved stockpiling plan.

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- B. Excavated material classified as spoil shall be segregated from fill and stockpiled or disposed of in low areas of the Class I landfill at no additional cost to the owner.
- C. Stockpiles of fill or spoil shall be no steeper than 3H:1V (horizontal: vertical); or at the material's natural angle of repose; or other slope approved by Engineer, graded to drain, sealed by tracking parallel to the slope with a dozer or other means, and dressed daily during periods when fill is taken from the stockpile. Contractor may cover fill stockpiles with plastic sheeting or other material in order to preserve the moisture content of the fill.
- D. Contractor shall establish erosion and sediment control methods for all stockpiles. Silt fencing shall be constructed around the perimeter of stockpiles.
- E. Excavated waste shall not be stockpiled for an extended period of time (i.e., time >48 hrs), but instead transported to the low areas of the Class I landfill or other appropriate disposal facility. Should excavated waste be stockpiled, the stockpile should also be covered to prevent leachate runoff and litter blowing away.

3.08 GRADING LAYER (SUBGRADE) PREPARATION

- A. Grading Layer Preparation consists of the addition of soil material to bring the current landfill area to specified grading, distribution of on-site material within landfill closure areas, including refuse and all types of material encountered when establishing required grading layer and finished grade elevations, when constructing surface drainage features, and below grade features. Refuse and debris encountered during grading layer preparation shall be dozed and compacted into place, or if excess shall be removed and disposed of at the landfill working face. The one foot of intermediate cover material may consist of existing intermediate cover soil material, imported soil or a combination of both.
- B. The finished surface shall be smooth and free of rocks, stones, sticks, roots, sharp objects, or debris of any kind. No stones or other hard objects that will not pass through a 3/8 inch screen shall be present at the top 1 inch of the surfaces to be covered. The surface shall provide a firm, unyielding foundation for the membrane with no sudden, sharp or abrupt changes or break in grade.
- C. Grade changes shall be made gradual, and slopes shall be blended into level areas. Corners at grade breaks shall be rounded. Completed grading layer slopes shall be constant and uniform. Remove all evidence of temporary work (access roads, benching, drilling, trenching, etc.) and other modifications made to the existing ground to install other portions of the work. Provide Subgrade Survey in

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accordance with paragraph 3.14 after Engineer acceptance of completed subgrade preparation.

- D. Unauthorized excavation consists of removal of materials beyond indicated Subgrade/grade or finished elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as any resulting remedial Work directed by Engineer, shall be at Contractor's expense. Backfill and compact unauthorized excavations with fill material, as determined by Engineer. Compact to a density not less than that specified for the subsequent material layers.
- E. Stability of Excavations: Side slopes of temporary excavations shall comply with local codes, ordinances and authorities having jurisdiction. Provide steel strutted trench boxes or properly designed sheeting, shoring, and bracing systems where excavations, space restrictions, or where depth of excavation exceeds 4 ft. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
- F. The requirements of the Occupational Safety and Health Act (OSHA) shall apply to all excavation, trenching, and ditching operations on this project. All trenches over 4 ft in depth shall be shored or laid back in compliance with the applicable federal and/or state regulations.
- G. Contractor shall minimize open overnight trenches.
- H. Contractor shall take all measures necessary to cover exposed waste and control disease vectors, odors, fire, wildlife attraction, scavenging, or blowing litter.
- I. Contractor shall be responsible for cleanup of windblown litter or other refuse spreading caused by Contractor operations, immediately after event that caused litter, or within 24 hours of notification by Engineer that cleanup is required.
- J. Upon completion of site preparation, excavation shall be carried out to the elevations and grades for the subgrade shown on the Drawings. Note that the subgrade has the same meaning as the intermediate cover or grading layer as noted elsewhere. All excavation work shall be carried out in compliance with all applicable OSHA regulations.
- K. After excavation and filling to the top subgrade, CQA Officer will inspect the subgrade. The CQA Officer will identify any areas that require additional excavation of wet or soft materials. Such excavation shall be backfilled with grading layer.

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- L. If directed by the CQA Officer, Contractor shall scarify the portion of the subgrade to a depth of not less than 8 in. and compact it in accordance with the requirements for grading layer.
- M. The subgrade surface shall be seal-rolled unless fill is to be immediately placed on the compacted surface.
- N. Excavation shall not be considered complete, and no fill shall be placed on the subgrade, until the CQA Officer confirms that the thicknesses and grades shown on the Drawings have been achieved in the field. Contractor shall be responsible for notifying the CQA Officer that the excavation (or a significant portion thereof) is complete and Contractor shall plan for the time required for the CQA Officer to confirm the thicknesses and grades of the excavation.
- O. The Contractor shall coordinate with Owner one calendar week in advance of planned waste removal activities. The Contractor shall assume that the waste is present 1 foot below the existing intermediate cover for estimation purposes. All waste required to be removed and hauled to the active landfill as instructed by Owner at no additional cost. In addition, Contractor shall maintain a minimum of 1 foot intermediate cover over waste upon completion of all grading activities. The thickness will be verified by the CQA Officer per the frequencies outlined in Section 3.11 of this Specification.

3.09 PROTECTIVE SOIL

- A. Protective soil shall be placed in a single lift and trimmed down to specified thickness. A sufficient number of passes shall be applied to achieve a minimum 95% compaction (ASTM D 698). Compaction shall be performed using low-ground pressure equipment meeting the ground pressure requirements of Part 3.15 of this Section, unless other compaction equipment is approved by Engineer. Other equipment or haul road thicknesses will require Engineer approval. Soil Cover material shall be placed by working from the lower slopes towards upper slopes, along the drainage line of the slope. No side slope equipment movement will be allowed. Employ placement methods for Protective Soil that do not disturb, wrinkle, fold, stretch, or damage geosynthetics. Any damage to geomembranes, geocomposite or geotextiles shall be repaired by the Contractor at no additional cost to the Owner.
- B. Prior to placing protective soil, moisture condition material so that moisture content is within plus or minus 4 percent of the optimum moisture content as determined by ASTM D 698. Soil moisture content shall be adjusted prior to placement by applying water and/or aerating soil, and even moisture content distribution shall be attained using by blading, ripping, discing or tilling as required.

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- C. If the defect is related to adverse site conditions, such as overly wet soils or surface desiccation, the CQA Consultant will define the limits and nature of the defect. If the moisture content of the structural fill is outside of the acceptable range, the soil shall be wetted or dried as appropriate. Wetting shall be accomplished using a water truck and spray nozzle, unless the CQA Consultant approves an alternative method. During wetting or drying, the soil shall be regularly disced or otherwise mixed so that uniform moisture conditions are obtained. Any delays in progress due to moisture conditioning (wetting or drying) of soil, however, are the responsibility of Contractor.
- D. No protective soil shall be placed over a geosynthetics layer that has not been tested and approved by the CQA Consultant.
- E. If protective soil freezes during construction, Contractor shall either remove and replace the frozen protective soil with suitable unfrozen structural fill, in accordance with these Specifications, or shall allow frozen protective soil to thaw in place, then scarify and dry the thawed structural fill until it has an acceptable moisture content. The frozen structural fill shall not be reused until it has thawed, been disced, and then reworked to an acceptable moisture content.

3.10 STRUCTURAL FILL PLACEMENT AND COMPACTION

- A. All earthwork performed shall be constructed to the lines and grades shown on the Drawings.
- B. The structural fill shall be placed and compacted in lifts to the lines and grades shown on the Drawings. The compacted thickness of each lift will be 6 in. maximum.
- C. The CQA Officer will test the compacted structural fill during construction as described in Table 02220-2.
- D. No fill shall be placed over a lift that has not been tested and approved by the CQA Officer. Should the tests indicate that the dry density of any layer of fill, or portion thereof is below the minimum acceptable value, the particular layer, or portion thereof, shall be reworked and recompactd at no cost to Owner.
- E. Contractor shall not place frozen structural fill, nor shall Contractor place structural fill on frozen ground.
- F. Extreme care shall be taken when backfilling and compacting anchor trenches to avoid any damage to underlying geotextile/geomembrane. Any material damaged during backfilling shall be replaced by the Contractor at no additional cost to the Owner.

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3.11 TOPSOIL

- A. Contractor shall place topsoil to the lines and grades shown on the Drawings and as specified in this Section.
- B. Topsoil shall be placed in one lift using low-ground pressure construction equipment meeting the requirements of Part 3.15 of this Section.
- C. The total thickness of the vegetative topsoil and protective cover soil shall be a minimum of 24 in.
- D. Vegetative topsoil shall not be over compacted so that it inhibits growth of vegetation.
- E. The CQA Consultant shall test the vegetative topsoil during construction as described in Table 02220-2.
- F. Contractor shall moisture-condition vegetative topsoil in either the stockpile area or work area. Any delays in progress due to moisture conditioning (wetting or drying) of soil, however, are the responsibility of Contractor.
- G. No vegetative topsoil shall be placed over a lift that has not been tested and approved by the CQA Consultant.
- H. Contractor shall not place frozen vegetative topsoil, nor shall Contractor place vegetative topsoil on frozen ground.
- I. If vegetative topsoil freezes during construction, Contractor shall either remove and replace the frozen vegetative topsoil with suitable unfrozen vegetative topsoil, in accordance with these specifications, or shall allow frozen vegetative topsoil to thaw in place, then scarify and dry the thawed vegetative topsoil until it has an acceptable moisture content. The frozen vegetative topsoil shall not be reused until it has thawed, been disced, and then reworked to an acceptable moisture content.

3.12 FIELD QUALITY ASSURANCE

- A. The CQA Officer shall perform testing in accordance with Table 02220-2. The Contractor shall take the testing frequencies into account in planning its construction schedule.
- B. A special testing frequency will be used at the discretion of the CQA Officer when visual observations of construction performance or material type indicate a potential problem.

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- C. If a defective area is discovered in the earthwork, the CQA Officer will determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Officer will determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Officer deems appropriate. If the defect is related to adverse site conditions, such as overly wet soils or surface desiccation, the CQA Officer will define the limits and nature of the defect.
- D. After the extent and nature of a defect has been determined. Contractor shall correct the deficiency to the satisfaction of the CQA Officer. The cost of corrective actions and additional testing shall be borne by the Contractor.
- E. Additional testing will be performed by the CQA Officer to verify that the defect has been corrected. This additional testing will be performed before any additional work is allowed in the area of the deficiency. The cost shall be borne by the Contractor.

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TABLE 02220-2

Testing During Placement (Conformance Testing)

Material	Test	ASTM No.	Frequency
Structural Fill	Standard Proctor	D 698	Upon visual change or change in source
	Soil Classification (USCS Classification System)	D 2487	
	Sieve Analysis	D 422	
	Natural Moisture Content	D 2216	
	Atterberg Limits	D 4318	
	Moisture Content/Density (anchor trenches only and under permanent access road)	D 6938	1 per 1,000 linear feet of anchor trench and 3 per 1,000 linear feet of access road, per 12-inch lift
Grading Layer (Subgrade)	Soil Classification	D 2487	Upon visual change or change in source
	Sieve Analysis	D 422	
	Atterberg Limits	D 4318	
	Standard Proctor	D 698	
	Moisture Content/Density	D 6938	2 per acre per lift
Protective/Cover Soil	Soil Classification	D 2487	Upon visual change or change in source
	Sieve Analysis	D 422	1/5,000 CY
	Standard Proctor	D 698	Upon visual change or change in source
	Moisture Content/Density	D 6938	Minimum 1 per acre per lift
	Permeability (See Note 1)	D 2434 D5084	1/5,000 CY and every change in soil conditioning or compaction technique

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Material	Test	ASTM No.	Frequency
Aggregates and Riprap	Classification	D 448	Upon visual change or change in source
	Sieve Analysis	C 136	Upon visual change or change in source
	Carbonate Content (only for aggregates used under final cover geomembrane, i.e. gas wells)	D 3042	Upon visual change or change in source
Topsoil	Soil Classification	D 2487	Upon visual change or change in source
	Organic Content		
	pH	E 70	
	Soluble Salts (Conductivity)		

Notes:

1. Permeability test shall be performed on a sample of cover soil remolded to be 95% of standard proctor (ASTM D698). The inflow to and outflow from the specimens shall be monitored with time and the hydraulic conductivity calculated for each recorded flow increment. The test shall continue until steady state flow is achieved and relatively constant values of hydraulic conductivity are measured. Permeameter confining pressures and saturation back pressures shall be proposed to the Engineer prior to testing for the Engineer's approval. The soil material source will only be considered suitable if the hydraulic conductivity of the soil meets minimum specified requirement.

3.13 SURVEYING AND CONSTRUCTION TOLERANCES

- A. Contractor shall retain a Surveyor with current licensure in Florida who shall be responsible for providing survey control of Contractor's Work.
- B. The Surveyor shall prepare "as-built" documentation in accordance with the requirements and schedule given in Section 01300 of these Specifications.

3.14 SPECIAL REQUIREMENTS

- A. Provide a sealed as-built survey of top of intermediate cover prior to geomembrane installation to verify the required thickness of intermediate cover is installed. Depth thickness determinations shall be obtained on a maximum 100 ft x 100 ft grid pattern. Depth verifications may be made by survey, test pits, temporary depth markers, or probes. Additional intermediate cover shall be placed in areas where insufficient depth is determined prior to

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geomembrane deployment in that area. Temporary depth markers, if used, shall be removed prior to installing geomembrane.

- B. Provide a signed and sealed as-built survey of top of final cover (i.e. top of topsoil layer) prior to sodding to verify the required thickness of protective cover and topsoil combined is installed. Depth thickness determinations shall be obtained on a maximum 100 ft x 100 ft grid pattern. Depth verifications may be made by survey, test pits, or temporary depth markers with careful attention to avoid damage to the underlying geosynthetics. Additional protective cover and/or topsoil, as appropriate, shall be placed in areas where insufficient depth is determined prior to laying sod in that area. Temporary depth markers, if used, shall be removed prior to installing sod. Survey shall be signed and sealed by a professional land surveyor.

3.15 PRODUCT PROTECTION

- A. Contractor shall use all means necessary to protect all prior Work, including all materials and completed Work of other sections.
- B. In the event of damage, Contractor shall immediately make all repairs and replacements necessary, with the approval of the CQA Officer and at no additional cost to Owner.

3.16 GROUND PRESSURE RESTRICTIONS OVER GEOSYNTHETICS

- A. Equipment shall not be driven directly on geosynthetics (e.g., geomembrane, geotextile, geocomposite) at any time.
- B. Unless otherwise specified by Engineer, all equipment operating on earthen materials overlying geosynthetics shall comply with the following:
- C. Allowable equipment ground pressure:

Allowable Equipment Ground Pressure (psi)	Thickness of Overlying Compacted Soil (ft)
<5	1.0
<10	1.5
<20	2.0
>20	3.0

END OF SECTION

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SECTION 02225 TRENCHING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, tools, supervision, transportation, and installation equipment to perform all trenching work as specified herein and as shown on the Drawings.
- B. The Contractor shall be prepared to construct all trenches in conjunction with other aspects of the Work.
- C. Work of this section includes, but is not necessarily limited to, trenching for subsurface drainage, stormwater pipe installation, anchor trenches and installation of backfill material.

1.02 RELATED SECTIONS

- A. Section 02220, Earthwork
- B. Section 02270, Soil Erosion and Sediment Control

1.03 SUBMITTALS

- A. Contractor shall notify Owner in writing a minimum of 7 days prior to starting trenching activities. The notice shall state the material to be used, the equipment to be used, the date and time that placement operations will start, and the name of the person in the field who will be in charge of the trenching activities.
- B. Contractor shall submit to Engineer the proposed layout for each trench 7 days prior to the start of trenching.
- C. If Work is interrupted for reasons other than inclement weather, Contractor shall notify Owner a minimum of 24 hours prior to the resumption of Work.

1.04 CONSTRUCTION QUALITY ASSURANCE

- A. Contractor shall be aware of the activities outlined in the CQA Plan and shall account for these activities in the construction schedule.
- B. Trenching activities will be visually monitored by the CQA Consultant.

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1.05 CONSTRUCTION LAYOUT AND TOLERANCE

- A. Prior to commencing any trenching, the Contractor shall satisfy himself as to the accuracy of all survey data as indicated on the drawings and in the specifications and/or as provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the survey data, he shall immediately notify the Engineer that proper adjustments can be anticipated or ordered. Commencement by the Contractor of any trenching shall be held as an acceptance of the survey data by him after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions, or inaccuracies of the survey data.
- B. Contractor shall be responsible for all construction layouts.
- C. Unless otherwise approved by Engineer, trenches shall be constructed to within the tolerances in Section 01300.
- D. All trenching shall be performed to strictly maintain slopes and drainage as shown on the drawings.

PART 2 PRODUCTS

2.01 EQUIPMENT

- A. The Contractor shall only use equipment that has been approved by the Engineer for this work.
- B. The Contractor shall furnish, operate, and maintain equipment as is necessary to produce uniform trenches.

PART 3 EXECUTION

3.01 FAMILIARIZATION

- A. Contours of existing ground elevations shown on the Drawings are believed to be reasonably correct for the date that the topographic survey was obtained. The Contractor is advised that grades depicted on the Drawings may vary from field conditions at the time of construction and that such variations will not be a justification for additional costs to Owner.
- B. The Contractor shall maintain and protect existing utilities that may pass through the work area.

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- C. The Contractor shall protect benchmarks and existing structures from excavation equipment and vehicular traffic.
- D. The Contractor shall protect above and below grade utilities that are to remain.

3.02 TRENCHING

- A. Trenching will extend into waste. Contractor shall take all necessary safety precautions during construction activities and shall conform to all applicable OSHA regulations, Owner's safety requirements, and Contractor's health and safety plan.
- B. Prior to starting trenching operations, Contractor shall remove topsoil found suitable by Owner for reuse. Such material shall be removed in a manner to separate it clearly from underlying material and shall be stored on site where directed by Owner. Topsoil shall remain the property of Owner.
- C. Trenches shall be constructed to the dimensions and alignments shown in approved trench layout plan. Alignments shall be adjusted by Contractor, if necessary and based on CQA Consultant's approval, to achieve the specified slope and spacing requirements.
- D. Excavated soil shall be separated from excavated waste wherever possible and any soil free of waste shall be reused upon approval by the Engineer. Any soil not suitable for reuse shall be loaded and hauled to the low areas of the Class I landfill by Contractor.
- E. Excavated refuse shall be relocated to low areas of the Class I landfill.
- F. The minimum anchor trench dimensions shall always be maintained. Anchor trench backfill material shall be structural fill material tested and approved in accordance with Section 02220.
- G. The Contractor shall minimize open overnight trenches.

3.03 WATER AND LIQUIDS

- A. Perched pockets of leachate may be encountered during trenching operations. Contractor shall notify the CQA Consultant immediately if leachate is encountered. Leachate seeps locations shall be excavated 4 feet (min) or until permeable waste is reached. Excavation shall be backfilled with AASHTO #57 or approved equal up to the leachate seep elevation. Compacted structural fill shall be placed over AASHTO #57 or approved equal to achieve bottom elevation of anchor trench.

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- B. The Contractor shall take every precaution to prevent water from entering an open trench. Should water enter the trench, the water shall be removed so as to return the trench bottom to a firm, dry condition. Water in trenches within the limits of liner shall be considered leachate and shall be hauled by Contractor to, and disposed of at, the on-site storage unit at no cost to Owner.

3.04 FIELD QUALITY ASSURANCE

The CQA Consultant will visually observe trenching operations to verify trench dimensions.

3.05 SAFETY PROVISIONS

Trenching shall be performed in strict accordance with OSHA and all other applicable laws and regulations, as well as Contractor's health and safety plan for this project. Job site safety is the sole responsibility of Contractor.

END OF SECTION

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SECTION 02270 SOIL EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, tools, supervision, transportation, installation equipment, and incidentals required to install erosion mat in drainage terraces, silt fence, sediment traps, diversion dikes, rock grade control structures, and temporary and permanent vegetation for erosion control as specified herein and as shown on the Drawings.
- B. The Contractor shall furnish all labor, materials, tools, supervision, transportation, installation equipment, and incidentals required to maintain all erosion and sediment control measures and structures throughout the duration of the Project and removal of temporary measures and structures, where necessary.

1.02 RELATED SECTIONS

- A. Section 02220, Earthwork
- B. Section 02225, Trenching
- C. Section 02485, Sodding
- D. Section 02486, Hydroseeding

1.03 REFERENCED STANDARDS

- A. Florida Erosion and Sediment Control Planning Handbook, or current edition.
- B. Florida Department of Transportation Standard Specifications for Roads and Structures Construction, Latest edition.

1.04 SUBMITTALS

- A. At least 14 days prior to starting the work of this section, Contractor shall submit the following to Engineer:
 - 1. Samples of proposed materials.
 - 2. Manufacturer's product data and recommended methods of installation.
 - 3. Contractor's proposed erosion and sedimentation control plan, based on Contractor's proposed Work staging and sequencing plan. Such plan shall include all temporary measures proposed to ensure sufficient measures to

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control stormwater run on, runoff, erosion, and sedimentation to protect the Work and the property. Contractor's proposed erosion and sedimentation control plan shall include, at a minimum, all erosion and sedimentation control measures described and illustrated in the Contract Documents, plus such additional measures to control erosion and sedimentation based on the Contractor's means, methods, staging and sequencing of construction.

- B. At the end of each work week from the Notice to Proceed until substantial completion, the Contractor's lead representative at the Work site shall complete an inspection of erosion and sedimentation control measures. The inspection form shall be submitted seven days after the Notice to Proceed for review by the Engineer. The weekly inspection forms shall be submitted at a maximum three days after the inspection date. The inspection form should be similar to the form contained in the latest edition of the State of Florida "Erosion and Sediment Control Designer and Reviewer Manual". At a minimum, the following items shall be inspected:

1. Culverts
2. Perimeter channels
3. Drainage retention area (ponds)
4. Drainage inlets
5. Installed erosion protection measures
6. Disturbed, un-vegetated areas and measures to minimize and contain erosion
7. Actions items
8. Update on action items undertaken from previous inspections

1.05 CONSTRUCTION QUALITY ASSURANCE

- A. The Contractor shall be aware of the activities outlined in the Construction Quality Assurance (CQA) Plan and shall account for these CQA activities.
- B. At the discretion of the Owner, the work of this Section may be subjected to CQA monitoring.

PART 2 PRODUCTS

2.01 EROSION MAT

Erosion mat shall be permanent North American Green SC250, or approved equivalent. Table 02270-1 provides the required minimum material property values.

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2.02 FABRIC FORMED CONCRETE

Filter point fabric-formed concrete shall be installed per the Section 02095.

2.03 SILT FENCE

Silt fence shall meet the requirements given in the Construction Drawings.

PART 3 EXECUTION

3.01 FAMILIARIZATION

- A. Prior to implementing any of the work described in this section, Contractor shall become thoroughly familiar with all portions of the work falling within this section.
- B. Inspection:
 - 1. Prior to implementing any of the work in this section, Contractor shall carefully inspect the installed work of all other sections and verify that all work is complete to the point where the installation of this section may properly commence without adverse impact.
 - 2. If Contractor has any concerns regarding the installed work of other sections, it shall notify Engineer in writing within 48 hours of its site inspection. Failure to inform Engineer in writing or installation of the work of this section will be construed as Contractor's acceptance of the related work of all other sections.

3.02 INSTALLATION

- A. Erosion Mat
 - 1. The mat shall be placed on a smooth surface that is free of trash, ruts, and rocks.
 - 2. Placement on Slopes:
 - a. Anchor trenches shall be located at the crest and the toe of the terrace. Anchor trenches shall be a minimum of 12 in. deep. The anchor trench at the crest shall be located at 1 ft from the edge of the slope. The geometry of the anchor trench, type of fastener, fastener spacing, and method of construction of the anchor

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trenches shall be in accordance with the Manufacturer's instructions.

- b. Erosion mat shall be unrolled as directed by the Manufacturer. Adjacent panels of erosion mat shall be installed with a minimum overlap of 4 in. Fastening of the erosion mat shall begin in the toe anchor trench and shall progress upslope to the crest anchor trench. Spacing of fasteners shall be in intervals of 3 to 5 ft vertically upslope. Horizontal spacing of fasteners shall be in accordance with the Manufacturer's instructions. Backfill shall be placed in anchor trenches over fasteners as installation proceeds, and sod over anchor trench after backfill has been placed.
- B. The Contractor shall install silt fence on a level grade downslope of all disturbed areas as shown on the Drawings and at locations where stockpiles and temporary measures not shown on Drawings need silt fence to prevent sedimentation. Both ends of the silt fence section must extend at least 8 feet upslope at 45 degrees to the main fence alignment. Sediment accumulated against the silt fence shall be removed when it reaches one half of the above-ground height of the fence and stockpiled as directed by the Owner.
- C. The Contractor shall re-vegetate all disturbed areas within 14 days of termination of earthwork activities per the contract specifications.
- D. The Contractor shall construct all stone check dams, erosion control mats, riprap and silt fence as shown on the Drawings.

3.03 PRODUCT PROTECTION

- A. The Contractor shall use all means necessary to protect all prior Work and materials and completed work of other sections.
- B. In the event of damage, Contractor shall immediately make all repairs and replacements necessary, to the approval of Owner and at no additional cost to Owner.

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TABLE 02270-1
EROSION MAT MATERIAL PROPERTY VALUES

Net Type	Matrix	Shear Stress (lb/ft ²)	Permissible Velocity (unvegetated) (ft/s)	Slope
Synthetic/Organic	Straw/Coconut	3.0*	9	> 1H:1V

*Shear stress is given for bare soil at 0.5 hr duration.

END OF SECTION

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SECTION 02485 SODDING

PART 1 GENERAL

1.01 SCOPE OF WORK

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

1.02 RELATED WORK

- A. Section 02220, Earthwork
- B. Section 02486, Hydroseeding

1.03 REFERENCED STANDARDS

- A. The latest edition of the Florida Department of Transportation (DOT) Standard Specifications for Road Bridge Construction (Standard Specifications) shall be referred to for both specific and general standards for materials, construction, workmanship, and quality control as specified herein with exceptions, as noted herein.
- B. The latest edition of DOT Roadway and Traffic Design Standards.

1.04 SUBMITTALS

Soil Analysis: If necessary to utilize fertilizer on sodding, the Contractor shall furnish a soil analysis for each borrow source or distinct on-site soil type used as topsoil for the final cover. The analysis shall be made by a qualified independent soil-testing agency, to be approved by the Engineer. The analysis shall state percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of the soils. The analysis shall state recommended quantities of nitrogen, phosphorus, and potash nutrients and any soil amendments to be added to produce satisfactory topsoil. The Contractor shall perform soil test 30 days prior to mobilizing for landscape construction.

PART 2 PRODUCTS

2.01 LIME

Lime for grassing shall conform to Section 982 of the Standard Specifications.

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2.02 FERTILIZER

- A. Fertilizer for grassing shall conform to Section 982 of the FDOT Standard Specifications.
- B. Fertilizer shall be granulated so that 80 percent is held on a 16-mesh screen, uniform in composition, dry, and free flowing. The Contractor shall test screen one bag of fertilizer per source and per shipment.

2.03 SODDING

- A. The following sections of the FDOT Standard Specifications shall apply:
 - 1. Section 575-1, 4, 5, 6
 - 2. Section 981-1, 981-3 and 981-5, Materials
- B. Sod shall be recognized Argentine Bahia grass and shall be well matted with roots and shall be of firm tough texture having a compact top growth and heavy root development. It shall not contain Bermuda grass, weeds or any other objectionable vegetation. Other sodding species may be utilized pursuant to the Project's product substitution procedures. The soil embedded in the sod shall be good, clean earth and free from stones and debris. The sod shall be free from fungus, vermin and other plant diseases and shall have been mowed at least three times with an approved lawn mower, with final mowing not more than seven days before the sod is cut. The sod shall be sufficiently thick to ensure a dense stand of live grass. The sod shall be live, fresh and uninjured at the time of planting. It shall be planted as soon after being dug up as possible and shall be shaded and kept moist from the time it is dug up until the time it is planted.

2.04 WATER

Water for sodding shall conform to Section 983 of the FDOT Standard Specifications. In addition, watering is required for sod installed above erosion control mat until vegetation is established.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. All areas within the limits of work and all areas disturbed by the Contractor's operations shall be sodded unless otherwise indicated on the Drawings.

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- B. The period of sod establishment shall begin immediately after the completion of sodding in an area and shall continue for a period of 1 year after the completion of sodding on the entire project unless the desired sod cover is established in a shorter period of time and shortening of the sod-establishment period is authorized by the Engineer.
- C. Areas to be sodded shall be graded to remove construction debris, litter, depressions, undulations, and irregularities in the surface before sodding and in accordance with the Drawings. Grading activities shall be conducted such that the minimum required thickness of topsoil is maintained.

3.02 SODDING

- A. Sodding shall be placed within the designated final closure areas and in all graded and disturbed areas that have a 4 (horizontal) to 1 (vertical) slope or steeper, excluding stockpiles, and other areas as shown on the Drawings.
- B. The following sections of the FDOT Standard Specifications shall apply:
 - 1. Section 570-3, Construction Methods
- C. Exceptions:
 - 1. Section 570-3.3, replace phrase "parallel with the roadway" with "an area."
 - 2. Section 570-3.3, Placing Sod; do not plant dormant sod or if ground is frozen. Rolled sod shall be placed parallel to contours. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. The offsets of individual staggered strips shall not exceed 6 inches. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass. The sod must be pegged using suitable wooden pegs. The pegs should be driven through the sod strips into firm earth, at a minimum frequency of 2 pegs per commercial rectangle (i.e. 2' by 3') and 1 peg per 50 square feet for rolled sodding. The pegs shall not be longer than 15 inches and shall be driven through the sod strips into firm earth, at suitable intervals. It is the responsibility of the CONTRACTOR to determine if the peg frequency should be increased and that sodding will not be displaced by gravity, low friction with the underlying topsoil, the flow of water or other means. The CONTRACTOR shall ensure that the pegs do not puncture or damage the underlying geosynthetics. Water sod thoroughly with a fine spray immediately after planting. Roll sod within 24 hours of placement to ensure contact between sod and subgrade.

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3. Section 570-3.6, watering shall conform to requirements previously specified herein. Replace the word "Department" with the Word "County" in the last sentence. The cost of resodding shall be borne exclusively by the Contractor.
4. Section 570-4, Maintenance shall be performed as specified herein.

3.03 CLEAN UP

All excess sod materials, stones, and other waste shall be removed from the site weekly and shall not be allowed to accumulate.

3.04 MAINTENANCE

- A. Maintenance shall begin immediately following the last operation of installation and continue until conclusion of the sod establishment period specified herein. Maintenance shall include watering, mowing, resodding, repair of erosion, and all other work necessary to produce a uniform stand of grass. During construction and for a period of 45 days after substantial acceptance of the project, the Contractor shall water the sod daily (or as necessary to support growth), maintain original grades, repair erosion damage and mow the sod. Sod will be considered for final acceptance when the sod roots are firmly anchored to underlying soil and the permanent grass is healthy and growing on 97 percent of the area with no bare areas wider than 12 inches, as determined by the Engineer. If the planted areas must be resodded, reshaped, or otherwise repaired, regardless of cause, the Contractor shall perform such work at the Contractor's expense. The period of sod establishment for areas that are resodded shall extend to 1 year after the completion of resodding unless otherwise authorized by Engineer.
- B. Mowing shall be done with approved mowing machines and any time the grass height reaches 6- inches. Mowing shall leave the grass a minimum of 3 inches high. The water used in the sodding operations may be obtained from any approved spring, pond, lake, stream, canal, or municipal water system. The water shall be free of excess and harmful chemicals, acids, alkalies, or any substance which might be harmful to plant growth. Saltwater shall not be used.

END OF SECTION

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SECTION 02486 HYDROSEEDING

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall furnish all labor, materials, equipment, and incidentals required and perform all operations in connection with the installation of hydroseeding in accordance with the lines, grades, design, and dimensions shown on the Construction Drawings and as specified herein. Seeding may only be used in designated areas on the Construction Drawings. All other areas shall be sodded.

1.02 RELATED WORK

- A. Section 02220, Earthwork
- B. Section 02485, Sodding

1.03 REFERENCED STANDARDS

- A. The latest edition of the Florida Department of Transportation (DOT) Standard Specifications for Road Bridge Construction (Standard Specifications) shall be referred to for both specific and general standards for materials, construction, workmanship, and quality control as specified herein with exceptions, as noted herein.
- B. The latest edition of DOT Roadway and Traffic Design Standards.

1.04 SUBMITTALS

- A. **Soil Analysis:** The Contractor shall furnish an analysis of on-site and off-site soils used as topsoil for the areas that will be hydroseeded. The analysis shall be made by a qualified independent soil-testing agency, to be approved by the Engineer. The analysis shall state percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of the soils. The analysis shall state recommended quantities of nitrogen, phosphorus, and potash nutrients and any soil amendments to be added to produce satisfactory topsoil. The Contractor shall perform soil test 30 days prior to mobilizing for landscape construction.
- B. **Method Statement:** Method Statement of Hydroseeding shall be provided to the Engineer at least ten (10) working days in advance for approval prior to

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execution. The Method Statement shall contain, but not be limited to, the following items:

1. Binder
2. Binder type.
3. Mix proportions.
4. Mixing Procedure
5. Spraying Equipment
6. Equipment for short-range application.
7. Equipment for long-range application.
8. Agitator
9. Pressure pump
10. Biodegradable Mat
11. Installation procedure.
12. Mat anchor type.
13. Size, length, and spacing of mat anchor

PART 2 PRODUCTS

2.01 FERTILIZER

- A. Fertilizer for grassing shall conform to Section 982 of the FDOT Standard Specifications.
- B. Fertilizer shall be granulated so that 80 percent is held on a 16-mesh screen, uniform in composition, dry, and free flowing. The Contractor shall test screen one bag of fertilizer per source and per shipment.

2.02 SEED BLEND AND QUALITY CERTIFICATION

- A. The application rate (lbs per acre) shall be:

Bahia grass, Pensacola	80
Bermuda grass, Unhulled	10
Bermuda grass, Hulled	10
Millet, Brown Top	20
Ryegrass, Annual or Gulf Annual	20
- B. Seasonal grasses:
 1. October 1 to March 31 using Annual or Gulf Annual Ryegrass.
 2. April 1 to September 30 using Brown Top Millet. (Delete Millet if birds are a concern.) Timing is subject to the weather.
- C. The seed shall not contain noxious or prohibited weed seeds. A laboratory that is certified by the State of Florida shall test the seed. The test date on the seed

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analysis card shall not be more than six (6) months old. Seed shall be packaged in containers that are fully labeled and comply with the state laws (Florida) and regulations. Seed analysis cards shall accompany the seed used as a part of the hydroseeding installation.

2.03 MULCH MATERIAL

- A. Wood cellulose fiber mulch for use with hydraulic application of grass seed and fertilizer shall consist of specially prepared wood cellulose fiber or a combination of wood cellulose and recycled newsprint, processed to contain no growth or germination inhibiting factors and dyed an appropriate color to facilitate visual metering of the application of materials.
- B. The mulch material shall be supplied in packages having a gross weight of not in excess of 100 pounds each. On air-dry weight basis, the wood cellulose fiber shall contain a maximum of 10 to 15 percent (10-15%) moisture, plus or minus 3 percent (3%), at the time of manufacture.
- C. The wood cellulose fiber shall be manufactured so that, after addition and agitation in slurry tanks with fertilizers, grass seed, water, and other approved additives, the fibers in the material will become uniformly suspended to form homogeneous slurry. When hydraulically sprayed on the ground, the material will form a blotter-like cover impregnated uniformly with grass seed.
- D. The cover will allow the absorption of moisture and allow rainfall or applied water to percolate to the underlying soil. Shrinkage after wetting shall not exceed 20 percent of the surface area.
- E. The Wood Cellulose Fiber shall be applied at the following rates:
 - 1. per 1,000 square feet 30 pounds
 - 2. per acre 1300 pounds (or at manufacturer's recommendations)

2.04 TACK MATERIAL

Binder (glue) shall be applied at the manufacturer's recommended rate. The tack/binder shall be a biodegradable (environmentally friendly) material. Polyvinyl acetate binder is not acceptable. A printed specification sheet shall be supplied upon request to the owner or owner's representative.

2.05 WATER

Water for seeding shall conform to Section 983 of the FDOT Standard Specifications.

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PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Hydroseeding shall be carried out as soon as practicable on graded and disturbed areas not designated for sod.
- B. Hydroseeding shall not be applied to areas that are 5% or steeper or in areas designated for sodding in the Construction Drawings.
- C. Seeding shall be carried out by means of a proper hydroseeder where approved slurry of seeds, mulch, fertilizers, binders, and organic matter are sprayed onto the prepared soil surface.
- D. The period of grass establishment shall begin immediately after the completion of hydroseeding in an area and shall continue for a period of 1 year after the completion of seeding on the entire project unless the desired grass cover is established in a shorter period of time and shortening of the grass-establishment period is authorized by the Engineer.
- E. Areas to be grassed shall be graded to remove construction debris, litter, depressions, undulations, and irregularities in the surface before grassing and in accordance with the Drawings.
- F. The Engineer or his designated Monitor shall be present during hydroseeding and material applications and observe and document that the seed, mulch, fertilizer, tackifier, and other materials were applied according to the specifications. The Monitor shall personally observe that all material was delivered to the site unopened and shall collect all bags and containers used to hold these products which will be submitted to the Engineer for inspection.

3.02 HYDROSEEDING

- A. Preparation of the Soil Surface Prior to Hydroseeding:
 - 1. The areas to be hydroseeded shall be uniform and shall conform with the finished grade shown on the plans or as otherwise designated. Minor shaping of uneven and rough areas outside the graded section shall be performed as directed by the Engineer in order to provide for more effective erosion control and for ease of subsequent mowing operations.
 - 2. Vertical striations or grooves shall be absent from the final trimmed slope; instead a rough-textured surface shall be prepared. Any surface rills in excess of 1" shall be rectified by re-trimming.

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3. Gullies or local washouts shall be backfilled with suitable material placed in layers of up to 8" thick, each layer being compacted as required by the earthwork specifications.
 4. Large clods of earth and stones greater than 2" shall be removed.
 5. Slopes that have been exposed for a long time must be trimmed and scaled to remove any oxidized layer prior to hydroseeding.
- B. The following sections of the FDOT Standard Specifications shall apply: Section 570-3, Construction Methods
- C. Exceptions:
1. Section 570-3.3, section does not apply
 2. Section 575-3.6, watering shall conform to requirements previously specified herein. Replace the word "Department" with the Word "County" in the last sentence. The cost of reseeding shall be borne exclusively by the Contractor.

3.03 CLEANUP

All excess hydroseeding materials, stones, and other waste shall be removed from the site weekly and shall not be allowed to accumulate.

3.04 MAINTENANCE

- A. Maintenance shall begin immediately following the last operation of installation and continue until conclusion of the seed establishment period specified herein. The Contractor is to ensure the full establishment of ground cover by taking the necessary maintenance procedures, such as regular watering, fertilizing, and reseeding of failed areas. The Contractor shall guarantee the success of the seeding work. Any dead grass or bare spots larger than 3 square feet shall be immediately replaced or re-sprayed at Contractor's own expense. If the planted areas must be replanted, reshaped, or otherwise repaired, regardless of cause, the Contractor shall perform such work at the Contractor's expense. The period of grass establishment for areas that are replanted shall extend to 1 year after the completion of replanting unless otherwise authorized by Engineer.
- B. Mowing shall be done with approved mowing machines and any time the grass height reaches 6- inches. Mowing shall leave the grass a minimum of 3 inches high. The water used in the seeding operations may be obtained from any approved spring, pond, lake, stream, canal, or municipal water system. The water

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shall be free of excess and harmful chemicals, acids, alkalies, or any substance which might be harmful to plant growth. Saltwater shall not be used.

END OF SECTION

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SECTION 02701 LLDPE GEOMEMBRANE LINER

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Work specified in this Section includes manufacturing and installing textured Linear Low Density Polyethylene (LLDPE) geomembrane liner as part of the final cover system as shown on the Construction Drawings and as specified herein.
- B. All materials shall conform to the following requirements and shall be of new stock of the highest grade available, free from defects, and recently manufactured.
- C. All installation shall be in conformance with the manufacturer's recommendations and with current industry standards. Sampling and testing of on-site and installed liner system components shall be coordinated with the Construction Quality Assurance (CQA) Consultant as provided in the CQA Plan.

1.02 RELATED SECTIONS

- A. Section 01300, Contract Administration
- B. Section 02220, Earthwork
- C. Section 02270, Erosion and Sediment Control
- D. Section 02930, Geocomposite

1.03 DEFINITIONS

- A. Lot: A quantity of resin (usually the capacity of one rail car) used in the manufacture of geomembranes. Finished roll will be identified by a roll number traceable to the resin lot used.
- B. Construction Quality Assurance Consultant (CONSULTANT): Party, independent from MANUFACTURER and INSTALLER that is responsible for observing and documenting activities related to quality assurance during the lining system construction.
- C. ENGINEER: The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.
- D. Geomembrane Manufacturer (MANUFACTURER): The party responsible for manufacturing the geomembrane rolls.

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- E. Geosynthetic Quality Assurance Laboratory (CQA TESTING LABORATORY): Party, independent from the OWNER, MANUFACTURER and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the Owner.
- F. INSTALLER: Party responsible for field handling, transporting, storing, deploying, seaming and testing of the geomembrane seams.
- G. Panel: Unit area of a geomembrane that will be seamed in the field that is larger than 100 ft².
- H. Patch: Unit area of a geomembrane that will be seamed in the field that is less than 100 ft².
- I. Subgrade Surface: Soil layer surface which immediately underlies the geosynthetic material(s).

1.04 REFERENCED STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - D 792 Specific Gravity (Relative Density) and Density of Plastics by Displacement
 - D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
 - D 1238 Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
 - D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
 - D 1603 Test Method for Carbon Black in Olefin Plastics
 - D 3895 Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
 - D 4218 Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds By the Muffle-Furnace Technique
 - D 4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
 - D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
 - D 5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
 - D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
 - D 5641 Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber

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D 5820 Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes

D 5994 Standard Test Method for Measuring Core Thickness of Textured Geomembranes

D 6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods

D 6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes

B. Geosynthetic Research Institute

GRI GM-14 Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes

GRI GM 17 Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes

GRI GM19 Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes

C. Daniel, D.E. and R.M. Koerner, (1993), Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities, EPA/600/R-93/182.

1.05 SUBMITTALS

A. As part of the Bid, Contractor shall submit the following information about the Geomembrane Manufacturer.

1. The geomembrane manufacturer's corporate background and information.
2. The manufacturing capabilities of the manufacturer, including:
 - a. manufacturing quality control procedures; and
 - b. list of material properties, including certified test results, to which are attached cap system samples.
3. The following information on the manufacturer experience (see Section 1.06A for requirements) shall be provided:
 - a. name, location, and type of facility, and date of installation;
 - b. names of owner, project manager, engineer, general contractor, fabricator (if any), and installer; and
 - c. thickness and surface area of geomembrane manufactured.

B. As part of the Bid, Contractor shall submit the following information about the Geosynthetics Installer.

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1. Corporate background and information.
 2. Copy of Installer's letter of approval or license by the Geomembrane Manufacturer and/or fabricator.
 3. The following information on the Installer experience (see Section 1.06B for requirements) shall be provided:
 - a. the name and type of the facility, its location, and dates of installation;
 - b. the names of owner, project manager, engineer, general contractor, geomembrane manufacturer, fabricator (if any), and the name of a contact at the facility who can discuss the project;
 - c. name and qualifications of the Installer's superintendent;
 - d. thickness and surface area of installed geomembrane;
 - e. type of seaming and type of seaming apparatus used; and
 - f. duration of installation.
 4. Resumes of all personnel who will perform seaming operations on this project, including dates and duration of employment.
 5. Resume of the superintendent to be assigned to this project, including references with telephone numbers, dates and duration of employment.
 6. Resume of the "master seamers" to be assigned to this project, including dates and duration of employment.
- C. Furnish the following product data to Engineer prior to delivery of the geomembrane material to the project site. The Owner will not accept delivery of materials until all required submittal information in Section 2701 1.04 has been submitted and approved in accordance with these specifications:
1. Manufacturer's qualifications
 2. Manufacturer's quality assurance data specified in Section 2701 2.02.
 3. Product description, technical data, and catalog cut sheets for all materials to be supplied
 4. Material properties, chemical composition, roll dimensions and maximum roll weight after fabrication
 5. Interface friction angle testing in accordance with Section 2701 2.05.

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6. Certification stating that the resin meets the specification requirements (see Section 2.01)
 7. Copies of quality control certificates issued by the resin supplier including the production dates of the raw material and origin of the raw materials used to manufacture the geomembrane for this Contract.
 8. Results of resin density and polymer melt index tests conducted by the resin supplier to verify the quality of the resin used to manufacture the geomembrane assigned to this Contract and the origin of the resin and quality control certificates issued by the resin supplier.
 9. A written certification stating that no reclaimed polymer is added to the resin during the manufacture of the geomembrane assigned for this Contract. The use of polymer recycled during the manufacturing process may be permitted if approved by Owner and Engineer and if the recycled polymer does not exceed 2% by weight of the total polymer weight.
 10. Manufacturer's written acceptance of Geomembrane Installer's qualifications for installation of geomembrane.
 11. Sample manufacturer warranty
 12. Certification that the geomembrane has been tested for pinholes in the manufacturing plant by electric spark testing or a similar method.
- D. The Installer shall furnish the following information to the Engineer and Owner prior to installation:
1. Installation layout drawings
 - a. Must show proposed panel layout including field seams and details
 - b. Must be approved prior to installing the geomembrane
 - (1) Approved drawings will be for concept only and actual panel placement will be determined by site conditions.
 2. Installer's Geosynthetic Field Installation Quality Assurance Plan including procedures for repairs
 3. Installer's qualifications including Installation Supervisor and Master Seamer(s) qualifications who will be on-site for the entirety of geosynthetic installation

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4. Installer's equipment for use on the geomembrane when deploying overlaying geosynthetic layer(s), soil and other material when less than 24 inches of earth soil is covering the geomembrane
 5. Proposed protection for geomembrane from wind uplift and other weather conditions
 6. Sample workmanship warranty
- E. The Installer will submit the following to the Engineer upon completion of installation:
1. Certificate stating the geomembrane has been installed in accordance with the Contract Documents
 2. The certification must be submitted on certification forms approved for use by the Owner and Engineer
 3. Material and installation warranties
 4. Record drawings showing actual geomembrane placement, repairs, destructive sample locations and seams including typical anchor trench detail
 5. Installer's field quality control documents specified in Section 3.04D
 6. Surveys required by Section 01300.

1.06 QUALITY ASSURANCE

- A. The Owner will engage and pay for the services of a Geosynthetic Quality Assurance Consultant and Laboratory to monitor geomembrane installation and conduct laboratory testing respectively.
- B. Manufacturing and installation of the geomembranes will be monitored and tested by the CQA Consultant as outlined in the CQA Plan.
- C. Installed material that does not conform to these specifications, whether tested by Contractor, Manufacturer or the CQA Consultant, shall be rejected and shall be replaced or repaired by Contractor at no cost to Owner.
- D. Contractor and Geosynthetics Installer shall be aware of the activities in the CQA Plan and shall account for these CQA activities in the installation schedule.

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1.07 QUALIFICATIONS

A. MANUFACTURER:

1. Geomembrane shall be manufactured by the following:
 - a. GSE Lining Technology, Inc.
 - b. Poly-Flex, Inc.
 - c. Agru/America, Inc.
 - d. Approved equal
2. Manufacturer shall have manufactured a minimum of 10,000,000 square feet of LLDPE geomembrane and have a minimum of 5 years' experience in the manufacturing of LLDPE geomembrane.

B. INSTALLER

1. Installer shall have installed a minimum of 2,000,000 square feet of LLDPE geomembrane during the last 5 years on 6 projects, all of which must have been on solid waste landfill applications, similar to the complexity of this project.
2. 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.
3. The Installer shall provide a minimum of one Master Seamer for work on the project. The Master Seamer must have completed a minimum of 5,000,000 square feet of polyethylene geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project.
4. Other welders shall have a minimum of 1,000,000 square feet of polyethylene geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project.

1.08 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

A. Labeling: Each roll of geomembrane delivered to the site shall be labeled by the MANUFACTURER. The label will identify:

1. Manufacturer's name
2. Product identification
3. Thickness
4. Length
5. Width

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6. Roll number
- B. Delivery: Rolls of liner will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.
 - C. Storage: The on-site storage location for geomembrane material, provided by the Installer to protect the geomembrane from punctures, abrasions and excessive dirt and moisture should have the following characteristics:
 1. level (no wooden pallets)
 2. smooth
 3. dry
 4. protected from theft and vandalism
 5. adjacent to the area being lined
 6. other recommendations by the Manufacturer
 - D. Handling: Materials are to be handled so as to prevent damage.

1.09 WARRANTY

- A. Material shall be warranted, on a pro-rata basis against Manufacturer's defects for a period of 20 years from the date of geomembrane installation. The guarantees shall be made, in writing, directly to the Owner (not the Contractor), and in a format acceptable to the Owner.
- B. Installation shall be warranted against defects in workmanship for a period of 1 year from the date of acceptance by the Owner. The guarantee shall be made directly to The Owner in a format acceptable to the Owner. The Contractor and the Geomembrane Manufacturer/Installer shall certify, in writing, that the installed geomembrane satisfy the requirements of these specifications and the CQA Plan. The warranty shall not be prorated.

PART 2 PRODUCTS

2.01 GEOMEMBRANE

- A. Material shall be LLDPE geomembrane textured on both sides as shown on the drawings.
- B. Resin
 1. Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane. No post-consumer resin (PCR)

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of any type shall be added to the formulation unless approved in accordance with Section 1.05 D.

2. Natural resin (without carbon black) shall meet the following requirements:

Property	Test Method	Value
Density [g/cm ³]	ASTM D 1505	>0.939
OIT [minutes]	ASTM D 3895	>100

C. Geomembrane Rolls

1. Do not exceed a combined maximum total of 1 percent by weight of additives other than carbon black.
2. Geomembrane shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.
3. Geomembrane material is to be supplied in roll form. Each roll is to be identified with water-proof labels indicating roll number, thickness, length, width and MANUFACTURER.
4. All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in Table 02701-1 and GRI GM17 and the geomembrane shall be tested by an acceptable method of inspecting for pinholes. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.
5. Factory seams are not allowed unless prior approval is approved by the Engineer and Owner. Testing of the factory seams will be performed at the Contractor's expense.

D. Textured surfaced geomembrane shall meet the requirements shown in Table 02701- 1.

E. Extrudate Rod or Bead

1. Extrudate material shall be made from same type resin as the geomembrane.
2. Additives shall be thoroughly dispersed.

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3. Materials shall be free of contamination by moisture or foreign matter.

2.02 MANUFACTURING QUALITY ASSURANCE

- A. Geomembrane Manufacturing Quality Assurance (MQA): The geomembrane liner shall be manufactured in accordance with a written quality assurance/quality control program (MQC). After this MQA/MQC program has been approved by the Engineer or Inspector, the Manufacturer shall not deviate from the program without written approval of the Engineer or Inspector. All testing shall be performed by the manufacturer and results shall be submitted to Engineer/Consultant for review. The MQA/MQC program shall include:
 1. Routine testing of incoming resin prior to manufacture of geomembranes. This testing shall include tests for density, melt index, and oxidative induction time, at a frequency of not less than one per 200,000 LB.
 2. Routine testing of the manufactured sheet for physical parameters. This testing shall include tests for carbon black, tensile strength, and elongation properties, at a frequency of not less than one per 20,000 LB of manufactured geomembrane; tear and puncture resistance and carbon black dispersion at a frequency of not less than one per 45,000 LB of manufactured geomembrane. Thickness shall be monitored continuously through the manufacturing process, or measured physically at a frequency of not less than one per roll of manufactured geomembrane. For textured sheet only, asperity height shall be measured every other roll.
 3. Extrusion rod shall be manufactured from resin identical to that used in geomembrane manufacturing.
 4. The Manufacturer shall reject resin shipments which do not conform with the density and melt index requirements of the approved MQA/MQC program. The Manufacturer shall reject manufactured geomembrane which does not conform to the sheet physical requirements of the approved MQA/MQC program
 5. The LLDPE textured geomembrane shall conform to the requirements prescribed in GRI Test Method GM17.
- B. Manufacturing QC data shall accompany the geomembrane shipment.

2.03 CONFORMANCE TESTING

- A. Samples of the geomembrane will be removed by the Engineer/CQA Consultant at Manufacturer's plant during production of the LLDPE. Samples will be sent to

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a geosynthetics CQA testing laboratory for testing to assure conformance with the requirements of this section. If mutually agreed upon by Owner, Engineer, Contractor, and FDEP, samples may be shipped from Manufacturer to the Engineer/CQA Consultant's designated laboratory, provided that adequate chain-of-custody documentation is prepared and submitted, including origin and destination of sample, lot number, roll number, product name, project name, date of production, and date of shipment, at a minimum. All shipping costs are to be paid for by the Contractor.

The CQA Testing Laboratory for this Project is:

Geotechnics, Inc.

Attn: J.P. Kline

544 Braddock Avenue

East Pittsburgh, PA 15112

- B. Samples and tests shall be selected by the Engineer/CQA Consultant in accordance with the procedures outlined in the CQA Plan.
- C. Samples shall be taken at a minimum frequency of one sample per 100,000 square feet with a minimum of one sample per lot.
- D. The Engineer/CQA Consultant may increase the frequency of sampling in the event that test results do not comply with the requirements of this section.
- E. As a minimum, the following properties of the geomembrane shall be performed: (i) thickness, (ii) specific gravity, (iii) tensile properties, (iv) carbon black content, and (v) carbon black dispersion.
- F. Any geomembrane material that is not certified in accordance with this Section, or that conformance testing indicates do not comply with the properties specified in this Section, will be rejected by Engineer.

2.04 RESPONSIBILITY FOR SAMPLING AND TESTING

- A. Prior to delivering the liner system materials, the Contractor is responsible for conducting several tests on the materials, including the tests identified in Tables 02701-1 and 02701-2 of this Section, and the soil material testing. These tests are performed to verify that the materials will meet the requirements of this project prior to delivery. All test results must be submitted to the CQA Consultant for review and Approval.
- B. The Owner is responsible for the independent testing required by the CQA Plan once the material is approved, including additional interface friction angle testing, conformance testing of geosynthetic materials to be delivered to the jobsite,

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laboratory testing of field seams joining geosynthetics (i.e. destructive testing), and verification testing. The Contractor shall work under the direction of the CQA Consultant to collect the samples associated with the tests specified in this Section, the CQA Plan, and any subsequent testing of a particular section after reworking. Samples shall be collected at locations identified or approved by the CQA Consultant. Destructive test sample locations shall be repaired by the Contractor immediately after sampling.

- C. All MQC tests specified shall be performed at the manufacturer's expense. Additional laboratory or field tests, including conformance testing as required in the CQA Plan, which, in the opinion of the Engineer, are necessary to confirm compliance with the requirements of these specifications, shall be conducted at the Owner's expense. The Contractor and Geomembrane Manufacturer/Installer shall provide access and samples needed for conducting these additional tests.

2.05 INTERFACE FRICTION TESTS

A. Interface Friction Tests

Laboratory friction tests shall also be conducted by both the Manufacturer/Contractor and the Engineer/Owner by their respective laboratory, with representative samples of the materials selected by the Contractor for use in the Work. The Contractor is responsible for shipping costs for materials and soil(s) to the CQA testing laboratory. The initial set of testing and conformance tests shall be paid for by the Contractor or Owner for their tests. If the Contractor changes geosynthetic materials or the material does not meet specifications, then the additional cost to qualify those materials shall be borne by the Contractor. Testing will include 1 interface friction test for each of the test configuration interfaces described as follows:

1. Test Configurations
 - a. Test Configuration No. 1 - Grading Layer – Textured LLDPE
 - b. Test Configuration No. 2 - Drainage Geocomposite – Textured LLDPE
 - c. Test Configuration No. 3 - Drainage Geocomposite – Protective Cover

Note: Refer to Section 02930 for Test Configuration No. 1 and 3 specifications.

2. The testing shall be performed in accordance with ASTM D5321.

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3. The materials shall be tested at normal stresses of 250 psf, 500 psf and 1,000 psf.
4. Displacement rates shall be in accordance with ASTM D5321 Procedure A for geosynthetic to geosynthetic interfaces and Procedure B for soil to geosynthetic interfaces. Set to 0.04 in/min unless Engineer approved.
5. Soil components shall be compacted to the same moisture-density requirements specified for full scale field placement and saturated prior to shear.
6. Each individual normal load will be applied for 1 hour before conducting the shear test.
7. All geosynthetic interfaces shall be sheared under saturated (tap water) conditions.
8. Geosynthetics shall be oriented such that the shear force is parallel to the downslope orientation of the testing components as deployed in the field (Typically the MD of the geosynthetic material). The testing laboratory shall confirm these criteria with the Engineer/CQA Inspector prior to performing the tests.
9. A minimum friction angle for each interface in the system defined as shear strength of 117.6 psf, 235.3, 470.6 psf, at each normal load of 250, 500, 1000 psf respectively. Shear Strength results can be a function of both phi angle and adhesion at each normal load.
10. Conduct test for each normal load to include Peak shear strength of interface through at minimum of 3 inches of displacement.
11. Report for each shear test will include a) Test configuration and conditions b) Plot of Shear Strength vs Displacement c) Plot of all normal loads vs shear strength d) best fit line through data points and report phi and y-intercept for both Peak and Residual tests.
12. Interface shear strength of the actual components which will be used in the liner system shall be tested with method ASTM D5321 or an equivalent test method.
13. This material is part of a closure cap system. The system shall meet the requirements before all the component materials can be deemed acceptable.

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14. Interface friction tests will be conducted by the CQA Testing Laboratory.

PART 3 EXECUTION

3.01 EQUIPMENT

- A. Welding equipment and accessories shall meet the following requirements:
 1. Gauges showing temperatures in apparatus (extrusion welder) or wedge (wedge welder) shall be present.
 2. An adequate number of welding apparati shall be available to avoid delaying work.
 3. Power source must be capable of providing constant voltage under combined line load.

3.02 DEPLOYMENT

- A. The installation is to be performed in conformance with the approved shop drawings, the specifications, the CQA Plan, or as otherwise directed by the Engineer. The geomembrane shall be laid out in such a manner as to minimize the number and length of field seams. The surface of the areas in contact with the geomembrane shall be free of rocks, sticks, roots or any other hard or sharp material and having the potential to puncture the geomembrane. The geomembrane shall be placed over the prepared surfaces in such a manner as to assure minimum handling and in accordance with the manufacturers approved installation procedures. The geomembrane shall be placed so as to minimize wrinkles. Please refer to Section 02220 for further discussion of subgrade preparation.
- B. Assign each panel a simple and logical identifying code. The coding system shall be subject to approval and shall be determined at the job site.
- C. Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.
- D. Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:
 1. Unroll geomembrane using methods that will not damage geomembrane and will protect underlying surface from damage (spreader bar, protected equipment bucket).

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2. Place ballast (commonly sandbags) on geomembrane which will not damage geomembrane to prevent wind uplift according to manufacturer's directives. The Contractor is responsible for protecting the product from damage due to weather at all times.
 3. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage it. Smoking will not be permitted on the geomembrane.
 4. Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than 6 psi.
 5. Do not store or deploy geomembrane in areas of heavy traffic.
 6. When temperatures are lower than 0 degrees C (32 degrees F), unless approved by the OWNER's Representative, no geomembrane material can be unrolled and/or deployed. The OWNER's Representative may adjust the minimum temperature for material deployment. The Installer and OWNER's Representative defines temperature limitations during the preconstruction meeting. Only deploy the quantity of geomembrane anchored and seamed together in one day.
- E. Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.

3.03 FIELD SEAMING

- A. The areas to be seamed shall be cleaned and prepared in accordance with the manufacturer's approved recommendations and the CQA Plan. The seaming equipment used shall be of the extrusion or fusion welding type and shall be capable of providing a uniform and continuous seam with a minimum width of one inch. All seams shall be non-destructively tested.
- B. Seams shall meet the following requirements:
1. To the maximum extent possible, orient seams parallel to line of slope, i.e., down and not across slope.
 2. Minimize number of field seams in corners, odd-shaped geometric locations and outside corners.
 3. Slope seams (panels) shall extend a minimum of five-feet beyond the grade break into the flat area.

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4. Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the Engineer and Installer.
5. Align seam overlaps consistent with the requirements of the welding equipment being used. A 6-inch overlap is commonly recommended for extrusion welding and 4 -inch overlap is commonly recommended for fusion welding.
6. Butt seam will be permitted on the sideslopes; however, the end of the panel will trimmed and seamed at a 45-degree angle to the panel so as not to form a horizontal seam on the slope. No more than two adjacent butt seams are permitted on the sidelslope. If more than two adjacent butt seams are on the sideslopes, then the butt seams shall be offset more than 10 feet up or down slope from each other. Butt seams can be deployed continuously on the inside portion of the terraces of the slope only or on the top of the landfill.

C. During Welding Operations

1. Provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.

D. Extrusion Welding

1. Hot-air tack adjacent pieces together using procedures that do not damage the geomembrane.
2. Clean geomembrane surfaces by disc grinder or equivalent.
3. Purge welding apparatus of heat-degraded extrudate before welding.

E. Hot Wedge Welding

1. Welding apparatus shall be a self-propelled device equipped with an electronic controller which displays applicable temperatures.
2. Clean seam area of dust, mud, moisture and debris immediately ahead of hot wedge welder.
3. Protect against moisture build-up between sheets.

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F. Trial Welds

1. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.
2. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.
3. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift. Additionally perform trial welds at any time the welding equipment is shut down and restarted.
4. Cut five, one-inch wide by six-inch long test strips from the trial weld.
5. Quantitatively test three specimens for peel adhesion (both sides), and then two for shear strength.
6. Four out of the five trial weld specimens shall meet or exceed the results shown in Table 02701-2. The fifth shall meet or exceed 80% of the given values.
 - a. The break, when peel testing, occurs in the liner material itself, not through peel separation (film-tear break (FTB)).
 - b. The break is ductile.
7. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.
8. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.

G. Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. The Installer shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.

H. Defects and Repairs

1. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.

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2. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

I. Cold weather installations should follow guidelines as outlined in GRI GM9.

3.04 FIELD QUALITY CONTROL

A. Manufacturer and Installer shall participate in and conform to all terms and requirements of the Owner's quality assurance program. Contractor shall be responsible for assuring this participation.

B. Quality assurance requirements are as specified in this Section, in the CQA Plan and in the Field Installation Quality Assurance Manual if it is included in the contract.

C. Field Testing

1. Non-destructive testing shall be carried out as the seaming progresses.

a. Vacuum Testing

(1) The equipment shall comprise 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 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 and applicator
- (e) A soapy solution

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- (2) The following procedures shall be followed:
 - (a) Energize the vacuum pump and reduce the tank pressure to approximately 5 psi gauge.
 - (b) Wet a strip of geomembrane seam having an area larger than the vacuum box assembly 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) Examine the geomembrane through the viewing window for the presence of soap bubbles for not less than 10 seconds.
 - (g) If no bubbles appear after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3-in. overlap, and repeat the process.
 - (h) All areas where soap bubbles appear shall be marked with a marker that will not damage the geomembrane and repaired in accordance with Section 3.05.

- b. Air Pressure Testing (For Double Fusion Seams Only)
 - (1) The equipment shall comprise 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, mounted on a cushion to protect the geomembrane.
 - (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 channel 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, allow two minutes for pressure to stabilize, and sustain the pressure for not less than 5 minutes.
 - (e) If loss of pressure exceeds 4 psi, or if the pressure does not stabilize, locate faulty area and repair in accordance with Section 3.05.

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- (f) Cut opposite end to verify continuity of seam, remove needle, or other approved pressure feed device, and seal repair in accordance with Section 3.05.
2. Destructive Testing (performed by CONSULTANT with assistance from INSTALLER)
 - a. Location and Frequency of Testing
 - (1) Collect destructive test samples at a frequency of one per every 500 lineal feet of seam length.
 - (2) Test locations will be determined after seaming.
 - b. Sampling Procedures are performed as follows:
 - (1) INSTALLER shall cut samples at locations designated by the CONSULTANT as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.
 - (2) CONSULTANT will number each sample, and the location will be noted on the installation record drawing.
 - (3) Samples shall be 12 inches wide by the seam and 42 inches long with the seam centered lengthwise.
 - (4) Cut the sample into three equal pieces for distribution as follows:
 - (a) One portion for INSTALLER
 - (b) One portion for the Third Party laboratory
 - (c) One portion for archive storage
 - (5) Each sample shall be numbered and recorded on the final panel layout record drawing, and cross-referenced to a field log which identifies:
 - (a) Panel/sheet number.
 - (b) Seam number.
 - (c) Top sheet.
 - (d) Date and time cut.
 - (e) Ambient temperature.
 - (f) Seaming unit designation.
 - (g) Name of seamer.
 - (h) Seaming apparatus temperature and pressures (where applicable).
 - (6) INSTALLER shall repair all holes in the geomembrane resulting from destructive sampling.
 - (7) Repair and test the continuity of the repair in accordance with these Specifications.
 - (8) A minimum of four 1-inch wide replicate specimens shall be cut from the Installer's sample.

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- (a) A minimum of 2 specimens shall be tested for shear strength and 2 for peel adhesion using an approved field quantitative tensiometer. Jaw separation speed shall be 2 inches per minute. To be acceptable, all field test specimens must meet the specified seam strength requirements and all must fail as Film Tear Bond.
- (b) If all field tests pass, 5 specimens shall be tested at the CQA Testing Laboratory for shear strength and 5 for peel adhesion in accordance with ASTM D6392 and GRI GM 19. The CQA Engineer/Consultant shall be responsible for shipping costs for the destructive seam sample sent to the CQA Laboratory. To be acceptable, 4 out of 5 replicate test specimens must meet the specified seam strength requirements and fifth sample must meet 80% required strength. All 5 specimens must fail at Film Tear Bond.
- (c) The minimum required strengths are found in Table 02701-2.

3. Failed Seam Procedures

- a. If the seam fails, INSTALLER shall follow one of two options:
 - (1) Reconstruct the seam between any two passed test locations.
 - (2) Trace the weld to intermediate location at least 10 feet minimum or where the seam ends in both directions from the location of the failed test. Re-test the length of the divided failed seams to pinpoint the location of the failed seam. Reconstruct the traced seam.
- b. The next seam welded using the same welding device is required to obtain an additional sample, i.e., if one side of the seam is less than 10 feet long.
- c. If sample passes, then the seam shall be reconstructed or capped between the test sample locations.
- d. If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

D. Geomembrane Installer's Documentation:

- 1. Daily Log: daily record that summarizes panels deployed, seams completed, seam testing, seam repair, personnel on site, weather conditions, and equipment on site.

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2. Material Conformance: maintain original conformance certificate(s) from geomembrane manufacturer.
3. Subgrade Acceptance Log: maintained originals of subgrade acceptance forms for each panel and signed by the Geomembrane Installer.
4. Panel Log: provides geomembrane roll number used and subgrade acceptance for each panel deployed.
5. Seam Testing Log: provides a complete record of all nondestructive and destructive seam tests performed as part of the Geomembrane Installer's QC program.
6. Seam/Panel Repair Log: provides a complete record of all repairs and vacuum box testing of repairs made to defective seams or panels.
7. Record Drawing: maintain an as-built drawing updated on a weekly basis.

3.05 REPAIR PROCEDURES

- A. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.
- B. Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.
- C. Installer shall be responsible for repair of defective areas.
- D. Agreement upon the appropriate repair method shall be decided between CQA Consultant and Installer by using one of the following repair methods:
 1. Patching: Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.
 2. Abrading and Re-welding: Used to repair short section of a seam.
 3. Spot Welding: Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.
 4. Capping: Used to repair long lengths of failed seams.
 5. Remove the unacceptable seam and replace with new material.
- E. The following procedures shall be observed when a repair method is used:

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1. All geomembrane surfaces shall be clean and dry at the time of repair.
2. Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.
3. Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.

F. Repair Verification

1. Number and log each patch repair (performed by Consultant).
2. Non-destructively test each repair using methods specified in this Specification.

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Table 02701-1

MINIMUM VALUES FOR LLDPE GEOMEMBRANES (TEXTURED BOTH SIDES)

Property	Test Method	Minimum Value	Frequency	
			MQC	CQA³
Thickness, mil (mm) Minimum Average Lowest Individual Reading	ASTM D D 5994	40 (1.0) 36 (0.91)	1/lot and 1/200,000 lb	1/100,000 SF
Asperity, mils (min. avg)	ASTM D7466	16	Every other roll	1/100,000 SF
Density, g/cm ³ (maximum)	ASTM D 1505	0.939	1/lot and 1/200,000 lb	1/100,000 SF
Tensile Properties(1): (each direction)	ASTM D 6693 Type IV		1/20,000 lb	1/100,000 SF
Strength at Break, lb/in		60	1/20,000 lb	1/100,000 SF
Elongation at Break, %	(2.0" gauge length)	250	1/20,000 lb	1/100,000 SF
Tear Resistance, lb	ASTM D 1004	22	1/45,000 lb	---
Puncture Resistance, lb	ASTM D 4833	44	1/45,000 lb	---
Carbon Black Dispersion, %	ASTM D 4218, modified	2.0 to 3.0	1/45,000 lb	1/100,000 SF
Carbon Black Dispersion	ASTM D 5596	Note 2	1/45,000 lb	1/100,000 SF
Oxidative Induction Time, min.	ASTM D 3895	100	1/lot and 1/200,000 lb	---
Interface Friction Test	ASTM D 5321	Note 4	1/Test Configuration	1/Test Configuration

Notes:

- 1) These tensile properties are average roll values.
- 2) 9 of 10 views shall be Category 1 or 2. No more than one view Category 3.
- 3) The CQA Consultant may increase the frequency of sampling in the event that test results do not comply with the requirements of this section.
- 4) Refer to Section 2701 Part 2.05 for testing requirements.

TABLE 02701-2

MINIMUM WELD VALUES FOR LLDPE GEOMEMBRANES

Property	Test Method	Minimum Value
Peel Strength (extrusion), ppi	ASTM D 6392	44
Peel Strength (fusion), ppi	ASTM D 6392	50
Shear Strength (fusion & ext.), ppi	ASTM D 6392	60

END OF SECTION

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SECTION 02930 GEOCOMPOSITE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Work specified in this Section includes the manufacture, fabrication, testing, delivery and installation of geocomposite (i.e., composite geonet) for use in the final cover system.
- B. All testing specified in this section is quality control (QC) testing and is the Contractor's responsibility and all costs shall be included in the bid price. The OWNER is responsible for the Quality Assurance (QA) testing described in the FDEP approved CQA Plan.

1.02 RELATED SECTIONS

- A. Section 02220, Earthwork
- B. Section 02270, Erosion and Sediment Control
- C. Section 02701, LLDPE Geomembrane

1.03 REFERENCED STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - D 1238 Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
 - D 1505 Standard Test Method for Density of Plastics by the Density Gradient Technique
 - D1777 Standard Test Method for Thickness of Textile Materials
 - D 3776 Standard Test Methods for Mass Per Unit Area (Weight) of Fabric
 - D 4218 Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds By the Muffle-Furnace Technique
 - D 4533 Standard Test Method for Trapezoid Tearing Strength of Geotextiles
 - D 4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
 - D 4716-00 Standard Test Method for Determining the (In-Plane) Flow Rate
 - D 4751-99 Standard Test Method for Determining Apparent Opening Size of a Geotextile
 - D 4833-88 (1996) Standard Test Method for Index Puncture Resistance
 - D 5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles

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D 5321 Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method

D7005-03 Determining The Bond Strength (Ply-Adhesion) of Geocomposites

- B. Geosynthetic Research Institute
GRI GC8 Determination of the Allowable Flow Rate of a Drainage Geocomposite
- C. Daniel, D.E. and R.M. Koerner, (1993), Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities, EPA/600/R-93/182.

1.04 SUBMITTALS

- A. Data showing manufacturer has a minimum of 5,000,000 ft² of geocomposite installation experience on similar projects.
- B. Product Information: The Contractor shall submit to the Engineer field and laboratory test data prior to importing and/or prior to any construction using the geocomposite. Submit the following information for each product prior to installation, to the Engineer for approval:
 - 1. Prequalification: Submit independent laboratory test results demonstrating compliance with the material properties listed in Table 02930-1, Table 02930-2, and Table 02930-3. In addition, the manufacturer must provide a certificate of compliance which states that the material to be installed will use the same manufacturing techniques, resin type, and formulation as that for which test results are submitted.
 - 2. Transmissivity: Submit manufacturer's test data that indicates transmissivity values shown in Table 02930-3 is met.
 - 3. Interface friction angle testing that indicates Section 02930 Section 2.04 is met.
 - 4. Installation Details: Installation details shall include cross sections, temporary anchorage, anchor trenches, and other terminations.
 - 5. Protection from Wind and Weather: Submit methodology to protect each product from wind, dirt, and direct sunlight. At a minimum, the methodology shall reflect that materials shall be shipped and stored in rolls furnished at the manufacturing facility to prevent exposure of the

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geotextile to ultraviolet light, precipitation, moisture, mud, dirt, dust, puncture, or other damaging conditions.

6. Rolls of products shall not be stacked upon one another to the extent that deformation of the core occurs. If stored outdoors, they shall be elevated from the ground and protected with a waterproof cover. Outdoor storage should not be allowed to exceed six months. For storage for more than six months, a temporary enclosure shall be constructed so that the geocomposite rolls are stored inside an enclosed facility.
 7. Material Data: Submit complete manufacturer's specifications, descriptive drawings, and literature for each product, including the product identification and suppliers of the polymer resin and recommended method for handling and storage of all materials prior to installation. Describe the manufacturer's methodology to comply with the requirements specified for manufacturing quality control.
 8. Manufacturing Quality Control: Submit a complete description of the manufacturer's formal quality control/quality assurance programs for manufacturing, fabricating, handling, installing, and testing. The description shall include, but not be limited to, polymer resin supplier and product identification, acceptance testing, production testing, installation inspection, installation techniques, repairs, and acceptance. The document shall include a complete description of methods for both roll end and roll side joining.
 9. Installation Instructions: Submit samples of the product with a complete set of specifications, and manufacturer's complete written instructions for storage, handling, installation and joining.
 10. Qualifications: Submit manufacturer's qualifications for each product. Submit manufacturer's letter of approval or license by geocomposite manufacturer allowing the installer to install the geocomposite.
 11. Geonet Resin: Submit the name of the HDPE resin supplier, the production plant, the brand name, and name of resin used to manufacture the product.
- C. Manufacturing Quality Control: Submit the following manufacturing quality control information to the QA Consultant prior to material shipment:
1. Production Dates: Submit statement of production dates for each product.
 2. Test Reports: See Part 2 of this Section for tests and test frequencies.

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- D. If the use of an alternate Geocomposite design or material is proposed by the Contractor or Manufacturer, then at no expense to the Owner or Engineer, the following items, at a minimum, shall be submitted to the Engineer for acceptance and pre-approval:
1. Product Literature with description of the product and product properties.
 2. A representative product sample, approximately 12"x12" in size.
 3. Installation Quality Control Manual
 4. MQC Test Data using the same material or installation methods as proposed for the Project.
 5. Detailed supporting design engineering calculations and drawings of the material and installation.
 6. Calculations shall demonstrate how the material and installation meet or exceed the project specifications.
 7. The Alternative material or design shall show any proposed change the lines or grades to the Project Drawings.
 8. The Alternative material or design shall be reviewed, signed and sealed, by a Professional Engineer licensed in the State of Florida.

1.05 WARRANTY

- A. Material shall be warranted, on a pro-rata basis against Manufacturer's defects for a period of 2 years from the date of geocomposite installation. The guarantees shall be made, in writing, directly to the Owner (not the Contractor), and in a format acceptable to the Owner.
- B. Installation shall be warranted against defects in workmanship for a period of 1 year from the date of acceptance by the Owner. The guarantee shall be made directly to The Owner in a format acceptable to the Owner. The Contractor and the Geomembrane Manufacturer/Installer shall certify, in writing, that the installed geocomposite satisfies the requirements of these specifications and the CQA Plan.

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PART 2 PRODUCTS

2.01 GEONET

- A. The geonet shall be as manufactured by GSE Environmental, LLC or Agru-America, Inc., or Skaps Industries, Inc., or an Engineer-approved substitution.
- B. The geonet shall be manufactured by extruding two or three sets of strands to form a structure to provide planar water flow meeting the requirements listed in Table 02930-1. Other structures will require Engineer approval for substitution.
- C. The geonet shall consist of new, first-quality products designed and manufactured specifically for the intended purpose designated in this specification, as satisfactorily demonstrated by prior use. The geonet shall contain stabilizers to prevent ultraviolet light degradation. The HDPE shall be unmodified HDPE containing no plasticizer, fillers, chemical additives, reclaimed polymers, or extenders. Approximately 2 percent carbon black shall be added to the resin for ultraviolet resistance. The only other allowable compound elements shall be antioxidants and heat stabilizers, of which up to 1.5 percent total, as required for manufacturing, may be added.

2.02 GEOTEXTILE

The geotextile shall meet the requirements listed in Table 02930-2.

2.03 GEOCOMPOSITE

- A. The final product material shall meet the requirements listed in Table 02930-3.
- B. Manufacturer: The geocomposite shall be fabricated by heat bonding the geotextile to both sides of the geonet. No burn-through of geotextiles shall be permitted. No glue or adhesive shall be permitted. The bond between the geotextile and the geonet shall meet the requirements listed in Table 02930-3.
- C. Labels: Geocomposite 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.

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- D. Roll Dimensions: The product shall be supplied as a continuous sheet with no factory seams. During installation, the roll length shall be maximized to provide the largest manageable roll for the fewest field seams.

2.04 INTERFACE FRICTION TESTS

A. Interface Friction Tests.

Laboratory friction tests shall be also be conducted, on behalf of the OWNER by the CQA Laboratory, with representative samples of the materials selected by the Contractor for use in the Work. The Contractor is responsible for shipping materials and soil to the testing CQA laboratory. The initial set of testing and subsequent conformance tests (if any) shall be paid for by the Owner. If the Contractor changes geosynthetic materials or the material does not meet specifications, then the additional cost to qualify those materials shall be borne by the Contractor. Testing will include 1 interface friction test for each of the test configuration interfaces described as follows:

1. Test Configurations

- a. Test Configuration No. 1 - Grading Layer – Textured LLDPE
- b. Test Configuration No. 2 - Drainage Geocomposite – Textured LLDPE
- c. Test Configuration No. 3 - Drainage Geocomposite – Protective Cover

Note: Refer to Section 2701 for Test Configuration No. 2 specifications.

2. The testing shall be performed in accordance with ASTM D5321.
3. The materials shall be tested at normal stresses of 250 psf, 500 psf and 1,000 psf.
4. Displacement rates shall be in accordance with ASTM D5321 Procedure A for geosynthetic to geosynthetic interfaces and Procedure B for soil to geosynthetic interfaces. Set to 0.04 in/min unless Engineer approved.
5. Soil components shall be compacted to the same moisture-density requirements specified for full scale field placement and saturated prior to shear.
6. Each individual normal load will be applied for 1 hour before conducting the shear test.

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7. All geosynthetic interfaces shall be sheared under saturated (tap water) conditions.
8. Geosynthetics shall be oriented such that the shear force is parallel to the downslope orientation of the testing components as deployed in the field (Typically the MD of the geosynthetic material). The testing laboratory shall confirm these criteria with the Engineer/CQA Inspector prior to performing the tests.
9. A minimum friction angle for each interface in the system defined in Table 02930-3.
10. Conduct test for each normal load to include Peak shear strength of interface through at minimum of 3 inches of displacement.
11. Report for each shear test will include:
 - a. Test configuration and conditions
 - b. Plot of Shear Strength vs Displacement
 - c. Plot of all normal loads vs shear strength
 - d. Best fit line through data points and report ϕ and y-intercept for both Peak and Residual tests.
12. Interface shear strength of the actual components which will be used in the liner system shall be tested with method ASTM D5321 or an equivalent test method.
13. This material is part of a closure cap system. The system shall meet the requirements before all the component materials can be deemed acceptable.
14. Interface friction tests will be conducted by the CQA Testing Laboratory.

2.05 CONFORMANCE TESTING

- A. Samples of the geocomposite will be removed by the CQA Officer at Manufacturer's plant during production of the geocomposite. The CQA Officer will sample the geotextile and geonet components before the components are bonded together and will sample the geocomposite material after the individual components are bonded. Samples will be sent to a geosynthetics CQA laboratory for testing to assure conformance with the requirements of this section. If mutually agreed upon by Owner, Engineer, Contractor, and FDEP, samples may be shipped from Manufacturer to the CQA Officer's designated laboratory, provided that adequate chain-of-custody documentation is prepared and submitted, including origin and destination of sample, lot number, roll number,

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product name, project name, date of production, and date of shipment, at a minimum.

- B. Samples shall be taken across the entire width of the roll and shall not include the first complete revolution of the roll. Unless otherwise specified, samples shall be full width of the roll and extend minimum 3 feet along length of the roll. The CQA Consultant shall mark the machine direction on the samples with an arrow.
- C. CQA Samples shall be taken at a minimum frequency of one sample per 100,000 square feet with a minimum of one sample per lot. If Contractor ships geocomposite that requires sampling and testing at a frequency greater than one per 90,000 square feet, then Contractor shall pay for the additional CQA sampling and testing beyond one per 90,000 square feet.
- D. The CQA Officer may increase the frequency of sampling in the event that test results do not comply with the requirements of this section.
- E. As a minimum, tests listed in Paragraphs 3.01 B, C, D and E shall be performed. The AOS and permittivity shall be performed at a frequency of one per lot.
- F. Any geocomposite material that is not certified in accordance with Part 1.3 of this section, or that conformance testing indicates do not comply with Part 2 of this section, will be rejected by Engineer.

PART 3 EXECUTION

3.01 MANUFACTURING QUALITY CONTROL TESTING

- A. All of the following specified tests in Section 02930 Part 3.01 are the Contractor's responsibility and costs. Testing during manufacturing shall be accomplished by the manufacturer's laboratory.
- B. HDPE resin shall be tested at a frequency of one test per resin batch for compliance with Table 02930-1. One batch is defined as one rail car load of resin. The finished rolls shall be identified by a roll number corresponding to the resin batch used. The following minimum test frequencies shall be observed:

Property	Test Method	Minimum Frequency
Polymer Density	ASTM D 1505	1 per batch
Polymer Melt Index	ASTM D 1238	1 per batch

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- C. The geonet shall be tested during manufacturing for compliance with Table 02930-1. The following minimum test frequencies shall be observed:

Property	Test Method	Minimum Frequency
Polymer Density	ASTM D 1505	1/100,000 sf
Mass per Unit Area	ASTM D 3776	1/100,000 sf
Thickness	ASTM D 1777	1/100,000 sf

- D. Geotextile shall be tested during manufacturing for compliance with Table 02930-2. The following minimum test frequencies shall be observed:

Property	Test Method	Minimum Frequency
Mass per Unit Area	ASTM D 3776	1/100,000 sf
AOS	ASTM D 4751	1/100,000 sf
Flow Rate	ASTM D 4491	1/100,000 sf
Grab Tensile	ASTM D 4632	1/100,000 sf
Trapezoidal Tear Strength	ASTM D 4533	1/100,000 sf
Puncture Resistance	ASTM D 4833	1/100,000 sf

- E. Upon fusion of the geotextile and geonet, the product shall be tested during manufacturing for compliance with Table 02930-3. The following minimum test frequencies shall be observed:

Property	Test Method	Minimum Frequency
Ply Adhesion (minimum)	ASTM D 7005	1/100,000 sf
Interface Friction (minimum)	ASTM D 7005	1/Test Configuration
Transmissivity (100-hr)	ASTM D 4716	1 / 3:1 slope & 1 / 4:1 slope
Transmissivity (1-hr)	ASTM D 4716	1/100,000 sf

- F. The Contractor shall inspect every roll for bonding integrity between the geonet and the geotextile. All poorly bonded and/or delaminated material shall be rejected.

3.02 FIELD QUALITY CONTROL

- A. Field Joining: The Contractor shall inspect all roll end joints and roll side joints. The results of these inspections shall be documented in the daily reports. Field joints shall comply with the requirements of Table 02930-4.

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- B. Quality Control Reporting Procedures: All information regarding the installation of the geocomposite will be recorded in the Contractor's daily report. This information shall include:
1. Reference to product submittals, certifications, substitutions and approvals.
 2. Dates of installation.
 3. Location and quantity of materials installed.
 4. Statement of whether materials were installed in accordance with the Technical Specifications.
 5. Additional information as required.
 6. All product certifications, filed appropriately for future reference.

3.03 MANUFACTURER'S RECOMMENDATIONS

Each Product shall be installed in accordance with the plans, specifications, and the manufacturer's recommendations. In case of a conflict between these documents, the more stringent requirements shall apply.

3.04 CLEANLINESS

The interface between the geocomposite and the geomembrane shall be clean, dry, and free of dirt and dust during installation. If dirt, dust, or water are present, the Contractor shall clean the work area. Products which are clogged with silts shall be discarded and shall not be installed.

3.05 ROLL JOINING METHODS

- A. Table 02930-4 summarizes acceptable roll joining methods.
- B. Lap Seams: The bottom layer of geotextile shall be lap seamed. Lap seaming is accomplished by overlapping adjacent geotextile a minimum of 6 inches.
- C. Nylon Ties: The geonet shall be overlapped and fastened with nylon ties. Nylon ties shall be yellow or white in color to facilitate inspection.
- D. Machine Sewn Seams: The top layer of geotextile shall be sewn. Sewing shall be accomplished with a lock-stitching sewing machine. The thread shall be polymeric thread which complies with manufacturer's recommendations. The

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seam shall be placed at a minimum of 4 inches from the geotextile edges. The finished seam shall be folded to one side.

3.06 ROLL JOINING REQUIREMENTS

- A. The minimum requirements for joining rolls are specified in Table 02930-4.
- B. Roll Ends: The end of each roll of geocomposite shall be overlapped a minimum of six inches. The geonet portion shall be shingled, with the uphill end overlapping the downhill end. The geonet portion shall be tied 2 feet on center at a minimum. The bottom layer of geotextile shall be overlapped a minimum of 6 inches. The upper layer of geotextile shall be machine sewn. Where the geocomposite is to terminate, the upper geotextile shall be folded over the ends with a minimum of 12 inches of geotextile placed under the geocomposite.
- C. Adjacent Roll Sides: At roll sides, the material shall be overlapped a minimum of 4 inches. The bottom geotextile shall be overlapped. The geonet shall be overlapped and tied a minimum of 5 feet on center with nylon ties as described above. The upper layer of geotextile shall be machine sewn as described above.

3.07 INSTALLATION

- A. The product shall be installed in accordance with the manufacturer's recommendations or as specified herein, whichever is more stringent.
- B. Orientation:
 - 1. Geocomposite shall be rolled down the slope in such a manner as to continually keep the material in tension. If necessary, the material shall be positioned by hand after unrolling to minimize wrinkles. Geocomposite shall not be placed in the horizontal direction (i.e., across the slope).
 - 2. Butt seam will be permitted on the side slopes; however, no more than two adjacent butt seams that form a continuous horizontal seam are permitted. If the butt seams are on the side slopes, then the butt seams shall be offset more than 10 feet up or down slope from each other or the butt seams. Butt seams can be deployed continuously on the inside portion of the terraces of the slope only or on the top of the landfill.
- C. The Installer shall provide sufficient ballast and temporary anchorage to protect the product according to the manufacturer's instructions. The ballast shall not damage the geosynthetics. The Installer shall be responsible for protecting the product from damage due to weather at all times.

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- D. Physical Damage:
1. Personnel walking on the product shall not engage in activities or wear footwear that could damage the material. Smoking shall not be permitted on or near the geosynthetics.
 2. Vehicular traffic shall not be permitted on the geosynthetics. Equipment shall not damage the material by handling, trafficking, or leakage of hydrocarbons. The surface shall not be used as a work area for preparing patches, storing tools and supplies, or other uses.
- E. Bridging: The product shall be installed to avoid bridging.
- F. Corners: In corners, where overlaps between rolls are staggered, an extra roll shall be installed from the top to the bottom of the slope.
- G. Weather Protection: Each product shall be protected from direct sunlight or precipitation prior to installation. After installation this product shall not be exposed to direct sunlight and shall be covered within 30 days of installation. Product which is exposed to direct sunlight for 30 days or more shall be replaced at the Contractor's expense.
- H. It is the Contractor's responsibility to provide all labor and materials for protection of the product during the period of time prior to installation of overlying soils. The Contractor's protection method is subject to the approval of the Engineer.

3.08 REPAIRS

- A. Limitations: In general, damaged, soiled, or delaminated products shall be discarded. Products which have major damage, which require extensive repairs or replacement, shall be discarded at the Contractor's expense.
- B. Minor Damage: Minor damage is defined as a hole 2 inches or smaller in diameter in the product. Minor damage shall be repaired by snipping out protruding geonet and machine sewing or thermal bonding a geotextile patch over the hole. The patch shall be a minimum of 12 inches larger than the damaged area in all directions. If thermal bonding is conducted, care shall be taken to prevent excessive heat damage to the surrounding geosynthetics.
- C. Major Damage: Major damage is defined as a hole larger than 2 inches in diameter through the product. Major damage shall be repaired by replacing the entire panel width.

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3.09 PLACEMENT OF COVER SOILS OVER GEOCOMPOSITE

- A. During placement of soils, no construction equipment shall be allowed directly on the geocomposite. The Contractor shall maintain a minimum of one foot over the geocomposite to prevent damage from occurring. Additional thickness of soil will be required depending on equipment weight, contractor's installation method, or at points where the geocomposite is under haul road or access points for rubber tired vehicles.
- B. The Contractor shall take measures to protect the geocomposite. Only large radius turns by equipment shall be permitted so twisting, shearing, folding, or damage to the geocomposite does not occur.
- C. Soils shall be placed in manner that does not stretch, tear, or fold over the geocomposite.
- D. Soil placement on the side slopes shall be from the toe of slope and pushed up the slope to the top of the landfill.
- E. During placement of the soil, the equipment shall move forward and backward, with minimal turning so avoid damage to the geocomposite until a minimum of 2 feet of soil has been placed over the geocomposite. A minimum of 4 feet of soil cover above the geocomposite is required for areas with rubber-tired vehicles and/or heavy travels areas.
- F. Placement of the 2-feet of cover soils will be done with equipment with a contact pressure of 5 psi or less.
- G. Any areas damaged during the placement of cover soils, will have all cover soils removed to allow for inspection and repair of the geocomposite and geomembrane.

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TABLE 02930-1
GEONET PROPERTIES

Property	Qualifier	Unit	Test Method	Specified Value
Thickness	Minimum Average	mil	ASTM D 5199	300
Tensile Strength (machine direction)	Minimum Average	lbs/in	ASTM D 7179	75
Carbon Black	Range	percent	ASTM D 4218	2 to 3
Density	Minimum Average	g/cm ³	ASTM D 1505	0.940

TABLE 02930-2
GEOTEXTILE PROPERTIES

Property	Qualifier	Unit	Test Method	Specified Value
Fabric Weight	MARV	oz/yd ²	ASTM D 5261	6
Grab Strength	MARV	lbs	ASTM D 4632	160
Puncture Resistance	MARV	lbs	ASTM D 4833	120
Water Flow Rate	MARV	gpm/ft ²	ASTM D 4491	110
AOS	MaxARV	sieve size(mm)	ASTM D 4751	#70 (0.212)

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TABLE 02930-3
GEOCOMPOSITE PROPERTIES

Property	Qualifier	Unit	Required Test Value			
Ply Adhesion	Minimum Average	lbs/inch	1.0			
Interface Friction See Note 1 (Each Test configuration per Section 02930 Part 2.4A)			Load (psf)	Phi	c	Shear Strength (psf)
	Minimum	psf	250	25.2	0	117.6
	Minimum	psf	500	25.2	0	235.3
	Minimum	psf	1,000	25.2	0	470.6
Transmissivity (100 hr) See Note 2						
Slope			Soil Permeability (cm/s)	Transmissivity (m ² /s)		
4(H):1(V)	Minimum	m ² /s	3.0 x 10 ⁻⁴	3.2 x 10 ⁻³		
	Minimum	m ² /s	1.0 x 10 ⁻⁵	1.1 x 10 ⁻⁴		
3(H):1(V)	Minimum	m ² /s	3.0 x 10 ⁻⁴	2.0 x 10 ⁻³		
	Minimum	m ² /s	1.0 x 10 ⁻⁵	6.7 x 10 ⁻⁵		
Transmissivity (1-hr) See Note 3						
4(H):1(V)	Minimum	m ² /s	--	9.0 x 10 ⁻⁴		
3(H):1(V)	Minimum	m ² /s	--	9.0 x 10 ⁻⁴		

Notes:

- Interface Friction Test – Refer to Section 02930 Part 2.4A for testing specifications.
- Transmissivity (100-hr) - Per ASTM D 4716 with a normal stress of 1,000 psf; water at 20°C (68°F); with a gradient of 0.25 or 0.33 for 4:1 or 3:1 slopes respectively; upper boundary is protective cover soil and lower boundary is 40 mil textured LLDPE, and a test time period of 100 hours. The protective cover soil, Geocomposite, and 40-mil textured LLDPE must be from the materials utilized in construction.
- Transmissivity (1-hr) - Per ASTM D 4716 with a normal stress of 1,000 psf; water at 20°C (68°F); with a gradient of 0.25 or 0.33 for 4:1 or 3:1 slopes respectively; upper boundary is steel plate/geocomposite and lower boundary is 40 mil textured LLDPE/steel plate, and a test time period of 1- hour. The geocomposite and 40-mil textured LLDPE must be from the materials utilized in construction.

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TABLE 02930-4
GEOCOMPOSITE JOINING METHODS

Location	Layer	Joining Method	Min. Overlap	Tying Frequency
Roll End (See Note 1)	Upper geotextile	Machine sewing/ thermal bonding	4"	N/A
	Geonet	Nylon ties	6"	2' on center
	Lower geotextile	overlap	6"	N/A
Roll Side	Upper geotextile	Machine sewing	4"	N/A
	Geonet	Nylon ties	4"	5' on center
	Lower geotextile	overlap	6"	N/A
Repair of minor damage (See Note 2)	Upper geotextile	Machine sewing/ thermal bonding	12"	N/A
	Geonet	N/A	N/A	N/A

Notes:

1. At termination of geocomposite fold over upper geotextile as defined in Part 3.06.
2. Minor damage is defined in Part 3.08.

END OF SECTION

DIVISION 15
MECHANICAL

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SECTION 15060 HDPE PIPE AND PIPE FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall supply all materials, equipment, and labor needed to install complete and make ready for use all pipe, pipe fittings, and valves as specified herein and as indicated on the Plans.

1.02 RELATED SECTIONS

- A. Section 02130, Gas Extraction Wells
- B. Section 02220, Earthwork
- C. Section 15079, Corrugated Polyethylene

1.03 DEFINITIONS

- A. SDR – Standard Dimension Ratio.
- B. ESCR – Environmental Stress Crack Resistance.
- C. HDPE – High Density Polyethylene Pipe.
- D. LFG – Landfill gas.

1.04 REFERENCED STANDARDS

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Use of the most recent version is required.

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. B16.5, Pipe Flanges and Flanged Fittings.
- B. ASTM International (ASTM):
 - 1. D1248 Specification for Polyethylene Plastics Molding and Extrusion Materials.
 - 2. D2513, Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
 - 3. D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter- Controlled Polyethylene Pipe and Tubing.

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4. D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
 5. D3350, Specification for Polyethylene Plastics Pipe and Fittings Materials.
 6. D4101, Standard Specification for Propylene Plastic Injection and Extrusion Materials.
- C. American National Standard Institute (ANSI):
1. B31.8, Code for Pressure Piping, Appendix N.
- D. Plastics Piping Institute (PPI):
1. PPI TR-31/9-79, Technical Report.

1.05 SUBMITTALS

- A. See Section 01300 for administration of submittals.
- B. The Contractor shall submit installer qualifications and experience for himself or subcontractor with regard to HDPE pipe installation for record purposes.
- C. The manufacturer's product data shall be submitted in accordance with Section 01300, Contract Administration. Submittals shall be made for each pipe material which will become a permanent part of the work and shall include all fittings and accessories.
- D. The Contractor shall prepare and submit to the Engineer, for review and approval prior to commencement of construction, certificates of compliance on materials furnished and manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, inspection, maintenance and repair of each type of pipe, pipe fitting, and valve furnished.
- E. Provide manufacturing test specification data listing resin type, cell classification, stock density, melt flow, flexural modulus, tensile strength, and coloration. Include results of tests with shipment of materials, with two (2) additional copies of test results furnished to Engineer.
- F. The Contractor shall prepare and submit Shop Drawings to the Engineer for review and approval. The Shop Drawings shall show the following:
1. All dimensions, slopes, and invert elevations at connections.
 2. Pipe Dimensions for each pipe size used:
 - a. Average outside diameter
 - b. Average inside diameter
 - c. Minimum average wall thickness

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3. Each pipe and fitting size to be used.

1.06 HANDLING, STORAGE, INSPECTION AND PROTECTION

- A. Care shall be taken during transport of all pipe to protect pipe from kinks, cuts, end damage, and other defects. Binding and tie down methods shall not damage or deflect pipe in any way. Pipe damaged during shipment shall be rejected.
- B. Pipe shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking of any pipe shall be limited to a height that will not cause deformation of the lower layers of pipe under anticipated temperature conditions. When necessary because of ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such widths to prevent deformation of the pipe at the point of contact with the sleeper or between supports. Pipe shall not be removed from storage until bedding or subgrade work is complete and ready to receive the pipe.
- C. Any plastic-type pipe stored on the job site shall be covered with canvas or other opaque material to protect it from sunlight. Air circulation shall be provided under the covering. HDPE pipe may be excluded from this requirement as recommended by the manufacturer.
- D. All pipe, fittings, and other accessories shall be inspected upon delivery and during the course of the work. Any defective or damaged materials found during field inspection or during tests shall be removed from the site and replaced by, and at the expense of, the Contractor.
- E. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times. Fittings shall be drained and stored in a manner that will protect them from damage by freezing.
- F. Manufacturer's written instructions regarding handling and storage of pipe and fittings shall be adhered to and shall be kept on site for inspection as required.

PART 2 PRODUCTS

2.01 GENERAL

- A. All pipe joints and fittings shall have the same or greater strength, pressure ratings, thermal resistance, chemical resistance, and other pertinent properties as the pipe being joined or connected. Plastic pipe fittings shall be manufactured of the same resin as used in the manufacture of the pipe being joined.

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- B. Fittings for use with plastic type pipe material herein specified shall be provided by the same manufacturer providing the pipe.
- C. Each pipe length shall be clearly marked with manufacturer's name or trademark, applicable ASTM ratings, size, and, where applicable, standard dimension ratio.
- D. All flange bolts, nuts, and washers shall be AISI Type 304 stainless steel, ASTM A 193, Grade B8M hex head bolts and ASTM A 194, Grade 8M hex head nuts. Bolts shall be fabricated in accordance with ANSI B18.2.1 and shall be provided with washers.
- E. Where threaded fittings are permitted, thread lubricant shall be Teflon tape.

2.02 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers of PE pipe are acceptable for landfill gas applications:
 - 1. Chevron Phillips Chemical Company LLC
 - 2. ISCO
 - 3. American Plastic Pipe and Supply LLC
 - 4. Lee Supply
 - 5. Ferguson Industrial Plastics
 - 6. Or approved alternative
- B. Submit requests for substitution in accordance with Specification Section 01300.

2.03 HIGH DENSITY POLYETHYLENE (HDPE) PIPING MATERIALS

- A. Pipe shall be extruded from a Type III, Class C, Category 5, Grade P34 compound as described in ASTM D 1248. It shall be classified as cell 345464 according to ASTM D 3350 and have the material designation of PE 3608. The pipe shall be manufactured to meet the requirements of ASTM D 2513. Manufacturer's literature shall be adhered to when "manufacturer's recommendations" are specified. All pipe and fittings shall be provided by one of the manufacturers specified in Section 2.02 of this specification.
- B. The HDPE pipe and fittings shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other injurious defects. Any pipe or fitting with nicks, scrapes, or gouges deeper than 5 percent of the nominal wall thickness shall be rejected.

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- C. HDPE piping shall be provided in the sizes and shall have a Standard Dimension Ratio (SDR) as indicated on the drawings. Dimensions and workmanship shall conform to the requirements of ASTM F 714.
- D. HDPE pipe and fitting joints shall be butt, heat fusion weld type only. No extrusion welds shall be permitted unless specifically noted on the drawings or specified herein. All welds shall achieve full penetration.
- E. HDPE fittings shall be either molded or shop-fabricated type. Shop-fabricated fittings shall be made from pipe sections using butt, heat fusion welding. Fittings with extrusion welding shall not be permitted unless otherwise noted on the drawings.
- F. HDPE fittings shall be free of internal projections; any and all internal projections resulting from molding or heat fusion fabrication shall be removed flush to the interior surface of the fitting at the factory or shop.
- G. Flanged joints, where required, shall utilize molded HDPE flange adapters and 316 stainless steel backup rings with ANSI B16.5 drilling. Flange bolting shall be as specified herein. Flanged HDPE joints shall have flat ring type Viton gaskets with gasket thickness and hardness as recommended by the manufacturer.
- H. Furnish appropriate size reducers and reducing fittings to mate pipe to equipment connections. Connection size requirements may change from those shown on drawings depending on equipment furnished.
- I. All pipe and fittings must be supplied by the same manufacturer.
- J. Identify each length of pipe clearly at intervals of 5 FT or less with the following markings:
 - 1. Manufacturer's name and trademark
 - 2. Nominal size of pipe
 - 3. Type of plastic (e.g. PE 3608)
 - 4. Standard dimension ratio (SDR)
 - 5. ASTM designations (i.e., ASTM D 2513)

2.04 PERFORATED HDPE PIPING MATERIALS

- A. Perforated HDPE pipe shall conform to the requirements specified for HDPE pipe.
- B. Perforations shall be drilled into the pipe at the pipe extrusion plant or fabrication shop. Any burrs remaining after drilling shall be removed. Perforations shall be

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drilled and deburred prior to pipe delivery to the job site. Job site perforation or perforation by the Contractor shall not be permitted.

- C. Unless indicated otherwise on the drawings, pipe perforations shall be 3/8 inch diameter ($\pm 1/16$ inch) on 3-inch ($\pm 1/4$ inch) centers down the length of the pipe. There shall be three holes spaced at 120° ($\pm 5^\circ$) around the perimeter of the pipe. Rows shall be parallel to the pipe axis.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. All pipe shall be laid and maintained straight and true to line in strict conformance with the lines, grades, and elevations indicated on the drawings. Line and grade tolerances, where applicable, shall be in accordance with limits given for specific material. Grade shall be measured at the pipe invert, not at the top of the pipe, due to permissible variations in pipe wall thickness.
- B. Contractor shall supply the Engineer drawings showing all installed HDPE pipe marked in 50-foot intervals corresponding to the stationing required for slope confirmation and conformance surveying. Each joint shall be marked at header and lateral joints. For main pipeline, station numbering shall be continuous and sequential. Station numbering shall be referenced in daily logs to document pipe installation progress.
- C. Trenching, bedding, and backfill shall be in accordance with Section 02220, Earthwork and 02225 Trenching.
- D. During laying operations, do not permit debris, tools, clothing, or similar items to be placed in pipes. Pipe interior shall be free of mud and kept clean at all times.
- E. Pipe ends shall be kept clear and clean and the Contractor shall ensure that inside surfaces are maintained smooth and free from any projections that may interfere with joint assembly or flow through the completed line.
- F. Care shall be exercised when lowering pipe into trenches or on subgrade to prevent damage or twisting of the pipe. After laying and prior to completion of backfill or cover operations, pipe shall be protected from any vehicular traffic.
- G. Remove standing water in trench before installation.
- H. Lengths of fused pipe to be handled as one segment shall not exceed 400 feet.

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- I. Existing piping flanged joints which are disassembled by the Contractor shall be fitted with new gaskets, as specified, upon reassembly.
- J. The Owner and Engineer shall be notified prior to any pipe being installed in the trench in order to have an opportunity to inspect the following items:
 - 1. All butt and saddle fusions.
 - 2. Pipe integrity.
 - 3. Trench excavation and bedding material for rocks and foreign material.
 - 4. Proper trench slope.
 - 5. Trench contour to ensure the pipe will have uniform and continuous support.
 - 6. Proposed backfill sand and soil.
- K. Any irregularities found by the Engineer during this inspection must be corrected before lowering the pipe into the trench. Pipe shall be allowed sufficient time to adjust to trench temperature prior to any testing, segment tie-ins, and/or backfilling.

3.02 HDPE PIPING INSTALLATION

- A. Line or grade shall not deviate from dimensions and elevations given on the drawings by more than ½ inch for line and 1/4 inch for grade at any point, provided that such variation does not result in a level or reverse sloping invert.
- B. Pipe and fittings shall be joined together using butt heat-fusion techniques in accordance with the pipe manufacturer's recommendations unless otherwise noted on the drawings. The heat-fusion welds shall not project into the interior of the piping high enough to interfere with passage of cameras and equipment used or piping system cleaning and videotaping inspection, and in no event shall such projections exceed 0.25 inch.
- C. Pipe and fittings shall be installed so that there will be no deviation at the joints and so that inverts present a smooth surface. Pipe and fittings that do not fit together to form a tight fitting joint are not permitted.
- D. Tie-ins shall be made out of the trench whenever possible. When tie-ins are to be made only in the trench, a bell hole shall be excavated large enough to ensure an adequate and safe work area.
- E. The Contractor shall ensure that kinking or excessive bend diameters of the pipe do not occur during the installation process.

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- F. The Contractor shall insure that the pipe installed in the trench is firmly supported. The Contractor shall follow the minimum length and type of backfill specified in the drawings.
- G. Cap pipe sections longer than single joint (usually 40 feet) on both ends during placement, except during fusing operations.
- H. All installed valves shall be tested in the presence of the Engineer. All repairs deemed necessary by the Engineer shall be made by the Contractor at the Contractor's expense.
- I. HDPE pipe and fittings shall be by the same manufacturer. The minimum strength of the fittings shall not be less than that of the pipe.
- J. Service taps shall be installed as shown on the Drawings.
- K. Changes in direction of HDPE Pipe:
 - 1. Do not bend pipe to greater degree than minimum radius recommended by manufacturer for type and grade.
- L. The Contractor shall remove cuttings from the interior and exterior. Shavings shall not be left on the ground and must be disposed of properly.
- M. HDPE shall not be field threaded and such threaded joints shall not be used in gas distribution systems.
- N. Prior to final acceptance, completely flush and clean all parts of the system. Flushing water shall be properly disposed. Flushing water shall not be discharged to the leachate aeration/storage basins. The leachate collection and leak detection pumps shall not be used to handle water resulting from flushing operations. Remove all accumulated construction debris, rocks, sand, gravel, and other foreign material.

3.03 PERFORATED HDPE PIPE IINSTALLATION

- A. All sections of perforated HDPE pipe shall be thoroughly cleaned and deburred after perforating and before welding or delivery to the job site to ensure all drill cuttings are removed from the pipe.
- B. Pipe shall be installed in gravel fill as specified in Sections 02220 Earthwork and 02225 Trenching.

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- C. Install perforated pipe in accordance with drawing details and as specified for HDPE pipe.
- D. Prior to final acceptance, completely flush and clean all parts of the system. Flushing water shall be disposed of properly. Flushing water shall not be discharged to the leachate storage tanks. The leachate collection and leak detection pumps shall not be used to handle water resulting from flushing operations. Remove all accumulated construction debris, rocks, sand, gravel, and other foreign material.

3.04 HEAT FUSION OF HDPE PIPING

- A. HDPE pipe shall be joined by butt-fusion methods, having a uniform and monolithic pipe interior according to the fusion joining procedures as instructed by the manufacturer as shown in the Construction Drawings.
- B. Each individual performing fusion joining shall have at least one (1) year of experience in the use of the fusion procedure.
- C. Join pipe sections at ground level to a maximum length of 400 feet, or a length recommended by the manufacturer such that maximum allowable stress, when pulling the pipe into position alongside the trench, is not exceeded. Use appropriate materials and equipment, as recommended by the HDPE pipe manufacturer, when pulling butt-fused pipe sections alongside the trench to prevent pipe damage.
- D. For summertime installations it may be necessary to provide a slightly longer length of HDPE pipe when connections are to be made between two fixed points or structures to compensate for contraction of the pipe in a cooler trench bottom. The additional pipe length requirements shall be in accordance with the HDPE pipe manufacturer's instructions.
- E. For cleaning pipe ends, solutions such as detergents and solvents, when required, shall be used in accordance with manufacturer's recommendations.
- F. Do not bend pipe to greater degree than minimum radius recommended by manufacturer for type and grade.
- G. Do not subject pipe to strains that will overstress or buckle pipe or impose excessive stress on joints.
- H. Branch saddle fusions shall be joined in accordance with manufacturer's recommendations and procedures. Branch saddle fusion equipment will be of the size to facilitate saddle fusion within the trench.

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- I. Before butt fusing pipe, each length shall be observed for presence of dirt, sand, mud, shavings, and other debris or animals. Remove all materials from the inside of the pipe.
- J. At end of each working day, cover open ends of fused pipe. Cap to prevent entry by animals or debris.
- K. Use compatible fusion techniques when polyethylene pipes of different melt indexes are fused together. Refer to manufacturer's specifications for compatible fusion.

3.05 FLANGE CONNECTIONS

- A. For flanged connections, the Contractor shall wrap and tape the flanges and bolts in 5 mil polyethylene sheeting prior to backfilling to help protect the assembly from corrosion.
- B. Flanges shall be joined with stainless steel studs and nuts. Stud lengths shall accommodate the required distance between flanges including spacers, if necessary.
- C. Tighten flange bolts at uniform rate which will result in uniform gasket compression over entire area of joint. Provide tightening torque in accordance with manufacturer's recommendations. CAUTION: Do not over-torque bolts.
- D. For flanged connections within the limits of refuse, all below grade back-up rings, studs, nuts and washers shall be thoroughly coated with a rubberized emulsion undercoating spray, or approved substitute.
- E. The Contractor shall wrap and tape the flanges and bolts in 5 mil polyethylene sheeting prior to backfilling.

3.06 FIELD QUALITY CONTROL

- A. Pipe may be rejected for failure to conform to Specifications, or for:
 - 1. Fractures or cracks passing through pipe wall, except single crack not exceeding two (2) inches in length at either end of pipe which could be cut off and discarded. Pipes within one shipment will be rejected if defects exist in more than 5% of shipment or delivery.
 - 2. Cracks sufficient to impair strength, durability, or serviceability of pipe.

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3. Defects indicating improper proportioning, mixing, and molding.
 4. Damaged ends, where such damage would prevent making satisfactory joints.
- B. Acceptance of fittings, stubs, or other specifically fabricated pipe sections shall be based on visual observation by the Owner or Engineer at the Project site and documentation that they conform to these Specifications.

3.07 CLEANING

- A. General Cleaning:
1. Clean interior of piping systems thoroughly of foreign matter before installing. Maintain pipe in clean condition during installation.
 2. Before joining pipe, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.
 3. Immediately prior to pressure testing of piping systems, clean and remove grease, dirt or other foreign materials which may have entered the system.
 4. Upon completion of work and prior to final acceptance, thoroughly clean work installed under these specifications. Clean pipe, valves and fittings of debris which may have accumulated by operation of system, from testing or from other causes.
 5. All pipe shavings from the heat fusion process must be removed completely from the interior of the pipe prior to pipe being used in the collection system construction.

3.08 TESTING AND INSPECTION

- A. The HDPE laterals and headers shall be subjected to pressure tests as described herein to detect any leaks in the piping. Testing shall be performed below grade (inside the trench). The Contractor shall accept the responsibility for locating, uncovering (if previously backfilled), and repairing any leaks detected during testing.
- B. Polyethylene piping shall be butt welded together into testing segments. Segments shall be connected to a testing apparatus on one end and fitted with fusion-welded caps on all openings.

Attachment B - Technical Specifications

- C. The segment to be tested shall be allowed time to reach constant and/or ambient temperature before initiating the test.
- D. The test must be performed during a period when the pipe segment will be out of direct sunlight; i.e., early morning, late evening, or cloudy days. This will minimize the pressure changes which will occur during temperature fluctuations.
- E. The test pressure for LFG header pipe and laterals shall be 10 psig with a maximum of 5% loss over a period of one hour. Failing pipe sections will be inspected for any visible leaks and re-tested. Engineer will determine protocol for any additional failures.
- F. Pressure drop during the test shall not exceed five percent of the testing gauge pressure over a period of one hour. The pressure drop shall be corrected for temperature changes before determining pass or failure.
- G. The Engineer shall be notified 1 week prior to commencement of the testing procedure and shall be present during the test.
- H. All equipment for this testing procedure, including an adequately sized air compressor, fittings, caps/pipe plugs, etc. shall be furnished by the Contractor. Other necessary equipment includes a flange adaptor with a steel or brass blind flange. Tapped and threaded into the blind flange will be a temperature gauge 0 to 100 degrees F with 1 degree interval, a pressure gauge with a scale that spans the test pressure range with increments equal to 0.1 percent of the test pressure, an appropriate valve to facilitate an air compressor hose, and a ball valve to release pipe pressure at completion of test. Pipe reducers shall be utilized to adapt test flange to size of pipe being tested.
- I. Contractor shall ensure wellheads are not connected to any pipe undergoing pressure testing. Isolation valves shall not be connected to piping during pressure testing.

3.09 TEST FAILURE

- A. The following steps shall be performed when a pipe segment fails the five percent/one hour test described in the Segment Testing Section.
 - 1. The pipe and all fusions shall be inspected for cracks, pinholes, or perforations.
 - 2. All blocked risers and capped ends shall be inspected for leaks.

Attachment B - Technical Specifications

3. Leaks shall be located and/or verified by applying a soapy water solution and observing soap bubble formation.
- B. All pipe and fused joint leaks shall be repaired by cutting out the leaking area and re-fusing the pipe.
- C. After all leaks are repaired, a retest shall be performed in accordance with Section 3.2.

3.10 TEST REPORTING

- A. Each test (pass or failure) shall be reported in writing on a form approved by the Engineer.
 1. If failure occurs, CONTRACTOR shall note the following:
 - a. Location of failure segment.
 - b. Nature of leaks.
 - c. Repairs performed.
 - d. Results of test.

END OF SECTION

Attachment B - Technical Specifications

SECTION 15079 CORRUGATED POLYETHYLENE PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This item shall consist of furnishing, fabricating, and installing corrugated polyethylene pipe of the types, classes, sizes, gauges, and dimensions as shown on the plans, at such places as are designated on the plans and profiles, or by the Engineer, in accordance with these specifications and in conformity with the lines and grades given.
- B. Piping locations include, but may not be limited to:
 - 1. Terrace drains.

1.02 RELATED SECTIONS

- A. Section 02220 Earthwork
- B. Section 02225 Trenching

1.03 SUBMITTALS

- A. The manufacturer's product data shall be submitted in accordance with Section 01300, Contract Administration. Submittals shall be made for each pipe material which will become a permanent part of the Work and shall include all fittings and accessories.
- B. Verify on Shop Drawing dimensions, schedule of pipe, fittings, and miscellaneous appurtenances. When special fittings are necessary, verify locations of items and include complete details.
- C. As Work progresses and again when Work is complete, submit Recorded Drawings of piping systems in project including project items and pre-existing items. Identify complete location, elevation, and description of piping systems. Relate piping systems to identified structures and appurtenances.

1.04 HANDLING, STORAGE, INSPECTION AND PROTECTION

- A. Care shall be taken during transport of all pipe to protect pipe from kinks, cuts, end damage, and other defects. Binding and tie down methods shall not damage or deflect pipe in any way. Pipe damaged during shipment shall be rejected.

Attachment B - Technical Specifications

- B. Pipe shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking of any pipe shall be limited to a height that will not cause deformation of the lower layers of pipe under anticipated temperature conditions. When necessary because of ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such widths to prevent deformation of the pipe at the point of contact with the sleeper or between supports. Pipe shall not be removed from storage until bedding or subgrade work is complete and ready to receive the pipe.
- C. Any plastic-type pipe stored on the job site shall be covered with canvas or other opaque material to protect it from sunlight. Air circulation shall be provided under the covering.
- D. All pipe, fittings, and other accessories shall be inspected upon delivery and during the course of the work. Any defective or damaged materials found during field inspection or during tests shall be removed from the site and replaced by, and at the expense of, the Contractor.
- E. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times. Fittings shall be drained and stored in a manner that will protect them from damage by freezing.
- F. Manufacturer's written instructions regarding handling and storage of pipe and fittings shall be adhered to and shall be kept on site for inspection as required.

PART 2 PRODUCTS

2.01 GENERAL

- A. Corrugated Polyethylene Pipe and Connections: This pipe and connections shall conform to the requirements of AASHTO M294-98.
- B. Pipes shall be dual-walled pipe, water tight connections and shall have a full circular cross-section, within an outer corrugated pipe wall and a smooth inner liner, ADS N-12 or approved equal. The pipe shall be perforated.
- C. Basic Materials: Pipe and fittings shall conform to the requirements of ASTM D3350, except the carbon black content shall not exceed 5 percent.
- D. Coupling Bands: Flexible pipe shall be firmly joined by coupling bands. These bands shall be not more than two nominal sheet thicknesses lighter than the thickness of the pipe to be connected.
 - 1. Soil/Watertight couplers shall be used to connect individual pipe sections.

Attachment B - Technical Specifications

2. Reinforced couplers shall be used where the possibility of separation is high. These couplers shall be constructed of a heavy cross-laminated polyethylene backing, rubberized mastic sealer, plastic straps with sheathing, and woven polypropylene reinforcing.
- E. Perforations shall be performed in the factory. Field perforations are not authorized.

PART 3 EXECUTION

3.01 EQUIPMENT

All equipment necessary and required for the proper construction of piping shall be on the project, in first class working condition. The Contractor shall provide such mechanical tampers as required to obtain the compaction of the pipe bedding and backfill as specified.

3.02 EXCAVATION

The Contractor shall perform all excavation to the depth and/or dimensions shown on the plans with special attention given to avoid damaging the underlying geosynthetic components of the final and temporary final cover system. Any damage to the final and temporary final cover system due to Contractor's action shall be repaired at Contractor's expense. The bedding for the pipe shall be so shaped that at least the lower quarter of the pipe shall be in continuous contact with the bottom of the trench. Bedding shall be as shown on the plans. Installation shall be accordance with ASTM D2321 and manufacturer's recommended guidelines.

3.03 CORRUGATED POLYETHYLENE PIPE INSTALLATION

- A. All pipe shall be laid and maintained straight and true to line in strict conformance with the lines, grades, and elevations indicated on the drawings. Line and grade tolerances, where applicable, shall be in accordance with limits given for specific material. Grade shall be measured at the pipe invert, not at the top of the pipe, due to permissible variations in pipe wall thickness.
- B. The pipe shall be laid with the separate sections joined firmly together with coupling bands with outside laps of circumferential joints pointing upgrade, and with longitudinal laps on the sides. The pipe shall be laid carefully and true to lines and grades on a bed which is uniformly firm throughout its entire length. Any pipe which is not in true alignment, or which shows any undue settlement after laid or is damaged, shall be taken up and relaid or replaced without extra compensation. Pipe shall not be laid on frozen ground.

Attachment B - Technical Specifications

- C. Trenching, bedding, and backfill shall be in accordance with Section 02220, Earthwork and 02225 Trenching.
- D. During laying operations, do not permit debris, tools, clothing, or similar items to be placed in pipes. Pipe interior shall be free of mud and kept clean at all times.
- E. Pipe ends shall be kept clear and clean and the Contractor shall ensure that inside surfaces are maintained smooth and free from any projections that may interfere with joint assembly or flow through the completed line.
- F. Care shall be exercised when lowering pipe into trenches or on subgrade to prevent damage or twisting of the pipe. After laying and prior to completion of backfill or cover operations, pipe shall be protected from any vehicular traffic.
- G. Remove standing water in trench before installation.
- H. Any irregularities found by the Engineer during this inspection must be corrected before lowering the pipe into the trench. Pipe shall be allowed sufficient time to adjust to trench temperature prior to any testing, segment tie-ins, and/or backfilling.
- I. Prior to final acceptance, completely flush and clean all parts of the system. Flushing water shall be properly disposed. Flushing water shall not be discharged to the leachate aeration/storage basins. The leachate collection and leak detection pumps shall not be used to handle water resulting from flushing operations. Remove all accumulated construction debris, rocks, sand, gravel, and other foreign material.

END OF SECTION

APPENDICES

APPENDIX A
CONSTRUCTION QUALITY ASSURANCE PLAN

LEON COUNTY SOLID WASTE MANAGEMENT FACILITY

**CONSTRUCTION QUALITY ASSURANCE
(CQA) PLAN**

Facility ID Number: NWD/37/00006660
Permit No.: 0009560-013-SO/0009560-016-SC-IM

Prepared for:

LEON COUNTY BOARD OF COUNTY COMMISSIONERS
7550 Apalachee Parkway
Tallahassee, Florida 32301-1860



Presented to:

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
2600 Blair Stone Road, MS #4500
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Prepared by:

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Certificate of Authorization #30066
Project No.: 07000-173-15

Performed under the
supervision of:

June 2016

Lisa J. Baker
FL PE No.: 74652

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Appendix A Technical Specifications

1.0 Introduction

1.1 General

The Construction Quality Assurance (CQA) Plan and the attached technical specifications contain the requirements for testing materials and monitoring construction of the Leon County Solid Waste Management Facility's closure of Class I Phases IIB, IIC, IID and Class III East, West and South disposal cells, including the responsibilities of CQA personnel, documentation control and reporting procedures. Elements of this CQA plan are based on the U.S. Environmental Protection Agency (EPA) Technical Guidance Document entitled, "Construction Quality Assurance for Hazardous Waste Land Disposal Facilities" (EPA/530-SW-86-031).

The plan was prepared to provide the Owner, Design Engineer, CQA Engineer, and the Contractor the means to govern the construction quality; to satisfy environmental protection requirements for current solid waste management regulations; and utilize state-of-the-art construction practices and testing procedures to adequately document proposed construction activities. The proposed construction, testing, and documentation procedures are also intended to provide the necessary safeguards and provisions accepted by the Owner upon completion. The roles of each party have been sufficiently defined and the level of responsibility explained. The proposed final cover system will be constructed in accordance with the design, the construction documents, and respective components approved and certified for acceptance.

The CQA Engineer has the primary responsibility of implementing and managing the CQA program described in this plan. When construction is complete, the CQA organization will prepare a construction certification report that will include information generated through the CQA program and will document the extent to which construction was performed in accordance with the contract documents. The CQA Plan is intended to be a supporting document to improve the overall implementation of the work. The Contractor is instructed to bring discrepancies in the contract documents to the attention of the Design Engineer or CQA Engineer for resolution. The Design Engineer has the sole authority to determine resolution of discrepancies existing within the Contract Documents. Unless otherwise determined by the Design Engineer, the more stringent requirement shall be the controlling resolution.

2.0 Definitions

2.1 Construction Quality Control (CQC)

A planned system of inspections that is used to directly monitor and control the quality of a construction project. CQC is normally performed by the geosynthetic installer, or for natural soil materials by the earthwork contractor, and is necessary to achieve quality in the constructed or installed system. CQC refers to measures taken by the installer or contractor to determine compliance with the requirements for materials and workmanship as stated in the plans and Specifications for the project.

2.2 Construction Quality Assurance (CQA)

A planned system of activities that provides the owner and permitting agency quality assurance that the facility was constructed as specified in the design. CQA includes construction observation and monitoring, materials testing, verifications, audits, and evaluations of materials and workmanship necessary to determine and document the quality of the constructed facility. CQA refers to measures taken by the CQA organization to assess if the installer or contractor is in compliance with the plans and Specifications for a project.

2.3 Manufacturing Quality Control (MQC)

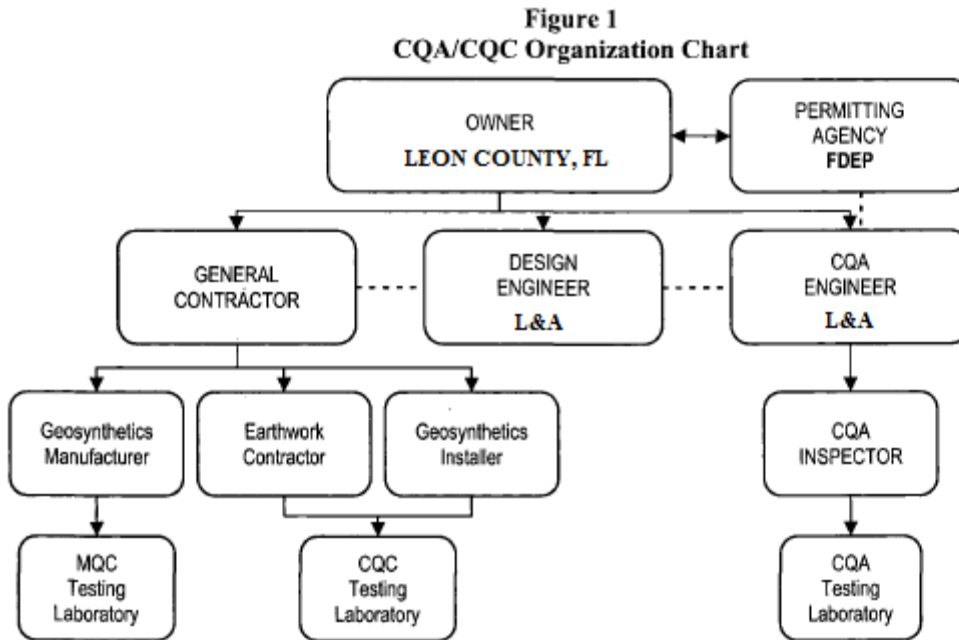
A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum, maximum or average specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract plans.

2.4 Manufacturing Quality Assurance (MQA)

A planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract plans. MQA includes manufacturing facility inspections, verifications, audits and evaluation of the raw materials and geosynthetic products to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the manufacturer is in compliance with the product certification and contract plans for a project.

3.0 Responsibility and Authority

The principal parties involved in the CQA and CQC of the facility include the Permitting Agency, Owner, Designer, CQA Consultant, Earthwork Contractor, General Contractor, Soils CQA Laboratory, Geosynthetics Manufacturer, Geosynthetics Installer, and Geosynthetics Laboratory. The general responsibilities of each of these parties is described in the following subsections. The responsibility and/or authority of a given party may be modified or expanded as dictated by specific needs as construction progresses. The following figure provides a breakdown of the parties involved with the project's quality control:



3.1 Permitting Agency

The permitting agency is the Florida Department of Environmental Protection (FDEP). The permitting agency is authorized by law to issue a permit for the construction of a closure for a solid waste disposal facility. It is the responsibility of the permitting agency to review the facility Owner/Operator's permit application, including the site-specific CQA plan, for compliance with the agency's regulations, and to make a decision to issue or deny a permit based on this review. The permitting agency will have the responsibility and authority to review and accept or reject any design revisions or requests for variance that are submitted by the facility Owner/Operator after the permit is issued. The agency also has the responsibility and authority to review all CQA documentation during or after facility construction to confirm that the approved CQA plan was followed and that the facility was constructed as specified.

3.2 Facility Owner / Operator

The facility is owned and operated by the Leon County Board of Commissioners. Operating personnel include Mr. Robert Mills, Jr., Assistant Public Works Director.

The facility Owner/Operator is responsible for the design, construction, and long-term care of the closed landfill facility. This responsibility includes complying with the requirements of the permitting agency in order to obtain a permit and assuring the permitting agency, by the submission of CQA documentation, that the facility was constructed as specified. The Owner/Operator has the authority to select and dismiss organizations charged with design, CQA, and construction activities. The Owner/Operator also has the authority to accept or reject design plans and specifications, CQA plans, reports, and recommendations of the CQA officer, and the materials and workmanship of the Contractor.

3.3 Design Engineer

The Design Engineer, or Engineer of Record, has the primary responsibility to design a solid waste disposal facility closure that fulfills the requirements of the facility Owner/Operator and the permitting agency. The Design Engineer may be requested to change some component designs if unexpected site conditions are encountered or changes in construction methodology occur that could adversely affect facility performance. CQA provides assurance that these unexpected changes or conditions will be detected, documented, and addressed during construction.

Additional responsibility and authority may be delegated to the Design Engineer by the expressed consent (i.e., a contractual agreement) of the facility Owner/Operator. Additional responsibility and authority includes formulating and implementing a site-specific CQA plan, periodically reviewing CQA documentation, modifying construction site activity, and specifying specific corrective measures in cases in which deviation from the specified design or failure to meet design criteria, plans, and specifications is detected by CQA personnel.

3.4 CQA Responsibility

The overall responsibility of the CQA personnel is to perform those activities specified in the CQA plan (e.g., observation, sampling, documentation). At a minimum, CQA personnel will include a CQA officer and the necessary supporting CQA observation personnel. The specific responsibilities and authority of each of these individuals will be defined clearly in the CQA plan and in the associated contractual agreements with the facility Owner/Operator.

- Specific responsibilities of the CQA Officer will include the following:
 - Reviewing design criteria, plans, and specifications for clarity and completeness so that the CQA plan can be implemented.
 - Educating CQA observation personnel on CQA requirements and procedures.
 - Scheduling and coordinating CQA observation activities.
- Directing and supporting the CQA observation personnel in performing observations and tests as follows:
 - Submitting blind samples (knowns, duplicates, and blanks) for analysis by the CQA observation personnel and one or more independent laboratories.

- Confirming that regular calibration of testing equipment is properly conducted and recorded.
 - Confirming that the testing equipment, personnel, and procedures do not change over time or making sure that any changes do not adversely impact the observation process.
 - Confirming that the test data are accurately recorded and maintained (this may involve selecting reported results and backtracking them to the original observation and test data sheets).
 - Verifying that the raw data are properly recorded, validated, reduced, summarized, and interpreted.
- Providing to the facility Owner/Operator reports on the observation results including the following:
 - Review and interpretation of all data sheets and reports.
 - Identification of work that the CQA Officer believes should be accepted, rejected, or uncovered for observation, or that may require special testing, observation, or approval.
 - Rejection of defective work and verification that corrective measures are implemented.
 - Verifying that a Contractor's construction quality control plan is in accordance with the site-specific CQA plan.
 - At the Owner/Operator's request, reporting to the Contractor results of all observations and tests as the work progresses and interacting with the Contractor to provide assistance in modifying the materials and work to comply with the specified design.

3.5 General Contractor

It is the responsibility of the Contractor to construct the landfill system in strict accordance with design criteria, Project Plans and Specifications, using the required construction procedures and techniques. The chosen Contractor will be registered in accordance with applicable local, state, and federal requirements and will have prior landfill-related experience.

The Construction Contractor's responsibilities include but are not limited to:

- Constructing the landfill closure system in strict accordance with the contract documents including Project Plans and Specifications using the necessary construction procedures and techniques.
- Contracting with subcontractors, such as manufacturers and specialty installers, and coordinating their activities.
- Supplying required materials and supporting QC documentation either directly or through subcontractors.
- Discussing procedures for locating and protecting construction materials and for implementing methods for preventing damage of the materials from inclement weather or other adverse effects.
- Coordinating activities with the CQA Engineer and CQA Inspector and providing the CQA organization with all necessary documentation as detailed in this plan.
- Updating original construction drawings and specifications to reflect any deviation from the original plans and furnishing as-built record drawings and all required quality control

documentation.

- Planning and monitoring construction site health and safety procedures.
- Approving shop drawings prior to submission to the CQA Engineer.
- Determining and verifying:
 - field measurement,
 - field construction criteria,
 - catalog numbers and similar data, and
 - conformance to Project Plans and Specifications.
 - Coordinating each submittal with other submittals and with the requirements of work and of the Project Plans and Specifications
 - Notifying the CQA Engineer in writing, at time of submission, of any variance in the submittals from the requirements of the Project Plans and Specifications. Any such deviations permitted by the Design Engineer will require modifications to the Project Plans and Specifications.

3.6 Earthwork Contractor

The Earthwork Contractor is responsible for excavation of soil and placement and compaction of soil and aggregate materials using procedures and equipment necessary to produce the results in conformance with the Contract Documents. The Earthwork Contractor may also be responsible for the preparation and completion of anchor trenches, dewatering, and other site-specific responsibilities as required by the Contract Documents.

3.7 Geosynthetics Manufacturer

The Geosynthetics Manufacturer(s) is responsible for the production of geosynthetics including geomembranes, geotextiles, and geocomposites. The Geosynthetics Manufacturer is responsible for providing adequate documentation regarding the characteristics of the raw material, final product, the testing performed to verify the characteristics and the MQC measures taken during manufacturing.

The Geosynthetics Manufacturer(s) is responsible for the transportation of the geosynthetics from the manufacturing plant to the site. The Geosynthetics Manufacturer(s) is responsible for loading and transporting geosynthetics, and for damage to the geosynthetics which may occur during these operations.

3.8 Geosynthetics Installer

The Geosynthetics Installer is responsible for unloading, field handling, storing, seaming, protection against wind and other aspects of the geosynthetics installation in accordance with this CQA plan and the Specifications.

The Geosynthetics Installer is responsible for the preparation of the panel layout drawing including dimensions and details, and for providing the installation schedule and a list of proposed field personnel and their qualifications. During installation, the Geosynthetics Installer is responsible for providing CQC documentation and subbase acceptance certificates. Upon completion of the installation, the Geosynthetics

Installer shall provide the geomembrane certification, the Manufacturer's warranty, and the installation warranty.

3.9 CQA Geosynthetics Laboratory

The CQA Geosynthetics Laboratory is responsible for performing the laboratory tests on geosynthetic materials as required by the Specifications. The CQA Geosynthetics Laboratory is also responsible for providing documentation of testing equipment used, analytical results and test methods followed. All results should be reported to the CQA Consultant. The CQA Soils Laboratory shall be the responsibility of the Owner or CQA Consultant.

3.10 CQA Soils Laboratory

The CQA Soils Laboratory is responsible for performing the laboratory testing on soils and aggregate required by the technical specifications and for providing documentation of analytical results, test methods followed, and testing equipment used. Work of the CQA Soils Laboratory should be reported to the CQA Consultant. The CQA Soils Laboratory shall be the responsibility of the Owner or CQA Consultant.

4.0 Communications and Project Meetings

Continuous communications between parties involved in the construction and CQA of this project, including the Owner, Geosynthetics Manufacturer, Geosynthetics Installer, Earthwork Contractor, CQA Consultant, Design Engineer, and Permitting Agency, coupled with regularly scheduled meetings are necessary components of this plan. Such communication and meetings are intended to resolve construction quality and design issues as early as possible, to keep all parties informed of schedules, and verifying that the work is proceeding in accordance with Specifications, schedules and this CQA plan. At a minimum there should be a Pre-Construction Meeting, regular Progress Meetings, and Construction Resolution Meetings as needed and as described below:

4.1 Pre-Construction Meeting

The Pre-Construction Meeting shall be held before the start of construction and should be attended by the Owner's representative, Geosynthetics Installer Superintendent, the Engineer, the CQA Consultant, and the Earthwork Contractor and surveyor. Specific topics at this meeting include, but are not limited to:

- Introduction of all personnel and review the responsibilities of each party, establish project communication, and delineate authority.
- Review the time schedule for construction, including material shipment and working hours.
- Review methods for documenting and reporting, and for distributing documents and reports.
- Establish protocols for testing, handling deficiencies, repairs, and retesting.
- Review seam testing and repair procedures, layout and numbering systems for panels and seams.
- Establish rules for writing on the geomembrane, i.e., who is authorized to write, what can be written and in what color.
- Outline procedures for packaging and storing archive samples.
- Establish locations for soil and geosynthetic materials stockpile.
- Review status of required submittals from Geosynthetics Installer and Earthwork Contractor.

The CQA Consultant shall record and distribute the meeting minutes to all parties involved.

4.2 Progress Meetings

Progress Meetings shall be held at a mutually agreed upon day and time and attended by representatives of the Geosynthetics Installer, Earthwork Contractor, CQA Consultant, Owner, and other parties that may be involved in specific activities occurring at that period of time.

Meeting shall be held on a routine basis (i.e. weekly) but may depend on the construction activities, unresolved issues. Meeting minutes shall be prepared by the CQA Consultant and distributed to all parties in attendance in addition to the established distribution list for project communications.

Topics for Progress Meetings shall include, but are not limited to:

- Work progress to date, and scheduled activities for the subsequent week(s).
- Review of construction issues including questions on Specifications, design, materials test results, test failures, retests, procedures, weather conditions, working hours, holidays, communications, minutes from previous meetings, problems and resolutions, documentation, Material Quality Control (MQC) certificates, and other project related topics.

4.3 Problem or Work Deficiency Meetings

In some cases, construction issues or problems arise that demand specific attention outside of the regular Progress Meetings, and may include parties not available at regular Progress Meetings. Such meetings shall be held as necessary to resolve construction problems or issues in a timely manner so that work can proceed. To the extent possible, these meetings shall be scheduled such that the key parties are available. Meeting minutes shall be prepared by the CQA Consultant and distributed to the established distribution list for project communications.

5.0 Earth Material Quality Assurance

5.1 General

This section of the plan describes CQA procedures for earth material (e.g. soil and rock) components of the project.

5.2 Testing Program

The two categories of quality assurance testing covered in this plan include Pre-Construction Testing and Construction Testing. Within these categories, quality assurance testing shall consist of the following:

- Material Evaluation.
- Construction Quality Evaluation.
- Special Testing.

5.3 Material Evaluation

Pre-construction material evaluations shall be performed on samples from potential soil borrow sources to ascertain their acceptability as construction materials. Construction testing shall be performed during the course of the work to verify material compliance with the project Specifications.

Criteria to be used for determination of acceptability of earth materials for use during construction shall be as defined in the project Specifications. All evaluation tests are to be performed in the CQA Soils Laboratory which has been approved for use by the Owner or his representative. Test reports will verify compliance with or state deviation from the applicable ASTM Standards or other accepted standards as outlined in the Specifications. Any testing deviations from requirements of Specifications shall be approved by Engineer prior to performing tests.

Soil materials shall meet or exceed the project Specifications.

5.4 Construction Quality Evaluation

Construction quality evaluation shall be performed on all soil components of the construction. These evaluations shall be performed at the frequencies indicated in the Specifications. Criteria to be used for determination of acceptability of the construction work shall be as identified in the project Specifications.

Construction evaluation testing includes the visual observations of the work, layer bonding, and clod sizes; in-place density/moisture content testing; surveys of as-built conditions and elevations; thickness monitoring; and special testing. Observations of the construction work shall include the following:

- Clod size and other physical properties of the soil during processing, placement and compaction.
- Thickness of lifts as loosely placed and as compacted.

- Action of the compaction equipment on the construction surface (sheepsfoot penetration, pumping, cracking, etc.).
- Procedures used to prevent desiccation of completed lifts and layers.

Determinations of in-place moisture and density shall be performed in accordance with the Specifications.

5.4.1 *Deficiencies*

If defects are discovered in the earthwork, the extent and nature shall be evaluated by the CQA Consultant. If a defect is indicated by a failing test, the CQA Consultant shall determine the limits of the affected area by additional tests, observations, a review of records, and other means deemed appropriate. If the defect is related to adverse site conditions, the CQA Consultant shall define the limits and nature of the defect.

5.4.2 *Notification*

The CQA Consultant shall notify the Owner and Earthwork Contractor after determining the nature and extent of the defect. Appropriate retests shall be scheduled by the CQA Consultant when the work deficiency is corrected.

5.4.3 *Repairs and Retesting*

Deficiencies shall be corrected by the Earthwork Contractor to the satisfaction of the CQA Consultant. The CQA Consultant shall also verify that all installation requirements have been met and that all submittals are provided.

5.5 Special Testing

Special testing to determine the acceptability of materials shall be conducted at the direction of the Owner, the Engineer or their representative. Criteria to be used for the determination of acceptability shall be as established by the Owner, the Engineer or their representative.

6.0 Geosynthetic Material Quality Assurance

6.1 Geomembranes

This quality assurance testing program has been established to verify that the specified geomembrane is manufactured, installed and tested according to the project Specifications.

6.1.1 *Manufacturer Quality Control Documentation*

The Geomembrane Manufacturer shall provide documentation and certification that the material meets the requirements outlined in the Specifications and that adequate quality control measures have been implemented during the manufacturing process.

The following should be provided prior to shipment of the geomembrane:

- Value certification including at a minimum, guaranteed values for all geomembrane properties required by the Specifications.
- An inventory list of quantities with descriptions of materials which comprise the geomembrane shipment(s).

The CQA Consultant shall verify that the property values certified by the Geomembrane Manufacturer meet the test methods listed in of the Specifications and required minimum property values.

6.1.2 *Manufacturer's Quality Control Certificate*

Prior to shipment, the Geomembrane Manufacturer shall also provide the CQA Consultant with quality control certificates for the geomembrane, signed by a responsible party employed by the Geomembrane Manufacturer. The Manufacturer shall be required to perform, at a minimum, the tests listed in the Specifications.

The CQA Consultant shall review the certificates and verify that the quality control certificates have been provided at the specified frequencies for all materials and rolls. The CQA Consultant shall also review the quality control certificates and verify that the test methods meet the requirements included in the Specifications and the Manufacturer's guaranteed minimum values which were provided prior to shipment.

6.1.2.1 Delivery and Storage

Upon delivery to the site, visual inspection by the Installer and the CQA Consultant shall be conducted on all rolls for evidence of defects or damage. This inspection shall be done without unrolling the rolls unless damage or defects are detected.

The Installer shall be responsible for the storage of the geomembranes on-site. The storage space shall provide protection from theft, vandalism, and traffic. The storage location shall be such that exposure to environmental factors, construction activities and handling are minimized.

6.1.2.2 Conformance Sampling and Testing

The CQA Consultant shall verify that the required number of conformance test samples are obtained for the geomembrane prior to delivery to the site. These samples shall be sent to the CQA Geosynthetics Laboratory for testing to verify conformance to the values listed in the Specifications. These tests shall be performed and test results reported and reviewed prior to installation. As a minimum, the following properties of the geomembrane shall be performed: (i) thickness, (ii) specific gravity, (iii) tensile properties, (iv) carbon black content, and (v) carbon black dispersion.

Samples shall be selected by the CQA Consultant and shall not include the first complete revolution. The sample shall be full width of the roll and extend minimum four feet along the length of the roll. Samples shall be taken at a rate of one per lot, but at a rate not less than one conformance test per 100,000 square feet or portion thereof.

Prior to the deployment of the geomembrane, the CQA Consultant shall review all conformance test results and report any nonconformance to the Owner. The CQA Consultant shall be responsible for verifying that all the test results meet or exceed the property values listed in the Specifications.

If failing test results may be the result of the sampling process or due to the CQA Geosynthetics Laboratory incorrectly conducting the test, the Manufacturer may request a retest to be conducted at the CQA Geosynthetics Laboratory in the presence of a representative of the Manufacturer.

All material from a lot represented by a failing test result shall be rejected, or additional conformance test samples may be taken to isolate the portion of the lot not meeting Specifications (this procedure is valid only when rolls in a lot are consecutively produced and numbered from one manufacturing line). Additional samples shall be taken from rolls on either side of the failing roll, until passing test results are achieved, to establish the range of failure within the lot. All rolls lying within this range of failure shall be rejected.

6.1.3 *Subgrade Preparation and Acceptance*

The Earthwork Contractor shall be responsible for preparing the subgrade upon which the geomembrane will be placed according to the Specifications.

Prior to acceptance, the CQA Consultant shall verify that:

- A qualified land surveyor has verified all lines and grades.
- The supporting soil meets the density and moisture Specifications, and provides a firm, unyielding foundation.
- The surface to be lined is relatively smooth and free of stones, protrusions, irregularities, roots, loose soil, abrupt changes in grade, large desiccation cracks, or other conditions that may puncture or abrade the geomembrane.
- There is no standing water or areas excessively softened by high moisture content.
- All subgrade density, moisture content, or other tests have been completed and meet Specification requirements, and that no other tests are necessary.

The Installer shall certify, in writing, that the surface on which the geomembrane will be installed is acceptable. A Certificate of Acceptance shall be given by the Installer to the CQA Consultant prior to commencement of geomembrane installation in the area under consideration and a copy of this certificate provided to the Owner.

After the supporting soil has been accepted by the Installer, it shall be the Installer's responsibility to indicate to the CQA Consultant any change in the supporting soil condition that may require correction. If the CQA Consultant concurs with the Installer, then the Owner shall ensure that the supporting soil is repaired.

6.1.4 *Subgrade Repair*

At any time during the geomembrane installation, the CQA Consultant shall indicate to the Installer and Owner locations which may not provide adequate support to the geomembrane so the areas in question can be tested and, if necessary, repaired.

6.1.5 *Anchor Trenches*

The CQA Consultant shall verify that the anchor trench has been constructed according to design Drawings and Specifications.

Rounded or smoothed comers shall be provided where the geomembrane enters the trench so as to avoid sharp bends in the geomembrane. No loose or excessively wet soil shall be allowed to underlie the geomembrane in the anchor trench.

The anchor trench shall be adequately drained to prevent ponding or otherwise softening of the adjacent soils while the trench is open. The anchor trench shall be carefully backfilled and compacted by the Earthwork Contractor or the Installer, as outlined in the Specifications. Care shall be taken when backfilling the trenches to prevent bridging of the geomembrane or damage.

6.1.6 *Field Panel Identification*

The CQA Consultant shall verify that each field panel is given a unique identification code (number or letter-numbered) consistent with the layout plan. This identification code shall be agreed upon by the Installer and CQA Consultant. The CQA Consultant and Installer shall establish a table or chart showing correspondence between roll numbers and field panel identification codes. The field panel identification code shall be used for all quality assurance documentation.

The CQA Consultant shall verify that field panels are installed at the location indicated in the Installer's layout plan, as approved or modified, and that the Installer has marked the identification code and roll number on each installed panel. The Installer and CQA Consultant shall also verify that the condition of the supporting soil has not changed detrimentally during installation. The CQA Consultant shall record the identification code, location, and date of installation of each field panel.

6.1.7 *Field Panel Placement and Deployment*

Geomembrane panel placement shall not be done during any precipitation, in the presence of excessive moisture (e.g., fog, dew), in areas of ponded water, or in the presence of strong winds. Manufacturer's recommendations or the Specifications should be followed, whichever is more stringent, for extreme ambient temperature conditions.

Panels shall be oriented according to the Installer's panel layout drawing as approved by the CQA Consultant and Owner. Seams shall be located outside of areas of potential high stress conditions, at slope intersections and comers, or other areas considered critical. To the maximum extent possible, orient seams parallel to line of slope, i.e., down and not across slope. The CQA Consultant shall review the seam orientations prior to seaming operations to determine if these conditions are satisfied.

The CQA Consultant shall verify that the geomembrane handling equipment used does not pose risk of damage to the geomembrane or subgrade, and that the Installer's personnel take care in handling the geomembrane at all times.

Contact between the soil liner and the geomembrane shall be maintained in all areas. The Installer shall take into account ambient temperature and its effect on the thermal expansion and contraction of the geomembrane. The geomembrane materials shall be deployed in a manner which minimizes wrinkling. Partial backfilling of anchor trenches, adequate loading of the toe of slope during lower ambient temperatures is recommended to prevent displacement by bridging.

The CQA Consultant shall also verify and notify the Owner that:

- Equipment used does not damage the geomembrane during trafficking, handling, excessive heat or other means.
- The method of deploying the geomembrane does not cause excessive scratches or crimps in the

geomembrane, and does not damage the approved subgrade surface.

- Personnel working on the geomembrane do not smoke or wear damaging shoes.
- The geomembrane is protected by appropriate means in areas of excessive traffic.
- Adequate ballast (e.g., sand bags) has been placed to prevent wind uplift and is not likely to damage the geomembrane. At a minimum continuous loading is recommended along edges of panels in high winds, or when work is terminated for several days or longer periods.

The CQA Consultant shall visually inspect each panel for defects or damage after placement and prior to seaming. Damaged panels or portions of damaged panels shall be marked and repaired, or removed from the work area. Repairs shall be made according to procedures described in the Specifications.

6.1.8 *Field Seaming*

6.1.8.1 Personnel Requirement

The Installer shall be prequalified in accordance with the Specifications and approved by the Owner.

The Installer's Superintendent shall be qualified based on previously demonstrated experience, management ability, and authority. The Superintendent is responsible for the Installer's field crew and will represent the Installer at all project meetings.

6.1.8.2 Seam Layout

Prior to the installation of geomembrane, the Installer shall provide the Owner and CQA Consultant with a panel layout drawing showing all expected major panel seams. The Owner or Owner's representative shall approve in writing the panel layout drawing.

6.1.8.3 Seaming Methods

Accepted seaming methods consist of those recommended by the Manufacturer of the geomembrane product, and which will result in seams that meet testing requirements as indicated in the Specifications for both destructive and non-destructive samples.

For polyethylene geomembranes, the accepted methods include extrusion and fusion-welding.

Proposed alternate methods shall be documented by the Installer and CQA Consultant. The CQA Consultant shall review all documentation regarding alternative seaming methods to be used. The Owner, Owner's representative, or Engineer shall approve in writing any alternative seaming methods.

Fusion-welding apparatus shall be an automated, roller-mounted device. The fusion-welding apparatus

shall be equipped with gauges indicating the applicable temperatures and pressures. The CQA Consultant shall log ambient, seaming apparatus, and geomembrane surface temperatures as well as seaming apparatus pressures.

Extrusion-welding apparatus shall be equipped with gauges indicating the temperature in the apparatus and at the nozzle.

The Installer shall provide documentation regarding the extrudate to the CQA Consultant, and shall certify that the extrudate is compatible with the Specifications and is comprised of the same resin as the geomembrane sheeting.

The CQA Consultant shall log apparatus temperatures, extrudate temperatures, ambient temperatures, and geomembrane surface temperatures at appropriate intervals.

6.1.8.4 Seam Preparation

The CQA Consultant shall verify that:

Seams are aligned with the fewest possible number of wrinkles and "fishmouths".

Prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris of any kind, and foreign material.

- If seam overlap grinding is required, the process is completed according to the Manufacturer's instructions within one hour of the seaming operation, and does not damage the geomembrane.
- For cross seams, the edge of the cross seam is ground to a smooth incline (top and bottom) prior to welding.
- A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage.
- The geomembrane is protected from damage in heavily trafficked areas.
- A movable protective layer (i.e., plywood, geomembrane) may be used as necessary directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between the sheets.
- The panels of geomembrane have a sufficient finished overlap to allow peel tests to be performed on the seam. A 6-inch overlap is commonly recommended for extrusion welding and 4 -inch overlap is commonly recommended for fusion welding.
- The procedure used to temporarily bond adjacent panels together does not damage the geomembrane.

6.1.8.5 Weather Conditions for Seaming

The Installer and CQA Consultant shall observe weather conditions during seaming operations to determine if excessive temperatures, moisture or humidity, or winds exist that could impact the welding process. Manufacturer's recommendations shall be followed for seaming under extreme weather

conditions, unless otherwise approved by the Owner and CQA Consultant based on the Installer's experience and recommendations.

As indicated in the Specifications, welding shall not occur when ambient air temperatures measured one-foot above the geomembrane are below 32-degrees F or above 104-degrees F and as noted in the Specifications. Preheating of the seams may be used if trial seams have been performed using the same preheating method(s) and meet all criteria for acceptance. Wind conditions shall also be considered in determination of acceptable ambient conditions.

6.1.8.6 General Seaming Procedures

During seaming, the CQA Consultant shall verify the following conditions:

- Seaming shall extend to the outside edge of panels placed within the anchor trench.
- A firm substrate shall be provided using a flat board or similar hard surface directly under the seam overlap to achieve proper support, if necessary.
- "Fishmouths" or wrinkles at the seam overlap shall be cut along the ridge in order to achieve a flat overlap. The cut "fishmouth" or wrinkle shall be seamed and any portion where the overlap is inadequate shall be patched with an oval or round geomembrane patch that extends a minimum of 6 inches beyond the cut in all directions.
- Adequate lighting shall be provided if seaming operations are performed at night or during periods of diminished natural light.
- Startup testing is conducted and recorded prior to initiating welding.

6.1.9 *Seam Testing*

6.1.9.1 Nondestructive Testing of Field Seams

The Installer shall nondestructively test all field seams over their full length using a vacuum test unit, air pressure test (double fusion seams only), or other approved method. The purpose of this testing is to determine the continuity of the seams only. Nondestructive testing shall be performed as work progresses, not at completion.

The CQA Consultant shall observe nondestructive testing procedures and inform the Installer and Owner of required repairs. The CQA Consultant shall record the location, date, name, and outcome of all testing.

The Installer shall complete required repairs in accordance with the Specifications. The CQA Consultant shall observe the repair and testing of the repair, document the repair and test results, and mark on the geomembrane that the repair has been completed. All repairs shall be shown on the record Drawings, and noted in repair logs and on daily reports.

Vacuum testing equipment and methods are discussed in the Specifications.

Air pressure testing procedures are applicable to fusion-welding that produces a double seam with an enclosed air channel. The equipment and methods are discussed in the Specifications.

6.1.9.2 Destructive Testing

Destructive seam tests shall be performed on seam samples cut from the geomembrane locations selected by the CQA Consultant. Seam strength testing shall be done as the seaming work progresses, not at the completion of all field seaming.

The CQA Consultant shall select locations where seam samples will be cut by the installer for laboratory testing. Those locations shall be established as follows:

- A minimum average frequency of one test location per 500 feet of seam length.
- At locations where the CQA Consultant suspects that inadequate seaming methods or conditions occurred or other factors causing to reduce seam strength exist.

The Installer shall not be informed in advance of the locations where the destructive seam samples will be taken.

6.1.9.3 Sampling Procedures

Samples shall be cut by the Installer at locations selected by the CQA Consultant as the seaming progresses, such that laboratory test results are available before the geomembrane is covered by another material.

The CQA Consultant shall observe the sample cutting, assign a number to each sample, and mark it accordingly, and record the sample location on the layout drawing.

All holes in the geomembrane resulting from destructive seam sampling shall be immediately repaired in accordance with specified repair procedures. The continuity of the new seams in the repaired area shall be non-destructively tested according to procedures described herein.

The sample for laboratory testing shall be 12 inches wide across the seam by 42 inches long with the seam centered lengthwise. The sample shall be cut into three segments and distributed as follows:

- 12 inches x 14 inches to the Installer for laboratory testing.
- 12 inches x 14 inches to the CQA Geosynthetics Laboratory for testing.
- 12 inches x 14 inches to the Owner for archive storage.

The CQA Consultant is responsible for packaging and shipping samples to the CQA Geosynthetics Laboratory in a manner which will not damage the samples.

6.1.9.4 CQA Geosynthetics Laboratory

Testing shall include ASTM D 4437 "Practice for Determining the Integrity of Field Seams Used in Joining Polymer Sheet Membranes". The minimum acceptable values to be obtained in these tests are those indicated in the Specifications. At least five specimens shall be tested for each test method. Specimens shall be selected from the samples and tested alternately (i.e., peel, shear, peel, shear, etc.). For double wedge welds, both inner and outer seams shall be tested and determined to be acceptable.

The CQA Geosynthetics Laboratory shall provide verbal test results no more than 24 hours after they receive the samples. The CQA Consultant shall review laboratory test results as soon as they become available, and make appropriate recommendations to the Installer.

6.1.9.5 Procedures for Destructive Test Failures

Acceptable seams must be bounded by two locations from which samples passing laboratory destructive tests have been taken. In cases exceeding 150 feet (50 m) of reconstructed seam, a sample taken from the zone in which the seam has been reconstructed must pass destructive testing.

The procedures outlined in the Specifications shall apply whenever a sample fails a destructive test, whether that test is conducted by the CQA Consultant, the Installer, the Contractor's independent CQC laboratory, or by field tensiometer.

The CQA Consultant shall document all actions taken in conjunction with destructive test failures.

6.1.10 Defects, Repairs and Wrinkles

The entire geomembrane, including seams, shall be visually examined by the CQA Consultant for identification of visual defects, holes, blisters, undispersed raw materials and signs of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of examination. The geomembrane surface shall be swept or washed by the Installer if dust, mud or other matter inhibits examination. Areas having defects and/or requiring repairs shall be repaired.

Work shall not proceed with any materials which will cover locations which have been repaired until the CQA Consultant has re-examined the repaired area and applicable laboratory test results with passing values are available.

Panels or portions of panels which are, in the opinion of the CQA Consultant, damaged beyond repair shall be removed from the site and replaced. Damage, which in the CQA Consultant's opinion, can be

repaired may be repaired or replaced.

Any portion of the geomembrane exhibiting a flaw or failing a destructive or nondestructive test shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be agreed upon between the CQA Representative, Installer, and Designer.

Each repair shall be numbered and logged. Each repair shall be non-destructively tested using the methods described in the Specifications 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 CQA Consultant. In the case of failed tests, the repair shall be redone and retested until a passing test results. The CQA Consultant shall observe repairs and non-destructive testing of repairs, note on the membrane that it has been repaired, and document each repair thoroughly.

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 CQA Consultant shall indicate which wrinkles should be cut and re-seamed by the Installer. Wrinkle size shall be evaluated during the time of day and under conditions similar to those expected when overlying protective cover/drainage layer material is to be placed. All wrinkles higher than they are wide (across their base) or more than 6 inches high shall be removed by repair methods and retested.

6.2 Geotextiles

This quality assurance testing program has been established to verify that specified geotextiles are manufactured, installed and tested according to project Specifications.

6.2.1 *Manufacturer Quality Control Documentation*

The Geotextile Manufacturer shall provide the CQA Consultant with the following information prior to the installation of the geotextile:

- A list of materials which comprise the geotextile and a Specification for the geotextile which includes all properties contained in the project Specifications measured using the appropriate test methods.
- Written certification that the minimum average roll values given in the Specification are guaranteed by the Manufacturer.
- Written certification that the Manufacturer has continuously inspected the geotextile for the presence of needles and found the geotextile to be needle free.
- Quality control certifications, which shall include roll identification numbers, sampling procedures, and quality control test results signed by a responsible party employed by the Manufacturer. At a minimum, results shall be given for:

1. Mass per unit area, oz/yd² (ASTM D 5261)

2. Apparent Opening Size, US sieve (ASTM D 4751)
3. Flow Rate, gpm/ft² (ASTM D 4491)
4. Puncture Strength, lb (ASTM D 4833)
5. Trapezoidal Tear Strength, lb (ASTM D 4533)
6. Grab Tensile, lb (ASTM D 4632)

Results of quality control tests conducted by the Manufacturer to verify the geotextile meets the project Specifications.

Quality control tests shall be performed in accordance with test methods and frequencies required by the project Specifications.

All rolls of geotextile shall be identified by the Manufacturer with the following:

- Manufacturer's Name.
- Roll Number.
- Product Identification.
- Roll Dimensions.

The CQA Consultant shall review these documents to verify that:

- Property values certified by the Manufacturer meet all Specifications listed in the Specifications.
- The Manufacturer's measurements of properties are properly documented and test methods used acceptable.
- Rolls are properly labeled.
- Project Specifications shall be met with the certified minimum average roll properties.
- Quality control certificates have been provided at the specified frequency for all rolls.

Any discrepancies shall be reported to the Owner and Manufacturer.

6.2.2 *Conformance Sampling and Testing*

The CQA Consultant shall verify that the required number of conformance test samples are obtained for the geotextile prior to delivery to the site. At a minimum, geotextile conformance tests performed are as follows:

- Mass per unit area, oz/yd² (ASTM D 5261)
- Apparent Opening Size, US sieve (ASTM D 4751)
- Flow Rate, gpm/ft² (ASTM D 4491)
- Grab Tensile, lb (ASTM D 4632)
- Trapezoidal Tear Strength, lb (ASTM D 4533)

- Puncture Strength, lb (ASTM D 4833)

The CQA Consultant shall select the rolls to be tested. Samples shall be full width of the roll and extend minimum three feet along length of the roll, and shall not include the first complete revolution of the roll. Samples shall not include any portion of a roll which has been subjected to excess pressure or stretching. All lots of material and the particular test sample that represents each lot shall be defined before the samples are taken.

Samples shall be taken at a rate of one per lot, but not less than one conformance test per 100,000 square feet of geotextile or portion thereof.

The CQA Consultant shall review all conformance test results and accept or reject the roll prior to deployment. All nonconforming test results shall be reported to the Owner and Installer. The CQA Consultant is responsible for reviewing test results to verify that the property values meet or exceed values listed in the project Specifications.

If any failing test results may be the result of the CQA Geosynthetics Laboratory incorrectly conducting the test, the Manufacturer may request a retest to be conducted at the CQA Geosynthetics Laboratory in the presence of a representative of the Manufacturer.

All material from a lot represented by a failing test should be rejected or additional conformance test samples may be taken to isolate the portion of the lot not meeting Specifications. (This procedure is only valid when rolls in a lot are consecutively produced and numbered from one manufacturing line). Additional samples shall be taken from rolls either side of the failing roll, until passing test results are achieved, to establish the range of failure within the lot. All rolls lying within this range of failure shall be rejected.

6.2.3 *Geotextile Storage, Handling and Placement*

Geotextile shall be protected from ultraviolet light exposure, precipitation, mud, puncture, cutting, or other deleterious conditions during shipment, handling and storage. Geotextile rolls shall be shipped and stored in relatively opaque and watertight wrapping which shall be removed shortly before deployment.

The Installer shall handle all geotextile in such a manner as to minimize damage, and the following shall be complied with:

- All deployed geotextile shall be stabilized with sandbags or the equivalent ballast in the presence of wind. Such sandbags shall remain until replaced with cover material.
- The entire surface of the geotextile shall be visually inspected to ensure that no potentially harmful foreign objects are present.
- On slopes, the geotextiles shall be securely anchored in the anchor trench and rolled down the slope in such a manner as to continually keep the geotextile sheet in tension.

- Geotextiles shall be cut using an approved geotextile cutter only. If in place, special care must be taken to protect other materials from damage which could be caused by the cutting of the geotextiles.
- The Installer shall take any necessary precautions to prevent damage to underlying layers during placement of the geotextile.
- Care shall be taken not to entrap stones, excessive dust, or moisture within the geotextile that could damage the geomembrane, result in clogging of drains or filters, or hamper subsequent seaming.
- After installation, a visual examination of the geotextile shall be carried out over the entire surface, to verify that no potentially harmful foreign objects, such as needles or staples, are present.

6.2.4 *Seaming Procedures*

Geotextile shall be overlapped in accordance with the requirements of the Specifications. To the maximum extent possible, orient seams parallel to line of slope, i.e., down and not across slope.

Sewing shall be done using polymeric thread with chemical or ultraviolet light resistant properties equal to or greater than those of the geotextile.

6.2.5 *Defects and Repairs*

Holes or tears in the geotextile shall be repaired with a patch of the same geotextile double-sewn or heat-tacked into place. Repairs occurring on slopes steeper than 1H: 1V shall be double-sewn in place. Should any tear exceed ten percent of the width of the roll, that roll shall be removed and replaced. Soil or other material which may have penetrated the torn geotextile shall be removed.

The CQA Consultant shall observe any repairs and report any noncompliance to the Owner.

6.2.6 *Placement of Soil Materials*

The Earthwork Contractor or Installer shall place all soil materials on top of a geotextile in such a manner as to minimize:

- Damage to the geotextile.
- Slippage of the geotextile on underlying layers.
- Excess tensile stresses in the geotextile.

Any noncompliance shall be noted by the CQA Consultant and reported to the Installer and Owner.

6.3 Geocomposites

6.3.1 *Manufacturer Quality Control Documentation*

This quality assurance testing program has been established to verify that specified geocomposites are manufactured, installed and tested according to Specifications.

The geocomposite manufacturer shall provide the CQA Consultant with a list of guaranteed properties that meet or exceed the requirements of the Specifications, with a written certification signed by an officer or the Quality Control Manager that the geocomposites delivered have properties which meet or exceed the specified properties.

The CQA Consultant shall examine all manufacturer's certifications to verify that the property values listed on the certifications meet or exceed those specified. Any deviations shall be reported to the Owner and Manufacturer.

The geocomposite manufacturer shall identify all rolls of geocomposites with the following:

- Manufacturer's name.
- Product identification.
- Lot number.
- Roll number.
- Roll dimensions.

The CQA Consultant shall examine rolls upon delivery and any deviation from the above requirements shall be reported to the Owner and Manufacturer.

6.3.2 *Shipment and Storage*

Geocomposite cleanliness is essential to their performance and geocomposite rolls should be wrapped in polyethylene sheets or otherwise protected against dust and dirt during shipping and storage. The wrapping should be removed less than 1 hour before placement. The CQA Consultant shall verify that geocomposites are free of dirt and dust just before installation and report the outcome of this verification to the Owner. If the geocomposites are judged dirty or dusty, they shall be washed by the Installer prior to installation. Washing operations shall be observed by the CQA Consultant.

6.3.3 *Conformance Sampling and Testing*

Upon delivery of the rolls of geocomposites, or prior to shipment to the jobsite, the CQA Consultant shall verify that samples are removed and forwarded to the CQA Geosynthetics Laboratory for testing. The Laboratory tests and sampling frequency have been indicated in the Specifications.

Samples shall be taken across the entire width of the roll and shall not include the first complete revolution of the roll. Unless otherwise specified, samples shall be full width of the roll and extend minimum 3 feet along length of the roll. The CQA Consultant shall mark the machine direction on the samples with an arrow.

Samples shall be taken at a minimum frequency of one sample per 100,000 square feet with a minimum of one sample per lot. If CONTRACTOR ships geocomposite that requires sampling and testing at a frequency greater than one per 90,000 square feet, then CONTRACTOR shall pay for the additional CQA sampling and testing beyond one per 90,000 square feet.

The CQA Consultant shall examine all results from laboratory conformance testing and shall report any nonconformance to the Owner.

6.3.4 *Handling and Placement*

The Installer shall handle all geocomposites in such a manner as to minimize damage to the geocomposites. The following shall be complied with:

- During placement of geocomposites, care shall be taken not to entrap any dirt or excessive dust in the geocomposite that could cause clogging of the drainage system, and/or stones that could damage the adjacent geomembrane. If dirt or excessive dust is entrapped in the geocomposite, it should be hosed clean prior to placement of the next material on top of it.
- On slopes, the geocomposites shall be secured in the anchor trench and the material rolled down the slope in such a manner as to continually keep the geocomposite sheet in tension. If necessary, the geocomposite shall be positioned by hand after being unrolled to minimize wrinkles. Geocomposites can be placed in the horizontal direction (i.e., across the slope) in some special locations (e.g., at the toe of a slope, if an extra layer of geocomposite is required, this extra layer of geocomposite can be placed in the horizontal direction). Such locations shall be identified by the Designer in the design Drawings.
- In the presence of wind, all geocomposites shall be ballasted with sandbags or the equivalent. Such sandbags shall be placed during placement of the geocomposites and shall remain until replaced with cover material.
- The Installer shall take necessary precautions to prevent damage to underlying layers during placement of the geocomposite.

The CQA Consultant shall note any noncompliance and report it to the Owner.

6.3.5 *Repair*

Holes or tears in the geocomposite shall be repaired by placing a patch extending 2 feet beyond the edges of the hole or tear. The patch shall be secured to the original geocomposite by spot welding or tying every 6 inches.

7.0 Documentation

The documents outlined below describe the various elements of CQA observation, reporting, and final completion documentation. Each of the presented items is essential to document that the completed facility has been constructed to meet or exceed design criteria, plans, and specification.

The CQA Consultant shall maintain at the site a complete file of design plans, project Specifications, test procedures, daily logs, and other pertinent documents.

7.1 Daily Reports

The standard daily report from the CQA Consultant will include a work summary with supporting observation/documentation sheets that are completed daily during construction. Items included are as follows:

- Unique document number.
- Date, project name, location, and other identification.
- Reports on any meetings held and their results.
- Activities and locations of construction under way during the time frame of the daily summary report.
- Equipment and personnel involved in construction activities including subcontractors.
- Descriptions of areas of work being inspected and documented.
- Description of off-site materials received, including any quality verification (vendor certification) documentation.
- Calibrations or recalibrations of test equipment, including actions taken as a result of recalibration.
- Decisions made regarding approval of material and/or corrective actions to be taken in instances of substandard quality.
- A summary of field/laboratory test results or reference to specific observation logs and/or test
- Signature of the CQA Consultant.

7.2 Observation Data and Testing Reports

The observation data sheets record the observations of field and laboratory test data. The formats range from reports, charts, graphs, notes, sketches, and photographs. At a minimum, items included are as follows:

- Unique identifying sheet number for cross-reference and document control.
- Description or title of the observation activity.
- Location of the observation activity or location from which the sample increment was obtained.
- Type of observation activity; procedure used (reference to standard method when appropriate).
- Recorded observation or test data, with all necessary calculations.
- Results of the observation activity; comparison with specification requirements.
- Personnel involved in the observation activity.

- Signature of the appropriate testing laboratory personnel.
- Signature of the CQA Consultant.

Reports describing problem identification, corrective measures reports or special construction situations shall be prepared by the CQA Consultant and cross-referenced to specific observation and testing reports. These reports shall include the following information:

- An identifying sheet number for cross-referencing and document control.
- A detailed description of the situation or deficiency.
- The location and probable cause of the situation or deficiency.
- How and when the situation or deficiency was found or located.
- Documentation of the response to the situation or deficiency.
- Final results of any responses.
- Any measures taken to prevent a similar situation from occurring in the future.
- The signature of the CQA Consultant and the signature of the Owner or Owner's representative indicating concurrence.

The Owner shall be made aware of any significant recurring nonconformance with the project specifications. The Owner shall then determine the cause of the nonconformance and recommend appropriate changes in procedures or specifications. These changes will be submitted to the Design Engineer for approval. When this type of evaluation is made, the results shall be documented, and any revision to procedures or project specifications will be approved by the Owner, Design Engineer, and, if necessary, the Permitting Agency.

7.3 Photo Documentation and Reporting Data Sheets

Photo documentation and reporting data sheets shall be cross-referenced with observation and test reports and/or problem identification and corrective measure reports.

These photographs will serve as a pictorial record of work progress, problems, and mitigation activities. The basic file shall contain color prints; digital files shall be stored on CD or flash drive in a separate file in chronological order. These records will be presented to the Owner upon completion of the project.

In support of photographic documentation, videotaping may be used to record work progress, problems, and mitigation activities.

7.4 Design And/Or Specification Changes

Design and/or project Specification changes may be required during construction. In such cases, the CQA Consultant shall notify the Owner and the Design Engineer. The Owner shall notify the Permitting Agency (DEP) of all design and/or project specification changes proposed during construction, prior to implementation.

Design and/or project Specification changes shall be made only with the written agreement of the Owner and the Design Engineer, and shall take the form of an Addendum to the project Specifications.

7.5 Progress Reports

The CQA Consultant shall prepare a progress report at time intervals established at the Preconstruction meeting and submit to the Owner. At a minimum, this report shall include the following information:

- An identifying sheet numbered for cross referencing and document control.
- Date, project name, location, and other identification.
- A summary of work activities during the progress reporting period.
- A summary of construction situations, deficiencies, and/or defects occurring during the progress reporting period.
- A summary of test results, failures, and retests.
- The signature of the CQA Consultant.

The Owner shall distribute copies of the Progress Reports to the Permitting Agency and, upon request, Geosynthetics Installer and Earthwork Contractor or as decided at the Pre-construction Meeting.

7.6 As-Built Drawings

As-Built Drawings shall include, but are not limited to the following:

- Scale plans depicting the location of construction.
- Details pertaining to the extent of construction (e.g., depths, plan dimensions, elevations, soil component thicknesses, over excavation, etc.).
- Grid to confirm elevation of waste, top of grading layer, and top of protective soil.
- Base maps required for the development of the record plans shall be done by a qualified land surveyor.
- Each layer of geomembrane identifying panels with appropriate numbers, destructive seam samples locations, patches, and repairs locations.
- Pipe, swale, and ditch inverts.
- Tolerances.
- Pertinent details.
- Changes from the construction Drawings.

7.7 Final Documentation Report And Certification

At the completion of the work, the CQA Consultant shall submit to the Owner the signed Final Documentation Report. At a minimum, the Final Documentation Report shall include:

- Summaries of all construction activities.
- Observation logs and test data sheets including sample location plans and supporting field and laboratory test results.
- Construction problems and solutions reports.
- Changes from design and material specifications.
- As-Built Drawings.
- FDEP Form 62-701.900(2) sealed and signed by a professional engineer registered in Florida that the construction has been completed in substantial conformance with project Specifications, design plans, and any deviations from plans and applications approved by the Department.

APPENDIX B
FDEP SOLID WASTE PERMIT



Attachment B - Technical Specifications
**Florida Department of
Environmental Protection**

Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Appendix B
Rick Scott
Governor

Carlos Lopez-Cantera
Lt. Governor

Jonathan P. Steverson
Secretary

November 28, 2016

NOTICE OF PERMIT

By-Email
millsro@leoncountyfl.gov

In the Matter of an
Administrative Closure Permit for:
Leon County Board of County Commissioners
7550 Apalachee Parkway
Tallahassee, FL 32311

Leon County
WACS # 6660
Leon County Solid Waste
Management Facility

Attention: Mr. Robert Mills

DEP File No: 0009560-016-SF-01
0009560-017-SF-T3
0009560-018-WT-02

Enclosed are Permit Numbers 0009560-016-SF-01 and 0009560-017-SF-T3 for the closure of the Class I Landfill Phases IIB, IIC, IID and the Class III Landfill East, West and South areas, and for continued operation of a waste tire processing facility, issued pursuant to Section 403.061(14) and 403.707, Florida Statutes.

A person whose substantial interests are affected by this modification of permit may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, F.S. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000.

Petitions by the applicant or any of the parties listed below must be filed within fourteen days of receipt of this written notice. Petitions filed by other persons must be filed within fourteen days of publication of the notice or receipt of the written notice, whichever occurs first. Under Section 120.60(3), F.S., however, any person who asked the Department for notice of agency action may file a petition within fourteen days of receipt of such notice, regardless of the date of publication. The petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57, F.S., or to intervene in this proceeding and participate as a party to it. Any subsequent intervention (in a proceeding initiated by another party) will be only

at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205, F.A.C.

A petition that disputes the material facts on which the Department's action is based must contain the following information:

- (a.) The name, address, and telephone number of each petitioner, the applicant's name and address, the Department File Number and the county in which the project is proposed;
- (b.) A statement of how and when each petitioner received notice of the Department's action or proposed action;
- (c.) A statement of how each petitioner's substantial interests are or will be affected by the Department's action or proposed action;
- (d.) A statement of all material facts disputed by petitioner or a statement that there are no disputed facts;
- (e.) A statement of the ultimate facts alleged, including a statement of the specific facts which the petitioner contends warrant reversal or modification of the Department's action or proposed action;
- (f.) A statement of the specific rules or statutes the petitioner contends require reversal or modification of the Department's action or proposed action; and
- (g.) A statement of the relief sought by the petitioner, stating precisely the action the petitioner wants the Department to take with respect to the Department's action or proposed action.

A petition that does not dispute the material facts on which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by Rule 28-106.301, F.A.C.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

In accordance with Section 120.573, F.S., the Department advises that mediation is not available in this case under the provisions of that statute. This does not prevent any interested parties from agreeing to other forms of alternate dispute resolution.

Any party to this order has the right to seek judicial review of it under Section 120.68, F.S., by filing a notice of appeal under Rule 9.110, Florida Rules of Appellate Procedure, with the clerk of the Department in the Office of General Counsel, Mail Station 35, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000, and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice of appeal must be filed within thirty days after this order is filed with the clerk of the Department.

Executed in Leon County, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION



Kimberly A. Walker, Program Administrator
Permitting and Compliance Assistance Program

FILING AND ACKNOWLEDGEMENT

FILED, on this date, pursuant to Section 120.52, F.S. with the designated Department Clerk,
receipt of which is hereby acknowledged.



Clerk

11-28-2016

Date

CERTIFICATE OF SERVICE

The undersigned duly designated deputy clerk hereby certifies that this NOTICE OF PERMIT and
all copies were sent before the close of business on November 28, 2016, to the listed persons.



Clerk

Enclosure: Permit Nos. 0009560-016-SF-01
 0009560-017-SF-T3
 0009560-018-WT-02

Copies furnished to:

Shawn Abbott, Leon County, AbbottS@leoncountyfl.gov
Lisa Baker, P.E., Locklear & Associates, Inc., lisa@locklearconsulting.com
John Locklear, P.G., Locklear & Associates, Inc., john@locklearconsulting.com
Dawn Templin, P.E., FDEP Northwest District, Dawn.Templin@dep.state.fl.us
Cory Dilmore, P.E., FDEP PCAP Solid Waste Section, Cory.Dilmore@dep.state.fl.us
James J. Jarmolowski, P.G., FDEP PCAP Solid Waste Section,
James.Jarmolowski@dep.state.fl.us



Florida Department of Environmental Protection

Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Appendix B
Rick Scott
Governor

Carlos Lopez-Cantera
Lt. Governor

Jonathan P. Steverson
Secretary

Permit Issued to:

Leon County Board of County Commissioners
7550 Apalachee Parkway
Tallahassee, Florida 32311

WACS Facility ID No.: 6660
Facility Name: Leon County Solid Waste Management Facility
Facility Address: 7550 Apalachee Parkway
Tallahassee, Leon County, Florida

Contact Person:
Robert Mills, Director, Office of Resources Stewardship
Leon County Board of County Commissioners
7550 Apalachee Parkway, Tallahassee, FL 32311
millsro@leoncountyfl.gov
850-606-1810

Solid Waste Closure Permit – Class I Landfill and Class III Landfill
Class I Permit No. 0009560-016-SF-01
Class III Permit No. 0009560-017-SF-T3
Waste Tire Processing Facility Permit No. 0009560-018-WT-02

Replaces Permit Nos. 0009560-013-SO-01, 0009560-014-SO-MM
and 0009560-015-SO-MM

Permit Issued: November 28, 2016
Permit Renewal Application Due Date: September 28, 2021
Permit Expires: November 28, 2021

Permitting Authority
Florida Department of Environmental Protection
Tallahassee Office
2600 Blair Stone Road
Tallahassee, Florida 32399
850-245-8707
850-245-8856

PERMITTEE: Leon County Board of County Commissioners
FACILITY NAME: Leon County Solid Waste Management Facility

PERMIT NO.: 009560-016-SF-01
0009560-017-SF-T3
0009560-018-WT-02
WACS Facility ID: 6660

SECTION 1 - SUMMARY INFORMATION

A. Authorization

The Permittee is hereby authorized to close and conduct long term care for the Class I Landfill Phases IIB, IIC, IID and the Class III Landfill East, West and South areas, of the Leon County Solid Waste Management Facility, as shown on the application and approved drawings, plans, and other documents attached hereto or on file with the Department and made a part hereof. This Closure Permit is issued under the provisions of Chapter 403, Florida Statutes, Florida Administrative Code Chapters 62-4 and 62-701.

This permit does not relieve the Permittee from complying with any other appropriate local zoning or land use ordinances or with any other laws, rules or ordinances. Receipt of any permits from the Department does not relieve the applicant from obtaining other federal, state, and local permits and/or modifications required by law, including those from other Sections within the Department or of the Water Management District.

B. Facility Location

The main entrance to the Leon County Solid Waste Management Facility is located at 7550 Apalachee Parkway, Tallahassee, Leon County, Florida. The facility is located at Latitude 30° 25' 21.69" North and Longitude 84° 08' 41.04" West in Sections 4, 5, 8, 9, Township 1 South, Range 2 East.

C. Facility Description

The Leon County Solid Waste Management Facility (LCSWMF) is owned and operated by the Leon County Board of County Commissioners. It has been permitted to dispose of solid waste since August 1977. The total land area is approximately 600 acres, of which approximately 162.4 acres are permitted landfill space (125 acres of Class I disposal and 37.4 acres of Class III disposal). 52.1 acres have been used through August 2016 for the current Class I landfill.

The facility also includes three closed landfill cells that have completed long term care; the unlined Class I Phase I cell, the lined Class I Phase IIA cell and the Class III North cell. These three cells were closed on November 4, 2014, and because of their history, the long term care period was reduced and determined by the Department to be complete on July 15, 2015.

Since April 2003 Leon County has sent its Class I waste to the Leon County Solid Waste Transfer Station on Gum Road. Until August 2016, the facility accepted materials from the Marpan C&D Recycling Facility. In addition to the Class I and Class III landfill disposal cells, the facility contains a waste tire processing facility, a household hazardous waste collection center, a mulching operation, and recyclable drop off center, which will remain open during and after completion of the closure operations. The facility has a Title V (NSPS) air operation permit No. 0730099-009-AV issued on March 6, 2013, which expires on March 6, 2018.

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FACILITY NAME: Leon County Solid Waste Management Facility

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D. Appendices Made Part of This Permit

APPENDIX 1 – General Conditions

APPENDIX 2 – List of Approved Documents Incorporated into the Permit

APPENDIX 3 – Water Quality Monitoring Plan

APPENDIX 4 – Gas Monitoring Locations

SECTION 2 - SPECIFIC CONDITIONS

A. Administrative Requirements

1. Documents Part of This Permit. The permit application as revised in final form replaced or amended in response to the Department's Request(s) for Additional Information are contained in the Department's files and are made a part of this permit. Those documents that make up the complete permit application are listed in APPENDIX 2.
2. Permit Modification. Any change to construction, operation, monitoring, or closure requirements of this permit may require a modification to this permit, in accordance with the provisions of Rule 62-701.320(4), F.A.C.
3. Permit Renewal. In order to ensure uninterrupted closure of this facility, a timely and sufficient permit renewal application must be submitted to the Department in accordance with Rule 62-701.320(10), F.A.C. A permit application submitted at least 61 days prior to the expiration of this permit is considered timely and sufficient.
4. Transfer of Permit or Name Change. In accordance with Rule 62-701.320(11), F.A.C., the Department must be notified by submitting Form 62-701.900(8) within 30 days: (a) of any sale or conveyance of the facility; (b) if a new or different person takes ownership or control of the facility; or (c) if the facility name or Permittee's legal name is changed.

B. Construction Requirements

1. Construction Requirements. This permit does not authorize construction of any new disposal areas. It does authorize construction activities related to the closure of the Class I Landfill Phases IIB, IIC, IID and the Class III Landfill East, West and South areas, as referenced in Section 2.G below.

C. Operation Requirements

1. Operation of Pollution Control Devices. The gas and storm water management systems shall be properly operated, monitored and maintained.

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2. Leachate Management.
 - a. The permittee shall operate the leachate management system (including the collection, removal, storage, and on-site treatment systems), and maintain the system as designed in accordance with the previously approved Operation Plan submitted on September 29, 2015, (included in APPENDIX 2, as Document 2), so that leachate is not discharged from the system except as provided for in the approved Operation Plan.
 - b. Routine inspections and maintenance of the leachate management system shall be conducted in accordance with an established schedule. The leachate collection pipes shall be cleaned or video inspected at least once every five years. A summary of the results shall be submitted with the permit renewal application.
 - c. The permittee, on a daily basis, shall record quantities of leachate generated in gal/day and precipitation at the facility, and shall compare these measurements.
3. Stormwater. Leachate shall not be discharged into the stormwater management system. Stormwater or other surface water which comes into contact with or mixes with the solid waste or leachate shall be considered leachate and is subject to the requirements of Rule 62-701.500(8), F.A.C. The final cover stormwater system for Class I Phases IIB, IIC IID and Class III South includes drainage swales built into the terraces of the cover system. Terraces are located at elevations 137 ft., 125 ft. and 110 ft. NGVD and are graded to drain to filter point mat spillways. Terraces include a 12" perforated pipe toe drain system with 12" solid HDPE header pipes located at each spillway. No changes were proposed for the existing drainage patterns for the Class III East and West disposal areas. Final grading drainage divides are located in accordance with the overall site stormwater master plan.
4. Waste Tire Processing Facility. This Permit authorizes Leon County Solid Waste Management Facility to continue to operate a waste tire processing facility located in the eastern portion of the facility. Storage of waste tires and the operation of the waste tire processing facility shall be in accordance with Chapter 62-711, F.A.C.; the approved Application for a Minor Modification to the Permit submitted November 18, 2014 (included in APPENDIX 2 as Document 1); and the approved Operation Plan submitted September 29, 2015 (included in APPENDIX 2, as Document 2). Based upon operating capabilities, the maximum storage of whole waste tires is 1,500 tires. Per Rule 62.711.530(5), F.A.C., quarterly reports shall be submitted by the 20th of the month following the close of each calendar quarter. Per Rule 62.711.520 (7), F.A.C., an annual report must be submitted each year of operation by March 1. When the Waste Tire Processing Facility ceases to accept waste tires, the permittee will:
 - a. Notify the Department of the closing;
 - b. Remove all waste tires and residual to a waste tire processing facility, solid waste management facility authorized to accept waste tires, or a legitimate user of waste tires;
 - c. Remove any solid waste to a permitted solid waste management facility; and, Notify the Department when the closing is complete.
5. Yard Trash and Compost Processing Facility: This Permit authorizes the Leon County Solid Waste Management Facility to continue operate a yard trash and compost processing facility, as follows:

Attachment B - Technical Specifications**Appendix B**

PERMITTEE: Leon County Board of County Commissioners
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- a. Compost as defined by Rule 62-709.200(6), F.A.C. and Yard Trash as defined by Rule 62-701.200(135), F.A.C. shall be managed in accordance with Rule 62-709.320, F.A.C., Rule 62-709.330, F.A.C. and Rule 62-709.350, F.A.C.
- b. Design and operating requirements.
 1. The facility shall have the operational features and equipment necessary to maintain a clean and orderly operation and shall include:
 - (1) An effective barrier to prevent unauthorized entry and dumping into the facility site;
 - (2) Dust and litter control methods; and
 - (3) Fire protection and control provisions to deal with accidental burning of solid waste, including:
 - (a) There shall be an all-weather access road, at least 20 feet wide, all around the perimeter of the site;
 - (b) None of the processed or unprocessed material shall be mechanically compacted; and
 - (c) None of the processed or unprocessed material shall be more than 50 feet from access by motorized firefighting equipment.
 2. The facility shall be operated in a manner to control vectors.
 3. The facility shall be operated in a manner to control objectionable odors in accordance with Rule 62-296.320(2), F.A.C.
 4. Any drains and leachate or condensate conveyances that have been installed shall be kept clean so that flow is not impeded.
 5. Solid waste received at a registered facility must be processed timely as follows:
 - (1) Any yard trash received at the facility shall be size-reduced or removed within 6 months, or within the period required to receive 3,000 tons or 12,000 cubic yards, whichever is greater. However, logs with a diameter of 6 inches or greater may be stored for up to 12 months before they are size-reduced or removed, provided the logs are separated and stored apart from other materials on site.
 - (2) Any putrescible waste such as vegetative wastes, animal byproducts, or manure received at a facility shall be processed and incorporated into the composting material, or removed from the facility, within 48 hours of receipt.
 6. If any of the following materials are discovered, they shall be immediately containerized and removed from the facility: treated or untreated biomedical waste; hazardous waste; or any materials containing a polychlorinated biphenyl (PCB) concentration of 50 parts per million or greater.
 7. If the Yard Trash or Compost Processing Facility ceases operation, all residuals, solid waste, and recyclable materials shall be removed from the site and recycled, or disposed of pursuant to the

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requirements of Chapter 62-701, F.A.C. Any remaining processed material shall be used in accordance with the requirements of this rule or disposed of pursuant to the requirements of Chapter 62-701, F.A.C.

8. An Annual report for Yard Trash shall be submitted to the Department in accordance with Rule 62-709.320(4)(a), F.A.C.

D. Water Quality Monitoring Requirements

1. Zone of Discharge. The primary zone of discharge for this facility shall be a three dimensional volume described as horizontally 100 feet from the edge of the waste disposal units or property line, whichever is closer, and shall extend vertically from the land surface down to the top of the low permeability zone located at approximately -34 feet North American Vertical Datum (NAVD). The permittee shall ensure that Class G-II water quality standards will not be exceeded at the boundary of the zone of discharge, per Rule 62-520.420, F.A.C., and that ground water minimum criteria will not be exceeded outside the boundary of the zone of discharge, per Rule 62-701.320(17), F.A.C.
2. Water Quality Monitoring Plan. The Water Quality Monitoring Plan, attached as APPENDIX 3, is made a part of this permit. Any modification of the Water Quality Monitoring Plan shall be initiated within ninety (90) days of Department approval.

E. Gas Management System Requirements

1. Gas Management System. The facility has an active gas collection system to collect and flare landfill gases from Phases IIB, IIC, and IID of the Class I landfill. The extraction system currently consists of 27 vertical wells located along the perimeter of Phases IIB, IIC and IID 58-acre disposal area. Landfill gas is routed from these wells to 6-inch laterals that all connect to a 12-inch header pipe that conveys gas to the blower and flare station. The flare station is located near the southeast corner of Phase IIC. An additional 36 passive collection vertical wells within the closure area of Phases IIB, IIC, IID and Class III South will be added to the landfill gas recovery facility requirements as a part of this closure permit. The landfill gas collection system is shown in APPENDIX 2, Document 4, Drawing C3.00.
2. Gas Monitoring Network. The facility's compliance monitoring network for methane detection consists of the office building, 8 perimeter probes located west of Phase IIC, 12 passive vents on the south side of Phase I and 14 methane monitoring probes constructed around the perimeter of Phases IIB, IIC and IID, 3 probes around the perimeter of Class III West and 3 probes around the perimeter of Class III East. An additional 9 surface monitoring locations and 3 passive vents will be sampled in the parking area on top of Class III West. APPENDIX 4 contains a summary table and a figure which contain information regarding the locations of the gas monitoring probes.

Attachment B - Technical Specifications

Appendix B

PERMITTEE: Leon County Board of County Commissioners
FACILITY NAME: Leon County Solid Waste Management Facility

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3. Certification of Construction Completion. After construction is completed for gas probes or of gas management system modifications, the engineer of record shall certify to the Department in accordance with Rule 62-701.320(9)(b), F.A.C., that construction of the permitted gas management system is complete and was performed in substantial conformance with the approved construction plans except where minor deviations were necessary. All deviations shall be described and the reasons therefore enumerated.
4. Operational Requirements. Gas controls shall be operated and maintained so that they function as designed.
5. Monitoring Requirements. All gas monitoring shall be performed quarterly to determine the effectiveness of the gas migration controls. Quarterly reports shall be submitted to the Department, Northwest District Office under separate cover on or before February 1, May 1, August 1, and November 1 of each year. The gas monitoring results shall be reported as a percent of the lower explosive limit (LEL), calibrated to methane.
6. Gas Remediation Plan. The facility landfill gas management system shall be operated to prevent the concentration of combustible gases from exceeding 25% of the lower explosive limit in structures, excluding gas control or recovery components, and from exceeding the lower explosive limit at or beyond the property boundary. If either of these limits is exceeded, a gas remediation plan shall be designed and implemented in accordance with Rule 62-701.530(3)(a), F.A.C.
7. Odor Remediation Plan. The facility shall be operated to control objectionable odors. If objectionable odors are confirmed beyond the property boundary, then upon notification by the Department the Permittee shall develop and implement an odor remediation plan in accordance with the requirements of Rule 62-701.530(3)(b), F.A.C.

F. Financial Assurance and Cost Estimates

1. Financial Assurance Mechanism. The Permittee shall maintain, in good standing, the financial assurance mechanisms to provide financial assurance for the long term care period. Supporting documentation and evidence of increases associated with cost estimate increases shall be submitted within the time frames specified in Rule 62-701.630, F.A.C.

All submittals in response to this specific condition shall be sent to:

Florida Department of Environmental Protection
Financial Coordinator – Permitting and Compliance Assistance Section
2600 Blair Stone Road, MS 4548
Tallahassee, Florida 32399-2400

2. Annual Long Term Care Cost Estimate.
 - a. The Permittee shall annually adjust the long term care estimate for inflation using Form 62-701.900(28). The annual adjustments shall be made in accordance with the requirements of Rule 62-701.630 (4), F.A.C., and 40 CFR Part 264.142(a) and 264.144(a), as applicable.

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- b. An owner or operator using an escrow account shall submit the annual inflation adjusted estimate(s) between July 1 and September 1. An owner or operator using a letter of credit, guarantee bond, performance bond, financial test, corporate guarantee, trust fund or insurance shall submit the inflation adjusted cost estimate(s) between January 1 and March 1.
- c. All submittals in response to this specific condition shall be sent to the Northwest District Office, the Tallahassee Permitting and Compliance Assistance Program, and a copy to the address identified in Specific Condition F.1 or to the following email address: Solid.Waste.Financial.Coordinator@dep.state.fl.us.

G. Closure Requirements

1. Closure Design. All closure activities shall be completed in accordance with the approved closure design plan, dated September 13, 2016, which is included in APPENDIX 2 as Document 7. The Department shall be notified before any changes, other than minor deviations, to the approved closure design are implemented in order to determine whether a permit modification is required.
2. Final Cover Design. The placement of final cover will be limited to the areas of Class I Phases IIB, IIC IID and Class III South. The final cover profile is provided in APPENDIX 2, Document 4, Sheet C2.32. The final cover includes, from the top down: sod, 6 inches of topsoil, 18 inches of protective cover soil, 300-mil double-sided geocomposite drainage net, a 40-mil LLDPE textured geomembrane, and 12 inches of initial soil cover (grading layer).
3. Side Slope Design. The side slope designs for the Class I Phases IIB, IIC IID and Class III South closure are 4H:1V with one area designed with maximum side slope of 3H:1V. Terraces are located at elevations 137, 125 and 110 NGVD and are graded to drain to filter point mat spillways. The top portion of the Class I and Class III South closure area is designed to have a minimum 2 percent slope to direct runoff to the terraces.
4. Construction Quality Assurance Plan. The Construction Quality Assurance (CQA) Plan shall be followed for installing and testing the liner system and related components. The CQA engineer or his designee shall be on-site at all times during construction of the liner system to monitor the construction activities. This document is included in APPENDIX 2 as Document 8.
5. Notification of Closure Activities.
 - a. The permittee shall notify the Department 30 days prior to commencing initial closure activities such as constructing the cap, side slopes, and stormwater drainage facilities.
 - b. The permittee shall notify the Department at least 10 days before these activities are completed.
6. Final Closure Elevation. The final (maximum) elevation for Phases IIB, IIC, IID, and

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the Class III South Cell shall not exceed 141 feet NGVD as shown in APPENDIX 2, Document 4, Sheet C2.00.

7. Survey after Construction. A survey shall be performed by an engineer or registered surveyor to verify that final contours and elevations of the facility are in accordance with the plans as approved in this permit. Aerial mapping techniques that provide equivalent survey accuracy may be substituted for the survey. Contours should be shown at no greater than five-foot intervals. The landfill owner or operator shall submit this information to the Department along with the Certification of Construction Completion required in Specific Condition No. 2.G.8.
8. Certification of Closure Construction Completion. After closure construction has been completed, the engineer of record shall certify to the Department on Form 62-701.900(2) that the closure is complete and that it was done in accordance with the plans submitted to the Department except where minor deviation was necessary. All deviations shall be described in detail and the reasons therefore enumerated.
9. Declaration to the Public. Once closure construction has been completed, the facility owner or operator shall file a declaration to the public in the deed records in the office of the county clerk of the county in which the facility is located. The declaration shall include a legal description of the property on which the facility is located and a site plan specifying the area actually filled with waste materials. The declaration shall also include a notice that any future owner or user of the site should consult with the Department prior to planning or initiating any activity involving the disturbance of the facility's cover, monitoring system or other control structures. A certified copy of the declaration shall be filed with the Department, Rule 62-701.600(7), F.A.C.

H. Long Term Care Requirements

1. Long-Term Care Period. In accordance with Rule 62-701.610(6), F.A.C., the long-term care period will not begin until the landfill is closed and the requirements for the official date of closing have been satisfied. The long-term care period for this landfill shall be 30 years unless otherwise approved by the Department.
2. Long Term Care Period Monitoring and Maintenance. The Permittee shall continue to monitor and maintain the integrity and effectiveness of the final cover as well as other appurtenances of the facility, control erosion, fill subsidence events, comply the ground water monitoring plan and gas monitoring program, and maintain the stormwater system, in accordance with an approved closure design.
3. Stabilization Report. Every five years after issuance of a permit for long-term care, the Permittee shall submit a report to the Department that addresses stabilization of the landfill. The submittal shall include the technical report required in Rule 62-701.510(9)(b), F.A.C., and shall also address subsidence, barrier layer effectiveness, ground water and storm water management, and gas production and management. For lined landfills, the submittal shall also address leachate collection and removal system effectiveness, leachate quality, and leachate quantity.

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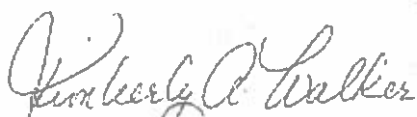
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- 4. Completion of Long Term Care. Following completion of the long-term care period for each solid waste management unit, the owner or operator shall submit to the Department a certification, signed and sealed by a professional engineer, verifying that long-term care has been completed in accordance with the closure plan, and has been placed in the operating record.

Executed in Leon County, Florida.

STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION



Kimberly A. Walker, Program Administrator
Permitting and Compliance Assistance Program

FILED, on this date, pursuant to Section 120.52, F.S. with the designated Department Clerk, receipt of which is hereby acknowledged.

Tamela Starling

Clerk

11-28-2016

Date

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APPENDIX 1

General Conditions

1. The terms, conditions, requirements, limitations and restrictions set forth in this permit, are "permit conditions" and are binding and enforceable pursuant to Sections 403.141, 403.161, 403.727, or 403.861, Florida Statutes. The Permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.
2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.
3. As provided in subsections 403.087(6) and 403.722(5), F.S., the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of rights, nor any infringement of federal, State, or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in this permit.
4. This permit conveys no title to land or water, does not constitute State recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.
5. This permit does not relieve the Permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the Permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.
6. The Permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed and used by the Permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.
7. The Permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at reasonable times, access to the premises where the permitted activity is located or conducted to:

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- (a) Have access to and copy any records that must be kept under conditions of the permit;
- (b) Inspect the facility, equipment, practices, or operations regulated or required under this permit; and
- (c) Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.
Reasonable time may depend on the nature of the concern being investigated.

8. If, for any reason, the Permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the Permittee shall immediately provide the Department with the following information:

- (a) A description of and cause of noncompliance; and
- (b) The period of noncompliance, including dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and

The Permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

9. In accepting this permit, the Permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.111 and 403.73, F.S. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.
10. The Permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance; provided, however, the Permittee does not waive any other rights granted by Florida Statutes or Department rules.
11. This permit or a copy thereof shall be kept at the work site of the permitted activity.
12. The Permittee shall comply with the following:
- (a) Upon request, the Permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.
 - (b) The Permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These

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materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

(c) Records of monitoring information shall include:

1. the date, exact place, and time of sampling or measurements;
 2. the person responsible for performing the sampling or measurements;
 3. the dates analyses were performed;
 4. the person responsible for performing the analyses;
 5. the analytical techniques or methods used;
 6. the results of such analyses.
13. When requested by the Department, the Permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the Permittee becomes aware the relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

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APPENDIX 2

List of Approved Documents Incorporated into the Permit

The approved application documents for the closure permit for the Class I Landfill Phases IIB, IIC, IID and the Class III Landfill East, West and South areas, of the Leon County Solid Waste Management Facility consist of the following:

Document 1 – “Application for a Minor Modification to the Permit”, dated November 18, 2014, prepared by Locklear & Associates, Inc., signed and sealed by Lisa Baker, P.E., received November 18, 2014.

[https://depedms.dep.state.fl.us:443/Oculus/servlet/shell?command=getEntity&\[guid=8.214197.1\]&\[profile=Permitting_Authorization\]](https://depedms.dep.state.fl.us:443/Oculus/servlet/shell?command=getEntity&[guid=8.214197.1]&[profile=Permitting_Authorization])

Document 2 – “2015 Permit Modification Application and Supporting Information”, dated September 29, 2015, prepared by Locklear & Associates, Inc., signed and sealed by Scott Karwan, P.E., received November 18, 2014.

[https://depedms.dep.state.fl.us:443/Oculus/servlet/shell?command=getEntity&\[guid=8.236760.1\]&\[profile=Permitting_Authorization\]](https://depedms.dep.state.fl.us:443/Oculus/servlet/shell?command=getEntity&[guid=8.236760.1]&[profile=Permitting_Authorization])

Document 3 – “2016 Permit Modification Application and Supporting Information for Class I Phases II-B, II-C, and Class III East, West, and South Landfill Closures”, dated June 16, 2016, prepared by Locklear & Associates, Inc., signed and sealed by Lisa Baker, P.E., received July 18, 2016.

[https://depedms.dep.state.fl.us:443/Oculus/servlet/shell?command=getEntity&\[guid=8.250422.1\]&\[profile=Permitting_Authorization\]](https://depedms.dep.state.fl.us:443/Oculus/servlet/shell?command=getEntity&[guid=8.250422.1]&[profile=Permitting_Authorization])

Document 4 – Appendix C, drawings for “2016 Permit Modification Application and Supporting Information for class I Phases II-B, II-C, and Class III East, West, and South Landfill Closures”, dated June 16, 2016, prepared by Locklear & Associates, Inc., signed and sealed by Lisa Baker, P.E., received July 18, 2016.

[https://depedms.dep.state.fl.us:443/Oculus/servlet/shell?command=getEntity&\[guid=8.250423.1\]&\[profile=Permitting_Authorization\]](https://depedms.dep.state.fl.us:443/Oculus/servlet/shell?command=getEntity&[guid=8.250423.1]&[profile=Permitting_Authorization])

Document 5 – FDEP First Request for Additional Information (RAI), dated August 8, 2016.

[https://depedms.dep.state.fl.us:443/Oculus/servlet/shell?command=getEntity&\[guid=8.250645.1\]&\[profile=Permitting_Authorization\]](https://depedms.dep.state.fl.us:443/Oculus/servlet/shell?command=getEntity&[guid=8.250645.1]&[profile=Permitting_Authorization])

Document 6 – Response to RAI #1, dated September 13, 2016, prepared by Locklear & Associates, Inc., signed and sealed by Lisa Baker, P.E., received September 13, 2016.

[https://depedms.dep.state.fl.us:443/Oculus/servlet/shell?command=getEntity&\[guid=8.251675.1\]&\[profile=Permitting_Authorization\]](https://depedms.dep.state.fl.us:443/Oculus/servlet/shell?command=getEntity&[guid=8.251675.1]&[profile=Permitting_Authorization])

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Document 7 – Approved Closure Plan, which was included as Attachment 2 of the Response to RAI #1, dated September 13, 2016, prepared by Locklear & Associates, Inc., signed and sealed by Lisa Baker, P.E., received September 13, 2016.

[https://depdms.dep.state.fl.us:443/Oculus/servlet/shell?command=getEntity&\[guid=8.251754.1\]&\[profile=Permitting_Authorization\]](https://depdms.dep.state.fl.us:443/Oculus/servlet/shell?command=getEntity&[guid=8.251754.1]&[profile=Permitting_Authorization])

Document 8 – Approved CQA Plan, which was included as Appendix B in the “2016 Permit Modification Application and Supporting Information for class I Phases II-B, II-C, and Class III East, West, and South Landfill Closures”, dated June 16, 2016, prepared by Locklear & Associates, Inc., signed and sealed by Lisa Baker, P.E., received July 18, 2016.

[https://depdms.dep.state.fl.us:443/Oculus/servlet/shell?command=getEntity&\[guid=8.251744.1\]&\[profile=Permitting_Authorization\]](https://depdms.dep.state.fl.us:443/Oculus/servlet/shell?command=getEntity&[guid=8.251744.1]&[profile=Permitting_Authorization])

NOTE: The above listed documents are referenced in this Permit by document number.

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APPENDIX 3 WATER QUALITY MONITORING PLAN

LEON COUNTY SOLID WASTE MANAGEMENT FACILITY

PERMIT NO: 0009560-016-SF-01 and 0009560-017-SF-T3

WACS FACILITY ID: 6660

I. GENERAL

1. The field testing, sample collection and preservation and laboratory testing, including quality control procedures, shall be in accordance with Chapter 62-160, F.A.C. Approved methods as published by the Department or as published in Standard Methods, ASTM, or EPA Methods shall be used. [62-701.510(2)(b), F.A.C.]
2. The organization collecting samples at this site must use the Field and Laboratory Standard Operating Procedures (DEP-SOP-001/01) referenced in Chapter 62-160, F.A.C. The laboratory designated to conduct the chemical analyses must be certified by the Florida Department of Health Environmental Laboratory Certification Program (DOH ELCP). This Certification must be for the test method and analyte(s) that are reported. [62-160.210(1), 62-160.300(1), 62-701.510(2)(b), F.A.C. and DEP SOP FS 1008.]

NOTE: DEP-SOP-001/01 can be accessed at:

<http://www.dep.state.fl.us/water/sas/sop/sops.htm>

3. The Permittee must ensure that the analytical laboratory conducting the analyses uses analytical methods capable of achieving detection limits at or below the Groundwater Cleanup Target Levels (GCTLs) or the Freshwater Surface Water Cleanup Target Levels (SWCTLs) in Table I, Chapter 62-777, F.A.C. except those listed in Table C of the "FDEP Guidance for the Selection of Analytical Methods and for the Evaluation of Practical Quantitation Limits dated 10/12/2004". GCTLs and SWCTLs that are not water quality standards are used as screening tools and interim guidelines for ground water minimum criteria until standards are promulgated. [DEP SOP FM 1000]
4. If, at any time, analyses detect parameters which are significantly above background water quality, or which are at levels above the Department's water quality standards or criteria specified in Chapter 62-520, F.A.C., in the detection wells or at the edge of the Zone of Discharge, the Permittee may confirm the data by resampling the affected wells within thirty (30) days of receipt of the sampling data. Should the Permittee choose not to resample, the Department will consider the water quality analysis as representative of current ground water conditions at the facility. If the data is confirmed, or if the Permittee chooses not to resample, the Permittee shall notify the Department within 14 days of this finding. [62-701.510(6)(a), F.A.C.]

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- 5. If the resampling event detects parameters which are significantly above background water quality, or which are at levels above the Department’s water quality standards or criteria specified in Chapter 62-520, F.A.C., the Permittee shall notify the Department in writing within 14 days of receipt of the sampling data. Confirmed data must be submitted to the Department within 60 days from completion of lab analyses, unless a different due date is approved. Use “CONF” (for confirmation data) in the report type column. [62-701.510(8)(a), F.A.C.]
- 6. Upon notification by the Department, the Permittee shall initiate evaluation monitoring in accordance with Rule 62-701.510(6)(a), F.A.C.

II. GROUND WATER QUALITY MONITORING

- 1. The twenty-one (21) ground water monitoring wells/piezometers included in this monitoring plan and designated for water quality testing and water level measurements are listed on Table 1 and shown on Figure 1. [62-701.510(3)(d)2 & 3, F.A.C.]
- 2. Any initial sample collected from a new ground water monitoring well, unless the new monitoring well is installed to replace an existing well within the monitoring network, shall be analyzed for the following Initial Ground Water Monitoring Parameters. [62-701.510(5)(b), F.A.C.]

Field Parameters	Laboratory Parameters
1. Static water level in wells before purging	1. Ammonia – N, Total
2. Dissolved oxygen	2. Chlorides
3. pH	3. Iron
4. Specific conductivity	4. Nitrate
5. Temperature	5. Sodium
6. Turbidity	6. Total dissolved solids (TDS)
7. Colors and sheens (by observation)	7. Those parameters listed in the 1991 version of CFR Part 258, Appendix II.*

* Mercury not listed because it is included in Appendix II.
 * Appendix I is not listed because it is a subset of Appendix II

- 3. The twenty-one (21) active monitoring wells for the landfill shall be routinely sampled and analyzed semi-annually prior to March 1 and September 1 of each year for the following Ground Water Monitoring Parameters. [62-701.510(5)(c) & (7)(a), F.A.C.]

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Monitoring Well ID	Field Parameters	Laboratory Parameters	Frequency	Well Type
Floridian Aquifer				
MW-AB	pH, Temperature, Dissolved Oxygen, Specific Conductivity, ORP, Turbidity and static water level in well before purging.	Ammonia, Boron, Chlorides, Iron, Mercury, Nitrate, Sodium, Strontium, Total Dissolved Solids (TDS), parameters listed in 40 CFR Part 258 Appendix I	Semi-annual*	Background
MW-AA, MW-AC, MW-QR			Semi-annual*	Compliance
MW-G, MW-H, MW-I, MW-J, MW-K, MW-L, MW-M, MW-R, MW-TR, MW-Y			Every Five Years	
MW-Y		Iron	Semi-annual	
MW-G and MW-I		Iron and TDS		
MW-J		Thallium and TDS		
MW-L		TDS and Vinyl Chloride		
MW-M		Iron, TDS and Vinyl Chloride		
MW-A, MW-C1A, MW-D, MW-F, MW-K, MW-R, MW-TR	Static water level in well	None		Water Level
Perched Surficial Groundwater				
MW-8, MW-21, MW-36	pH, Temperature, Dissolved Oxygen, Specific Conductivity, ORP, Turbidity and static water level in well before purging.	Benzene	Semi-annual	Detection

Semi-annual* - Sample semi-annually for five years to build a historical database.

- A report of laboratory data will be submitted to DEP for each sampling period no later than April 1 and October 1 of each year, respectively.
- All water quality analyses will be performed on unfiltered samples unless approved by the Department.

III. SURFACE WATER MONITORING

- Surface water monitoring is not required.

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IV. MONITORING WELL REQUIREMENTS

1. If a monitoring well or piezometer becomes damaged or inoperable, the Permittee shall notify the Department within two (2) days of discovery with a written report within ten (10) days of notice. The written report shall describe what problem has occurred and the remedial measures that have been taken to prevent a recurrence. The Department can require the replacement of inoperable monitoring wells or piezometers. [62-520.600(6)(l), F.A.C.]
2. New or replacement monitoring well design or placement must be approved by the Department. The design and construction of these wells must be based on site-specific borings with appropriate supporting data such as grain size distribution analyses, in-situ hydraulic conductivity testing, and depth to water. Wells shall be installed using standard, accepted practices for well construction. [62-701.510(3), F.A.C. and 62-550.600(3) and (6), F.A.C.]
3. All wells and piezometers shall be clearly and permanently labeled and the well site maintained so that the well is visible at all times. Unless otherwise authorized in a Department permit, new monitoring wells, and existing monitoring wells at the time of permit renewal, shall have protective bollards or other devices installed around them if they are located in areas of high traffic flow to prevent damage from passing vehicles. [62-701.510(3)(d)5, F.A.C.]
4. The Department shall be notified in writing before any monitoring wells are abandoned or plugged. Wells shall be abandoned using standard, accepted practices for well abandonment. [62-701.510(3)(d)6, F.A.C.]

V. REPORTING REQUIREMENTS

A. FIELD ACTIVITIES

1. The Department must be notified in writing, hard copy or e-mail, at least fourteen (14) days prior to the installation and/or sampling of any monitoring well(s) so that the Department may collect split samples. [62-701.510(8)(a), F.A.C.]

B. MONITORING WELL COMPLETION REPORT

2. One (1) electronic copy (Adobe pdf format) of the Monitoring Well Completion Report, Form 62-701.900(30), F.A.C., must be submitted to the Department within thirty (30) days after installation of any new or replacement monitoring well(s). In addition, as-built well construction diagrams and soil boring logs that cover the entire depth of the monitoring well(s) must be submitted to the Department. [62-520.600(6)(j), F.A.C.]

NOTE: The top of casing elevation of each well, to the nearest 0.01 feet, and the latitude and longitude of each well in degrees, minutes and seconds, to at least two (2) decimal places, must be determined and certified by a Florida Licensed Surveyor and Mapper and provided on the form. [62-701.510(3)(d)1 & 62-520.600(6)(i), F.A.C.]

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C. SURVEYING

3. One (1) electronic copy (Adobe pdf format) of a drawing must be submitted within sixty (60) days following monitoring well installation showing the location of all monitoring sites (active, abandoned, and Evaluation Monitoring), piezometers, water bodies and waste filled areas. The location of features on the drawing must be horizontally and vertically located by standard surveying techniques. The drawing shall include all monitoring well locations, each monitoring well name and identification (WACS) number, the top of casing, pad elevation, permanent benchmark(s) and/or corner monument marker(s) referenced to a nationally recognized datum (such as NGVD 1929 or NAVD 1988) to the nearest 0.01 feet. The latitude and longitude of each well in degrees, minutes and seconds, to at least two (2) decimal places, must be determined and provided on the drawing. The survey shall be conducted and certified by a Florida Licensed Surveyor and Mapper. [62-701.510(1)(c)&(3)(d)1, and 62-520.600(6)(i), F.A.C.]
4. If a monitoring well is being replaced or new wells are being added to an existing ground water monitoring plan, only the new wells need to be surveyed as long as all other monitoring wells in the monitoring plan have been surveyed and certified by a Florida Licensed Surveyor and Mapper and there is no reason to believe that the elevations have changed. The location and elevation determinations and the certification must be provided with the Monitoring Well Completion Report upon completion of each new well. [62-701.510(3)(d)1, F.A.C.]

D. DEPTH MEASUREMENTS

5. A total depth measurement must be made on each well every five years. This measurement is to be reported as total apparent depth below ground surface and should be compared to the original total depth of the well.

E. INITIAL AND SEMI-ANNUAL SAMPLING AND SUBMITTING ELECTRONIC DATA

6. Required monitoring reports must be submitted to the Department within sixty (60) days from completion of laboratory analyses and shall follow the Department's electronic reporting requirements using the ADaPT software. [Rule 62-701.510(8)(a), F.A.C.]
7. Required water quality monitoring reports and analytical results shall be submitted electronically. Water quality monitoring reports shall be submitted in Adobe pdf format. The water quality data Electronic Data Deliverable (EDD) shall be provided to the Department in a comma separated text file electronic format consistent with requirements for importing the data into the Department's databases as summarized at:
<http://www.dep.state.fl.us/waste/ADaPT/>
Water quality monitoring reports shall be signed and sealed by a Florida registered professional geologist or professional engineer with experience in hydrogeological investigations and shall include the following:
 - a) Cover letter;
 - b) Summary of exceedances and recommendations;

Attachment B - Technical Specifications

Appendix B

PERMITTEE: Leon County Board of County Commissioners
FACILITY NAME: Leon County Solid Waste Management Facility

PERMIT NO.: 009560-016-SF-01
0009560-017-SF-T3
0009560-018-WT-02
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- c) Groundwater elevation contour maps;
- d) Chain of custody forms;
- e) Water levels, water elevation table;
- f) Water Quality Monitoring Certification using Form Rule 62-701.900(31), F.A.C.;
- g) Appropriate information using the Groundwater Sampling Log, Form FD 9000-24 (DEP-SOP-001/01); and,
- h) Laboratory and Field EDDs and error logs, as applicable.

All submittals in response to this specific condition shall be sent both to:

<p>Florida Department of Environmental Protection Northwest District Office, Solid Waste Section, 160 W. Government Street, Suite 100 Pensacola, Florida 32502 Email to: Northwest.District@dep.state.fl.us</p>	<p>Florida Department of Environmental Protection Solid Waste Section 2600 Blair Stone Road, MS 4565 Tallahassee, Florida, 32399-2400 Email to: ADaPT.EDDs.and.Reports@dep.state.fl.us</p>
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F. WATER ELEVATIONS

- 8. Water levels in all monitoring wells, whether sampled or not, all piezometers and all surface water sites must be measured to the nearest 0.01 foot and reported semi-annually. Surface water elevations at sampling locations must be measured to the nearest 0.01 foot on the same day as ground water levels in the wells and piezometers and reported semiannually. All water level measurements must be made within a one-day period. These measurements should be reported in a table that includes well or surface water point name, date and time of water level measurement, measuring point elevation referenced to a nationally recognized datum (such as NGVD 1929 or NAVD 1988), depth to water and calculated water level elevation referenced to the same nationally recognized datum. The ground water elevations shall be reported in the ADaPT data for the upload into WACS. [62-701.510(8)(a)8, F.A.C.]

G. GROUND WATER CONTOUR MAPS

- 9. Ground water elevation contour maps for each monitored aquifer zone must be submitted semi-annually to the Department, with contours at no greater than one foot intervals unless site specific conditions dictate otherwise. Ground water elevation contour map(s) should include monitoring well and piezometer locations, ground water elevation at each monitoring well or piezometer location referenced to a nationally recognized datum (such as NGVD 1929 or NAVD 1988), a bar scale, north arrow, ground water contour interval, date of measurement and ground water flow direction. The map(s) must incorporate adjacent and on-site surface water elevations where appropriate. These maps shall be signed and sealed pursuant to Florida Statutes (F.S.) Chapters 471 and 492 which require that documents requiring the practice of professional engineering or professional geology, as described in Chapter 471 or 492, F.S., be signed and sealed by the professional(s) who

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prepared or approved them. This certification must be made by a licensed professional who is able to demonstrate competence in this subject area. [62-701.510(8)(a)9, F.A.C.]

H. TECHNICAL REPORT

10. A technical report, signed and sealed by a professional geologist or professional engineer with experience in hydrogeologic investigations, shall be submitted to the Department approximately every two and one-half years during the closure process of the facility, and every five years during the long-term care period. The report shall summarize and interpret the water quality monitoring results and water level measurements collected since the last Technical Report. Tidal data and water level measurements should be discussed in this report. The report shall contain, at a minimum, the following [62-701.510(8)(b), F.A.C.]:
- Tabular displays of any data which shows that a monitoring parameter has been detected, and graphical displays of any leachate key indicator parameters detected (such as pH, specific conductance, TDS, TOC, sulfate, chloride, sodium and iron), including hydrographs for all monitor wells;
 - Trend analyses of any monitoring parameters consistently detected;
 - Comparisons among shallow, middle, and deep zone wells;
 - Comparisons between background water quality and the water quality in detection and compliance wells;
 - Correlations between related parameters such as total dissolved solids and specific conductance;
 - Discussion of erratic and/or poorly correlated data;
 - An interpretation of the ground water elevation contour maps, including an evaluation of ground water flow rates; and
 - An evaluation of the adequacy of the water quality monitoring frequency and sampling locations based upon site conditions.
11. One (1) paper copy and one (1) electronic copy (Adobe pdf format) of the Technical Report shall be submitted to the Department on the following schedule: [62-701.510(8)(b), F.A.C.]

Report	Sampling Periods Covered	Number of Semi-annual Sampling Events in Report	Date Technical Report Due
Mid-Permit Report	January 2016 through January 2018	5	4/01/2018
Renewal Report	July 2018 through July 2020	5	10/01/2020

12. Required water quality monitoring reports and water quality data for the Technical Report shall be submitted in electronic format as described in Section V. Subsection E of this Appendix. [62-160.240 and 62-701.510(8)(a), F.A.C.]

Attachment B - Technical Specifications

Appendix B

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I. LINKS TO FORMS

- a. Links to the items and forms referenced in this section are as follows:

ADaPT Electronic Reporting Requirements

ftp://ftp.dep.state.fl.us/pub/WACS-ADaPT/EDD_guidance.pdf

Ground Water Monitoring Report Certification Form

[http://www.dep.state.fl.us/water/groundwater/forms/62-520.900\(2\).pdf](http://www.dep.state.fl.us/water/groundwater/forms/62-520.900(2).pdf)

Monitoring Well Completion Report Form

[http://www.dep.state.fl.us/water/groundwater/forms/62-520.900\(3\).pdf](http://www.dep.state.fl.us/water/groundwater/forms/62-520.900(3).pdf)

Groundwater Sampling Log

http://www.dep.state.fl.us/waste/quick_topics/publications/pss/pcp/GW_Sampling_Log.docx

List of Attachments

Table 1 – Water Quality Sampling Testsite Information

Figure 1 – Site Plan - Ground Water Monitoring Plan

Attachment B - Technical Specifications

Appendix B

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 Management Facility

PERMIT NO.: 009560-016-SF-01
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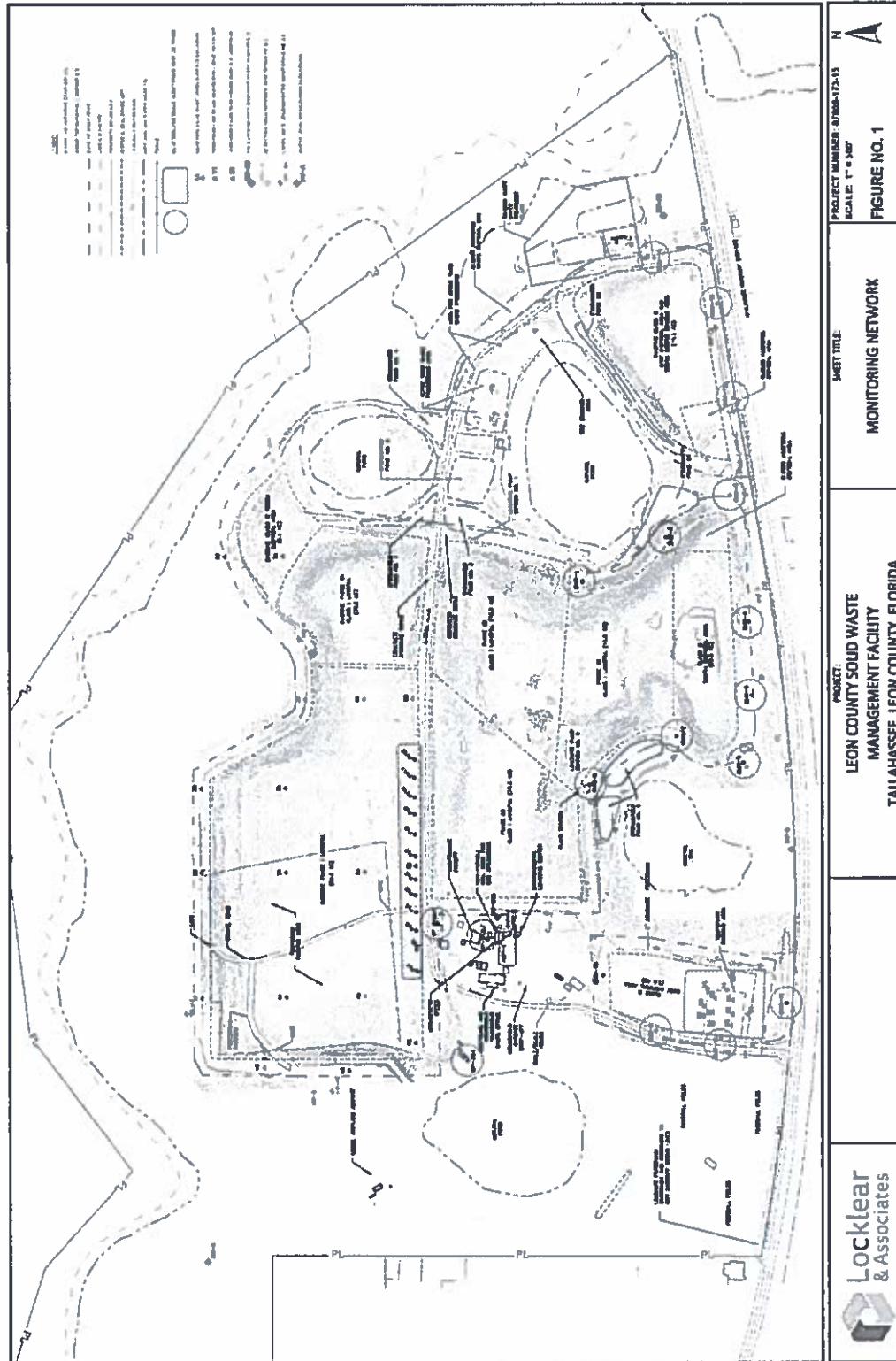
Table 1. Water Quality Sampling Testsite Information

Testsite Name	Testsite WACS No.	Designation	Aquifer
MW-AA	28886	Compliance	Floridan
MW-AB	28887	Background	Floridan
MW-AC	28991	Compliance	Floridan
MW-A	9734	Water Level	Floridan
MW-CIA	9860	Water Level	Floridan
MW-D	9787	Water Level	Floridan
MW-F	9789	Water Level	Floridan
MW-G	9790	Compliance	Floridan
MW-H	9791	Compliance	Floridan
MW-I	9826	Compliance	Floridan
MW-J	9828	Compliance	Floridan
MW-K	9863	Compliance	Floridan
MW-L	9829	Compliance	Floridan
MW-M	9835	Compliance	Floridan
MW-QR	28113	Compliance	Floridan
MW-R	9842	Compliance	Floridan
MW-TR	9887	Compliance	Floridan
MW-Y	23552	Compliance	Floridan
MW-8	9731	Detection	Perched Surficial
MW-21	23545	Detection	Perched Surficial
MW-36	24491	Detection	Perched Surficial

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Figure 1. Site Plan – Groundwater Monitoring Plan



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APPENDIX 4

GAS MONITORING LOCATIONS

PERMITTEE: Leon County Board of County Commissioners
 FACILITY NAME: Leon County Solid Waste
 Management Facility

PERMIT NO.: 009560-016-SF-01
 0009560-017-SF-T3
 0009560-018-WT-02
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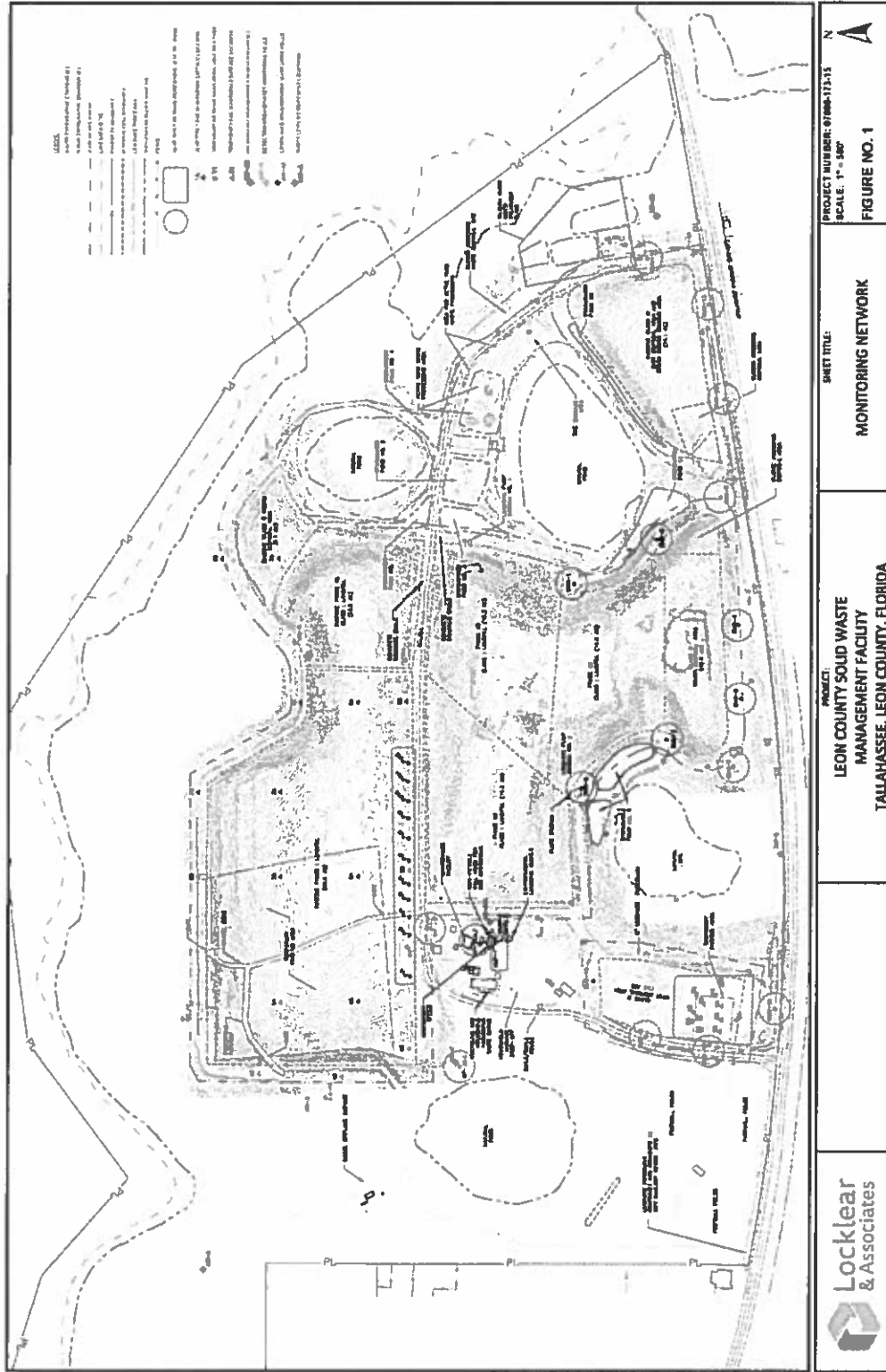
Summary Table of Gas Monitoring Locations

Monitoring Location Names	Type	Location
Office crawl space	Ambient Monitoring Point	West of Phase IIC and south of Phase I
PV-1 through PV-12	Passive Vents	Along southern Phase IA disposal boundary
MP-1 A,B,C, MP-2 A,B,C, MW-3 B,C	Monitoring Probes	West of Phase IIC and south of Phase I
GMW-1 through GMW-14	Monitoring Probes	Along perimeter of Phase IID and Class III South Cell
Temporary Monitoring Location Names	Type	Location
S1 through S9	Surface Locations	Class III West Cap near temporary parking area
V1 through V3	Passive Vents	Class III West Cap near temporary parking area

PERMITTEE: Leon County Board of County Commissioners
FACILITY NAME: Leon County Solid Waste Management Facility

PERMIT NO.: 009560-016-SF-01
0009560-017-SF-T3
0009560-018-WT-02
WACS Facility ID: 6660

Figure 1. Site Plan – Gas Monitoring Locations



APPENDIX C
LEON COUNTY ENVIRONMENTAL
MANAGEMENT PERMIT

LEON COUNTY
DEPARTMENT OF DEVELOPMENT SUPPORT AND ENVIRONMENTAL MANAGEMENT
ENVIRONMENTAL MANAGEMENT PERMIT

PERMIT EXPIRES: 11/10/2016 SPEAK TO AN ENVIRONMENTAL INSPECTOR, CALL (850) 606-1300. Printed By: BOGGSK

PERMIT EXPIRES THIRTY-SIX (36) MONTHS FROM ISSUANCE PER ARTICLE 5, SECTION 7-41(4)(A)(I), ENVIRONMENTAL MANAGEMENT ACT

PERMIT #: LEM1600045
PROJECT NAME: LEON COUNTY LANDFILL CLOSEOUT
Location: 7550 APPALACHEE PKWY
PERMITTEE: MAGNOLIA ENGINEERING LLC

DATE ISSUED: 11/10/2016
PARCEL TAX ID#: 32-04-20-851-0000

FEE INFORMATION:

Short Form A Non Res:	\$0.00
Short Form B High:	\$0.00
Short Form B Low:	\$4,228.00
Standard Form:	\$0.00
Tree:	\$0.00
Landscape:	\$0.00
App/Resubmittal:	\$0.00
General Utility:	\$0.00
Discovery After the Fact:	\$0.00

TOTAL FEES: \$4,228.00
TOTAL PAYMENTS: \$4,228.00
BALANCE: \$0.00



John P. Kraynak
 John P. Kraynak, Director
 Environmental Services Division

ACCEPTANCE OF THIS PERMIT ACKNOWLEDGES PERMISSION FOR LEON COUNTY PERSONNEL TO INSPECT AT REASONABLE TIMES THE PROPERTY AND WORK ASCRIBED IN THIS PERMIT. FAILURE TO POST THE PERMIT PLACARD IN A CONSPICUOUS PLACE ON-SITE OR FAILURE TO HAVE THE APPROVED PERMIT AND PLANS AVAILABLE ON-SITE MAY RESULT IN THE IMMEDIATE ISSUANCE OF A STOP WORK ORDER.

APPENDIX D
BORROW SOURCE SOILS TESTS

Mayo, Wayne

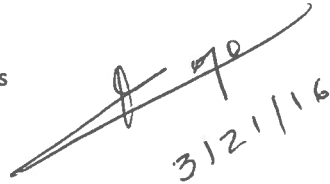
To: cjackson@sandcofl.com; Bob Myrick
Cc: D.J. Newsome
Subject: Final "draft" Permeability Test Results

Carlton/Bob, attached you will find the final "draft" permeability of the 2 samples tested. These samples are described as requested as "Orange" sample and "Green" sample. I have indicated draft due to the fact the engineer has not signed them, however there should be no change in the data. I have copied Mr Newsome as per your request.

Regards



Wayne O. Mayo
Director of Field and Lab Services
3175 West Tharpe Street
Tallahassee, FL 32303
www.Ardaman.com
850-576-6131
850-574-0735 fax


3/21/16

This message may include confidential, proprietary or legally privileged information. Any dissemination or use of this information by anyone other than the intended recipient is strictly prohibited. If you have received this message in error, please advise the sender by reply e-mail, and then delete this message and any attachment from your system.

ARDAMAN & ASSOCIATES, INC
GEOTECHNICAL TESTING LABORATORY
HYDRAULIC CONDUCTIVITY TEST SUMMARY SHEET

File Number	Sandco	Data Input By:	CDS	Date:	3/16/2016
Project Name	12-41-1155	Checked By:		Date:	
Sample	Green Sample				
Sample Description	Reddish sand w/clay				
Permeability Test Results			Permeability Test Conditions		
k @ 20°C	1.9E-04	cm/sec	Cell Pressure	190	psi
Test Duration	1	days	Back-Pressure	185	psi
Avg. Head	100.5	cm	σ'_c	5	psi
Avg. Gradient	13.0		B-Factor	95	%
Cumulative Flow	6.593	cc	At $\Delta\sigma_c$	7,11,15	psi
Measured at end of test					

Initial Specimen Conditions

Dimensions	Physical Properties Based on w_d		Physical Properties Based on WWSi	
D1	3.568	cm	WDS	129.86
D2	3.569	cm	Saturation, S_t	53.4 %
D3	3.576	cm	Void ratio, e_i	0.636
Davg	3.571	cm	Porosity, n_i	0.389
Area	10.015	cm ²	w_i	12.4 %
H1	7.695	cm	γ_{di}	104.9
H2	7.717	cm		
H3	7.731	cm	WWSi	145.91
Havg	7.714	cm	G_s	2.75 Assumed
V_i	77.262	cm ³		
Trimblings Moisture Content				
WWS + Tare	87.44	g		
WDS + Tare	81.17	g		
Tare	30.42	g		
w_c	12.35	%		

Final Specimen Conditions

Dimensions	Physical Properties Based on S=100%		Physical Properties Based on WDSf	
D1	3.576	cm	WDS _f	129.86
D2	3.611	cm	Saturation, S_t	100.00 %
D3	3.545	cm	Void ratio, e_f	0.602
Davg	3.577	cm	Porosity, n_f	0.376
Area	10.051	cm ²	w_f	21.9 %
H1	7.763	cm	γ_{df}	107.2
H2	7.742	cm	V_f	75.64
H3	7.795	cm	A_f	9.739
Havg	7.767	cm	D_f	3.521
V_f	78.06	cm ³	$(V_f - V_i)/V_i$	-2.1
Final Moisture Content				
WWS + Tare	169.47	g	(Consolidation)	
WDS + Tare	141.15	g	WWS _f	158.28
Tare	11.74	g	Excess Soil	0.00
w_f	21.88	%	K-corr H_f/A_f	1.99E-04
				cm/sec

Selected Readings for Report

Head	Readings	K- readings	cm/sec
100.2	100.0		1.98E-04
	104.8		1.94E-04
	99.7		1.85E-04
	98.1		1.94E-04
			1.91E-04
Avg. Head	100.5	Average K	1.92E-04

ARDAMAN & ASSOCIATES, INC
GEOTECHNICAL TESTING LABORATORY
HYDRAULIC CONDUCTIVITY TEST SUMMARY SHEET

File Number	Sandco	Data Input By:	CDS	Date:	3/16/2016
Project Name	12-41-1155	Checked By:		Date:	
Sample	Orange Sample				
Sample Description	Orange brown sand + clay				
Permeability Test Results			Permeability Test Conditions		
k @ 20°C	8.7E-06	cm/sec	Cell Pressure	190 psi	
Test Duration	1	days	Back-Pressure	185 psi	
Avg. Head	114.2	cm	σ'_c	5 psi	
Avg. Gradient	14.9		B-Factor	100 %	
Cumulative Flow	10.91	cc	At $\Delta\sigma_c$	6,11,16	psi
Measured at end of test					

Initial Specimen Conditions

Dimensions	Physical Properties Based on w_{di}		Physical Properties Based on WWSi	
D1	3.542	cm	WDS	132.18 g
D2	3.557	cm	Saturation, S_i	70.0 %
D3	3.561	cm	Void ratio, e_i	0.585
Davg	3.553	cm	Porosity, n_i	0.369
Area	9.917	cm ²	w_i	14.9 %
H1	7.681	cm	γ_{di}	108.3 pcf
H2	7.686	cm		
H3	7.674	cm	WWSi	151.85 g
Havg	7.680	cm	G_s	2.75 Assumed
Vi	76.163	cm ³	WWSi	151.32 g
Trimming Moisture Content				
WWS + Tare	68.01	g	G_s	2.75 Assumed
WDS + Tare	63.34	g		
Tare	31.96	g		
w_c	14.88	%		

Final Specimen Conditions

Dimensions	Physical Properties Based on S=100%		Physical Properties Based on WDSf	
D1	3.483	cm	WDS _f	132.18 g
D2	3.561	cm	Saturation, S_f	100.00 %
D3	3.490	cm	Void ratio, e_f	0.523
Davg	3.511	cm	Porosity, n_f	0.343
Area	9.684	cm ²	w_f	19.0 %
H1	7.701	cm	γ_{df}	112.7 pcf
H2	7.678	cm	V _f	73.21
H3	7.587	cm	A _f	9.564
Havg	7.655	cm	D _f	3.490
V _f	74.13	cm ³	(V _f - V _i)/V _i	-3.9
Final Moisture Content				
WWS + Tare	169.56	g	(Consolidation)	
WDS + Tare	144.48	g	WWS _f	157.33 g
Tare	12.66	g	Excess Soil	0.00 g
w _f	19.03	%	K-corr H _f /A _f	8.88E-06 cm/sec
			K-corr H _f /A _f	8.99E-06 cm/sec

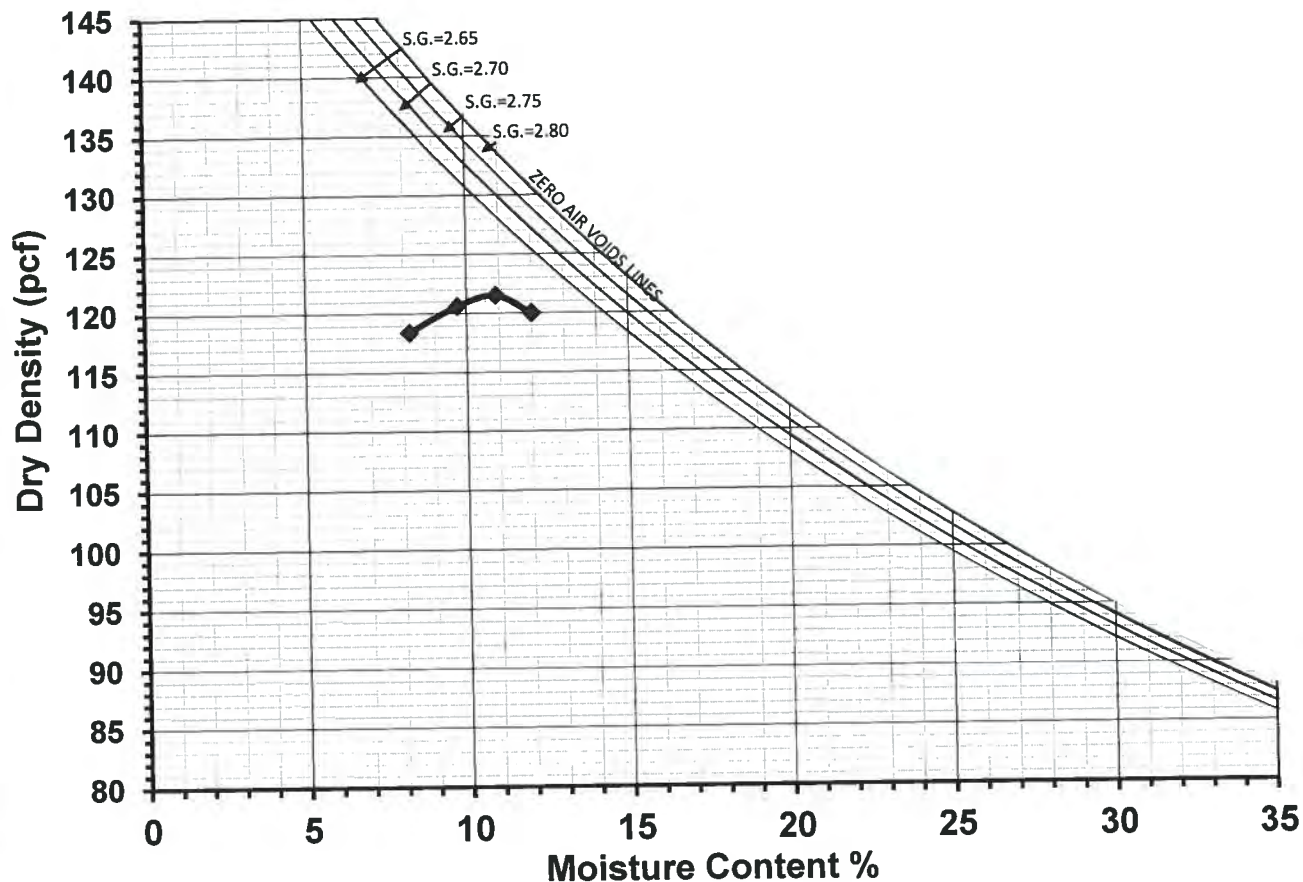
Selected Readings for Report

Head	Readings	K- readings	Value
115.8	112.4		8.59E-06 cm/sec
	112.4		8.68E-06 cm/sec
	117.0		8.93E-06 cm/sec
	113.2		8.72E-06 cm/sec
	114.2		8.57E-06 cm/sec
Avg. Head	114.2	Average K	8.70E-06 cm/sec



3175 West Tharpe Street
Tallahassee, Florida 32303
(850) 576-6131

MOISTURE - DENSITY RELATIONSHIP TEST



PROJECT INFORMATION

Project Name:	Land Fill Cap	Date Of Sampling:	3/21/2016
Client:	Crowder Excavating	Sampled By:	Client
File No.:	14-41-1007 Report 31616	Date Performed:	3/24/2016
Soil Description:	Brown White Clayey Sand	Performed By:	GS
Sample Location:	Tower Road		
Type Of Sample:	N/A		
Intended Use:	N/A		

TEST RESULT

Test Method:	Standard	Maximum Dry Density (pcf):	121.5
AASHTO:	T-99	Optimum Moisture Content %:	10.9
Wt. of Hammer (lb):	5.5	Liquid Limit	31
Mold Dia. (in) :	4	Plastic Limit	19.0
		Plastic Index	12.0
		% Passing #200	33.5
		AASHTO M-145 Classification	A-2-6

Florida Certificate of Authorization No. 5950
Georgia Certificate of Authorization No. PE03678

MICHAEL S. WILSON
Professional Engineer
No. 46088
Reviewed by: Michael S. Wilson, P.E.
Ej. Eng. License No. #46088
APR 07 2016

NOTE: This report does not address the suitability of the soils tested. Reference project specifications for performance. Additional testing such as classification testing (i.e. soil fines passing #200 sieve, sieve analysis and Atterberg limits) may be required to validate compliance.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS, OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL.