

ONONDAGA LAKE SCA FINAL DESIGN

LIST OF SPECIFICATIONS

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SECTION 01030

ENVIRONMENTAL PROTECTION

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The Work specified in this Section consists of all labor, equipment, tools, materials, services, supervision and incidentals necessary for environmental pollution control and abatement for the Work as described herein, shown on the Project Drawings, or as directed by the Engineer. Work in this Section includes, but is not limited to controlling environmental pollution requiring the consideration of air, water and land; management of noise, solid and hazardous waste, and other pollutants.
 - 1. Related Work specified in other Sections includes, but is not limited to:
 - a. Section 02085 – Groundwater Monitoring Well Abandonment
 - b. Section 02140 - Construction Water Management
 - c. Section 02200 – General Earthwork
 - d. Section 02370 - Erosion Control

1.02 PERFORMANCE REQUIREMENTS

- A. The Contractor shall comply with all applicable Federal, State and Local codes, ordinances, regulations, statutes and standards.

1.03 REFERENCES

- A. New York State Standards and Specifications for Erosion and Sediment Control, (Latest Version).
- B. New York Department of Transportation: Standard Specifications (US Customary), 2009.
- C. New York State Department of Environmental Conservation: Draft 6 NYCRR Part 375, Environmental Remediation Programs, 2006.
- D. Resource Conservation and Recovery Act (RCRA)
- E. Toxic Substances Control Act (EPA)

1.04 DEFINITIONS

- A. Environmental Pollution shall be defined as the presence of chemical, physical, or biological elements or agents which:

1. Adversely affect human health or welfare.
2. Unfavorably alter ecological balances of importance to human life.
3. Affect other species of importance to man.
4. Degrade the utility of the environment for aesthetic and/or recreational purposes.

B. Prohibited Construction Practices include, but are not limited to the following:

1. For any stream corridor, wetland, surface water or any unspecified location:
 - a. Dumping of spoil material
 - b. Indiscriminate, arbitrary or capricious operation of equipment
 - c. Pumping of silt-laden water from trenches or other excavations
 - d. Disposal of trees, brush and other debris
2. Permanent or unspecified alteration of the flow line of any stream.
3. Explosive blasting.
4. Burning of refuse and debris at the project site.

1.05 SUBMITTALS

A. The Contractor shall submit the following in accordance with Section 01300 – Submittal Procedures and as elsewhere specified in this Section:

1. A Contractor's SWPPP with a description of and illustration showing anticipated stormwater control and erosion control measures to be implemented during construction. This shall be submitted prior to mobilization to the Site.
2. Material Safety Data Sheets (MSDS) for all products having MSDS's 10 working days prior to delivery of such product to Site. MSDS's must be maintained and readily available on-site.
3. The Contractor shall be responsible for completing an inspection form for each piece of equipment, tool or bulk recyclable remnant structure or pipe being removed from the Site that required decontaminated.
4. An "Off-Site Disposal Record" as part of the Final Closeout Report.

1.06 PROJECT AND SITE CONDITIONS

A. The Contractor shall carefully examine the site to determine the full extent, nature and location of the Work required to conform to the Contract Drawings and Specifications. The Contractor shall bring any inaccuracies or discrepancies between the Contract Drawings and Specifications to the Engineer's attention in order to clarify the exact nature of the Work to be performed.

PART 2 – PRODUCTS

2.01 DECONTAMINATION PRODUCTS

- A. Cleaning products anticipated for use in decontamination include, but are not limited to the following:
 - 1. A pressure washer (or equivalent) furnished and used by the Contractor shall be a high-pressure, low-volume unit from an industry-recognized manufacturer.
 - 2. The Contractor shall provide miscellaneous tools such as shovels and brushes.
 - 3. The Contractor shall provide cleaning agents such as non-phosphate detergents for use as necessary.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Prior to commencement of the Work, the Contractor shall meet with the Engineer to develop mutual understanding relative to compliance with these provisions and administration of the environmental pollution control program.
- B. The Contractor shall schedule and conduct all Work in a manner that will minimize the erosion of soils in the area of the Work and shall provide erosion control measures as described in Section 02370 – Erosion Control. All erosion control measures shall be in place and in operating condition in an area prior to any construction activity in that area.
- C. The Contractor shall manage construction water in accordance with Section 02140 – Construction Water Management and sequence and conduct earthwork activities to limit the generation of construction water as appropriate.

3.02 TEMPORARY ENVIRONMENTAL CONTROL FEATURES

- A. The Contractor will dismantle and remove temporary environmental control features only when permanent control features have been installed and assessed as correctly functioning by the Engineer. Permanent control features shall be incorporated into the Project at the earliest practicable time in light of construction scheduling, and shall be in place and functioning upon project completion.

3.03 GENERAL REQUIREMENTS

- A. Flow of surface water into excavated areas shall be prevented as much as is practical.

- B. Ditches around construction areas shall also be used to carry non-contact surface storm water away from the excavated areas.
- C. At the completion of the Work, temporary ditches shall be backfilled and the ground surface restored to its original condition.

3.04 PROTECTION OF STREAMS AND SURFACE WATERS

- A. The Contractor shall take all precautions to prevent, or reduce to a minimum, any damage to any stream or surface water from pollution by debris, sediment or other material, or from the manipulation of equipment and/or materials in or near such streams or surface water.
- B. The Contractor shall take all preventative measures to avoid spillage of petroleum products and other pollutants. In the event of any spillage, prompt remedial action shall be taken in accordance with all applicable Federal, State and Local codes, ordinances, regulations, statutes and standards and as approved by the Engineer.
- C. Water that has been used for washing or processing, or that contains oils or sediments that will reduce the quality of the water in the stream or surface water shall not be directly returned to the stream or surface water. Such waters shall be diverted to the Temporary Water Treatment Plant or as directed by the Engineer.
- D. On-Site Discharge: Refer to Section 02140 – Construction Water Management regarding potential discharge into streams, surfacewater, groundwater and/or storm sewers.

3.06 PROTECTION OF LAND RESOURCES

- A. The Contractor shall restore land resources within the project boundaries and outside the limits of permanent Work to conditions upon completion of construction such that these will appear to be natural and not detract from the appearance of the project. Confine all construction activities to areas shown on the Contract Drawings or as approved by the Engineer.
- B. Outside the Limits of Clearing and Grubbing as indicated on the Contract Drawings, the Contractor shall not de-face, injure, destroy or remove trees, shrubs, fencing, structures or other landscape features without prior approval by the Engineer. No ropes, cables, or guys shall be fastened to any existing trees, shrubs, fencing, structures or other landscape features for anchorage unless specifically authorized by the Engineer.
- C. Prior to operations, the Contractor shall ensure adequate protection for trees, shrubs, fencing, structures or other landscape features that may possibly be de-faced, bruised, injured or otherwise damaged by the construction equipment or other operations. Monuments and markers shall be similarly protected.

- D. Any trees, shrubs, fencing, structures or other landscape features scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to their original condition. The Engineer will decide the method of restoration to be used and whether damaged trees shall be treated and healed or removed and disposed of.
- E. The location of the Contractor's support areas shall be approved by the Engineer and shall not be within wetlands or floodplains. The preservation of the landscape shall be an imperative consideration in the selection of support area locations. Drawings showing support area locations shall be submitted for approval of the Engineer.
- F. If the Contractor proposes to construct temporary roads or embankments and excavations for support areas, it shall submit the following for approval at least 10 days prior to scheduled start of such temporary work:
 - 1. A layout of all temporary roads, excavations, embankments, and drainage to be constructed within the site.
 - 2. Details of temporary road construction.
 - 3. Drawings and cross-sections of proposed embankments and their foundations, including a description of proposed materials.
 - 4. A landscaping drawing showing the proposed restoration of the area. The Drawing must include, but not be limited to the following:
 - a. The proposed removal of any trees, shrubs, fencing, structures or other landscape features outside the limits of clearing and grubbing.
 - b. The locations of guard posts or barriers required to protect trees, shrubs, fencing, structures or other landscape features to be maintained undamaged.
 - c. The locations of guard posts or barriers required to control vehicular traffic.
 - d. The provision for the obliteration of construction scars and for a natural final appearance of the area.
- G. Modification of the Contractor's approved drawings shall be made only with the written approval of the Engineer. No unauthorized road construction, excavation or embankment construction, including disposal areas will be permitted.
- H. The Contractor shall remove all signs of support areas or any other vestiges of construction as directed by the Engineer. It is anticipated that excavation, filling and plowing of roadways will be required to restore the area to near-natural conditions in order to allow the growth of vegetation. Roadways will be restored to existing conditions or as directed by the Engineer. The disturbed areas shall be prepared and seeded as approved by the Engineer.

3.07 PROTECTION OF AIR QUALITY

A. Dust Control

1. The Contractor is responsible for dust control for all excavations, embankments, stockpiles, access roads, plant sites, waste areas, borrow areas and all other work areas.
2. An approved method of dust control is sprinkling of water from a water source approved by the Engineer.
3. The use of any other stabilization methods may be permitted with approval from the Engineer. Product samples and manufacturer's literature must be submitted to the Engineer in accordance with Section 01300 - Submittals and all other relevant Sections contained in the Specifications. All products that are approved for dust control shall be used in accordance with the manufacturer's instructions.
4. Sprinkling must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the Contractor shall have sufficient competent equipment to accomplish this. Dust control shall be performed as the Work proceeds and whenever a dust nuisance or hazard occurs, or as determined by the Engineer.

B. Odor Control

1. If odors are an issue as determined by the Engineer, the Contractor shall provide an odor control material or applicable procedure acceptable to the Engineer.

3.08 NOISE CONTROL

- A. The Contractor shall be aware of all applicable Federal, State and Local codes, ordinances, regulations, statutes and standards related to noise. The Contractor shall adhere to any local regulations and restrictions regarding the start and stop times of work activities at the site.

3.09 MANAGING WASTE MATERIAL

A. Managing Waste Material Requirements

1. The Contractor shall manage the handling, segregation, stabilization, containment, storage, loading and transportation of all waste materials resulting from the performance of the Work.
2. All waste storage, staging and loading areas shall be in a location determined by the Engineer.
3. Litter, clean construction debris, metal, wood, office trash, etc. or other non-contaminated materials may be disposed of at approved disposal facility.

B. Waste Segregation

1. The Contractor shall segregate litter, construction debris, hazardous wastes and non-hazardous wastes based on generator knowledge.
2. The Contractor shall further segregate non-hazardous wastes (contaminated or uncontaminated) in a similar manner.
3. The Contractor shall keep wastes of unknown classification separate from other wastes and manage as if they were hazardous until a waste determination has been made.
4. If wastes cannot be classified based solely on generator knowledge, the Contractor shall collect waste samples as directed by the Engineer.

C. Waste Containers

1. The Contractor shall furnish appropriate containers (metal dumpsters with secure lids or covered roll-off containers), for construction debris and/or uncontaminated non-hazardous waste as required.
2. Waste shall be disposed of at frequent and regular intervals as required to prevent the overfilling of such containers. Place non-hazardous solid wastes, construction debris, and litter in containers in accordance with this specification.
3. The Contractor shall visually inspect all containers of wastes for leaks or damage prior to being loaded for transportation and off-site disposal. Transfer contents of any leaking or damaged container to another container or overpacks and re-inspect prior to loading. Clean up, contain and label spilled materials for disposal in accordance with the Contract Documents.
4. Any material that spills from containers shall be immediately cleaned and placed back into the waste containers.

D. Waste Transportation and Disposal

1. Dumpsters shall be emptied every two weeks, when full, or as directed by the Engineer. There shall be no liquid allowed in the containers.
2. No waste material shall be buried on-site or used as landfill for any part of grading activities.
3. All Contractor and Subcontract personnel must be trained on correct waste disposal procedures.
4. Honeywell shall agree to the selection of disposal facilities in advance in writing.
5. The Contractor shall dispose of waste oils and petroleum products generated during the Work in a safe and environmentally responsible manner.
6. A Honeywell Representative will sign all waste profile sheets for waste characterization and manifest(s) for off-site waste disposal of all regulated site generated waste.

E. Non-Hazardous Wastes

1. The Contractor shall load, transport and dispose of non-hazardous wastes generated in performance of the Work.
2. Waste containers shall be "sealed" non-leaking dumpsters, or equivalent; maintained to prevent leakage.
3. Before waste containers become full, the Contractor shall dispose of waste off-site.
4. If required, the Contractor shall dispose of non-hazardous wastes at a permitted off-site facility using a permitted waste transporter.
5. A non-hazardous waste manifest or Bill of Lading, signed by Honeywell, shall accompany each waste shipment. The original paperwork, stamped received and signed by the disposal facility, shall subsequently be returned to the Engineer.
6. The Contractor shall furnish all paperwork to the Engineer.

F. Hazardous & TSCA Waste

1. Honeywell will contract the transportation and disposal (T&D) of all hazardous wastes requiring off-site disposal directly with the T&D facility. Honeywell will decide who will be responsible for waste characterization.
2. Honeywell shall select waste transportation and disposal contractor(s) and issue necessary Purchase Order(s).
3. The Contractor shall:
 - a. Manage hazardous wastes in accordance with RCRA and/or TSCA regulations.
 - b. Place drummed wastes in a lined temporary staging area with berms, aisle space, stacking height, periodic logged inspections, stormwater management and security in accordance with applicable RCRA regulations for drum management.
 - c. Furnish itemized estimated volumes for Hazardous and TSCA Wastes to be generated by their operations (decontamination waste, used PPE, emergency response waste, etc).
 - d. Place waste materials for off-site disposal in the proper transportation containers, label waste containers, sample and characterize waste, provide temporary storage, prepare waste manifest and coordinate transportation with Honeywell.
 - e. Coordinate the management, handling, transport and off-site disposal of hazardous or TSCA regulated wastes resulting from the Work.
 - f. Allow seven working days for Honeywell to review and agree to the characterization and manifest documentation prior to scheduling transportation.

3.10 USE OF CHEMICAL PRODUCTS

- A. Chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, shall be approved by the U.S. EPA or U.S. Department of Agriculture or any other applicable regulatory agency.
- B. The Contractor shall obtain required certifications, permits and inspections and comply with all Federal, State, Local, and DOT codes, ordinances, regulations, statutes and standards governing transportation, handling, storage and use of chemical products and residues.
- C. The Contractor shall refer to the pertinent MSDS for information on all chemical products used or present at the Site.

3.11 FUEL AND LUBRICANTS

- A. The Contractor shall comply with all applicable Federal, State and Local codes, ordinances, regulations, statutes and standards concerning transportation and storage of fuels and lubricants.
- B. Fuel storage area and fuel equipment shall be approved by the Engineer prior to installation.
- C. The Contractor shall report spills or leaks from fueling equipment or construction equipment to the Engineer and cleanup as required.
- D. The Engineer will require the Contractor to remove damaged or leaking equipment from Project site.

3.12 DECONTAMINATION

- A. The Contractor shall properly decontaminate all tools and equipment before removal from site.
- B. The Contractor shall properly decontaminate all supplies and materials before removal from site, or manage as waste materials in accordance with the requirements of this specification.
- C. The Contractor shall use decontamination pads in order to separate exclusion and clean zones as required as follows:
 - 1. The decontamination pad shall be used and maintained to accommodate the anticipated construction equipment at the approved location. The area shall be returned to its previous condition upon completion of the Work unless otherwise directed by the Engineer.
 - 2. When not in use, each decontamination pad shall be covered with a waterproof liner to prevent the collection of precipitation.

3. Wood planks may be placed over the impermeable liner at the Contractor's discretion to provide a traveling surface for vehicle wheels and equipment tracks.
4. All decontamination water collected in the decontamination pad shall be managed as construction water as per Section 02140 – Construction Water.
5. All equipment and material decontamination procedures shall be carried out on the decontamination pad.
6. The collection sump shall be purged at the end of each work day and as required, and/or following a rainfall event.

[END OF SECTION]

SECTION 01300

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. The purpose of this Section is to define the roles and responsibilities of the Contractor and Engineer in the submittal process and to present the procedures for review, approval, and final disposition of contractor submittals during the construction phase.
- B. This specification applies to all incoming or outgoing documentation originated by the Contractor throughout the duration of the SCA Construction Project.

1.02 DEFINITIONS

- A. General definitions:
 - 1. Document- Any technical drawings, specifications, data sheets, manuals, calculations, etc., received from the Contractor including electronic media such as CD-ROM, email file attachments, etc.
 - 2. Submittal Coordinator- Employee of Engineer responsible for the receipt, coordination, and status reporting, of Contractor documentation.
 - 3. Procurement Manager- Employee of Engineer responsible for distributing request for proposal (RFP) and supporting documentation packages.
 - 4. Website Administrator- Employee of Engineer responsible for providing access to the Project Website, assisting with questions and maintaining the Project Website.
 - 5. Prints/Copies- The documents submitted will be distributed for Engineer review.
 - 6. Reproducible- Unbound document available for use in duplication.
 - 7. Electronic Copy- Files and attachments sent electronically via email or uploaded to the Project Website shall be in **PDF, XLS, DOC**, formatting.

1.02 SUBMITTAL REQUIREMENTS

- A. General: The submittal of all documentation will include:
 - 1. Dimensions and calculations are to be in standard units.
 - 2. Language Requirements: English
 - 3. All documents must be numbered appropriately (See Paragraph 1.3.D & 1.5.C)
 - 4. Submittals shall include a Document Transmittal Form.

- B. Preliminary drawings & documents to contain sufficient information to enable Engineer to proceed as necessary
 - 1. Submittals shall be uploaded to the Project Website.
- C. Contractor Project Website
- D. Parsons “Project Website”, also known as the “ParShare Site” is a Microsoft SharePoint website, designed to allow a central storage and collection site for documentation, information and ideas. The website has been developed to facilitate and maintain deliverables submitted between the Contractor and the Engineer. Documents uploaded by the Contractor will not be accessible by any other group other than the Engineer. If outside parties are required to review the documents, then the files will be transferred appropriately.
 - 1. Project Website Access
 - a. The Contractor must receive permission from the Website Administrator to access the Project Website. Prior to receiving access, the Contractor must submit names, and email addresses of individuals who will require access to the website.
 - b. Permission will be assigned based on the intended use and activity of the Contractor.
 - c. The Contractor will receive an email from the Website Administrator that provides a username and password. Upon receipt of this email, the user will be required to access the website and change their password. Instructions for changing passwords forward at the time permission is granted
- E. All submittals shall be labeled with the submittal number and shall be included on the Transmittal. (e.g., 1, 2, 3, etc.)

1.03 SUBMITTAL PROCEDURES

- A. The Contractor shall upload the required documents to the Project Website.
 - 1. Project Website and Submittals
 - a. The website will be used to transfer documentation between the Contractor and Engineer.
 - b. The Contractor will upload the submittal documents to the project website in the proper folder location.
 - c. The Contractor will notify the Submittal Coordinator and Construction Manager that a submittal has been uploaded to the project website via email. The email shall contain the submittal title and corresponding submittal number.
- B. The Submittal Coordinator will distribute the submittal documents to the Engineer for appropriate management, engineering/design, project control, etc., document review.

- C. Following the Engineer document review, the Submittal Coordinator shall return the submittal with the disposition based on the comments.
1. The Submittal Coordinator will upload the submittal response to the Project Website.
 2. The Submittal Coordinator will notify the Contractor that the submittal has been reviewed via email.
 3. The Engineer will provide a disposition to each reviewed submittal using the following codes:
 - a. Approved - Approved without comments, work may proceed.
 - b. Approved as noted - Approved with comments, work may proceed, incorporate comments.
 - c. Approved as noted/Resubmit - Approved with comments, work may proceed, incorporate comments and resubmit.
 - d. Revise and Resubmit- Work may NOT proceed. Incorporate comments and resubmit for review.
 - e. Rejected- Work may NOT proceed. Revise and resubmit.
 - f. For Information Only – Review not required, work may proceed.
 - g. Other- Refer to specific information on transmittal
 4. If comments or revisions are provided by the Engineer, the Submittal Coordinator shall return redlined, submittals showing changes, and/or comments to the Contractor either electronically or on hardcopy, as appropriate for the document submittal. A document transmittal shall be included identifying disposition and comments.
 5. The Contractor shall resubmit revised documents as necessary until submittal document achieves an Approval disposition.

1.04 TRANSMITTAL PROCEDURES

- A. The Contractor shall include Document Transmittal Form (Attachment 1) with the submittal.
- B. Document Transmittal Forms will be numbered sequentially and identify document resubmitted as follows:
1. Original Transmittal Number – Example: 1
 2. Resubmitted Document Transmittal Number- Example: 1a
 3. New Document Submittal- Example: 02

1.05 REVIEW PROCEDURE

- A. The Contractor shall be required to submit all documentation in accordance with the agreed dates.
- B. The Engineer shall review the documentation within two (2) weeks following the submittal.

DOCUMENT TRANSMITTAL FORM

Project: SCA Construction
Syracuse, NY

Transmittal No. _____

Date: _____

TRANSMITTAL To (Engineer): _____

Date: _____

A

From (Subcontractor): _____

By: _____

☐ Resubmission

**Submittal /
Number**

**Title/
Description**

Remarks on above submission: _____

☐ One copy retained by sender

Signature: _____

Printed Name: _____

TRANSMITTAL To (Sub/other): _____

Attn: _____

Date Rec'd by Sub: _____

B

From (Engineer): _____

☐ Other By: _____

Date Trnsmt'd Eng: _____

- ☐ Approved
- ☐ Approved as noted
- ☐ Approved as noted / Resubmit
- ☐ Submission Incomplete / Resubmit

- ☐ Revise / Resubmit
- ☐ Rejected / Resubmit
- ☐ For Information Only
- ☐ Other: _____

☐ One copy retained by sender

Comments on above submission: _____

Signature: _____

Printed Name: _____

DOCUMENT TRANSMITTAL FORM

Transmittal No. _____

TRANSMITTAL To (Eng): _____

Attn: _____

Date Rec'd by Eng: _____

C

From (Sub/Other): _____

By: _____

Date Trnsmt'd by Sub: _____

Submittal Number

☐ One copy retained by sender

- ☐ Submitted for review and approval
☐ For Information Only

- ☐ Resubmitted for review and approval
☐ Other: _____

Other remarks on above submission: _____

Signature: _____

Printed Name: _____

TRANSMITTAL To (Sub/Other): _____

Attn: _____

Date Rec'd by Sub: _____

D

From (Eng): _____

☐ Other

By: _____

Date Trnsmt'd by Eng: _____

- ☐ Approved
☐ Approved as noted
☐ Approved as noted / Resubmit
☐ Submission Incomplete / Resubmit

- ☐ Revise / Resubmit
☐ Rejected / Resubmit
☐ For Information Only
☐ Other: _____

☐ One copy retained by sender

Other remarks on above submission: _____

Signature: _____

Printed Name: _____

DOCUMENT TRANSMITTAL FORM

TRANSMITTAL To (Eng): _____ Attn: _____ Transmittal No. _____
_____ From (Sub/Other): _____ By: _____ Date Rec'd by Eng: _____
Date Trnsmt'd by Sub: _____

Submittal Number

☐ One copy retained by sender

☐ Submitted for review and approval
☐ For Information Only

☐ Resubmitted for review and approval
☐ Other: _____

Other remarks on above submission: _____

Signature: _____

Printed Name: _____

TRANSMITTAL To (Sub/other): _____ Attn: _____ Date Rec'd by Sub: _____
_____ From (Engineer): _____ ☐ Other By: _____ Date Trnsmt'd Eng: _____

☐ Approved
☐ Approved as noted
☐ Approved as noted / Resubmit
☐ Submission Incomplete / Resubmit

☐ Revise / Resubmit
☐ Rejected / Resubmit
☐ For Information Only
☐ Other: _____

☐ One copy retained by sender

Comments on above submission: _____

Signature: _____

Printed Name: _____

Project: SCA Construction	Date:
From:	RFI No.
To:	Ref:
Subject:	

Est. Work Impacted:	
Est. Schedule Impact:	
Est. Cost Impact:	
Request Response By:	

Drawing Reference:	
Specification Reference:	

REQUEST:

PROPOSED SOLUTION:

ANSWER:

Name:	Date:

- C. The Contractor shall have one (1) week to revise and make any necessary comments. The Contractor may request addition revision time if needed based on the extent of comments. The Engineer must acknowledge and confirm extension in writing to the Contractor.
- D. The Engineer shall have one (1) week to review and return any resubmitted documents.
- E. Subsequent reviews and resubmittals will follow the guideline of one (1) week review cycle.

1.06 REQUEST FOR INFORMATION

- A. The Contractor may request additional information/clarification from the Engineer through a Request for Information (RFI) process and submittal of the RFI Form (Attachment 2)
- B. The Contractor shall upload a completed RFI form to the Project Website and notify the Construction Manager and Submittal Coordinator via email.
- C. RFI Forms shall be numbered sequentially
 - 1. Example- RFI-01; RFI-02.

[END OF SECTION]

SECTION 01620

HEALTH AND SAFETY REQUIREMENTS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This Section shall communicate the minimum Safety, Health and Emergency Response requirements for performing field activities necessary for completion of the Work as described herein, as shown on the Project Drawings, or as directed by the Engineer.

1.02 PERFORMANCE REQUIREMENTS

- A. The Contractor shall comply with all applicable Federal, State and Local codes, ordinances, regulations, statutes and standards.
- B. The Contractor shall plan for, and ensure that, all personnel comply with the basic provisions of OSHA General Construction Standards (29 CFR 1926), and any applicable local, state, and federal regulations related to worker health and safety.
- C. The Contractor shall plan for, and ensure that, all personnel directly involved in waste excavation, trenching operations, or other intrusive work shall meet applicable requirements of OSHA Hazardous Waste Operations and Emergency Response, Final Rule (29 CFR 1910).
- D. The Contractor shall ensure that all project training, documentation and work conforms to their Contractor's Health and Safety Plan.

1.03 REFERENCES

- A. *Title 29 Code of Federal Regulations, Part 1910 Occupational Safety and Health Standards* - US Department of Labor, OSHA.
- B. *Title 29 Code of Federal Regulations, Part 1926 Safety and Health Regulations for Construction* - US Department of Labor, OSHA.

1.04 SUBMITTALS

- A. The Contractor shall submit the following in accordance with Section 01300 – Submittal Procedures and as elsewhere specified in this Section:
 - 1. The Contractor Health and Safety Plan (HASP).

1.05 PROJECT AND SITE CONDITIONS

- A. The Contractor shall carefully examine the site to determine the full extent, nature, and location of work required to conform to the Contract Drawings and Specifications. The Contractor shall bring any inaccuracies or discrepancies between the Contract Drawings and Specifications to the Engineer's attention in order to clarify the exact nature of the Work to be performed.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.01 HEALTH AND SAFETY PLAN

- A. The Contractor shall prepare a site-specific health and safety plan (HASP). The Contractor is solely responsible for adequacy of the HASP's preparation, monitoring, management and enforcement. The Contractor's HASP shall reference the Parsons 2007 SHARP (Safety, Health and Risk Program) Management, and shall address, but not be limited to, the following:
 - 1. Hazard evaluation
 - 2. On-site safety responsibilities
 - 3. Work zones
 - 4. Drum Removal
 - 5. Personnel training
 - 6. Personal protection, clothing and equipment
 - 7. Medical Surveillance
 - 8. Emergency procedures
 - 9. Equipment Maintenance and Cleaning
 - 10. Material Safety Data Sheets (MSDS)
 - 11. Noise and Dust Management
 - 12. Fall Protection
 - 13. Confined Space Entry
 - 14. Crane Safety
 - 15. Hot Work
 - 16. Utility Clearance
 - 17. Hazardous Energy Control
 - 18. Excavations
 - 19. Scaffolds and Ladders
- B. The HASP shall be submitted in prior to the start of work for approval by the Engineer. Any delay in work due to lack of approved HASP shall be the responsibility of the Contractor.

[END OF SECTION]

01620 ATTACHMENT 1

CD-13-1
SAFETY & OCCUPATIONAL HEALTH
COMPLIANCE

TO: Honeywell Site Superintendent _____.

FROM: Contractor _____.

The employees listed below:

	<u>Name</u>	<u>If Employed by Sub-Contractor List Sub's Name</u>		<u>Name</u>	<u>If Employed by Sub-Contractor List Sub's. Name</u>
1.	_____	_____	11.	_____	_____
2.	_____	_____	12.	_____	_____
3.	_____	_____	13.	_____	_____
4.	_____	_____	14.	_____	_____
5.	_____	_____	15.	_____	_____
6.	_____	_____	16.	_____	_____
7.	_____	_____	17.	_____	_____
8.	_____	_____	18.	_____	_____
9.	_____	_____	19.	_____	_____
10.	_____	_____	20.	_____	_____

have started to work at the _____ site of Honeywell.

All the Safety rules presented in 01620, and all special safety and occupational health matters pertaining to this project site and its operations have been explained to those contractor employees listed above.

We believe that these employees understand the rules and risks of work at this site and that they fully intend to work safely within the spirit and letter of the documents mentioned above. If we observe any deviations, we will call it to their attention immediately and take any other corrective action, including dismissal, to comply with Honeywell's intention of safe, productive work with minimal occupational risk.

For Contractor:_____

Date:_____

01620 ATTACHMENT 1

**CD-13-2
CONTRACTOR'S SAFETY DECLARATION**

TO: Honeywell Site Superintendent _____.

FROM: Contractor's Safety Officer _____.

As the duly authorized and designated representative and agent of _____, hereinafter called "Contractor", I hereby certify and agree for myself and for and on behalf of Contractor that:

- (1) I have been advised and instructed by the Honeywell Site Superintendent concerning working conditions including hazards, if any, involved in the job and/or job location in which Contractor and Contractor's agents and employees will be working or present;
- (2) I have already instructed or will immediately instruct all such agents and employees with respect to such conditions and/or hazards and the proper safety precautions to be observed in regard thereto. I will also see to it that each Contractor employee signs form CD-13-3 5/88 and will submit these weekly for all new employees;
- (3) All necessary, adequate and operative protective clothing and equipment have been or will be immediately issued to all such agents and employees, together with full instructions and training for their use;
- (4) Procedures including employee clothing and equipment requirements will be put into effect; that all such agents and employees will be properly supervised to insure compliance in the use of protective clothing and equipment and in the strict observance of safety rules and regulations; and
- (5) The following items among other items, were specifically covered:
 - a.) General safety rules and regulations
 - b.) Special safety and occupational health matters pertaining to this site and its environs.
 - c.) Compliance with 29 CFR 1910.120.

Date: _____

Signature of Contractor's Representative for
himself and for and on behalf of Contractor

Signature of Honeywell employee giving instructions

01620 ATTACHMENT 1

**CD-13-3
CONTRACTOR'S EMPLOYEE SAFETY DECLARATION**

TO: Honeywell Site Superintendent_____.

FROM: Contractor_____.

I have been instructed in detail on and understand the following:

1. The existence and requirements of the OSHA Hazard Communications Standard.
2. The chemical hazards present in the areas where I will be working.
3. The hazards associated with these chemicals.
4. Where the Project Site maintains the written Health and Safety Plan.
5. The list of Material Safety Data Sheets and the location of these sheets.
6. Site Specific Health and Safety Plan

Employee Signature

Employee Name Printed

Contractor Name Printed

SECTION 02085
GROUNDWATER MONITORING WELL ABANDONMENT

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The Work specified in this Section consists of all labor, equipment, tools, materials, services, supervision and incidentals necessary to perform abandonment of existing groundwater monitoring wells and piezometers as necessary for completion of the Work as described herein, shown on the Project Drawings, or as directed by the Engineer. Work in this Section includes, but is not limited to:
 - 1. Abandonment of existing groundwater monitoring wells and piezometers as noted in Schedule A.
- B. Related Work specified in other Sections includes, but is not limited to:
 - 1. Section 02200 - Earthwork

1.02 PERFORMANCE REQUIREMENTS

- A. The Contractor shall comply with all applicable Federal, State and Local codes, ordinances, regulations, statutes and standards.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C150 Standard Specification for Portland Cement.
 - 2. ASTM D5299 Guide for the Decommissioning of Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes and Other Devices for Environmental Activities.
- B. New York State Department of Environmental Conservation (NYSDEC) CP-43: "Ground Water Monitoring Well Decommissioning Policy", November 2009.

1.04 SUBMITTALS

- A. The Contractor shall submit the following in accordance with Section 01300 – Submittal Procedures and as elsewhere specified in this Section:
 - 1. The proposed methods of abandonment including drilling and grouting as required. The Contractor shall be responsible for the adequacy and safety of the methods.

2. Mixes - Grout mixes, bentonite mixture.
3. Equipment - Drill rig and related equipment.
4. Drilling Contractor - Name and address of the proposed well driller and a list of at least five completed projects of similar construction.
5. Piezometer/Well Field Inspection Log (Attachment A).
6. Piezometer/Well Decommissioning Record (Attachment B).

1.05 PROJECT AND SITE CONDITIONS

- A. The Contractor shall carefully examine the site to determine the full extent, nature, and location of work required to conform to the Contract Drawings and Specifications. The Contractor shall bring any inaccuracies or discrepancies between the Contract Drawings and Specifications to the Engineer's attention in order to clarify the exact nature of the Work to be performed.

PART 2 – PRODUCTS

2.01 MATERIAL

- A. Grout
 1. Provide a standard Portland Cement/bentonite grout mixture consisting of Portland Cement (ASTM C150 Type I), bentonite and water in the proportions of one 94-pound bag of Type I Portland Cement, 3.9 pounds of powdered bentonite, and 7.8 gallons of potable water. Slightly more water may be used in order to penetrate a sand pack when a screen transects multiple flow zones. This mixture results in a grout with a bentonite content of four percent by weight and will be used in all cases except in boreholes where excessive use of grout is anticipated. In these cases refer to NYSDEC CP-43, Section 6.2.
- B. Bentonite
 1. Provide ½-inch diameter sodium bentonite pellets or equal.
 2. Baroid – Ben Seal or equal.

2.02 EQUIPMENT

- A. The Contractor shall use equipment suitable for well abandonment activities.

PART 3 – EXECUTION

3.01 PREPARATION

- A. No abandonment activities shall commence without the prior approval of the Engineer.
- B. Perform abandonment in accordance with the requirements of this Section.

- C. Review available information concerning each well and piezometer to be abandoned, including well construction diagrams and abandonment summary table (Schedule A), prior to commencement of work.
- D. Complete the Well Field Inspection Log (Attachment A) prior to work.

3.02 ABANDONMENT

- A. The following refers to all monitoring wells and piezometers that are single-cased and do not penetrate into bedrock. All shall be abandoned by one of the following methods:
 - 1. Grouting In-Place.
 - 2. Perforating the Casing Followed by Grouting In-Place.
 - 3. Grouting In-Place Followed by Casing Pulling.
 - 4. Overdrilling and Grouting With or Without a Temporary Casing.
- B. Refer to Schedule A for the selection method for abandonment of each monitoring well.
- C. Methods
 - 1. Grouting In-Place
 - a. For the purposes of these procedures, the well-seal is defined as the bentonite seal above the sand pack.
 - b. If the well-seal is not compromised and there is no confining layer present, grouting in-place is considered a satisfactory abandonment procedure.
 - c. If the seal is compromised, Method 2 may be necessary.
 - d. Grouting in-Place Procedure
 - i. Do not remove the outer protective casing until grouting is complete.
 - ii. Using a tremie, pump the well casing and screen with grout according to the procedures in Section 6.4 of NYSDEC CP-43.
 - iii. The outer protective steel casing should be removed from either a five foot depth or below the frostline, whichever is greater.
 - iv. Cut the well casing at a minimum five foot depth and remove it and any associated well materials.
 - v. The upper five feet of casing and the outer protective casing may be removed in one operation if a casing-cutter is used.
 - 2. Perforating the Casing Followed by Grouting In-Place
 - a. This is the preferred method for well abandonment if the well annulus was either allowed to be backfilled with cuttings, or the grouting documentation is of poor quality.

- b. This method involves puncturing, splitting or cutting the well casing and screen, followed by grouting the well as per Section 6.4 of NYSDEC CP-43.
 - c. If required by Schedule A, the Contractor shall submit a method for casing and screen perforation based on site conditions for approval by the Engineer.
 - d. As per ASTM D5299, the following are required:
 - i. A minimum of four rows of perforations several inches long around the circumference of the pipe; and
 - ii. A minimum of five perforations per linear foot of screen and casing.
- 3. Grouting In-Place Followed by Casing Pulling
 - a. This method of abandonment is to be used when the well assembly must be removed to clear the site.
 - b. The well construction and depth must be such that pulling will not break the riser.
 - c. This method is acceptable only when:
 - i. No contamination is present; or
 - ii. If contamination is present, the well does not penetrate or cross a confining layer.
 - d. If contamination is likely to cross a penetrating layer during pulling, a temporary casing may be used. (See 4. Overdrilling and Grouting With or Without a Temporary Casing
 - e. Casing Pulling Procedure:
 - i. If the protective steel casing shall interfere with the down-hole work, it may be removed in a manner that minimizes disturbance to the well casing and surrounding ground.
 - ii. Lower a drill rod down the well and perforate the bottom well-cap.
 - iii. Grout as per Section 6.4 of NYSDEC CP-43.
 - iv. Pull the well by grappling the casing with appropriate devices and pulling the casing and well materials as a single unit.
 - v. Additional grout must be used as the well casing and screen are withdrawn to ensure that the void spaces are adequately filled.
 - vi. If the well is highly contaminated, is installed in a collapsible formation or if the bottom well-cap cannot be punctured, the casing or screen must be perforated prior to pulling.
 - vii. If all of the well materials are not withdrawn during the pulling process, overdrilling of the remaining portions may be required as directed by the Engineer.
- 4. Overdrilling and Grouting With or Without a Temporary Casing.
 - a. This technique will remove an entire well, its sandpack, and old grout column.

- b. This technique is to be used where the assembly is expected to sever or break or the well penetrates a confining layer, and the well materials must be removed.
- c. A temporary casing may be required prior to drilling, pulling and grouting.
- d. The Overdrilling Method should follow the original well borehole, be at least the diameter of the original well borehole, and advance at least 0.5 foot beyond the original well borehole depth.
- e. The Overdrilling Method should remove all construction materials.
- f. In order to keep the augers centered on the original well borehole, fill the well column with grout after perforating the bottom well-cap, prior to proceeding with overdrilling while the grout is not yet dry.
- g. If required by Schedule A, the Contractor shall submit a method for overdrilling based on site conditions for approval by the Engineer.
- h. Refer to Section 2.4 of NYSDEC CP-43 for further details of techniques for the Overdrilling Method.

3.03 COMPLETION

- A. Dispose of well and piezometer materials and associated soil cuttings in a temporary lined and covered stockpile on Wastebed 13 (exact location to be determined by the Engineer). Removed and abandoned well materials (i.e. well casings, screens, steel casings, and etc.) shall be cut into 10 foot or shorter sections prior to disposal.
- B. Upon completion of grouting, ensure that the final grout level is approximately five feet below land surface. Embed a ferrous metal marker in the top of the grout to indicate the location of the former well. Place a fabric “utility” marking one foot above the grout.
- C. Restore the area in the vicinity of each well location as shown on the Contract Drawings or as directed by the Engineer.
- D. Complete the Well Decommissioning Record (Attachment B) following completion of the Work.
- E. Following drilling activities, decontaminate equipment in accordance with the decontamination protocol in Section 01030 - Environmental Protection.

[END OF SECTION]

SCHEDULE A

Monitoring Well ID	Abandonment Method		Monitoring Well ID	Abandonment Method
SB915-PZ13-01S	Grouting In-Place		SB915-PZ-A3I	Grouting In-Place
SB915-PZ13-01D	Grouting In-Place		SB915-PZ-A3N	Grouting In-Place
SB915-PZ13-01N	Grouting In-Place		SB915-PZ-A4S	Grouting In-Place
SB915-PZ13-03S	Grouting In-Place		SB915-PZ-A4I	Grouting In-Place
SB915-PZ13-03I	Grouting In-Place		SB915-PZ-A4N	Grouting In-Place
SB915-PZ13-03D	Grouting In-Place		SB915-PZ-A5S	Grouting In-Place
SB915-PZ13-04S	Grouting In-Place		SB915-PZ-A5I	Grouting In-Place
SB915-PZ13-04I	Grouting In-Place		SB915-PZ-A5N	Grouting In-Place
SB915-PZ13-04D	Grouting In-Place		SB915-PZ-A6S	Grouting In-Place
SB915-PZ13-04N	Grouting In-Place		SB915-PZ-A6I	Grouting In-Place
PZ-01A	Grouting In-Place		SB915-PZ-A6N	Grouting In-Place
PZ-01B	Grouting In-Place		SB915-PZ-A7S	Grouting In-Place
PZ-02S	Grouting In-Place		SB915-PZ-A8I	Grouting In-Place
PZ-02I	Grouting In-Place		SB915-PZ-A9N	Grouting In-Place
PZ-02D	Grouting In-Place		SB915-PZ-A10N	Grouting In-Place
PZ-02N	Grouting In-Place		SB915-PZ-A11I	Grouting In-Place
BA-025	Grouting In-Place		SB915-PZ-A12N	Grouting In-Place
SB915-PZ-A1S	Grouting In-Place		SB915-INEX-A1	Grouting In-Place
SB915-PZ-A1I	Grouting In-Place		SB915-INEX-A2	Grouting In-Place
SB915-PZ-A1N	Grouting In-Place		SB915-INEX-A7	Grouting In-Place
SB915-PZ-A2S	Grouting In-Place		SB915-INEX-A8	Grouting In-Place
SB915-PZ-A2I	Grouting In-Place		SB915-INEX-A10	Grouting In-Place
SB915-PZ-A2N	Grouting In-Place		SB915-INEX-A13	Grouting In-Place
SB915-PZ-A3S	Grouting In-Place			

ATTACHMENT A FIELD INSPECTION LOG

DATE/TIME: _____
PZ/WELL ID: _____

	YES	NO
WELL VISIBLE? (If not, provide directions below)		
WELL I.D. VISIBLE?		
WELL LOCATION MATCH SITE MAP? (if not, sketch actual location on back).....		
WELL I.D. AS IT APPEARS ON PROTECTIVE CASING OR WELL:		
	YES	NO
SURFACE SEAL PRESENT?		
SURFACE SEAL COMPETENT? (If cracked, heaved etc., describe below)		
PROTECTIVE CASING IN GOOD CONDITION? (If damaged, describe below)		
HEADSPACE READING (ppm) AND INSTRUMENT USED.....		
TYPE OF PROTECTIVE CASING AND HEIGHT OF STICKUP IN FEET (If applicable)		
PROTECTIVE CASING MATERIAL TYPE:		
MEASURE PROTECTIVE CASING INSIDE DIAMETER (Inches):		
	YES	NO
LOCK PRESENT?		
LOCK FUNCTIONAL?		
DID YOU REPLACE THE LOCK?		
IS THERE EVIDENCE THAT THE WELL IS DOUBLE CASED? (If yes, describe below)		
WELL MEASURING POINT VISIBLE?		
MEASURE WELL DEPTH FROM MEASURING POINT (Feet):		
MEASURE DEPTH TO WATER FROM MEASURING POINT (Feet):		
MEASURE WELL DIAMETER (Inches):		
WELL CASING MATERIAL:		
PHYSICAL CONDITION OF VISIBLE WELL CASING:		
ATTACH ID MARKER (if well ID is confirmed) and IDENTIFY MARKER TYPE		
PROXIMITY TO UNDERGROUND OR OVERHEAD UTILITIES.....		
DESCRIBE ACCESS TO WELL: (Include accessibility to truck mounted rig, natural obstructions, overhead power lines, proximity to permanent structures, etc.); ADD SKETCH OF LOCATION ON BACK, IF NECESSARY.		
DESCRIBE WELL SETTING (For example, located in a field, in a playground, on pavement, in a garden, etc.) AND ASSESS THE TYPE OF RESTORATION REQUIRED.		
IDENTIFY ANY NEARBY POTENTIAL SOURCES OF CONTAMINATION, IF PRESENT (e.g. Gas station, salt pile, etc.):		
REMARKS:		

ATTACHMENT B

WELL DECOMMISSIONING RECORD

Site Name:	Well I.D.:
Site Location:	Driller:
Drilling Co.:	Inspector:
	Date:

DECOMMISSIONING DATA (Fill in all that apply)		WELL SCHEMATIC*	
OVERDRILLING		Depth (feet)	
Interval Drilled			
Drilling Method(s)			
Borehole Dia. (in.)			
Temporary Casing Installed? (y/n)			
Depth temporary casing installed			
Casing type/dia. (in.)			
Method of installing			
CASING PULLING			
Method employed			
Casing retrieved (feet)			
Casing type/dia. (in.)			
CASING PERFORATING			
Equipment used			
Number of perforations/foot			
Size of perforations			
Interval perforated			
GROUTING			
Interval grouted (FBLs)			
# of batches prepared			
For each batch record:			
Quantity of water used (gal.)			
Quantity of cement used (lbs.)			
Cement type			
Quantity of bentonite used (lbs.)			
Quantity of calcium chloride used (lbs.)			
Volume of grout prepared (gal.)			
Volume of grout used (gal.)			
COMMENTS:		* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.	

Drilling Contractor

Engineer

SECTION 02100
SITE CLEARING

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. The Work specified in this Section consists of all labor, equipment, tools, materials, services, supervision and incidentals necessary to remove and dispose of debris, brush, trees, vegetation, topsoil, and other objectionable materials from Work areas as described herein, shown on the Contract Drawings, or as directed by the Engineer. Work in this Section includes, but is not limited to:
1. Clearing to limits shown on the Contract Drawings;
 2. Clearing to establish access routes, support areas, and other work areas as shown on the Contract Drawings, as necessary to complete the Work, or as directed by the Engineer;
 3. Protection and preservation of trees and vegetation outside the Limits of Clearing; and
 4. Cutting, chipping, and on-site use or disposal of above-grade timber and brush.

1.02 RELATED WORK

- A. Work in this section includes, but is not limited to:
1. Section 01030 Environmental Protection
 2. Section 01300 Submittal Procedures
 3. Section 01620 Health and Safety Requirements
 4. Section 02140 Construction Water Management
 5. Section 02200 Earthwork
 6. Section 02370 Erosion Control

1.03 PERFORMANCE REQUIREMENTS

- A. The Contractor shall comply with all applicable Federal, State, and Local codes, ordinances, regulations, statutes and standards.

1.04 SUBMITTALS

- A. The Contractor shall submit the following in accordance with Section 01300 – Submittal Procedures and as elsewhere specified in this Section:
1. The Limits of Clearing; and
 2. The proposed methods for managing debris, brush, trees, stumps, vegetation, and other debris.

1.05 PROJECT AND SITE CONDITIONS

- A. The Contractor shall carefully examine the site to determine the full extent, nature, and location of work required to conform to the Contract Drawings and Specifications. The Contractor shall bring any inaccuracies or discrepancies between the Contract Drawings and Specifications to the Engineer's attention in order to clarify the exact nature of the Work to be performed.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.01 SITE CLEARING

- A. Provide erosion control measures prior to and throughout all clearing activities, in accordance with Section 02370 - Erosion Control.
- B. Limit clearing activities to the Limits of Disturbance shown on the Contract Drawings, or as otherwise approved by the Engineer.
- C. Manage construction water in accordance with Section 02140 - Construction Water Management. Sequence clearing activities to limit the generation of construction water as appropriate.
- D. Remove all vegetation within the limits of excavation and limits of disturbance, including, but not limited to brush, trees, shrubs, stumps, logs, debris, and boulders. Dispose of all removed material on the areas of Wastedbed (WB) 13 not designated for SCA or other facility construction.
- E. Immediately restore or replace any damaged items.
- F. Provide a chipper and/or grinder of sufficient size to handle material expected from the cleared areas and chip/grind cleared vegetation.
- G. Do not burn on or off-site.

3.02 GUARANTEE

- A. The Contractor shall guarantee that Work performed under this Section will not permanently damage trees, shrubs, turf or plants designated to remain, or other adjacent work or facilities. If damage resulting from operations appears during a period up to 12 months after completion of the project, the Contractor must replace damaged items.

[END OF SECTION]

SECTION 02140

CONSTRUCTION WATER MANAGEMENT

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. The Work specified in this Section consists of all labor, equipment, tools, materials, services, supervision and incidentals necessary to collect, handle, store, analyse, treat, transport and dispose of construction water and associated residual solids as described herein, or as directed by the Engineer. Work in this Section includes, but is not limited to:
 - 1. The development of acceptable Construction Water Management Procedures detailing the collection, handling, storage, analysis, treatment, transportation and disposal of all construction water and associated residual solids generated during construction.
 - 2. Provision of all labor, equipment, tools, materials, services, supervision and incidentals required for the collection, handling, storage, analysis, treatment, transportation and disposal of all construction water and associated residual solids in accordance with the Engineer-approved Construction Water Management Procedures.
 - 3. Performance of all specified and necessary sampling and analyses to ensure compliance with the Contract Documents, required permits, applicable Federal, State and Local codes, ordinances, regulations, statutes and standards; or as directed by the Engineer.
 - 4. Prevention of WB 13 surface water runoff from flowing into SCA construction areas and in areas where geomembrane is deployed.
- B. Related Work specified in this Section includes, but is not limited to:
 - 1. Section 01030 Environmental Protection;
 - 2. Section 01300 Submittal Procedures
 - 3. Section 01620 Health and Safety Requirement;
 - 4. Section 02200 Earthwork
 - 5. Section 02250 Low Permeability Soil Layer
 - 6. Section 02300 Gravel Drainage Layer
 - 7. Section 02235 Protective Soil Layer
 - 8. Section 02910 Vegetative Soil Layer

1.02 PERFORMANCE REQUIREMENTS

- A. The Contractor shall comply with all applicable Federal, State and Local codes, ordinances, regulations, statutes and standards.

- B. The Contractor is to obtain and operate within all applicable Local, State, and Federal permits and requirements necessary to implement the proposed Construction Water Management Procedures. Any and all civil, criminal, and monetary penalties associated with non-compliance in any regard shall be the responsibility of the Contractor.

1.03 REFERENCES

- A. New York State Standards and Specifications for Erosion and Sediment Control, (Latest Version).
- B. New York State Stormwater Management Design Manual, (Latest Version)

1.04 DEFINITIONS

- A. Construction Water shall be defined as the following:
 - 1. Groundwater or surface water entering excavations or trenches.
 - 2. Liquids generated during decontamination activities.
 - 3. Surface water resulting from precipitation during construction which has come in contact with potentially contaminated soils, sediments, fill, or debris that have had the surface disturbed or are otherwise altered by construction-related activities.
 - 4. Water or other liquids, which have come into contact with potentially exposed contaminated soils, sediments, or debris, in addition to that resulting from precipitation.
 - 5. Construction Water does not include precipitation that falls on geomembrane, provided that this water is kept separate from water that has contacted the surface of WB 13.
- B. Residual solids shall be defined as solids resulting from the construction water management operations, including sediment accumulated in settling ponds or basins, chemically flocculated sediments, precipitates, and filtered suspended solids.

1.05 SUBMITTALS

- A. The Contractor shall submit the following in accordance with Section 01300 – Submittal Procedures and as elsewhere specified in this Section:
 - 1. Construction Water Management Procedures including, but not limited to:
 - a. Procedures and equipment proposed to minimize generation of Construction Water.
 - b. Procedures and equipment proposed to transport Construction Water to the existing leachate ponds.
 - c. Procedures and equipment proposed to prevent Construction Water from flowing onto geomembrane-covered areas.

- d. Procedures and equipment proposed to transport water off the geomembrane to the existing surface water control system.
- 2. Contract Drawings and details, including but not limited to:
 - a. Decontamination Pad(s);
 - b. Discharge Points and Related Structures

1.06 PROJECT AND SITE CONDITIONS

- A. The Contractor shall carefully examine the site to determine the full extent, nature, and location of work required to conform to the Contract Drawings and Specifications. The Contractor shall bring any inaccuracies or discrepancies between the Contract Drawings and Specifications to the Engineer's attention in order to clarify the exact nature of the Work to be performed.
- B. The Contractor shall review site data provided as information with the Contract Documents. Upon mobilization, the Contractor shall assume full responsibility for Construction Water Management.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Water Management Procedures
 - 1. The Contractor shall prepare and submit Construction Water Management Procedures for the Engineer's approval. The procedures shall include, but not be limited to, the Contractor's proposed method of collection, handling, storage, analysis, treatment, transportation and disposal of all construction water and associated residual solids generated during construction. Methods of minimizing the generation of construction water shall be identified.
 - 2. The acceptable methods of managing Construction Water are limited to on-site discharge to the existing leachate basins.
 - 3. The acceptable methods of managing water collected from the geomembrane is discharge to the existing surface water control system at the outside toe of the WB 13 dike.
- B. Services, Facilities and Personnel
 - 1. The Contractor shall provide all means, methods, services, facilities, power, equipment, tools, material, consumables, incidentals, labor and supervision necessary to collect, handle, store, analyze, treat, transport, dispose and otherwise manage construction water.

PART 3 – EXECUTION

3.01 PREPARATION

- A. The Contractor shall be responsible for estimating the quantity and quality of construction water and residual solids expected for this project based on the existing site conditions and proposed activities.
- B. It shall be the responsibility of the Contractor to investigate and comply with all applicable Federal, State and Local codes, ordinances, regulations, statutes and standards governing the collection, handling, storage, analysis, treatment, transportation and disposal of all construction water and associated residual solids generated during the execution and completion of the Work. All construction water shall be disposed of in a manner which meets applicable permit requirements, codes, ordinances, regulations, statutes and standards.
- C. The Contractor shall obtain all required permits, manifests, and approvals required for the collection, handling, storage, analysis, treatment, transportation and disposal of all construction water and associated residual solids generated during the execution and completion of the Work.
- D. Any sampling and analyses necessary to protect the health and welfare of the Contractor's employees and/or agents and/or to characterize collected water, treated water or residual solids shall remain the sole responsibility of the Contractor.
- E. Construction water shall be managed using equipment compatible with anticipated contaminants which may be present.

3.02 DISCHARGE REQUIREMENTS

- A. At discharge points, the Contractor shall construct temporary stone aprons or other suitable means to dissipate flow and reduce turbidity.

3.03 MINIMIZATION OF CONSTRUCTION WATER

- A. The Contractor shall make every effort to minimize the generation of construction water and associated residual solids. Methods to minimize generation of construction water include, but are not limited to:
 - 1. Erection of temporary berms to prevent surface water flow to the SCA construction area, and geomembrane-covered areas.
 - 2. Engineering controls on construction activities to minimize contact of personnel and equipment with contaminated areas thus minimizing the amount of decontamination or other methods required.

[END OF SECTION]

SECTION 02200

EARTHWORK

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, supervision and incidentals necessary to perform all excavation, backfilling and grading necessary for completion of the work shown on the Drawings and as specified herein. The work shall include, but is not necessarily limited to: site preparation, dewatering, excavation, relocating, screening, stockpiling, preparing and/or hauling soils for proper disposal offsite or reuse onsite, subgrade preparation and grading, provision of imported fills, placement and compaction of engineered fill, survey control associated with earthworks, appurtenant work completed in accordance with the Drawings and Specifications, and all related work and as directed by the Engineer.
- B. All soil fill placed as a part of this project, including the perimeter berms, shall be considered as engineered fill and shall be placed, tested, and documented in accordance with the requirement of this Section unless specifically approved by the Engineer.
- C. The low permeable soil liner, gravel drainage layer, and final cover components are not considered as engineered fill.
- D. All excavation, trenching, sheeting, bracing, etc. shall comply with the requirements of OSHA excavation safety standards (29 CFR PART 1926.650 Subpart P).

1.02 RELATED WORK

- A. Work in this section includes, but is not limited to:
 - 1. Section 01030 Environmental Protection
 - 2. Section 01300 Submittal Procedures
 - 3. Section 01620 Health and Safety Requirements
 - 4. Section 02100 Site Clearing
 - 5. Section 02140 Construction Water Management
 - 6. Section 02270 Erosion & Sedimentation Control

1.03 REFERENCES

- A. Latest version of American Society for Testing and Materials (ASTM) Standards:

1. ASTM D 422 Standard Test Method for Particle Size Analysis of Soils.
2. ASTM D 698 Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
3. ASTM D 1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
4. ASTM D 2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
5. ASTM D 2487 Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
6. ASTM D 2937 Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.
7. ASTM D 4318 Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
8. ASTM D 2974 Standard Test Method for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
9. ASTM D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.04 SUBMITTALS

- A. The Contractor shall submit the following information to Engineer for review and approval in accordance with Section 01100 – Remediation and as elsewhere specified in this Section 30 calendar days prior to initiating earthwork activities:
 1. List of equipment proposed for the earthwork;
 2. Proposed offsite borrow source(s);
 3. Dewatering methods and techniques;
 4. Dust control equipment and procedures;
 5. Methods for supporting trenches, backfilling, compaction, grading, and stormwater control;
 6. Coordination of survey requirements for the earthwork;
 7. Locations of on-site temporary soil stockpile areas;
 8. Coordination of earthwork activities with surface-water management and erosion and sediment control measures;
 9. Schedule for earthwork activities; and
 10. Quality Control Work Plan.
- B. The Contractor shall be responsible for the adequacy and safety of the methods.
- C. Test results as specified herein shall be submitted to the Engineer for review within two (2) working days of receipt of results. The Contractor shall not deliver material to the site prior to submission and approval by the Engineer of the geotechnical and analytical chemistry test results.

1.05 CONSTRUCTION QUALITY CONTROL

- A. The Contractor shall submit a Quality Control (QC) Workplan for review. Once instituted, the Contractor shall use the QC Workplan to ensure that the Work performed under the contract meets the requirements of the Contract Documents.
- B. The Contractor shall submit the name of a qualified Independent Testing Laboratory (ITL) to the Engineer for review.
 - 1. The Contractor shall submit to the Engineer for approval, the company name, address, and qualifications of the selected ITL proposed for use at the project. Included in this submittal will be the names and qualifications of the individuals who are proposed for assignment to the site. The Engineer reserves the right to request other information regarding the qualifications of the ITL for use in the evaluation process.
- C. Sampling
 - 1. The Contractor shall be responsible for collecting samples and conducting tests using a qualified ITL to document material property compliance with the specifications.
 - 2. The Contractor shall be responsible for collecting samples and conducting tests using a qualified ITL to certify and document that imported material meets the allowable analytical compound concentrations and properties specified in this Section. These samples will be collected and transported in compliance with the QC Workplan. The Engineer reserves the right to observe sampling and testing of the materials. The Contractor shall provide at least 24-hours notice of a sampling event to the Engineer.
 - 3. Representative samples of each specific material type from each specific material source will be obtained by compositing at least five randomly selected individual samples of approximately equal weight. The total composite sample mass shall be at least the minimum size required to conduct all of the required material property and analytical chemistry tests for that material type. Each of the individual samples will be obtained from within the boundaries of the material mass that the composite sample represents. In addition, at least one (1) pound of each individual sample will be retained in a separate, sealed clean glass jar for mercury testing and for additional duplicate testing, if needed.
 - 4. Contractor quality control samples may be obtained from in situ samples for pre-approval of a dedicated borrow source area. The sampling methodology and means for assuring the material dedication to the project shall be submitted to the Engineer for approval prior to the commencement of sampling.
 - 5. Contractor quality control samples may also be obtained from dedicated stockpiles or storage/transportation vessels. The sampling methodology and means for assuring the material dedication to the project shall be

submitted to the Engineer for approval prior to the commencement of sampling.

D. Sample Frequency

1. Each imported material type shall be tested at the following batch sizes:
 - a. For the first 25,000 cubic yards of each material type from a specific material source, a representative composite sample will be obtained from each 2,500 cubic yards (in-place volume) batch or part thereof.
 - b. If no unacceptable test results have been obtained on samples representing the first 25,000 cubic yards of each material type and the material continues to be from the same material source with consistent appearance and source area or process, then the batch size can be increased to 5,000 cubic yards for the subsequent material deliveries.
 - c. If no unacceptable test results have been obtained on samples representing the first 75,000 cubic yards of each material type and the material continues to be from the same material source with consistent appearance and source area or process, then the batch size can be increased to 10,000 cubic yards for the subsequent material deliveries.
2. Analytical Chemistry Testing
3. These samples will be sent to an Analytical Chemistry Testing Laboratory (ACTL) selected by the Engineer. Each composite sample for each material shall be tested for the compounds in Table 375-6.8(b) "Restricted Use Soil Cleanup Objectives" in NYSDEC Subpart 375. All test results shall be below the Commercial cleanup objective concentrations provided in this table. Failure of a single compound test result shall mean that the entire material batch will be rejected unless specifically accepted on a test-by-test basis in writing by the Engineer.
4. Each individual sample used to construct the composite sample shall be tested for total mercury. The result for all of the individual samples for a composite sample must be below the Commercial cleanup objective concentrations provided in Table 375-6.8(b) "Restricted Use Soil Cleanup Objective" in NYSDEC Subpart 375. Failure of a single individual sample in a batch shall mean that the entire batch will be rejected unless specifically accepted on a test-by-test basis in writing by the Engineer.

F. Material Property Testing

1. Each composite sample shall be tested for material properties as defined in the specific specification section or sub-section for that material type.

G. General

1. No imported materials shall be delivered to the project site before the required material property and analytical chemistry testing for that batch has been provided to the Engineer and written approval received from the Engineer. Unapproved material shall be removed from the site at the Contractor's expense.
2. Contractor shall be responsible for repairing or reconstructing the deficiencies at his own expense to meet this specification and other Contract Documents.

1.06 CONSTRUCTION QUALITY ASSURANCE

- A. The Engineer shall conduct quality assurance sampling on materials delivered to the site.
1. The Contractor shall provide access and support to the delivered materials in order for representative sampling and testing to be conducted.
 2. The Engineer shall have the right to visit the borrow source at any time during borrow pit working hours to observe mining, manufacturing, stockpiling or loading operations.

1.07 AS-BUILT DOCUMENTATION

- A. The Contractor shall follow the general requirements for As-Built Documentation contained in Section 01100 - Remediation.
- B. In addition to preparation of as-built revisions to the Project Drawings, the Contractor shall provide as-built documentation for the top surface of placed engineered fill.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Engineered fill is defined as placed and compacted soil, as required herein, to achieve grade elevations.
- B. Soil materials used for engineered fill shall consist of relatively homogeneous natural soils free of materials, which, due to nature or size, are deleterious to the intended use. Unless otherwise specified herein, engineered fill shall classify as SC, SM, ML, CL, GM, or GC according to the Unified Soil Classification System (per ASTM D 2487) or combinations of these materials. Classification shall be based on the results of soil conformance tests.
- C. The Contractor shall perform the following material property tests, prior to material being delivered to the site, at the frequency specified in Section 1.05:

1. Grain size (ASTM D422)
 2. Moisture (ASTM D2216)
 3. Standard Proctor (ASTM D1556)
 4. Atterberg Limits (ASTM D4318)
 5. Organic Content (ASTM D2974)
- D. These control tests will be performed at each visual or textural change in source material, or as directed by the Engineer. Test results shall be submitted to the Engineer in accordance with Part 1.04.

2.02 EQUIPMENT

- A. Contractor shall furnish equipment to perform the scope of work described in this specification, including excavate, haul, place, spread, and compact engineered fill.

PART 3 – EXECUTION

3.01 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Material not immediately used as engineered fill shall be stockpiled in areas approved by Engineer.
- B. Stockpiled material shall be managed in accordance with the Contractor's procedures approved by Engineer.

3.02 SITE PREPARATION

- A. Contractor shall coordinate the work such that required inspections and testing of work that will be covered up by the placement of engineered fill will be complete prior to placement of the engineered fill.
- B. The Contractor shall construct staging and stockpile areas in approved areas if needed.
- C. The Contractor shall construct temporary haul roads and drainage structures as required for the Contractor to access the staging areas and soil stockpiles.
- D. Locate monitoring wells, piezometers, utilities, and other subsurface structures in the work area. Protect and maintain or abandon these structures and utilities during the excavation and grading activities in accordance with the notes on the Project Drawings.
- E. Prior to earthwork activity, the Contractor shall perform clearing and preparation of work areas in accordance with Section 02100 – Site Clearing.
- F. Prior to the start of construction, notify the appropriate organizations and have underground utilities staked or marked. Utilities include, but are not limited to

water, gas, electric, telephone, cable, storm sewer, sanitary sewers, laterals and services. If utility locations indicate a possible interference, or points of connection to existing facilities need to be identified, perform exploratory excavations to determine the utility's location and elevation. Provide the utility owner with results from exploratory excavations for review. Allow the Engineer sufficient time to review exploratory excavation results and evaluate if changes are required to the Contract Documents prior to the start of construction.

3.03 SUMP EXCAVATION

- A. Sump excavation shall be performed to achieve the grades shown on the Project Drawings. Appropriate excavation protection measures shall be taken to protect the stability of the excavation and safety of workers.
- B. Sump excavation shall be carried out during the presence of the Engineer. Sump excavation schedule shall be closely coordinated with the Engineer and subsequent liner construction activities to minimize the time the excavation remains open. Temporary backfill may be used as an interim excavation protection measure if it is not feasible to complete the liner system construction in the sump area and install the risers and backfill with the drainage layer gravel within a reasonable period of time.
- C. Material excavated from the sump area shall be placed in an area of Wastebed 13, as directed by the Engineer and rough graded to blend into the surrounding topography.

3.04 ABANDONING WEIR BOX

- A. One of the three existing weir boxes at the site shall be abandoned in accordance with the Project Drawings and as directed by the Engineer. Weir box abandoning shall be carried out during the presence of the Engineer.

3.05 INSTRUMENTATION

- A. The Contractor shall excavate instrumentation trenches and backfill them as presented on the Project Drawings and as directed by the Engineer.

3.06 DUST CONTROL

- A. Contractor shall provide and operate necessary equipment and personnel to maintain dust control during construction. Contractor is responsible for establishing the means and methods for dust control.
- B. Contractor shall implement dust control measures during periods of site construction activities. Areas to receive dust control measures include active work areas, site access roads, and other areas of the site with activities that may generate dust.

3.07 STOCKPILING

- A. The Contractor shall stockpile soils as needed in areas approved by Engineer.
- B. The Contractor shall construct stockpiles no steeper than 3-horizontal to 1-vertical (3H:1V) grade to drain and seal by tracking perpendicular to the slope contours with a bulldozer and dress daily during periods when fill is taken from the stockpile. Stock piles shall not exceed a height of 10 feet without prior approval on a case by case basis by the Engineer.
- C. The Contractor shall stabilize stockpiles that will remain out of active use for a period greater than 6 months by vegetation with a seed mix that shall be approved by the Engineer.

3.08 SITE GRADING

- A. Perform earthworks to the lines and grades as shown on the Project Drawings.
- B. In work areas where water ponding is observed, implement measures to remove the water.

3.09 ENGINEERED FILL

- A. Use engineering fill material that meets the material requirements of this Section. Place engineered fill material to the limits and grades shown on the Project Drawings.
- B. Place engineered fill material on surfaces that are free of debris, branches, vegetation, mud or other deleterious materials.
- C. Place fill material in loose lifts with a thickness of $8'' \pm 2''$. In areas where compaction is to be performed using hand-operated equipment, place the fill material in loose lifts with a thickness of $4'' \pm 1''$. The first lift shall be placed with a loose lift thickness of $12'' \pm 2''$.
- D. Remove visible rock particles with a maximum dimension larger than $4''$ for $8'' \pm 2''$ thick loose lifts. For $4'' \pm 1''$ thick loose lifts, the maximum rock particle size shall be $2''$.
- E. Prior to placing a succeeding lift of fill material over a previously compacted lift or the prepared subgrade, thoroughly scarify the previous lift to a depth of $2''$ by discing, raking, or tracking with a dozer. Moisture condition the preceding lift if the moisture content is not within the range of acceptable moisture contents specified in this Section.
- F. Fill slopes steeper than three horizontal to one vertical shall be constructed by overfilling beyond the planned finished fill surface and cutting the slope back to expose properly compacted engineered fill.

- G. Trafficking of scarified surfaces by trucks or other equipment, with rubber tires is not permitted.
- H. The maximum acceptable soil clod size is 3". Reduce clod size by discing, raking, tracking with a dozer, using a soil stabilizer, or other approved means.
- I. Engineered fill shall be compacted to a minimum dry density of 95 percent of the maximum dry density, and -2 to 2 percent of the optimum moisture content as measured using ASTM-D 698. The first lift is not be subjected to this compaction requirement.
- J. Moisture condition the fill material to achieve the compaction requirements of this Section. Use a water spraying system for wetting. During wetting or drying, regularly disc, rake, or otherwise mix the material to thoroughly blend the moisture throughout the lift. Use discing, raking, or other appropriate methods to dry the material as required.
- K. Replace and rework materials that become unsuitable or unstable as a result of work during inclement weather.
- L. Rework or remove and replace engineered fill that does not meet the compaction requirements of this Section.

3.10 SURVEY CONTROL

- A. Survey the limits and elevations of completed prepared subgrade and top of finished fill surface in accordance with Section 01100 - Remediation. The thickness of layers shall be verified to be within specified tolerances prior to placement of overlying layers. Thickness verification may be by survey, or by the placement of marker rods or posts on the top of the completed lift indicating the maximum lift thickness before placement of the loose soil materials, or by excavation of potholes to measure loose lift thickness following placement and before compaction.
- B. Provide As-Built drawings in accordance with Section 01100 - Remediation.

3.11 TOLERANCES

- A. Construct the finished surface of engineered fill and excavations slopes to a tolerance of +0.2% of the slopes indicated on the Project Drawings when measured at any point along a 50 feet straight-edge. These tolerances shall not result in slopes that are less than the minimum slopes required on the Project Drawings.

[END OF SECTION]

SECTION 02235

PROTECTIVE SOIL LAYER

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. The work covered in this Section consists of the placement of a Protective Soil Layer as part of the final cover system for the Sediment Consolidation Area (SCA). This layer shall be placed directly on the final cover geomembrane on gently sloped areas of the SCA and on the final cover geocomposite drainage layer placed over the final cover geomembrane on the side slopes of the SCA in accordance with the Project Specifications and Drawings. The Contractor shall furnish all labor, materials, equipment, supervision and incidentals necessary to perform the scope of work.

1.02 RELATED WORK

- A. Work in this section includes, but is not limited to:
1. Section 01030: Environmental Protection
 2. Section 01300: Submittal Procedures
 3. Section 01620: Health and Safety Requirements
 4. Section 02140: Construction Water Management
 5. Section 02270: Erosion & Sedimentation Control
 6. Section 02200: Earthwork
 7. Section 02740: Geomembrane
 8. Section 02735: Geocomposite Drainage Layer
 9. Section 02910: Vegetative Soil Layer

1.03 REFERENCES

- A. Latest version of American Society for Testing and Materials (ASTM) standards:
1. ASTM D 422 Standard Test Method for Particle Size Analysis of Soils.
 2. ASTM D 2487 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 3. ASTM D 698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600kN-m/m³)).
 4. ASTM D 2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

5. ASTM D 4318 Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
6. ASTM D 5321 Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.
7. ASTM D 2974 Standard Test Method for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
8. ASTM D 6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.04 SUBMITTALS

- A. The Contractor shall submit the following information to Engineer for review and approval in accordance with Section 01300 – Submittal Procedures and as elsewhere specified in this Section 30 days prior to initiating Protective Soil Layer activities:
 1. List of equipment proposed for the earthwork;
 2. Proposed offsite borrow source(s);
 3. Dust control equipment and procedures;
 4. Methods for cover soil placement compaction, grading, and stormwater control;
 5. Coordination of survey requirements for cover soil placement;
 6. Locations of on-site temporary soil stockpile areas;
 7. Coordination of construction activities with surface-water management and erosion and sediment control measures;
 8. Schedule for construction activities; and
 9. Quality Control Workplan.
- B. The Contractor shall be responsible for the adequacy and safety of the methods.
- C. Test results as specified herein shall be submitted to the Engineer for review within two (2) working days of receipt of results. The Contractor shall not deliver material to the site prior to submission and approval by the Engineer of the geotechnical and analytical chemistry test results.

1.05 CONSTRUCTION QUALITY CONTROL

- A. The Contractor shall submit a Quality Control (QC) Workplan for review. Once instituted, the Contractor shall use the QC Workplan to ensure that the Work performed under the contract meets the requirements of the Contract Documents.
- B. The Contractor shall submit the name of a qualified Independent Testing 1. Laboratory (ITL) to the Engineer for review.
 2. The Contractor shall submit to the Engineer for approval, the company name, address, and qualifications of the selected ITL proposed for use at

the project. Included in this submittal will be the names and qualifications of the individuals who are proposed for assignment to the site. The Engineer reserves the right to request other information regarding the qualifications of the ITL for use in the evaluation process.

C. Sampling

1. The Contractor shall be responsible for collecting samples and conducting tests using a qualified ITL to document material property compliance with the specifications.
2. The Contractor shall be responsible for collecting samples and conducting tests using a qualified ITL to certify and document that imported material meets the allowable analytical compound concentrations and properties specified in this Section. These samples will be collected and transported in compliance with the QC Workplan. The Engineer reserves the right to observe sampling and testing of the materials. The Contractor shall provide at least 24-hours notice of a sampling event to the Engineer.
3. Representative samples of each specific material type from each specific material source will be obtained by compositing at least five randomly selected individual samples of approximately equal weight. The total composite sample mass shall be at least the minimum size required to conduct all of the required material property and analytical chemistry tests for that material type. Each of the individual samples will be obtained from within the boundaries of the material mass that the composite sample represents. In addition, at least one (1) pound of each individual sample will be retained in a separate, sealed clean glass jar for mercury testing and for additional duplicate testing, if needed.
4. Contractor quality control samples may be obtained from in situ samples for pre-approval of a dedicated borrow source area. The sampling methodology and means for assuring the material dedication to the project shall be submitted to the Engineer for approval prior to the commencement of sampling.
5. Contractor quality control samples may also be obtained from dedicated stockpiles or storage/transportation vessels. The sampling methodology and means for assuring the material dedication to the project shall be submitted to the Engineer for approval prior to the commencement of sampling.

D. Sample Frequency

1. Each imported material type shall be tested at the following batch sizes:
 - a. For the first 25,000 cubic yards of each material type from a specific material source, a representative composite sample will be obtained from each 2,500 cubic yards (in-place volume) batch or part thereof.
 - b. If no unacceptable test results have been obtained on samples representing the first 25,000 cubic yards of each material type and the material continues to be from the same material source with

consistent appearance and source area or process, then the batch size can be increased to 5,000 cubic yards for the subsequent material deliveries.

- c. If no unacceptable test results have been obtained on samples representing the first 75,000 cubic yards of each material type and the material continues to be from the same material source with consistent appearance and source area or process, then the batch size can be increased to 10,000 cubic yards for the subsequent material deliveries.

E. Analytical Chemistry Testing

1. These samples will be sent to an Analytical Chemistry Testing Laboratory (ACTL) selected by the Engineer. Each composite sample for each material shall be tested for the compounds in Table 375-6.8(b) "Restricted Use Soil Cleanup Objectives" in NYSDEC Subpart 375. All test results shall be below the Commercial cleanup objective concentrations provided in this table. Failure of a single compound test result shall mean that the entire material batch will be rejected unless specifically accepted on a test-by-test basis in writing by the Engineer.
2. Each individual sample used to construct the composite sample shall be tested for total mercury. The result for all of the individual samples for a composite sample must be below the Commercial cleanup objective concentrations provided in Table 375-6.8(b) "Restricted Use Soil Cleanup Objective" in NYSDEC Subpart 375. Failure of a single individual sample in a batch shall mean that the entire batch will be rejected unless specifically accepted on a test-by-test basis in writing by the Engineer.

F. Material Property Testing

1. Each composite sample shall be tested for material properties as defined in the specific specification section or sub-section for that material type.

G. General

1. No imported materials shall be delivered to the project site before the required material property and analytical chemistry testing for that batch has been provided to the Engineer and written approval received from the Engineer. Unapproved material shall be removed from the site at the Contractor's expense.
2. Contractor shall be responsible for repairing or reconstructing the deficiencies at his own expense to meet this specification and other Contract Documents.

1.06 CONSTRUCTION QUALITY ASSURANCE

- A. The Engineer shall conduct quality assurance sampling on materials delivered to the site.

1. The Contractor shall provide access and support to the delivered materials in order for representative sampling and testing to be conducted.
2. The Engineer shall have the right to visit the borrow source at any time during borrow pit working hours to observe mining, manufacturing, stockpiling or loading operations.

PART 2 – PRODUCTS

2.01 MATERIAL FOR PROTECTIVE SOIL LAYER

- A. The Protective Soil Layer shall be free of any metals, roots, trees, stumps, concrete, construction debris, or any other organic matter or deleterious material.
- B. The Protective Soil Layer shall have a maximum particle size of 1 inch and shall not be gap graded.
- C. The Protective Soil Layer shall classify as SC, SM, or CL according to the Unified Soil Classification System (per ASTM D 2487) or combinations of these materials. Classification shall be based on the results of soil conformance tests.
- D. The Contractor shall perform the following tests, prior to the material being delivered on site, at the frequency specified in Section 1.05:
 1. Grain size (ASTM D422)
 2. Moisture (ASTM D2216)
 3. Standard Proctor (ASTM D1556)
 4. Atterberg Limits (ASTM D4318)
 5. Organic Content (ASTM D2974)
 6. Interface Direct Shear (ASTM D 5321) 1 test per source
- E. The Contractor shall perform a minimum of one round of the following tests per borrow source, prior to material being delivered to the site:
 1. Interface Direct Shear (ASTM D 5321)
- F. The Protective Soil Layer material shall meet the minimum required peak and residual internal/interface friction angles of this specification when tested as a layered sandwich representing the side slope cover system of the SCA (leveling layer, geomembrane, geocomposite drainage layer, and Protective Soil Layer) in accordance with ASTM D 5321.
- G. The quality control tests will be performed at each visual or textural change in source material, or as directed by the Engineer. Test results shall be submitted to the Engineer in accordance with Part 1.04.

- H. Construction water for moisture conditioning Protective Soil Layer material shall be obtained from an on-site water source approved by the Engineer.

2.02 EQUIPMENT

- A. Contractor shall furnish equipment to perform the scope of work described in this specification, including haul, place, spread, and compact the Protective Soil Layer.

PART 3 – EXECUTION

3.01 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Material not immediately used as protective soil shall be stockpiled in areas approved by Engineer.
- B. Stockpiled material shall be managed in accordance with the Contractor's procedures approved by Engineer.

3.02 MATERIAL PLACEMENT

- A. The Protective Soil Layer shall be placed directly on top of the previously placed geosynthetics as shown on the Drawings. The Protective Soil Layer shall be placed using a low ground-pressure dozer in accordance with the ground pressure requirements of this Section. Tracked equipment shall operate only over previously placed material.
- B. The Protective Soil Layer material shall be placed in a loose lift which results in an installed lift thickness of no less than 12 inches. Protective Soil Layer shall be compacted to a minimum dry density of 90 percent of the maximum dry density, and -3 to 3 percent of the optimum moisture content as measured using ASTM-D 698. The first lift is not be subjected to this compaction requirement.
- C. Contractor shall be responsible for protecting the Protective Soil Layer from being washed out during rain events until vegetation is established on the cover.
- D. The equipment used to spread and compact the Protective Soil Layer shall comply with the following:

Maximum Allowable Equipment Ground Pressure (psi)	Thickness of Protective Soil Layer/ granular drainage layer over Liner (in.)
<5	12
<10	18
<20	24
>20	36

3.03 DUST CONTROL

- A. Contractor shall provide and operate necessary equipment and personnel to maintain dust control during construction. Contractor is responsible for establishing the means and methods for dust control.
- B. Contractor shall implement dust control measures during periods of site construction activities. Areas to receive dust control measures include active work areas, site access roads, and other areas of the site with activities that may generate dust.

3.04 SURVEY CONTROL

- A. Survey the limits and elevations of completed prepared subgrade and top of finished fill surface in accordance with Section 01050 - Surveying. The thickness of layers shall be verified to be within specified tolerances prior to placement of overlying layers. Thickness verification may be by survey, or by the placement of marker rods or posts on the top of the completed lift indicating the maximum lift thickness before placement of the loose soil materials, or by excavation of potholes to measure loose lift thickness following placement and before compaction.
- B. Provide As-Built drawings in accordance with Section 01300 – Submittal Procedures.

3.05 TOLERANCES

- A. Construct the finished surface of Protective Soil Layer slopes to a tolerance of +0.2% of the slopes indicated on the Project Drawings when measured at any point along a 50 feet straight-edge. These tolerances shall not result in slopes that are less than the minimum slopes required on the Project Drawings.

[END OF SECTION]

Figure 1: Minimum Required Peak Interface/Internal Shear Strength Parameters for Cover System Components

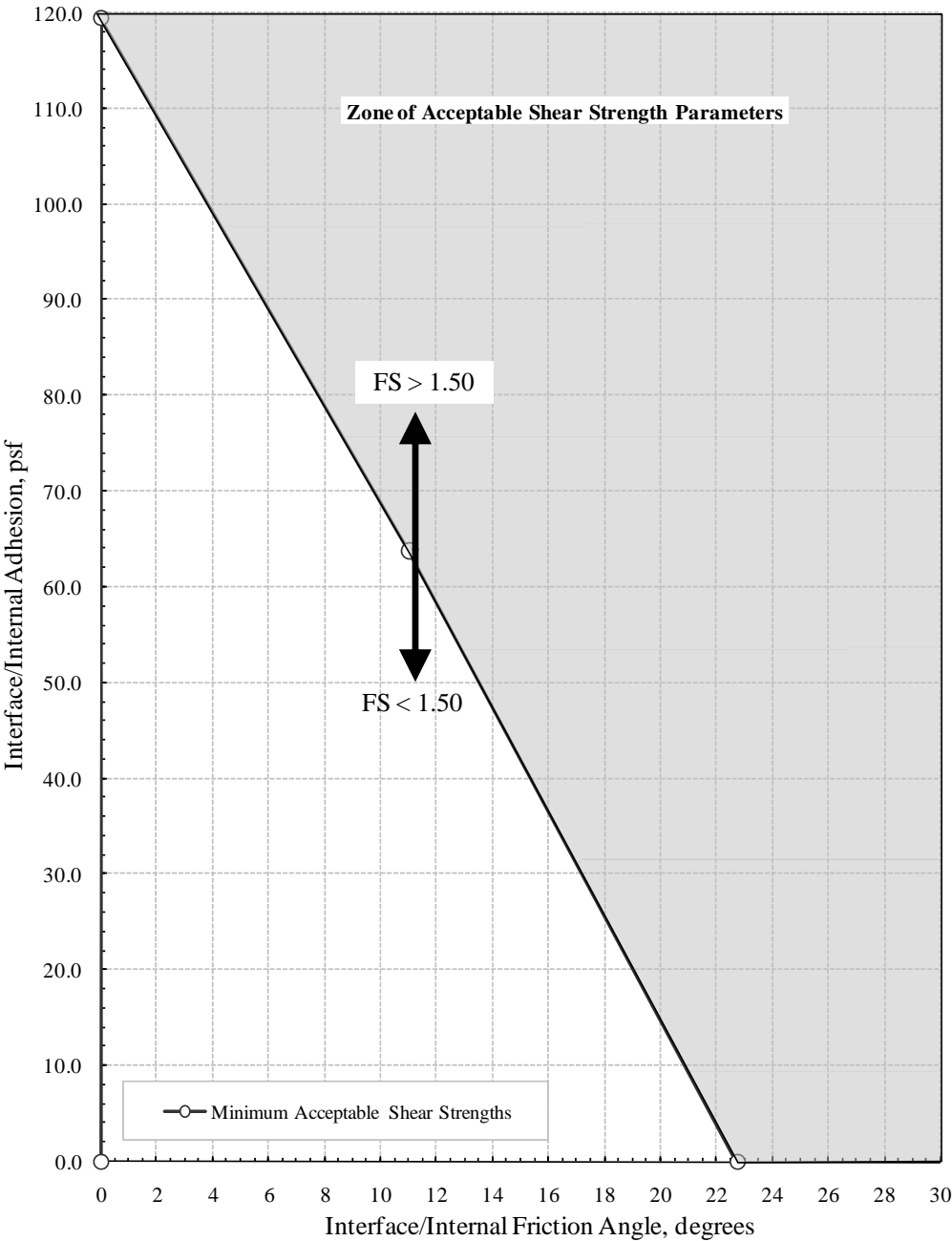
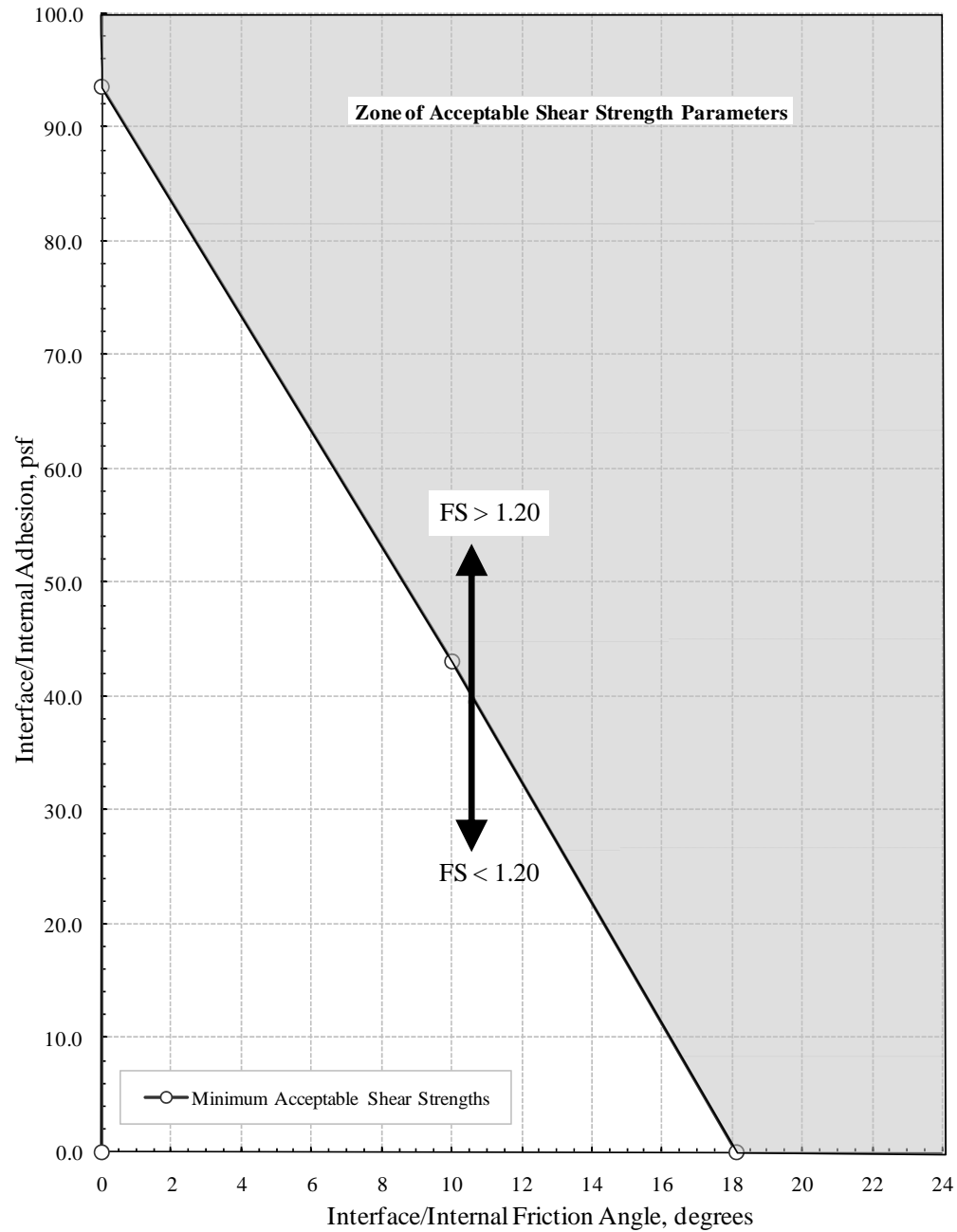


Figure 2: Minimum Required Residual Interface/Internal Shear Strength Parameters for Cover System Components



SECTION 02250

LOW PERMEABILITY SOIL LAYER

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. The work covered in this Section consists of the placement of a Low Permeability Soil Layer as part of the base liner system for the Sediment Consolidation Area (SCA) over the existing Solvay Waste in Wastebed 13. This layer shall be placed on prepared subgrade in accordance with the Project Specifications and Drawings. The Contractor shall furnish all labor, materials, equipment, supervision, and incidentals necessary to perform the scope of work.
- B. The Low Permeability Soil Layer is to be constructed out of uniform material to a minimum 12” thickness (minimum 18” in sump areas). The top six (6) inches of the Low Permeability Soil Layer shall have a hydraulic conductivity of no more than 1×10^{-6} cm/sec.

1.02 RELATED WORK

- A. Work in this section includes, but is not limited to:
 - 1. Section 01030 Environmental Protection
 - 2. Section 01300 Submittal Procedures
 - 3. Section 01620 Health and Safety Requirements
 - 4. Section 02100 Site Clearing
 - 5. Section 02140 Construction Water Management
 - 6. Section 02270 Erosion & Sedimentation Control
 - 7. Section 02200 Earthwork

1.03 REFERENCES

- A. Latest version of American Society for Testing and Materials (ASTM) Standards:
 - 1. ASTM D 422 Standard Test Method for Particle-Size Analysis of Soils.
 - 2. ASTM D 698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600kN-m/m³)).
 - 3. ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³))

4. ASTM D 1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
5. ASTM D 2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
6. ASTM D 2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
7. ASTM D 2937 Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
8. ASTM D 4318 Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
9. ASTM D 5084 Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
10. ASTM D 5321 Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.
11. ASTM D 2974 Standard Test Method for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
12. ASTM D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.04 SUBMITTALS

- A. The Contractor shall submit the following information to Engineer for review and approval in accordance with Section 01300 – Submittal Procedures and as elsewhere specified in this Section 30 calendar days prior to initiating Low Permeability Soil Layer activities.
 1. Mechanical mixing procedure and equipment to uniformly blend the borrow source soil used for the Low Permeability Soil Layer if needed;
 2. Equipment and methods for management of various stockpiles, including moisture conditioning and stabilization of stockpiles. Management of stockpiles shall also include methods to measure and monitor material stockpiles;
 3. Equipment and methods to load and haul processed material from the material stockpiles if needed;
 4. Equipment and methods to scarify, place, spread, and moisture condition Low Permeability Soil Layer material;
 5. Repair procedure for Low Permeability Soil Layer;
 6. Proposed offsite borrow source(s);
 7. Coordination of survey requirements for the earthwork;
 8. Locations of on-site temporary soil stockpile areas;
 9. Coordination of construction activities with surface-water management and erosion and sediment control measures; and
 10. Schedule for construction activities; and

11. Quality Control Work Plan.
 12. The Contractor shall be responsible for the adequacy and safety of the methods.
- B. Test results as specified herein shall be submitted to the Engineer for review within two (2) working days of receipt of results. The Contractor shall not deliver material to the site prior to submission and approval by the Engineer of the geotechnical and analytical chemistry test results.

1.05 CONSTRUCTION QUALITY CONTROL

- A. The Contractor shall submit a Quality Control (QC) Workplan for review. Once instituted, the Contractor shall use the QC Workplan to ensure that the Work performed under the contract meets the requirements of the Contract Documents.
- B. The Contractor shall submit the name of a qualified Independent Testing Laboratory (ITL) to the Engineer for review.
1. The Contractor shall submit to the Engineer for approval, the company name, address, and qualifications of the selected ITL proposed for use at the project. Included in this submittal will be the names and qualifications of the individuals who are proposed for assignment to the site. The Engineer reserves the right to request other information regarding the qualifications of the ITL for use in the evaluation process.
- C. Sampling
1. The Contractor shall be responsible for collecting samples and conducting tests using a qualified ITL to document material property compliance with the specifications.
 2. Representative samples of each specific material type from each specific material source will be obtained by compositing at least five randomly selected individual samples of approximately equal weight. The total composite sample mass shall be at least the minimum size required to conduct all of the required material property tests for that material type. Each of the individual samples will be obtained from within the boundaries of the material mass that the composite sample represents.
 3. Contractor quality control samples may be obtained from in situ samples for pre-approval of a dedicated borrow source area. The sampling methodology and means for assuring the material dedication to the project shall be submitted to the Engineer for approval prior to the commencement of sampling.
 4. Contractor quality control samples may also be obtained from dedicated stockpiles or storage/transportation vessels. The sampling methodology and means for assuring the material dedication to the project shall be

submitted to the Engineer for approval prior to the commencement of sampling.

D. Sample Frequency

1. Each imported material type shall be tested at the following batch sizes:
 - a. For the first 25,000 cubic yards of each material type from a specific material source, a representative composite sample will be obtained from each 2,500 cubic yards (in-place volume) batch or part thereof.
 - b. If no unacceptable test results have been obtained on samples representing the first 25,000 cubic yards of each material type and the material continues to be from the same material source with consistent appearance and source area or process, then the batch size can be increased to 5,000 cubic yards for the subsequent material deliveries.
 - c. If no unacceptable test results have been obtained on samples representing the first 75,000 cubic yards of each material type and the material continues to be from the same material source with consistent appearance and source area or process, then the batch size can be increased to 10,000 cubic yards for the subsequent material deliveries.

E. Material Property Testing

1. Each composite sample shall be tested for material properties as defined in the section 2.01.E

F. General

1. No imported materials shall be delivered to the project site before the required material property testing for that batch has been provided to the Engineer and written approval received from the Engineer. Unapproved material shall be removed from the site at the Contractor's expense.
2. Contractor shall be responsible for repairing or reconstructing the deficiencies at his own expense to meet this specification and other Contract Documents.

1.06 CONSTRUCTION QUALITY ASSURANCE

- A. The Engineer shall conduct quality assurance sampling and field compaction testing on Low Permeability Soil Layer materials.
1. The Contactor shall provide access and support for the sampling and testing.
 2. The Engineer shall have the right to visit the borrow source at any time during borrow pit working hours to observe mining, manufacturing, stockpiling or loading operations.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Material for the Low Permeability Soil Layer shall be obtained from off-site borrow areas. The borrow sources and blending and processing procedures, as needed, will be established in accordance with this Section. The Contractor shall not add any additives to meet the hydraulic conductivity requirements of this Section without performing additional laboratory testing of a sample of amended soil as required by the Engineer and subject to approval by the Government Agencies. Segregate and stockpile non-conforming soils, as needed. Process only those materials as needed and identified through pre-conformance testing as meeting the material requirements of this Section.
- B. Soils not meeting the requirements of this Section shall be considered for use for other construction in accordance with the requirements of Section 02200-Earthwork.
- C. Low Permeability Soil Layer material shall meet the following requirements:
 - 1. Meet the following particle size requirements (ASTM D 422):
 - a. the Low Permeability Soil Layer shall have 100 percent of the particles having a maximum dimension not greater than one (1) inch; and
 - b. the Low Permeability Soil Layer shall have not less than 50 percent of the particles, by weight, passing through the standard U.S. No.200 standard sieve.
 - c. the Low Permeability Soil Layer shall classify as SC, SM, ML, or CL according to the Unified Soil Classification System (per ASTM D 2487) or combinations of these materials.
 - 2. The Low Permeability Soil Layer material shall have a hydraulic conductivity not more than 1×10^{-6} cm/s when tested in the laboratory in accordance with ASTM D 5084 at a confining pressure of 3000 psf and a hydraulic gradient less the 30.
- D. The Low Permeability Soil Layer material shall meet the minimum required peak and residual internal/interface friction angles when tested as a layered sandwich representing the liner system of the SCA (low permeability soil, geomembrane, geotextile, and gravel drainage layer) in accordance with ASTM D 5321.
- E. The Contractor shall perform the following tests, prior to material being delivered to the site, at the frequency specified in Section 1.05:
 - 1. Grain size (ASTM D422)
 - 2. Moisture (ASTM D2216)
 - 3. Standard Proctor (ASTM D1556)

4. Atterberg Limits (ASTM D4318)
 6. Organic Content (ASTM D2974)
 7. Hydraulic Conductivity (ASTM D 5084) test methods:
 8. Modified Proctor (ASTM D 1557)
 9. Standard Proctor (ASTM D 698)
 10. A reduced effort based on Standard Proctor (ASTM D 698) with 15 blows per layer instead of 25.
 - a. The samples shall be prepared at optimum moisture content determined for that test method, 3 percent above optimum moisture content, and 3 percent below optimum moisture content. The reduced effort samples shall be prepared based on ASTM D 698 optimum moisture content.
 - b. Test these samples for hydraulic conductivity using ASTM D 5084 at a confining pressure of 3,000 psf and a hydraulic gradient less than 30.
 - c. The material shall have a hydraulic conductivity of 1×10^{-6} cm/sec or less in at least 4 of these prepared samples to be acceptable for use as Low Permeability Soil Layer material. The range of dry densities and moisture contents defining the APZ shall be based on this laboratory testing and shall be subject to approval by the Engineer. The APZ shall include the requirement for compacting to a minimum dry density of 95 percent of the maximum dry density, as measured using ASTM-D 698.
- F. The Contractor shall perform a minimum of one round of the following tests per borrow source, prior to material being delivered to the site:
1. Interface Direct Shear (ASTM D 5321)
 2. Certification and test results certifying that the material meets Table 375-6.8(b) "Restricted Use Oil Cleanup Objectives" in NYSDEC Subpart 375. All test results shall be below the Commercial cleanup objective concentrations provided in this table.
- G. These control tests will be performed at each visual or textural change in source material, or as directed by the Engineer. Test results shall be submitted to the Engineer in accordance with Part 1.04.
- H. Construction water for moisture conditioning Low Permeability Soil Layer material shall be obtained from an on-site water source approved by the Engineer.

2.02 EQUIPMENT

- A. The Contractor shall provide equipment required to obtain soil samples for pre-conformance testing, process, stockpile, and load soil for the borrow area and stockpile as specified in this Section and indicated on the Project Drawings.

- B. The Contractor shall provide equipment to haul and place Low Permeability Soil Layer material in uniform loose lift thicknesses as specified in this Section.
- C. The Contractor shall provide tank trucks, hoses, sprinkles, soil stabilizers, or other equipment designated to apply water uniformly and in controlled quantities to moisture condition Low Permeability Soil Layer material and to reduce drying to soil surfaces.
- D. The Contractor shall provide equipment to compact soil lifts to the moisture content, dry density, and hydraulic conductivities specified in this Section.
- E. The Contractor shall provide grading equipment to achieve uniform layers, sections, and smoothness of grade for compaction and drainage.

PART 3 – EXECUTION

3.01 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. The soil stockpile area shall be managed as approved by the Engineer.

3.02 LOW PERMEABILITY SOIL LAYER PERFORMANCE CRITERIA

- A. The Low Permeability Soil Layer is to be constructed out of uniform material to a minimum 12” thickness (minimum 18” in sump areas). The top six (6) inches of the Low Permeability Soil Layer shall have a hydraulic conductivity of no more than 1×10^{-6} cm/sec and have dry density and moisture content combinations within the APZ. All other parts of the Low Permeability Soil Layer shall be compacted to a minimum dry density of 90 percent of the maximum dry density, and -3 to 3 percent of the optimum moisture content as measured using ASTM-D 698. The first lift shall not be subjected to the above requirements.
- B. The Low Permeability Soil Layer material shall meet the minimum required peak and residual internal/interface friction angles when tested as a layered sandwich representing the liner system of the SCA (low permeability soil, geomembrane, geotextile, and gravel drainage layer) in accordance with ASTM D 5321.
- C. If conformance tests indicate that any portion of the compacted Low Permeability Soil does not meet the requirements of this Section, the Engineer shall delineate the extent of the non-conforming area. The Contractor shall rework the non-conforming area until acceptable test results are obtained.

3.03 MATERIAL PLACEMENT

- A. The Contractor shall place the Low Permeability Soil Layer material only after completion of conformance testing and written confirmation of acceptance of Low Permeability Soil Layer material by the Engineer.

- B. Prior to placement of Low Permeability Soil Layer material, clear the surface on which the Low Permeability Soil Layer material is to be placed so that the surface is free of debris, mud and other deleterious material.
- C. Prepare surface of underlying subgrade and survey in accordance with Section 1.07 prior to scarification.
- D. Construct Low Permeability Soil Layer to the minimum thicknesses and slopes shown on the Project Drawings. The thickness of the Low Permeability Soil Layer at any location shall be perpendicular to the plane of the slope at that location.
- E. Remove visible rock particles with a maximum dimension larger than one (1) inch for the Low Permeability Soil Layer material during placement, spreading, stabilizing, compaction, grading, and sealing. Place rock particles removed from the Low Permeability Soil Layer material in a stockpile in an area approved by the Engineer.
- F. In areas where compaction is to be performed, place the Low Permeability Soil Layer material in loose lifts with a thickness of $8'' \pm 2''$. In areas where compaction is to be performed using hand-operated equipment, place the Low Permeability Soil Layer material in loose lifts with a loose lift thickness of $4'' \pm 1''$. Loose lift thicknesses shall be measured after spreading. The first lift shall be placed with a loose lift thickness of $12'' \pm 2''$.
- G. Do not place a succeeding lift of Low Permeability Soil Layer material over any area until the conformance testing by the Engineer of the compacted lift in the area is approved and complete.
- H. Prior to compacting a succeeding lift of material over a previous lift, scarify the previous lift to a depth of 2". Moisture condition the succeeding lift in accordance to this Section. Scarify each preceding lift prior to placing the next lift by using a disc, tracking back and forth with a bulldozer, or a combination of both.
- I. Limit the trafficking of scarified surfaces by trucks or other equipment, except stabilizer, moisture conditioning, and compaction equipment.
- J. Moisture condition the loose lift of Low Permeability Soil Layer material prior to compaction if necessary. Distribute the moisture through the loose lift using soil stabilizer or other approved equipment. Moisture condition, if necessary, as follows:
 - 1. If the Low Permeability Soil Layer material is drier than required, process the material using the procedure established in this Section to obtain a uniform consistency, distribute water uniformly into the soil to achieve the required moisture content, and then process the material again to obtain uniform mixing. The Contractor shall check the moisture content of the

soil at the completion of these three steps and/or after compaction. Repeat the latter two steps if the measured moisture content is not within the acceptable range specified in this Section.

2. If the Low Permeability Soil Layer material is wetter than required, dry the material by processing using the procedure established in this Section. The Contractor shall check the moisture content of the soil at the completion of processing or compaction. Repeat the processing if the measured moisture content is not within the acceptable range specified in this Section.
 3. After moisture conditioning, remove visible rock particles with a maximum dimension larger than one (1) inch for the Low Permeability Soil Layer.
- K. Prepare the last lift of the layer to meet the minimum thicknesses and slopes indicated on the Project Drawings. Meet the construction tolerance requirements specified in this Section.

3.04 MATERIAL COMPACTION

- A. Compact loose lifts using appropriate number of passes, and equipment, and equipment overlap to achieve the performance criteria specified in this Section.
- B. Maintain surface of Low Permeability Soil Layer material in moist condition to avoid crusting and desiccation. In the event crusting and desiccation occurs, protect the compacted Low Permeability Soil Layer in accordance to this Section.
- C. Prepare the finished compacted Low Permeability Soil Layer surface to be acceptable for placement of the geomembrane layer.

3.05 PERFORATION

- A. Backfill perforations in the Low Permeability Soil Layer resulting from survey stakes or other activities as specified in this Section. Perforations resulting from sand-cone or drive cylinder density tests shall be filled by the Contractor.
- B. Prepare soil-calcium bentonite mix for use in backfilling of perforations as specified in this Section. The mix shall consist of a minimum of 10 percent by weight calcium bentonite granules mixed with Low Permeability Soil Layer material by dry weight basis.
- C. Backfill perforations with soil-calcium bentonite mix. Place soil-calcium bentonite mix in perforations in approximately 3" thick loose lifts and rod tamp to compact.
- D. Perforations in the compacted Low Permeability Soil Layer resulting from density testing shall be backfilled with calcium bentonite powder or granules or

the soil-calcium bentonite mix furnished by the Contractor and compacted by hand tamping,

3.06 PROTECTION OF WORK

- A. Avoid crusting and desiccation cracking of compacted Low Permeability Soil Layer. Regularly moisture condition the surface of the compacted Low Permeability Soil. If cracks wider than the thickness of a 10 cent piece are observed, moisture condition and recompact the surface. Seal roll the surface of the Low Permeability Soil Layer to reduce evaporation, or alternatively protect exposed surfaces using light-colored or translucent membranes, that will inhibit drying.
- B. Repair areas of crusting or desiccation cracks deeper than 2". Scarify the surface of such areas to a depth of 2" or to the depth of the desiccation cracks, whichever is greater, and then moisture condition, process, and recompact the area in accordance with the requirements of this Section.
- C. Using the specified equipment, the Contractor shall coordinate sealing of the compacted Low Permeability Soil Layer surface at the end of every working day and when precipitation is forecast.
- D. Compacted Low Permeability Soil Layer may be protected using tarping, Polyvinyl Chloride (PVC) geomembrane, or other means selected by the Contractor, to shed rainfall runoff during periods of extended rain.
- E. If the compacted Low Permeability Soil Layer surface cannot be maintained in a moist condition to prevent desiccation, a soil protection layer shall be placed over the compacted Low Permeability Soil Layer if construction of overlying layers or lifts is to be delayed by more than 10 calendar days. Compact the soil protection layer by tracking with a bulldozer. The loose thickness of the soil protection layer shall be $4'' \pm 1''$. The soil protection layer can also be used to protect Low Permeability Soil Layer against excessive rainfall.
- F. Remove the compacted soil protection layer prior to placement of overlying lifts. The soil protection layer may be removed in panels or areas in coordination with ongoing construction. Where the soil protection layer is removed, prepare the surface to receive an overlying lift as required by this Section.
- G. Synthetic sealants or other chemical treatments to the compacted Low Permeability Soil Layer material shall not be applied.

3.07 SURVEY CONTROL

- A. The Contractor shall provide as-built documentation for the top surface and bottom surface of the Low Permeability Soil Layer. In addition, Contractor shall also provide thickness measurements or calculations for the Low

Permeability Soil Layer as it is being constructed. These thickness values measured or calculated during construction are less likely to be affected by the settlement of the soft foundation material than the elevation measurements of the top of the Low Permeability Soil Layer taken after the construction. Therefore, the thickness measurements or calculations performed during construction shall be used to verify that the minimum thickness requirements are met. The elevation measurements of the top of the Low Permeability Soil Layer taken after the construction shall be used to verify general conformance with base slopes to meet positive drainage requirements. The elevation measurements shall be performed at a maximum spacing of 50 ft by 50 ft. The thickness measurements or calculations shall be performed at a maximum spacing of 100 ft by 100 ft.

- B. Provide survey information for Engineer to confirm the thicknesses and grades of complete areas. A maximum of 3 working days shall be allowed for the Engineer to confirm and accept the survey results.

3.08 TOLERANCES

- A. Construct the Low Permeability Soil Layer to within minus 0 to plus 2" of the thicknesses shown on the Project Drawings.
- B. Construct the finished surface of Low Permeability Soil Layer slopes to a tolerance of +0.2% of the slopes indicated on the Project Drawings when measured at any point along a 50 feet straight-edge. These tolerances shall not result in slopes that are less than the minimum slopes required on the Project Drawings.
- C. Provide survey information for Engineer to confirm the thicknesses and slopes of complete areas 3 working days prior to the start of the covering layers.

[END OF SECTION]

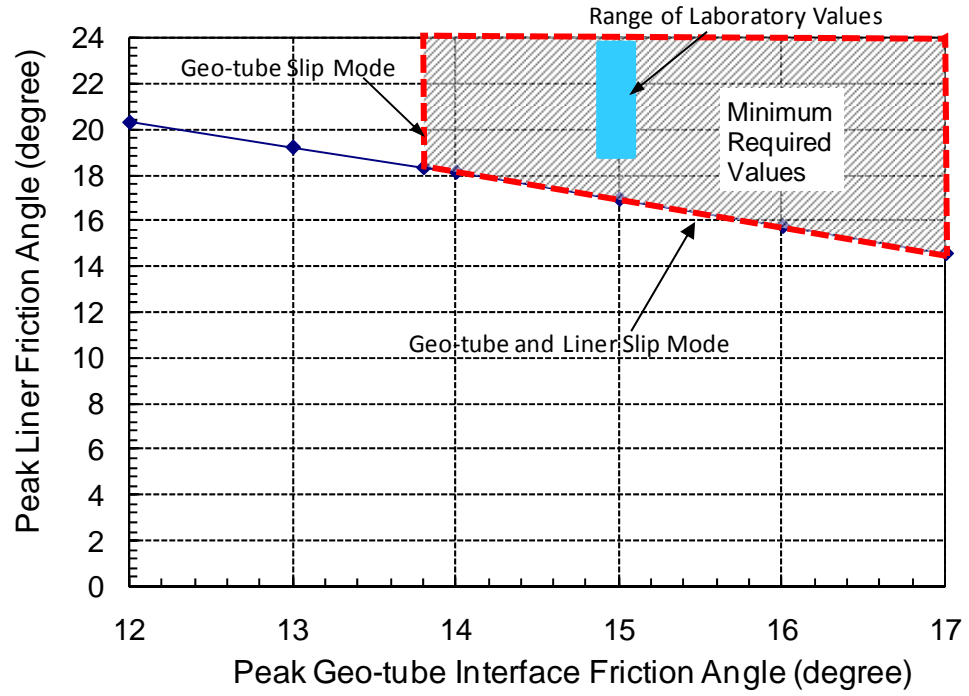


Figure No. 1. Minimum Required Peak Interface/Internal Friction Angles

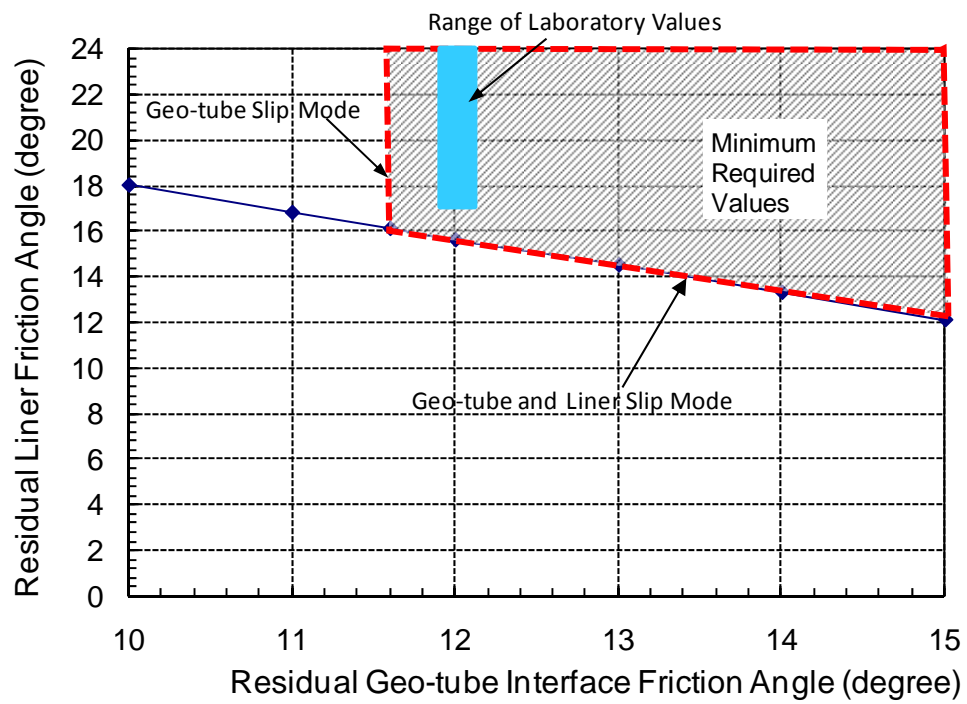


Figure No. 2. Minimum Required Residual Interface/Internal Friction Angles

SECTION 02300

GRAVEL DRAINAGE LAYER

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. The work covered in this Section consists of furnishing and placing the layer of granular material within the liner system, which is part of the Sediment Consolidation Area (SCA). The granular material is placed on top of the geotextile cushion in accordance with the Project Specifications and Drawings and in conformity with the lines, grades, thicknesses, and typical cross-sections shown on the plans or established by the Engineer.

1.02 RELATED WORK

- A. Work in this section includes, but is not limited to:
 - 1. Section 01030 Environmental Protection
 - 2. Section 01300 Submittal Procedures
 - 3. Section 01620 Health and Safety Requirements
 - 4. Section 02100 Site Clearing
 - 5. Section 02140 Construction Water Management
 - 6. Section 02270 Erosion & Sedimentation Control
 - 7. Section 02931 Topsoil, Seeding and Vegetation
 - 8. Section 02200 Earthwork
 - 9. Section 02250 Low Permeability Soil Layer

1.03 REFERENCES

- A. Latest version of American Society for Testing and Materials (ASTM) Standards:
 - 1. ASTM C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D 75 Standard Practice for Sampling Aggregates
 - 3. ASTM D 2434 Standard Test Method for Permeability of Granular Soils (Constant Head).
 - 4. ASTM D 2487 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - 5. ASTM D 3042 Standard Test Method for Insoluble Residue in Carbonate Aggregate.

1.04 SUBMITTALS

- A. The Contractor shall submit the following information to Engineer for review and approval in accordance with Section 01300 – Submittal Procedures and as elsewhere specified in this Section 30 calendar days prior to initiating Gravel Drainage Layer activities.
 - 1. Handling and stockpiling methods to minimize particle segregation;
 - 2. Equipment and methods for management of various stockpiles. Management of stockpiles shall also include methods to measure and monitor material stockpiles;
 - 3. Equipment and methods to load and haul material from the material stockpiles;
 - 4. Equipment and methods to place the material;
 - 5. Repair procedures;
 - 6. Proposed offsite borrow source(s);
 - 7. Coordination of survey requirements for the work;
 - 8. Locations of on-site temporary soil stockpile areas;
 - 9. Coordination of construction activities with surface-water management and erosion and sediment control measures;
 - 10. Schedule for construction activities; and
 - 11. Quality Control Work Plan
- B. The Contractor shall be responsible for the adequacy and safety of the methods.
- C. Test results as specified herein shall be submitted to the Engineer for review within two (2) working days of receipt of results. The Contractor shall not deliver material to the site prior to submission and approval by the Engineer of the geotechnical and analytical chemistry test results.

1.05 CONSTRUCTION QUALITY CONTROL

- A. The Contractor shall submit a Quality Control (QC) Workplan for review. Once instituted, the Contractor shall use the QC Workplan to ensure that the Work performed under the contract meets the requirements of the Contract Documents.
- B. The Contractor shall submit the name of a qualified Independent Testing Laboratory (ITL) to the Engineer for review.
 - 1. The Contractor shall submit to the Engineer for approval, the company name, address and qualifications of the selected ITL proposed for use at the project. Included in this submittal will be the names and qualifications of the individuals who are proposed for assignment to the site. The Engineer reserves the right to request other information regarding the qualifications of the ITL for use in the evaluation process.

C. Sampling

1. The Contractor shall be responsible for collecting samples and conducting tests using a qualified ITL to document material property compliance with the specifications.
2. Representative samples of each specific material type from each specific material source will be obtained by compositing at least five randomly selected individual samples of approximately equal weight. The total composite sample mass shall be at least the minimum size required to conduct all of the required material property tests for that material type. Each of the individual samples will be obtained from within the boundaries of the material mass that the composite sample represents.
3. Contractor quality control samples may be obtained from in situ samples for pre-approval of a dedicated borrow source area. The sampling methodology and means for assuring the material dedication to the project shall be submitted to the Engineer for approval prior to the commencement of sampling.
4. Contractor quality control samples may also be obtained from dedicated stockpiles or storage/transportation vessels. The sampling methodology and means for assuring the material dedication to the project shall be submitted to the Engineer for approval prior to the commencement of sampling.

D. Sample Frequency

1. Each imported material type shall be tested at the following batch sizes:
 - a. For the first 25,000 cubic yards of each material type from a specific material source, a representative composite sample will be obtained from each 2,500 cubic yards (in-place volume) batch or part thereof.
 - b. If no unacceptable test results have been obtained on samples representing the first 25,000 cubic yards of each material type and the material continues to be from the same material source with consistent appearance and source area or process, then the batch size can be increased to 5,000 cubic yards for the subsequent material deliveries.
 - c. If no unacceptable test results have been obtained on samples representing the first 75,000 cubic yards of each material type and the material continues to be from the same material source with consistent appearance and source area or process, then the batch size can be increased to 10,000 cubic yards for the subsequent material deliveries.

E. Material Property Testing

1. Each composite sample shall be tested for material properties as defined in the section 2.01.E

F. General

1. No imported materials shall be delivered to the project site before the required material property testing for that batch has been provided to the Engineer and written approval received from the Engineer. Unapproved material shall be removed from the site at the Contractor's expense.
2. Contractor shall be responsible for repairing or reconstructing the deficiencies at his own expense to meet this specification and other Contract Documents.

1.06 CONSTRUCTION QUALITY ASSURANCE

- A. The Engineer shall conduct quality assurance sampling on Gravel Drainage Layer materials.
1. The Contractor shall provide access and support for the sampling and testing.
 2. The Engineer shall have the right to visit the borrow source at any time during borrow pit working hours to observe mining, manufacturing, stockpiling or loading operations.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. The drainage layer material shall be reasonably free of thin, flat, or elongated pieces, shall contain no organic matter, or soft friable particles, and shall not contain visible asbestos or hydrocarbons.
- B. Drainage layer material shall be classified as GW or GP in accordance with the Unified Soil Classification System (USCS) per ASTM D 2487 and shall have 100% passing the 3" sieve, less than 5% passing the #4 sieve, and less than 3% passing the #200 sieve. Alternate gravel gradations may be allowed based on approval of the Design Engineer.
- C. Drainage layer material shall have a minimum hydraulic conductivity of 10 centimeters per second (cm/s) based on laboratory permeability testing conducted in accordance with ASTM D 2434.
- D. The required gradation shall be obtained by screening or blending processes as may be necessary. Crushing may be allowed based on approval by the Engineer.
- E. The Contractor shall perform the following tests, prior to material being delivered to the site, at the frequency specified in Section 1.05:
1. Grain size (ASTM C 136)
 2. Hydraulic Conductivity (ASTM D 2434)

- F. The Contractor shall perform a minimum of one round of the following tests per borrow source, prior to material being delivered to the site:
 - 1. Certification and test results certifying that the material meets Table 375-6.8(b) "Restricted Use Oil Cleanup Objectives" in NYSDEC Subpart 375. All test results shall be below the Commercial cleanup objective concentrations provided in this table.
- G. These control tests will be performed at each visual or textural change in source material, or as directed by the Engineer. Test results shall be submitted to the Engineer in accordance with Part 1.04.

2.02 EQUIPMENT

- A. Furnish equipment to haul, place, spread, and compact drainage layer materials.
- B. Low ground pressure equipment shall be used to place, spread and compact drainage layer materials, as approved by the Engineer. Areas such as access roads that may have truck traffic shall have at least 24 inches of gravel thickness before such traffic can be allowed.

PART 3 – EXECUTION

3.01 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Drainage layer material delivered to the site may be stockpiled in areas designated on the Project Drawings or other areas approved by the Engineer.
- B. Stockpiled drainage material shall be managed and controlled to prevent mixing with other materials in accordance with the Contractor's procedures.

3.02 MATERIAL PLACEMENT

- A. The drainage layer materials shall not be placed until Engineer has reviewed and approved the initial source certifications, required test data for material stockpiled at the site, and required test data and submittals, including survey information, for the underlying soil layer.
- B. Place the drainage layer material directly on top of the underlying geotextile layer, as shown on the Project Drawings and then carefully spread using equipment and procedures that will not cause damage or rutting to the underlying geotextile. The Gravel Drainage Layer thicknesses at each location shall be in accordance with the Project Drawings and shall not be less than 12 inches at any location. Areas such as access roads that may have truck traffic shall have at least 24 inches of gravel thickness before such traffic can be allowed.

- C. The drainage layer material shall be delivered as a uniform mixture and shall be placed to limit segregation of materials and the formation of pockets of coarse and fine materials. Placement of the materials in windrows or layers shall be done to limit the distance that the drainage layer materials must be spread to achieve the required thickness.
- D. Drainage layer materials shall not be hauled directly on the underlying layers.
- E. Spread the drainage layer material over the underlying geotextile by pushing the material forward to cascade rather than be shoved across the underlying layer.
- F. Drainage layer material shall be placed in loose lift thicknesses of one foot or greater to the lines, thicknesses and grades shown on the drawings and as approved by Engineer. The thickness of the Drainage Layer at any location shall be measured perpendicular to the plane of the slope at each location. Due to the compressible nature of the foundation, a strict conformance with the design elevations is not required. Gravel Drainage Layer material can be used to locally adjust the slopes to improve stability during filling of geo-tubes as needed.
- G. Drainage layer material placement should be placed in coordination with the Engineer.

3.03 SURVEY CONTROL

- A. Contractor shall provide as-built documentation for the top surface of the Gravel Drainage Layer. In addition, Contractor shall also provide thickness measurements or calculations for the Gravel Drainage Layer as it is being constructed. These thickness values measured or calculated during construction are less likely to be affected by the settlement of the soft foundation material than the elevation measurements of the top of the Gravel Drainage Layer taken after the construction. Therefore, the thickness measurements or calculations performed during construction shall be used to verify that the minimum thickness requirements are met. The elevation measurements of the top of the Gravel Drainage Layer taken after the construction shall be used to verify general conformance with base slopes. The elevation measurements shall be performed at a maximum spacing of 50 feet. The thickness measurements or calculations shall be performed at a maximum spacing of 100 feet.
- B. Provide survey information for Engineer to confirm the thicknesses and grades of complete areas. A maximum of 3 working days shall be allowed for the Engineer to confirm and accept the survey results.

3.04 TOLERANCES

- A. Construct the finished surface of the Gravel Drainage Layer slopes to a tolerance of $\pm 0.2\%$ of the slopes indicated on the Project Drawings when measured at any point along a 50 feet straight-edge.

- B. Tolerance requirement may be waived by the Engineer to achieve grades in a manner to facilitate placement of geotextile tubes.

[END OF SECTION]

SECTION 02370

EROSION CONTROL

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. The Work specified in this Section consists of the labor, equipment, tools, materials, and services needed to provide and maintain erosion control measures prior to and throughout construction as described herein, and shown on the Contract Drawings. Work in this Section includes, but is not limited to:
1. Preparation of a Contractor's Storm Water Pollution Prevention Plan (SWPPP).
 2. Coordination with the Engineer regarding USEPA and NYSDEC requests pertaining to erosion and sedimentation control.
 3. Installation and maintenance of temporary and permanent sedimentation and erosion control measures.
 4. Control of erosion from stockpiles.
 5. Inspection of erosion control measures during and after rainfall.
 6. Repair of failed sedimentation and erosion control measures.
 7. Removal and disposal of sediment deposits in a manner that does not result in additional erosion or pollution.
 8. Removal of temporary erosion control measures once construction and permanent stabilization is complete.

1.02 RELATED WORK

- A. Work in this section includes, but is not limited to:
1. Section 01030 Environmental Protection;
 2. Section 01300 Submittal Procedures;
 3. Section 01620 Safety, Health, and Emergency Response;
 4. Section 02140 Construction Water Management;
 5. Section 02200 Earthwork;
 6. Section 02250 Low Permeability Soil Layer;
 7. Section 02300 Gravel Drainage Layer;
 8. Section 02235 Protective Soil Layer; and
 9. Section 02910 Vegetative Soil Layer.

1.03 REFERENCES

- A. New York Department of Transportation. Standard Specifications (US Customary), 2009.

- B. New York State Standards and Specifications for Erosion and Sediment Control, (Latest Version).

1.04 SUBMITTALS

- A. The Contractor shall submit the following in accordance with Section 01300 – Submittal Procedures and as elsewhere specified in this Section:
 - 1. Product Data - Provide product data for each component to be used in erosion and sediment control prior to their delivery and implementation at the Site.
 - 2. Methods - Provide a Contractor's SWPPP with a description of and illustration showing anticipated stormwater control and erosion control measures to be implemented during construction. This shall be submitted prior to mobilization to the Site.

1.05 PROJECT AND SITE CONDITIONS

- A. The Contractor shall carefully examine the site to determine the full extent, nature, and location of work required to conform to the Contract Drawings and Specifications. The Contractor shall bring any inaccuracies or discrepancies between the Contract Drawings and Specifications to the Engineer's attention in order to clarify the exact nature of the Work to be performed.

1.06 SCHEDULE

- A. Taking into account specific constraints or other criteria outlined herein, the Contractor shall prepare and incorporate a schedule into the overall construction schedule, which sets forth the program of operations to effectively control erosion and sediment runoff. The schedule shall be arranged to include:
 - 1. Chronological completion dates for temporary and permanent measures for controlling erosion and sediment.
 - 2. Location, type, and purpose for each temporary measure to be undertaken.
 - 3. Dates when those temporary measures will be removed.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Haybales/Strawbales and Stakes shall meet the requirements of *NYSDOT 209-2.04 Haybale/Strawbale*.
- B. Silt Fences shall meet the requirements of *NYSDOT 209-2.08 Silt Fence*.
- C. Sand bags shall meet the requirements of *NYSDOT 209.2.10 Sand Bag*.

- E. Stone Filling shall meet the requirements of *NYSDOT 620-2.02 – Stone Filling Light*.
- F. Temporary or Permanent Rolled Erosion Control Products shall meet the requirements of *NYSDOT 713-07 Rolled Erosion Control Products and Soil Stabilizers* and shall meet the Type and Class shown on the Contract Drawings for that location.
- G. Oil Sorbents.
 - 1. Booms – New Pig Spaghetti Boom or equal shall be used.
 - 2. Socks – New Pig Skimmer Socks or equal shall be used.

2.02 METHODS

- A. Sediment Barriers - Sediment barriers shall be haybales/strawbales, stone, silt fences, ecoberms, or other approved materials that will prevent migration of silts and sediment to receiving waters.
- B. Temporary and Permanent Diversion Ditches – Permanent diversion ditches shall be installed as shown on the Contract Drawings. Temporary diversion ditches shall be installed by the Contractor to control surface water and minimize construction water. In both cases, erosion control products shall be installed within the ditches to minimize soil erosion.
- C. Oil Sorbent Booms/Socks - Oil sorbent booms/socks shall be installed to contain oil sheens emanating from waste materials. The Contractor shall maintain a supply of clean oil sorbent booms/socks on-site at all times and install within one hour after discovery of a sheen.
- D. Slope Protection – Rolled erosion control products shall be installed as required by the Contractor's SWPPP, and shall be installed per the procedures in *NYSDOT 209.3.12*.

PART 3 – EXECUTION

3.01 PERFORMANCE REQUIREMENTS

- A. The Contractor shall comply with all applicable Federal, State, and Local codes, ordinances, regulations, statutes and standards.
- B. Observe government policy established by United States Environmental Protection Agency (USEPA).
- C. Conform to all erosion and sedimentation control policies and procedures established by the State of New York.

- D. Erosion control within the berms of Wastebed (WB) 13 is not required since there is no surface runoff from WB 13. Work outside the WB 13 dikes will require erosion control.
- E. Install temporary erosion and sediment control measures as one of the first steps of site preparation, before any clearing and grubbing or earthwork occurs. Temporary erosion and sediment control measures shall be maintained throughout the construction, and shall not be removed until permanent cover is completely established and stabilized, with no visible unstable rills or erosion, subject to the approval of the Engineer.
- F. Temporary erosion and sediment control measures are a dynamic project element. The Contractor shall install, maintain, and modify control measures as required by changing remedial construction needs over time.
- G. The Contractor shall plan and execute the Work to minimize routing of storm or flood water over disturbed areas in order to minimize erosion and sedimentation to the extent practicable. Similarly, the control measures shall minimize, to the extent practicable, the flow of stormwater over ground such that rills or unplanned ditches are not formed.

3.02 GENERAL REQUIREMENTS

- A. It is the Contractor's responsibility to implement and maintain erosion and sedimentation control measures to effectively minimize erosion and sedimentation.
- B. Construction, including but not limited to site clearing, earthwork, low permeability soil layer construction, protective soil layer construction, and vegetative soil layer construction shall be conducted in such a manner as to minimize erosion and sedimentation.
- C. Install erosion and sedimentation control products in accordance with manufacturers' recommendations.
- D. Erosion and sedimentation control measures shall be inspected by the Contractor daily. Repairs shall be made as soon as practical.
- E. Cover staged soil piles with temporary liners when precipitation is expected in order to minimize soil erosion.
- F. Employ, construct and maintain all temporary erosion and sediment control measures in accordance with the *New York State Standards and Specifications for Erosion and Sediment Control, (Latest Version)*.

3.03 SPECIAL CONDITIONS

- A. Prohibited construction practices include, but are not limited to the following:

1. Dumping of spoil material into any stream corridor, wetland, surface water, unspecified locations or any location not expressly approved by the Engineer.
2. Indiscriminate, arbitrary or capricious operation of equipment in any stream corridor, wetland, surface water or other location. All equipment operation in water bodies or wetlands shall be in accordance with the Contract Documents.
3. Pumping of silt-laden water from trenches or other excavations into any stream corridor, wetland or surface waters, or location not expressly approved by the Engineer.
4. Disposal of trees, brush and other debris in any stream corridor, wetland, surface water, or location not expressly approved by the Engineer.
5. Permanent or unspecified alteration of the flowpath of any stream not shown on the Contract Drawings or expressly approved by the Engineer.
6. Open burning of construction project debris.

3.04 ADJUSTMENT OF PRACTICES

- A. If the planned measures do not result in effective control of erosion and sediment runoff to the satisfaction of the regulatory agencies having jurisdiction over the project, the Contractor shall immediately adjust the program and/or institute additional measures in order to eliminate excessive erosion and sediment runoff.
- B. If the Contractor fails or refuses to comply promptly, the Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor.

[END OF SECTION]

SECTION 02710
GEOTEXTILE CUSHION

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. This Section describes the materials, installation, and testing requirements to perform the installation, quality control, and maintenance of the geotextile cushion for the base liner system of the Sediment Consolidation Area (SCA).

1.02 RELATED WORK

- A. Work in this section includes, but is not limited to:
1. Section 01030 Environmental Protection
 2. Section 01300 Submittal Procedures
 3. Section 01620 Health and Safety Requirements
 4. Section 02100 Site Preparation
 5. Section 02740 Geomembrane Liner
 6. Section 02225 Gravel Drainage Layer

1.03 REFERENCES

- A. Latest version of American Society for Testing and Materials (ASTM) Standards:
1. ASTM D 4355 “Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus”.
 2. ASTM D 4533 “Standard Test Method for Trapezoid Tearing Strength of Geotextiles”.
 3. ASTM D 4632 “Standard Test Method for Grab Breaking Load and Elongation of Geotextiles”.
 4. ASTM D 4833 “Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products”.
 5. ASTM D 4873 “Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples”.
 6. ASTM D 5261 “Standard Test Method for Measuring Mass per Unit Area of Geotextiles”.
 7. ASTM D 5321 Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.
 8. ASTM D 5514 Standard Test Method for Large Scale Hydrostatic Puncture Testing of Geosynthetics.

9. ASTM D 6193 “Standard Practice for Stitches and Seams”.

1.04 SUBMITTALS

- A. Submit the following to the Engineer for review not less than 21 calendar days prior to shipment.
 - 1. Geotextile Manufacturer and product name.
 - 2. Certification of minimum average roll values and the corresponding test procedures for all geotextile properties listed in Table 1.
 - 3. Projected geotextile delivery dates.
 - 4. Manufacturer quality control tests and manufacturer certifications per Section 2.02.
- B. Submit to the Engineer for review at least 14 calendar days prior to geotextile shipment, manufacturing quality control certificates for each roll of geotextile as specified in this Section. This documentation must be reviewed and approved by the Engineer to satisfy the requirements of these specifications prior to transporting any geotextile to the site.

1.05 AS-BUILT DOCUMENTATION

- A. The Contractor shall provide as-built revisions to the Project Drawings in accordance with Section –01300 – Submittal Procedures.
- B. In addition to preparation of as-built revisions to the Project Drawings, the Contractor shall provide as-built documentation for the placed geotextiles.

1.06 CONSTRUCTION QUALITY ASSURANCE

- A. The installation of geotextiles will be monitored by the Engineer as required in the CQA Plan.
- B. The Engineer will perform material conformance testing of the geotextiles.
- C. The Contractor shall be aware of the activities required of the Engineer by the CQA Plan and shall account for these activities in the construction schedule.
- D. The Contractor shall correct all deficiencies and nonconformances identified by the Engineer at no additional cost to the Owner.

PART 2 – PRODUCTS

2.01 GEOTEXTILE

- A. Furnish geotextile products with minimum average roll values (95 percent lower confidence limit) meeting or exceeding the required property values in Table 1.

- B. Furnish geotextiles that are manufactured from first quality polymers, with not more than 20 percent reclaimed polymer used in production.
- C. Furnish polymeric threads for stitching that are ultra-violet (UV) light stabilized to at least the same requirements as the geotextile to be sewn. Furnish polyester or polypropylene threads that have a minimum size of 2,000 denier.
- D. Furnish geotextile material that meets the minimum required peak and residual internal/interface friction angles shown in Section 02215: Low Permeability Soil Layer when tested as a layered sandwich representing the base liner system of the SCA (low permeability soil, 60-mil LLDPE geomembrane, geotextile cushion and gravel drainage layer) in accordance with ASTM D 5321. This test shall be performed at the frequency specified in Section 02215.

2.02 MANUFACTURING QUALITY CONTROL

- A. Sample and test the geotextile to demonstrate that the material conforms to the requirements of this Section.
- B. Perform manufacturing quality control tests to demonstrate that the geotextile properties conform to the values specified in Table 1. Perform as a minimum, the following manufacturing quality control tests at a minimum frequency as shown:

Test	Procedure	Frequency (min)
Mass per unit area	ASTM D 5261	one per 90,000 ft ²
Grab strength	ASTM D 4632	one per 90,000 ft ²
Tear strength	ASTM D 4533	one per 90,000 ft ²
Puncture strength	ASTM D 4833	one per 90,000 ft ²
UV resistance	ASTM D 4355	one per formulation

- C. Submit quality control certificates signed by the geotextile Manufacturer quality control manager. Certificates shall state that the material is resistant to UV exposure and that the geotextiles are continuously inspected and are needle-free. The quality control certificates shall also include: lot, batch, and roll number and identification; and results of manufacturing quality control tests including description of test methods used.
- D. Do not supply any geotextile roll that does not comply with the manufacturing quality control requirements.
- E. If a geotextile sample fails to meet the quality control requirements of this Section, sample and test rolls manufactured at the same time or in the same lot

as the failing roll. Continue to sample and test the rolls until the extent of the failing rolls are bracketed by passing rolls. Do not supply failing rolls.

2.03 PACKAGING AND LABELING

- A. Supply geotextiles in rolls wrapped in relatively impermeable and opaque protective wrapping. Wrapping which becomes torn or damaged shall be repaired with similar materials.
- B. Mark or tag geotextile rolls in accordance with ASTM D 4873 with the following information:
 - 1. manufacturer's name;
 - 2. product identification;
 - 3. lot or batch number;
 - 4. roll number; and
 - 5. roll dimensions.
- C. Geotextile rolls not labeled in accordance with this Section or on which labels are illegible shall be rejected and replaced.

2.04 HANDLING AND STORAGE

- A. Protect geotextiles from sunlight, moisture, excessive heat or cold, puncture, mud, dirt, and dust or other damaging or deleterious conditions. Follow all geotextile manufacturer recommendations for handling and storage.
- B. Store geotextile rolls on pallets or other elevated structures. Do not store geotextile rolls directly on the ground.
- C. Outdoor storage of rolls shall not exceed the manufacturer's recommendation or longer than 6 months, whichever is less.

PART 3 – EXECUTION

3.01 PLACEMENT

- A. Handle geotextiles so as to ensure they are not damaged in any way.
- B. Take necessary precautions to prevent damage to underlying layers including rutting during placement of the geotextiles.
- C. After unwrapping the geotextiles from its opaque cover, do not leave them exposed for a period in excess of 14 calendar days.
- D. If white colored geotextiles are used, take precautions against "snow blindness" of personnel. Precautions against "snow blindness" include wearing sunglasses and avoiding exposure for long periods of time.

- F. Anchor or weight geotextile with sandbags, or the equivalent, to prevent damage from wind. Install sandbags during placement and maintain them until overlying material is placed. Geotextiles installed on slopes shall be secured in anchor trenches, as shown on the drawings.
- G. Examine the geotextile surface after installation to ensure that no potentially harmful foreign objects are present. Remove any such objects and replace any damaged geotextiles.

3.02 SEAMS AND OVERLAPS

- A. Seams shall be overlapped or seamed. When seamed, continuously overlap a minimum of 6 inches and sew geotextiles (i.e., spot sewing is not allowed) using a "single prayer" seam. Sew seams using Stitch Type 401 as per ASTM D 6193. When overlapped, the geotextile panels need to be shingled in the direction of fill placement to prevent the top geotextile from peeling as the fill is spread. Overlaps (without seams) shall be at least 3 feet long.
- B. Do not install horizontal seams on slopes that are steeper than 10 horizontal to 1 vertical. Seams shall be along, not across, the slopes.
- C. All geotextiles should be placed with all seams up to facilitate inspection and repair.

3.03 REPAIR

- A. Repair any holes or tears in the geotextiles using a patch made from the same geotextile material. Extend geotextile patches a minimum of 1 foot beyond the damaged area. Sew geotextile patches into place no closer than 1 inch from any panel edge. Should any tear exceed 50 percent of the width of the roll, remove, and replace that roll.
- B. Remove any soil or other material that may have penetrated the torn geotextiles.

3.04 PLACEMENT OF SOIL AND AGGREGATE MATERIALS

- A. Place soil materials on top of geotextiles in such a manner as to ensure that:
 - 1. the geotextiles and the underlying materials are not damaged; and
 - 2. slippage does not occur between the geotextile and the underlying layers during placement.
- B. Spread soil on top of the geotextile to cause the soil to cascade over the geotextile rather than be shoved across the geotextile.
- C. Equipment placing soil and aggregate material on geotextile shall be as approved by the Engineer.

- D. Place aggregate over geotextile cushion as indicated on the Project Drawings prior to trafficking.

[END OF SECTION]

TABLE 1. REQUIRED PROPERTY VALUES FOR GEOTEXTILE CUSHION

PROPERTIES	QUALIFIER	UNITS	SPECIFIED ⁽¹⁾ VALUES	TEST METHOD
Type				
nonwoven needlepunched				(-)
Polymer composition	Minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	Minimum	oz/yd ²	Value determined by testing gravel drainage layer, geotextile, and geomembrane per ASTM D 5514 under a load equivalent to 5,000 psf.	ASTM D 5261
Mechanical Requirements				
Grab strength	minimum	lb	230	ASTM D 4632 ⁽³⁾
Tear strength	minimum	lb	95	ASTM D 4533 ⁽⁴⁾
Puncture strength	minimum	lb	a load equivalent to 5,000 psf.	ASTM D 4833 ⁽⁵⁾
Shear strength	minimum		See Note 2.	ASTM D 5321
Durability				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

Notes:

- (1) All values represent minimum average roll values.
- (2) The required peak and residual shear strength parameters are included in a figure as part of Section 02215.
- (3) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
- (4) Minimum value measured in machine and cross machine direction.
- (5) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
- (6)

mm	=	millimeter
%	=	percent
oz/yd ²	=	ounce per square yard
sec	=	second
lb	=	pound
psi	=	pound per square inch

SECTION 02735
GEOCOMPOSITE DRAINAGE LAYER

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. This Section describes the materials, installation, and testing requirements to perform the installation, quality control, and maintenance of the geocomposite drainage layer for the side slopes of the final cover system of the Sediment Consolidation Area (SCA).

1.02 RELATED WORK

- A. Work in this section includes, but is not limited to:
1. Section 01030 Environmental Protection
 2. Section 01300 Submittal Procedures
 3. Section 01620 Health and Safety Requirements
 4. Section 02100 Site Preparation
 5. Section 02200 Earthwork
 6. Section 02235 Protective Soil Layer
 7. Section 02740 Geomembrane Liner

1.03 REFERENCES

- A. Latest version of American Society for Testing and Materials (ASTM) Standards:
1. ASTM D 1238. Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
 2. ASTM D 1505. Standard Test Method for Density of Plastics by the Density-Gradient Technique.
 3. ASTM D 1603. Standard Test Method for Carbon Black in Olefin Plastics.
 4. ASTM D 4218. Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by Muffle-Furnace Technique.
 5. ASTM D 4491. Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 6. ASTM D 4533. Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 7. ASTM D 4632. Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
 8. ASTM D 4716. Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic

- Transmissivity of a Geosynthetic Using a Constant Head.
9. ASTM D 4751. Standard Test Method for Determining Apparent Opening Size of a Geotextile.
 10. ASTM D 4833. Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
 11. ASTM D 5199. Standard Method for Measuring the Nominal Thickness of Geosynthetics.
 12. ASTM D 5261. Standard Test Method for Measuring Mass Per Unit Area of Geotextiles.
 13. ASTM D 5321. Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.
 14. ASTM F 904. Standard Test Method for Comparison of Bond Strength or Ply Adhesion of Similar Laminates Made from Flexible Materials.

1.04 SUBMITTALS

- A. Submit the following to the Engineer for review not less than 21 calendar days prior to shipment.
 1. Geocomposite manufacturer and product name.
 2. Certification of minimum average roll values and the corresponding test procedures for all geocomposite drain properties listed in Table 1.
 3. Projected geocomposite drain delivery dates.
 4. Manufacturer quality control tests and manufacturer certifications per Section 2.02.
- B. Submit to the Engineer for review at least 14 calendar days prior to geocomposite shipment, manufacturing quality control certificates for each roll of geocomposite drain as specified in this Section. This documentation must be reviewed and approved by the Engineer to satisfy the requirements of these specifications prior to transporting any geocomposite drain to the site.
- C. Submit to the Engineer for review at least 14 calendar days prior to mobilization, evidence that the foreman shall have supervised the installation of a minimum of 50 acres of comparable geosynthetic systems, on a minimum of 5 different projects.

1.05 AS-BUILT DOCUMENTATION

- A. The Contractor shall provide as-built revisions to the project drawings in accordance with Section –01300 – Submittal Procedures.
- B. In addition to preparation of as-built revisions to the Project Drawings, the Contractor shall provide as-built documentation for the placed geocomposites.

1.06 CONSTRUCTION QUALITY ASSURANCE

- A. The installation of geocomposite drains will be monitored by the Engineer as required in the CQA Plan.
- B. The Engineer will perform material conformance testing of the geocomposite drains.
- C. The Contractor shall be aware of the activities required of the Engineer by the CQA Plan and shall account for these activities in the construction schedule.
- D. The Contractor shall correct all deficiencies and nonconformances identified by the Engineer at no additional cost.

PART 2 – PRODUCTS

2.01 GEOCOMPOSITE MATERIAL

- A. The geocomposite shall be composed of a high density polyethylene drainage net with a nonwoven, needle-punched geotextile bonded to each side of the drainage net. The geotextile shall not be glued or bonded to the geonet in any manner other than heat bonding. Along edges, six inches of the geotextile shall not be heat bonded to the geonet to allow connection in the field.
- B. The geocomposite shall meet the minimum required peak and residual internal/interface friction angles shown in Section 02235: Protective Soil Layer when tested as a layered sandwich representing the side slope cover system of the SCA (leveling layer, geomembrane, geocomposite drainage layer, and protective soil layer) in accordance with ASTM D 5321. This test shall be performed at the frequency specified in Section 02235.

2.02 MANUFACTURING QUALITY CONTROL

- A. The geocomposite shall be manufactured with quality control procedures that meet generally accepted industry standards.
- B. The geocomposite manufacturer shall sample and test the geocomposite to demonstrate that the material complies with the required property values shown in Table 1. The manufacturer shall provide test results for these procedures, as well as certification that the materials meet or exceed the specified values. Perform as a minimum, the following manufacturer quality control tests at a minimum frequency, as shown:

Component	Test	Procedure	Frequency (min)
Geonet	Transmissivity	ASTM D 4716	one per 50,000 ft ²
Geonet	Density	ASTM D 1505	one per 50,000 ft ²
Geonet	Carbon black content	ASTM D 1603 or D 4218	one per 50,000 ft ²

Component	Test	Procedure	Frequency (min)
Geonet	Nominal thickness	ASTM D 5199	one per 50,000 ft ²
Geonet	Melt flow index	ASTM D 1238	one per resin lot
Geotextile	Mass per unit area	ASTM D 5261	one per 100,000 ft ²
Geotextile	Apparent opening size	ASTM D 4751	one per 100,000 ft ²
Geotextile	Permittivity	ASTM D 4491	one per 100,000 ft ²
Geotextile	Grab strength	ASTM D 4632	one per 100,000 ft ²
Geotextile	Tear strength	ASTM D 4533	one per 100,000 ft ²
Geotextile	Puncture strength	ASTM D 4833	one per 100,000 ft ²
Geocomposite	Transmissivity	ASTM D 4716	one per 500,000 ft ²
Geocomposite	Peel strength	ASTM F 904	one per 50,000 ft ²

- C. Any geocomposite sample that does not comply with this Section will result in rejection of the roll from which the sample was obtained.
- D. If a geocomposite sample fails to meet the quality control requirements of this Section, then the geocomposite manufacturer shall sample and test each roll manufactured in the same lot, or at the same time, as the failing roll. Sampling and testing of rolls shall continue until a pattern of acceptable test results is established.
- E. Additional sample testing may be performed, at the geocomposite manufacturer's direction, to more closely identify any non-complying rolls and/or to qualify individual rolls.

2.03 PACKING AND LABELING

- A. The geocomposite shall be supplied in rolls wrapped in relatively waterproof and opaque protective covers. During shipment and storage, the geocomposite shall be protected from mud, dirt, dust, cutting, or other damaging or deleterious conditions. The geocomposite shall be stored off the ground and out of direct sunlight.
- B. Geocomposite rolls shall be labeled with the following information.
 - 1. manufacturer's name;
 - 2. product identification;
 - 3. lot or batch number;
 - 4. roll number; and
 - 5. roll dimensions.
- C. If any special handling is required, it shall be so marked on the geotextile component e.g., "This Side Up".

PART 3 – EXECUTION

3.01 HANDLING AND PLACEMENT

- A. The geocomposite shall be handled in such a manner as to ensure the geocomposite is not damaged in any way.
- B. Necessary precautions shall be taken to prevent damage to underlying layers during placement of the geocomposite.
- C. The geocomposite shall only be cut using manufacturer's recommended procedures.
- D. In the presence of wind, all geocomposite panels shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain until replaced with cover material.
- E. Care shall be taken during placement of geocomposite not to entrap dirt or excessive dust in the geocomposite that could cause clogging of the drainage system, and/or stones that could damage the adjacent geosynthetic. Care shall be exercised when handling sandbags, to prevent rupture or damage of the sandbags.
- F. Unless otherwise specified, geocomposites shall not be welded to geomembranes.
- G. The geocomposite shall be positioned by hand after being unrolled to minimize wrinkles.
- H. Tools and sandbags shall not be left on, in, or under the geocomposite.
- I. After unwrapping the geocomposite from its opaque cover, the geocomposite shall not be left exposed for a period in excess of 30 days, unless if approved by the Engineer.

3.02 SEAMS AND OVERLAPS

- A. The components of the geocomposite (i.e., geotextile - geonet - and geotextile) are not to be bonded together at the edges of the rolls. Each component shall be secured or seamed to the like component at overlaps.
- B. Geonet Components:
 - 1. The geonet components shall be overlapped by at least 4 inches. These overlaps shall be secured by tying.
 - 2. Tying shall be achieved by plastic fasteners or polymer braid. Tying devices shall be white or yellow for easy inspection. Metallic devices shall not be used.

3. Tying shall be every 5 feet along the slope, every 2 feet on end-to-end seams.

C. Geotextile Components:

1. The bottom layers of geotextile shall be overlapped a minimum of 4 inches prior to seaming. The top layers of geotextiles shall be continuously sewn (i.e., spot sewing or thermal bonding is only allowed for repairs). Geotextiles shall be overlapped a minimum of 6 inches prior to seaming.
2. Horizontal seams shall be discontinuous (i.e., staggered) between adjacent panels. No horizontal seam shall be less than 5 feet from the toe of the slope.
3. Polymeric thread, with chemical resistance properties equal to or exceeding those of the geotextile component, shall be used for all sewing. The seams shall be sewn using Stitch Type 401.

3.03 REPAIR

- A. If the geonet is undamaged but the geotextile is damaged, the damaged area shall be repaired as follows:
 1. remove damaged geotextile;
 2. cut patch of new geotextile to provide minimum 12-inch overlap in all directions; and
 3. thermally bond geotextile patch to existing geocomposite.
- B. All seams that have no geotextile flaps available for sewing shall have a geotextile patch, extending 1-ft beyond the edges of the panel, thermally bonded.
- C. Any holes or tears in the geocomposite shall be repaired by removing the damaged portion of the geonet, placing a patch extending 0.5 ft beyond the edges of the hole or tear. The patch shall be secured by tying fasteners through the bottom geotextile and the geonet of the patch, and through the panel. The patch shall be secured every 6 inches with approved tying devices. A geotextile patch shall be heat sealed to the top of the geocomposite needing repair. If the hole or tear width across the panel is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be joined in accordance with this Section.

3.04 PRODUCT PROTECTION

- A. All means necessary shall be used to protect all prior work, and all materials and completed work of other Sections.

Table 1. Required Geocomposite Property Values

PROPERTIES	QUALIFIER	UNITS	SPECIFIED VALUES ⁽¹⁾	TEST METHOD
<i>Geonet Component:</i>				
Polymer composition	Minimum	%	95% polyethylene by weight	---
Density	Minimum	g/cm ³	0.94	ASTM D 1505
Carbon black content	Range	%	2.0 -3.0	ASTM D 1603 or D 4218
Nominal thickness	Minimum	mils	200	ASTM D 5199
Melt flow index	Maximum	g/10min	≤1.0	ASTM D 1238
<i>Geotextile Components:</i>				
Type	None	none	needlepunched nonwoven	---
Polymer composition	Minimum	%	95% polyester or polypropylene	
Mass per unit area	Minimum	oz/yd ²	6	ASTM D 5261
Apparent opening size	Maximum	mm	0 ₉₅ ≤0.21 mm	ASTM D 4751
Permittivity	Minimum	sec ⁻¹	1.0	ASTM D 4491
Grab strength	Minimum	lb	160	ASTM D 4632 ⁽²⁾
Tear strength	Minimum	lb	70	ASTM D 4533 ⁽²⁾
Puncture strength	Minimum	lb	90	ASTM D 4833 ⁽³⁾
<i>Geocomposite</i>				
Transmissivity	Minimum	m ² /s	5 × 10 ⁻⁴	ASTM D 4716 ⁽⁴⁾
Peel strength	Minimum	lb/in	1.0	ASTM F 904
Shear strength	Minimum		See Note 5	ASTM D 5321

- Notes:**
1. All values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table).
 2. Minimum value measured in machine and cross machine direction.
 3. Tension testing machine with a 1.75-in. diameter ring clamp, the steel ball bearing replaced with 0.31-in. a solid steel cylinder with a flat tip centered with the ring clamp.
 4. The transmissivity is the hydraulic transmissivity of the geocomposite drainage layer measured using water at 68°F with a gradient of not less than 0.10, under a compressive stress of not less than 2,000 psf.
 5. The required peak and residual shear strength parameters are included in a figure as part of Section 02235.
 6. % = percent
mils = milli inches
g/cm³ = gram per cubic centimeter
lb = pound
g/10min = grams per 10 minutes
oz/yd² = ounces per square yard
sec = seconds
mm = millimeter
lbs/in. = pounds per inch
m²/s = square meter per second.

[END OF SECTION]

SECTION 02740

GEOMEMBRANE LINER

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. The work covered in this Section consists of the placement of a linear low density polyethylene (LLDPE) geomembrane for the Sediment Consolidation Area (SCA). This Section refers to both the 60-mil LLDPE base liner geomembrane (textured on both sides) placed on the Low Permeability Soil Layer and the 40-mil LLDPE final cover geomembrane (smooth on both sides for gently sloping areas and textured on both sides for side slope areas and extending at least 10 feet into the gently sloping areas) placed on the Leveling Layer. These geomembranes shall be placed in accordance with the Project Specifications and Drawings. The Contractor shall furnish all labor, materials, equipment, supervision, and incidentals necessary to perform the scope of work.
- B. All geomembrane material placed as a part of this project shall be placed, tested and documented in accordance with this Section unless specifically approved by the Engineer.

1.02 RELATED WORK

- A. Work in this section includes, but is not limited to:
 - 1. Section 01100 Remediation
 - 2. Section 01620 Health and Safety Requirements
 - 3. Section 02215 Low Permeability Soil Layer
 - 4. Section 02235 Protective Soil Layer
 - 5. Section 02710 Geotextile Cushion
 - 6. Section 02735 Geocomposite Drainage Layer

1.03 REFERENCES

- A. Latest version of the American Society for Testing and Materials (ASTM) standards:
 - 1. ASTM D 746 Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
 - 2. ASTM D 792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
 - 3. ASTM D 1004 Standard Test Method of Tear Resistance (Graves Tear) of Plastic Film and Sheeting.

4. ASTM D 1204 Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
5. ASTM D 1238 Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
6. ASTM D 1505 Standard Test Methods for Density of Plastics by the Density-Gradient Technique.
7. ASTM D 1603 Standard Test Method for Carbon Black Content in Olefin Plastics.
8. ASTM D 4833 Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
9. ASTM D 5321 Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.
10. ASTM D 5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.
11. ASTM D 5596 Standard Test Method for Microscopic Examination the Dispersion of Carbon Black in Polyolefin Geosynthetics.
12. ASTM D 5994 Standard Test Method for Measuring the Core Thickness of Textured Geomembrane.
12. ASTM D 6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
13. ASTM D 6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes.
14. ASTM D 7466 Standard Test Method for Measuring the Asperity Height of Textured Geomembrane

1.04 SUBMITTALS

- A. Submit the following information to the Engineer for review not less than 45 calendar days prior to use for all additional geomembrane furnished.
 1. Geomembrane manufacturer capabilities, including daily production capacity available for this contract and manufacturing quality control procedures.
 2. A list of 10 completed facilities for which the Manufacturer has manufactured a minimum total of 10,000,000 square feet of polyethylene geomembrane. Provide the following information for each facility:
 - a. Name, location, purpose of facility, and date of installation;
 - b. Names of owner, project manager, design engineer, and installer; and
 - c. Thickness and surface area of geomembrane provided.

3. Origin (resin supplier's name, resin production plant) and identification (brand name, number) of the polyethylene resin used.
 4. Certification of minimum average roll values (95 percent lower confidence limit) for physical, mechanical, and environmental properties and the corresponding test procedures for the geomembrane properties listed in Table 1A for the 60-mil base liner geomembrane and Table 1B for the 40-mil cover geomembrane, respectively. Submit values that are specific to the resin used in manufacturing of the geomembrane.
 5. Certification that LLDPE welding rod is compatible with the specifications and consists of the same resin as the geomembrane.
 6. Manufacturer warranty as specified in this Section.
- B. Submit to the Engineer for review not less than 30 calendar days prior to geomembrane use the following documentation on the resin used to manufacture any additional geomembranes:
1. Copies of quality control certificates issued by the resin supplier including the production dates and origin of the resin used to manufacture the geomembrane for this Contract.
 2. Results of tests conducted by the Manufacturer to verify the quality of the resin used to manufacture the geomembrane rolls assigned to the project.
 3. Certification that no reclaimed polymer is added to the resin during the manufacturing of the geomembrane to be used for this project except as allowed by this specification.
- C. Submit to the Engineer for review the following documentation on geomembrane roll production at least 14 calendar days prior to transporting any geomembrane to the site.
1. Manufacturing certificates for each shift's production of geomembrane, signed by the Manufacturer quality control manager, and notarized.
 2. Certificate shall include roll numbers and identification, sampling procedures and results of Manufacturer quality control tests, including descriptions of the test methods used (the Manufacturer quality control tests to be performed are given in Part 2 of this Section).
- D. Submit to the Engineer for review the following information from the Installer at least 14 calendar days prior to mobilization of the Installer to the site.
1. Layout drawings showing the installation layout identifying geomembrane panel configurations, dimensions, details, locations of seams, as well as any variance or additional details which deviate from the Construction Drawings. The layout drawings shall be adequate for use as a construction plan and shall include dimensions, details, etc. The layout drawings, as modified and/or approved by the Engineer, shall become part of the contract.
 2. Installation schedule.

3. Copy of Installer's letter of approval or license by the Manufacturer.
 4. Installation capabilities, including information on equipment proposed for this project, average daily production anticipated for this project and quality control procedures to include quality control organization.
 5. A list of 10 completed facilities for which the Installer has installed a minimum of 5,000,000 square feet of polyethylene geomembrane. The following information shall be provided for each facility:
 - a. Name and purpose of the facility, its location, and installation dates.
 - b. Names of owner, project manager and geomembrane manufacturer.
 - c. Name and qualifications of the supervisor of the installation crew;
 - d. Thickness and surface area of installed geomembrane;
 - e. Type of seaming and type of seaming apparatus used; and
 - f. Duration of installation.
 6. Resumes of the Installer Superintendent and quality control chief to be assigned to this project, including dates and duration of employment.
 7. Resumes of all personnel who will perform seaming operations on this project, including dates and duration of employment.
 8. Evidence that the installation crew has the following experience.
 - a. The foreman shall have supervised the installation of a minimum of 50 acres of comparable geosynthetic systems, on a minimum of 5 different projects.
 - b. At least one seamer shall have experience seaming a minimum of 500,000 square feet of polyethylene geomembrane using the same type of seaming apparatus to be used at this site. Seamers with such experience will be designated "master seamers" and shall provide direct supervision over less experienced seamers.
 - c. All other seaming personnel shall have seamed at least 100,000 square feet of polyethylene geomembrane using the same type of seaming apparatus to be used at this site. Personnel who have seamed less than 100,000 square feet of seams shall be allowed to seam only under the direct supervision of the master seamer or Superintendent.
- E. Submit to the Engineer for review at least 14 days prior to geomembrane placement, a Certificate of Calibration less than 12 months old for the field tensiometer. Tensiometer shall be calibrated within one year of date of test. Calibration shall be traceable to national or industry recognized standards where possible.
- F. Submit subgrade acceptance certificates, signed by the Installer, for each area to be covered by the geomembrane prior to that area being covered by geomembrane.
- G. Within 14 calendar days of completion of the geomembrane installation, submit a one-year installation warranty to the Engineer.

1.05 AS-BUILT DOCUMENTATION

- A. The Contractor shall submit as-built revisions to the Project Drawings in accordance with Section –01300 – Submittal Procedures.
- B. In addition to preparation of as-built revisions to the Project Drawings, the Contractor shall provide as-built documentation for the placed geomembrane.

1.06 CONSTRUCTION QUALITY ASSURANCE

- A. The construction of the geomembrane will be monitored as required in the CQA Plan.
- B. The Engineer will perform material conformance testing of geomembrane materials and installation quality assurance testing of the geomembrane seams, as required in the CQA Plan.
- C. The Contractor shall be aware of the activities required of the Engineer by the CQA Plan and shall account for these activities in the construction schedule.
- D. The Contractor shall correct all deficiencies and nonconformances identified by the Engineer at no additional cost. The Contractor shall also provide assistance as needed to the post-construction electrical leak location survey to be performed for the base liner by a specialty leak location contractor reporting to the CQA Engineer. The work may include but not limited to: providing electrical isolation around perimeter and or liner penetrations; exposing the liner manually to create and repair test hole through the geomembrane; providing access to AC power; providing laborers to layout out survey grid; adding of water to soils (above and below liner) to promote electrical conductivity; installing electrical probes and wires under the liner; and assisting in the repair of any identified leaks.

PART 2 – PRODUCTS

2.01 RESIN

- A. Provide geomembrane manufactured from new, first-quality polyethylene resin. Do not add reclaimed polymer to the resin. The use of polymer recycled during the manufacturing process is permitted if performed with appropriate cleanliness and if the recycled polymer during the manufacturing process does not exceed 2 percent by weight of the total polymer weight.
- B. Use linear low density polyethylene (LLDPE) resin having the following properties:
 - 1. Density: 0.939 g/ml maximum (ASTM D792 Method A or ASTM D1505)
 - 2. Melt Flow Index: 1.0 g/10 min., maximum (ASTM D1238 Condition E)

2.02 GEOMEMBRANE PROPERTIES

- A. The Contractor shall furnish LLDPE geomembrane having properties that comply with the required values shown in Table 1A for 60-mil LLDPE geomembrane or Table 1B for 40-mil LLDPE geomembrane.
- B. The 60-mil LLDPE liner geomembrane material shall meet the minimum required peak and residual internal/interface friction angles shown in Section 02215: Low Permeability Soil Layer when tested as a layered sandwich representing the base liner system of the SCA (low permeability soil, geomembrane, geotextile cushion and gravel drainage layer) in accordance with ASTM D 5321. This test shall be performed at the frequency specified in Section 02215.
- C. The 40-mil LLDPE cover geomembrane material shall meet the minimum required peak and residual internal/interface friction angles shown in Section 02235: Protective Soil Layer when tested as a layered sandwich representing the side slope cover system of the SCA (leveling layer, geomembrane, geocomposite drainage layer, and protective soil layer) in accordance with ASTM D 5321. This test shall be performed at the frequency specified in Section 02235.
- D. In addition, furnish geomembrane that:
 - 1. contains a maximum of 1 percent by weight of additives, fillers, or extenders not including carbon black;
 - 2. does not have striations, pinholes, bubbles, blisters, nodules, undispersed raw materials, or any sign of contamination by foreign matter on the surface or in the interior;
 - 3. is free of holes, blisters, modules, undispersed raw materials, or any sign of contamination by foreign matter; and
 - 4. is manufactured in a single layer (thinner layers shall not be welded together to produce the final required thickness).

2.03 MANUFACTURING QUALITY CONTROL

- A. Resin:
 - 1. Sample and test resin at a minimum frequency of one test per rail car to demonstrate that the resin complies with the requirements of this Section. Perform tests on resin after the addition of additives to the virgin resin. Certify in writing that the resin meets the requirements of this Section.
 - 2. Do not use any noncomplying resin.
- B. Rolls:
 - 1. Continuously monitor for geomembrane defects during manufacturing.
 - 2. Do not supply geomembrane that exhibits any defects.

3. Regularly monitor for geomembrane thickness during manufacturing.
4. Do not supply geomembrane that fails to meet the specified thickness.
5. Sample and test the geomembrane, to demonstrate that its properties conform to the values specified in Table 1. Perform the following quality control tests at a minimum of once every 50,000 square feet:

Test	Procedure
thickness	ASTM D 5199 ASTM D 5994
tensile strength	ASTM D 6693
tensile elongation	ASTM D 6693
tear resistance	ASTM D 1004
carbon black content	ASTM D 1603
carbon black dispersion	ASTM D 5596
specific gravity	ASTM D 1505
asperity height	ASTM D 7466

6. Provide a geomembrane sample for use in sandwich shear testing (ASTM D 5321) to demonstrate that the geomembrane properties conform to the shear strength parameters specified in Table 1.
 7. If a geomembrane sample fails to meet the quality control requirements of this Section, sample and test rolls manufactured, in the same resin batch, or at the same time, as the failing roll. Continue to sample and test the rolls until the extent of the failing rolls are bracketed by passing rolls. Do not supply any failing rolls.
- C. Permit the Engineer to visit the manufacturing plant for project specific visits. If possible, such visits will be prior to, or during, the manufacturing of the geomembrane rolls for this project.

2.04 LABELING

- A. Label the geomembrane rolls with the following information.
1. thickness of the material;
 2. length and width of the roll;
 3. name of Manufacturer;
 4. product identification;
 5. lot number; and
 6. roll number.
- B. Geomembrane rolls not labeled in accordance with this Section or on which labels are illegible will be rejected and replaced.

2.05 TRANSPORTATION, HANDLING AND STORAGE

- A. Deliver geomembranes to the site at least 14 calendar days prior to the planned deployment date to allow the Engineer adequate time to perform conformance testing on the geomembrane samples as described in the CQA Plan.
- B. Provide proper handling and storage of the geomembrane at the site. Protect the geomembrane from excessive heat or cold, dirt, puncture, cutting, or other damaging or deleterious conditions. Provide any additional storage procedures required by the Manufacturer.
- C. Store geomembrane rolls on palates or other elevated structures. Do not store geomembrane rolls directly on the ground surface. Do not store more than 3 rolls high.

PART 3 – EXECUTION

3.01 FAMILIARIZATION

- A. Prior to implementing any of the work described in this Section, the Contractor shall become thoroughly familiar with all portions of the work falling within this Section.
- B. Inspection:
 - 1. Within 21 days of Notice to Proceed, the Contractor shall inspect all rolls of geomembrane currently stored at the site. If geomembrane is defective or deficient in any way, the Contractor shall notify the Engineer in writing. Failure to inform the Engineer of any defect or deficiency will be construed as the Contractor's acceptance of responsibility for the geomembrane.
 - 2. Prior to implementing any of the work in this Section, the 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.
 - 3. If the Contractor has any concerns regarding the installed work of other Sections, the Contractor shall immediately notify the Engineer in writing. Failure to inform the Engineer in writing or continuance of installation of the geomembrane will be construed as the Contractor's acceptance of the related work of all other Sections.

3.02 SUBGRADE SURFACE PREPARATION

- A. The Contractor shall provide certification in writing from the Geomembrane Installer that the surface on which the geomembrane will be installed is acceptable. This certification of acceptance shall be given to the Engineer prior to commencement of geomembrane installation in the area under consideration.

- B. Special care shall be taken to maintain the prepared soil surface.
- C. No geomembrane shall be placed onto an area which has been softened by precipitation or which has excessively cracked due to desiccation. The soil surface shall be observed daily to evaluate the effects of desiccation cracking and/or softening on the integrity of the subgrade.
- D. Any damage to the subgrade caused by installation activities shall be repaired at the Contractor's expense.

3.03 GEOMEMBRANE DEPLOYMENT

A. General:

- 1. The Contractor shall produce layout drawings prior to geomembrane deployment. These drawings shall indicate the geomembrane configuration, dimensions, details, locations of seams, etc. The layout drawings must be approved by the Engineer prior to the installation of any geomembranes. The layout drawings, as modified and/or approved by the Engineer, shall become part of these specifications.
- 2. Do not deploy geomembrane until the layout drawings are approved by the Engineer.
- 3. Do not deploy a geomembrane panel in an area until the Engineer has been provided with a certificate of subgrade acceptance for that area.
- 4. Do not deploy geomembranes until Engineer completes conformance evaluation of the geomembrane and performance evaluation of previous work, including evaluation of Contractor's survey results for previous work.
- 5. Deploy each geomembrane panel in accordance with the approved layout drawings.

B. Field Panel Identification:

- 1. A geomembrane field panel is a roll or a portion of roll cut in the field.
- 2. Give each field panel an identification code (number or letter-number). This identification code shall be agreed upon by the Engineer and the Installer.

C. Field Panel Placement:

- 1. Place each geomembrane panel one at a time and seam each panel immediately after its placement.
- 2. Use temporary rubsheets as required to prevent displacement or damage to underlying geosynthetics. High spots in geomembrane-backed geosynthetic clay liners shall be covered by a temporary rubsheets during placement of geomembrane.
- 3. Do not place geomembrane panels when the ambient temperature is below 40° Fahrenheit (F), unless authorized in writing by the Engineer. For cold

weather (<40°F) deployment, use the additional procedures authorized in writing by the Engineer.

4. Do not place geomembranes during any precipitation, in the presence of heavy fog or dew, in an area of ponded water, or in the presence of high wind.
 5. Ensure that:
 - a. No vehicular traffic drives directly on the geomembrane.
 - b. Equipment used does not damage the geomembrane by handling, trafficking, or leakage of hydrocarbons (i.e., fuels).
 - c. Personnel working on the geomembrane do not smoke, bring glass onto the geomembrane, or engage in other activities that could damage the geomembrane.
 - d. The method used to unroll the panels does not scratch or crimp the geomembrane and does not damage lower geosynthetics or the supporting soil.
 - e. The method used to place the panels minimizes wrinkles (especially differential wrinkles between adjacent panels). The method used to place the panels results in intimate contact with geosynthetic clay liner. Adjust or repair any area of geomembrane wrinkles where the wrinkle height, measured perpendicular to the slope during the hottest portion of the day, is more than 4 inches.
 - f. The method used to place the panels does not cause the panels to lift up or trampoline during the coolest portion of the day.
 - g. The geomembrane is anchored or weighted with sandbags, or the equivalent, to prevent damage or uplift from wind. Install sufficient anchoring or weighting to prevent uplift and maintain such system until overlying material is placed.
 6. Replace any field panel or portion thereof that becomes damaged (torn, twisted, or crimped). Remove from the work area damaged panels or portions of damaged panels.
- D. Do not install geomembrane between one hour before sunset and one hour after sunrise unless approved by the Engineer.

3.04 FIELD SEAMING

- A. Personnel shall be experienced as specified in this Section. Do not perform seaming unless a “master seamer” and the Engineer is on-site.
- B. Orient seams parallel to the line of maximum slope (i.e., oriented down, not across, the slope). Minimize the number of seams in corners and at odd-shaped geometric locations. No horizontal seam shall be less than 10 feet from the toe of the slope, except where approved by the Engineer. Do not locate seams at an area of potential stress concentration.
- C. Weather Conditions for Seaming:

1. Do not seam geomembrane at ambient temperatures below 40°F or above 104°F, unless authorized in writing by the Engineer. Do not seam geomembrane at sheet temperatures above 158°F. For cold (<40°F) or hot (>104°F) weather seaming, use the additional procedures authorized in writing by the Engineer.
2. Measure ambient temperatures between 0 to 6 inches above the geomembrane surface.
3. In all cases the geomembrane seam areas shall be dry and protected from wind. Do not seam geomembrane during periods of precipitation or if winds are in excess of 20 miles per hour.

D. Overlapping and Temporary Bonding:

1. Sufficiently overlap geomembrane panels for welding and to allow peel tests to be performed on the seam. Any seams that cannot be destructively tested because of insufficient overlap are failing seams.
2. Control the temperature of the air at the nozzle of heat bonding apparatus such that the geomembrane is not damaged.

E. Seam Preparation:

1. Prior to seaming, clean the seam area and ensure that area to be bonded is free of moisture, dust, dirt, debris of any kind, and foreign material.
2. If seam overlap grinding is required, complete the process according to the Manufacturer's instructions or within 60 minutes of the seaming operation. Do not grind to a depth that exceeds ten percent of the geomembrane thickness. Grinding marks shall not appear beyond 0.25 inch of the extrudate after it is placed.
3. Align seams with the fewest possible number of wrinkles and "fishmouths".

F. General Seaming Requirements:

1. Extend seams to the outside edge of panels to be placed in the anchor trench.
2. If required, place a firm substrate such as a flat board or similar hard surface directly under the seam overlap to achieve proper support.
3. Cut fishmouths or wrinkles at the seam overlaps along the ridge of the wrinkle to achieve a flat overlap. Seam the cut fishmouths or wrinkles and patch any portion where the overlap is less than 6 inches with an oval or round patch of geomembrane that extends a minimum of 6 inches beyond the cut in all directions.
4. Place the electric generator used for power supply to the welding machines outside the area to be lined or mount it on soft tires such that no damage occurs to the geomembrane. Properly ground the electric generator. Place a smooth insulating plate or fabric beneath the hot welding apparatus after use.

G. Seaming Process:

1. Approved processes for field seaming are extrusion welding and fusion welding. The primary method of welding shall be fusion. Seaming equipment shall not damage the geomembrane. Use only geomembrane Manufacturer-approved equipment.
2. Extrusion Equipment and Procedures:
 - a. Maintain at least one spare operable seaming apparatus on site.
 - b. Equip extrusion welding apparatus with gauges giving the temperature in the apparatus and at the nozzle.
 - c. Prior to beginning a seam, purge the extruder until all heat-degraded extrudate has been removed from the barrel. Whenever the extruder is stopped, purge the barrel of all heat-degraded extrudate.
3. Fusion Equipment and Procedures:
 - a. Maintain at least one spare operable seaming apparatus on site.
 - b. Fusion-welding apparatus shall be automated self-propelled devices equipped with gauges giving the applicable temperatures and pressures.
 - c. Fusion-welding apparatus shall produce a double-track seam.
 - d. Abrade the edges of cross seams to a smooth incline (top and bottom) prior to extrusion welding.

H. Trial Seams:

1. Make trial seams on excess pieces of geomembrane to verify that seaming conditions are adequate. Conduct trial seams on the same material to be installed and under similar field conditions as production seams. Conduct trial seaming at the beginning of each seaming period, after every four hours of continuous seaming, every time seaming equipment is changed and if significant changes in geomembrane temperature are observed, for each seaming apparatus used that day prior to seaming. In addition, each seamer shall make at least one trial seam each day, for each day that seaming is performed by that seamer. Conduct trial seaming under the same conditions as the actual seaming. Prepare trial seams that are at least 15 feet long by 1 foot wide (after seaming) with the seam centered lengthwise for fusion equipment and at least 3 feet long by 1 foot wide for extrusion equipment. Prepare seam overlap as indicated in the "Overlapping and Temporary Bonding" Article of this Part.
2. Cut four specimens, each 1.0 inch wide, from the trial seam sample. Test two specimens in shear and two in peel, using a field tensiometer. The test specimens shall not fail in the seam. If a specimen fails, repeat the entire operation. If the additional specimen fails, do not accept the seaming apparatus or seamer until the deficiencies are corrected and two consecutive successful trial seams are achieved. A seamer may start production seaming prior to testing of the trial seams. In the event the trial seam fails, all production seams by the seamer are failed seams.

I. Nondestructive Seam Continuity Testing:

1. Nondestructively test for continuity field seams over their full length. Perform continuity testing as the seaming work progresses, not at the completion of field seaming. Record the location, date, unit number of test apparatus, name of tester and results of testing. Complete any required repairs in accordance with the “Defects and Repairs” Article of this Part. Apply the following procedures:
 - a. use vacuum testing for extrusion welds; and
 - b. use air pressure testing for double-track fusion seams.
2. Vacuum Testing:
 - a. Use the following equipment:
 - i. A vacuum box assembly consisting of a stiff housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, port hole or valve assembly, and a vacuum gauge.
 - ii. A system for applying 5 pound per square inch (psi) gauge suction to the box.
 - iii. A bucket of soapy solution and applicator.
 - b. Follow these procedures:
 - i. Energize the vacuum pump and reduce the tank pressure to 5 \pm 1 psi gauge.
 - ii. Wet an area of the geomembrane seam larger than the vacuum box with the soapy solution.
 - iii. Place the box over the wetted area.
 - iv. Close the bleed valve and open the vacuum valve.
 - v. Ensure that a leak tight seal is created.
 - vi. Examine the geomembrane through the viewing window for the presence of soap bubbles for not less than 20 seconds.
 - vii. If no bubbles appear after 20 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 inch overlap, and repeat the process.
 - viii. Mark all areas where soap bubbles appear with a marker that will not damage the geomembrane and repair in accordance with the “Defects and Repairs” Article of this Part.
3. Air Pressure Testing:
 - a. Use the following equipment:
 - i. an air pump (manual or motor driven) or air reservoir, equipped with a pressure gauge, capable of generating and sustaining a pressure between 25 and 30 pounds per square inch;
 - ii. a rubber hose with fittings and connections; and
 - iii. a hollow needle, or other approved pressure feed device..
 - b. Follow these procedures:
 - i. Seal both ends of the seam to be tested.

- ii. Insert needle, or other approved pressure feed device, into the tunnel created by the fusion weld.
- iii. Insert a protective cushion between the air pump and the geomembrane.
- iv. Energize the air pump to a pressure between 25 and 30 pounds per square inches, close valve, and sustain the pressure for not less than 5 minutes.
- v. If loss of pressure exceeds 3 pounds per square inches, or does not stabilize, locate faulty area and repair in accordance with the “Defects and Repairs” Article of this Part.
- vi. Cut opposite end of air channel from pressure gauge and observe release of pressure to ensure air channel is not blocked.
- vii. Remove needle, or other approved pressure feed device, and seal both ends in accordance with the “Defects and Repairs” Article of this Part.

J. Destructive Testing:

- 1. Destructive testing shall be performed by the CQA Personnel. The Contractor shall provide assistance if requested by the CQA Personnel to obtain samples. Perform destructive seam tests to evaluate seam strength and integrity (see Tables 2A and 2B for seam properties of 60-mil LLDPE and 40-mil LLDPE, respectively). Perform destructive testing as the seaming work progresses, not at the completion of field seaming.
- 2. Sampling and Testing:
 - a. Collect destructive test samples at a minimum average frequency of one test location per 500 feet of seam length and at additional locations of suspected nonperformance. A minimum of one test sample for each seaming machine operating on a given day is required. The Engineer will select test locations, including locations with evidence of excess geomembrane crystallinity, contamination, offset seams, or any other evidence of inadequate seaming.
 - b. Cut samples at the locations designated by the Engineer at the time the locations are designated. Number each sample and identify the sample number and location on the panel layout drawing. Immediately repair all holes in the geomembrane resulting from the destructive seam sampling in accordance with the repair procedures described in the “Defects and Repairs” Article of this Part. Test the continuity of the new seams in the repaired areas according to “Nondestructive Seam Continuity Testing” Article of this Part.
 - c. Cut two strips 1 inch wide and 12 inch long with the seam centered parallel to the width from either side of the sample location. Test the two 1-inch wide strips in the field tensiometer in the peel mode. The Engineer may request an additional test in the shear mode. If these samples pass the field test, prepare a laboratory sample at least 1 foot wide by 3.5 feet long with the seam centered lengthwise. Cut the laboratory sample into three parts and distribute as follows:

- i. one portion 1 foot long to the Installer;
 - ii. one portion 1.5 feet long to the Engineer for testing; and
 - iii. one portion 1 foot long to the Engineer for archival storage.
3. In the event of failing field or laboratory test results, the Contractor may reconstruct the entire seam between two passing destructive tests; otherwise, the Engineer will identify the extent of the nonconforming area following the procedures given in the CQA Plan. Obtain additional samples for testing as requested by the Engineer.

K. Defects and Repairs:

1. Inspect the geomembrane before and after seaming for evidence of defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of inspection. Sweep or wash the geomembrane surface if surface contamination inhibits inspection.
2. Test each suspect location, both in seam and non-seam areas, using the methods described in the “Nondestructive Seam Continuity Testing” Article of this Part. Repair each location that fails nondestructive testing.
3. Cut and reseam wrinkles not conforming with Part 2 of this Section. Test the seams thus produced like any other seam.
4. Repair Procedures:
 - a. Repair any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test. Use the most appropriate of the available procedures:
 - i. patching, used to repair large holes, tears, undispersed raw materials, and contamination by foreign matter;
 - ii. abrading and reseaming, used to repair small sections of extruded seams;
 - iii. spot seaming, used to repair minor, localized flaws;
 - iv. capping, used to repair long lengths of failed seams;
 - v. topping, used to repair areas of inadequate seams, which have an exposed edge less than 4 inches in length; and
 - vi. removing bad seam and replacing with a strip of new material seamed into place (used with long lengths of fusion seams).
 - b. When making repairs, satisfy the following:
 - i. abrade surfaces of the geomembrane that are to be repaired no more than 20 minutes prior to the repair;
 - ii. clean and dry all geomembrane surfaces immediately prior to repair;
 - iii. only use approved seaming equipment;
 - iv. extend patches or caps at least 6 inches beyond the edge of the defect, and round corners of patches to a radius of at least 3 inches; and

- v. cut the geomembrane below large caps to avoid potential for water or gas collection between the two sheets.
- 5. Repair Verification:
 - a. Test each repair using the methods described in the “Nondestructive Seam Continuity Testing” Article of this Part. Repairs that pass the nondestructive test are adequate unless the Engineer elects to also perform destructive tests. Re-repair and retest failed tests.

3.05 MATERIALS IN CONTACT WITH THE GEOMEMBRANE

- A. Take all necessary precautions to prevent damage to the geomembrane during the installation of other components of the liner system.
- B. Do not drive equipment directly on the geomembrane. Only use low ground pressure equipment above the geomembrane.

3.06 SURVEY CONTROL

- A. Survey the installed geomembrane in accordance with Section 01100 – Remediation.
- B. Locate panel seams and intersections as requested by the Engineer.

3.07 GEOMEMBRANE ACCEPTANCE

- A. The Contractor shall retain all ownership and responsibility for the geomembrane until accepted by the Engineer.
- B. The geomembrane shall be accepted by the Owner when:
 - 1. The installation is finished;
 - 2. All documentation of installation is completed including the Engineer’s final report; and
 - 3. Verification of the adequacy of all field seams and repairs, including associated testing, is complete.

3.08 PROTECTION OF WORK

- A. The Contractor shall use all means necessary to protect all prior work and all materials and completed work of other Sections.
- B. In the event of damage, the Contractor shall make all repairs and replacements necessary to be in full compliance with the Contract Documents and at no additional cost.

TABLE 1A
REQUIRED GEOMEMBRANE PROPERTIES FOR 60-MIL LLDPE

Properties	Qualifiers	Units ⁽¹⁾	Specified Values	Test Method
<u>Physical Properties</u>				
Thickness	Minimum average	mils	60	ASTM D 5994
Asperity Height (Note 3)	Minimum average	mils	10	ASTM D 7466
Density	maximum	g/cm ³	0.939	ASTM D 1505
Carbon Black Content	range	%	2.0-3.0	ASTM D 1603
Carbon Black Dispersion	N/A	none	9 of 10 views in category 1 or 2	ASTM D 5596
<u>Tensile Properties (each direction)</u>				
1. Tensile Strength (force per unit width at break)	minimum	lb/in	90	ASTM D 6693
2. Elongation at Break	minimum	%	250	ASTM D 6693
Tear Resistance	minimum	lb	33	ASTM D 1004 Die C Puncture
Puncture Resistance	minimum	lb	66	ASTM D 4833
Shear Strength	minimum		See Note 2	ASTM D 5321

Notes:

1. mils = milli-inches
 % = percent
 g = grams
 g/cm³ = grams per cubic centimeter
 lb = pound
 lb/in = pounds per inch
2. The required peak and residual shear strength parameters are included in a figure as part of Section 02215.
3. Of 10 readings, 8 out of 10 must be greater or equal to 7 mils and the lowest must be greater or equal to 5 mils.

TABLE 1B
REQUIRED GEOMEMBRANE PROPERTIES FOR 40-MIL LLDPE

Properties	Qualifiers	Units ⁽¹⁾	Specified Values	Test Method
<u>Physical Properties</u>				
Thickness	Minimum average	mils	40	ASTM D 5994
Asperity Height (Note 3)	Minimum average	mils	10	ASTM D 7466
Density	maximum	g/cm ³	0.939	ASTM D 1505
Carbon Black Content	range	%	2.0-3.0	ASTM D 1603
Carbon Black Dispersion	N/A	none	9 of 10 views in category 1 or 2	ASTM D 5596
<u>Tensile Properties (each direction)</u>				
1. Tensile Strength (force per unit width at break)	minimum	lb/in	60	ASTM D 6693
2. Elongation at Break	minimum	%	250	ASTM D 6693
Tear Resistance	minimum	lb	22	ASTM D 1004 Die C Puncture
Puncture Resistance	minimum	lb	44	ASTM D 4833
Shear Strength	minimum		See Note 2	ASTM D 5321

Notes:

1. mils = milli-inches
 % = percent
 g = grams
 g/cm³ = grams per cubic centimeter
 lb = pound
 lb/in = pounds per inch
2. The required peak and residual shear strength parameters are included in a figure as part of Section 02235.
3. Of 10 readings, 8 out of 10 must be greater or equal to 7 mils and the lowest must be greater or equal to 5 mils. This test is applicable only to textured geomembranes.

TABLE 2A
REQUIRED GEOMEMBRANE SEAM PROPERTIES FOR 60-MIL LLDPE

Properties	Qualifiers	Units ⁽³⁾	Specified Values	Test Method
<u>Shear Strength</u> ⁽¹⁾				
Fusion	minimum	lb/in	90	ASTM D 6392
Extrusion	minimum	lb/in	90	ASTM D 6392
Peel Adhesion			FTB ⁽²⁾	
Fusion	minimum	lb/in	75	ASTM D 6392
Extrusion	minimum	lb/in	66	ASTM D 6392

TABLE 2B
REQUIRED GEOMEMBRANE SEAM PROPERTIES FOR 40-MIL LLDPE

Properties	Qualifiers	Units ⁽³⁾	Specified Values	Test Method
<u>Shear Strength</u> ⁽¹⁾				
Fusion	minimum	lb/in	60	ASTM D 6392
Extrusion	minimum	lb/in	60	ASTM D 6392
<u>Peel Adhesion</u>			FTB ⁽²⁾	
Fusion	minimum	lb/in	50	ASTM D 6392
Extrusion	minimum	lb/in	44	ASTM D 6392

Notes:

1. Also called “Bonded Seam Strength”.
2. FTB = Film Tear Bond. (Maximum 10 percent seam separation)
3. lb/in = pounds per inch

[END OF SECTION]

SECTION 02910
VEGETATIVE SOIL LAYER

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. The work covered in this Section consists of the placement of a Vegetative Soil Layer as part of the final cover system for the Sediment Consolidation Area (SCA). This layer shall be placed on top of the Protective Soil Layer in accordance with the Project Specifications and Drawings. The Contractor shall furnish all labor, materials, equipment, supervision, and incidentals necessary to perform the scope of work.

1.02 RELATED WORK

- A. Work in this section includes, but is not limited to:
1. Section 01030 Environmental Protection
 2. Section 01300 Submittal Procedures
 3. Section 01620 Health and Safety Requirements
 4. Section 02140 Construction Water Management
 5. Section 02270 Erosion & Sedimentation Control
 6. Section 02235 Protective Soil Layer
 7. Section 02200 Earthwork

1.03 REFERENCES

- A. Latest version of American Society for Testing and Materials (ASTM) standards:
1. ASTM D 2487 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 2. ASTM D 2974 Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
 3. ASTM D 4972 Standard Test Method for pH of Soils.
 4. ASTM D 6913 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.

1.04 SUBMITTALS

- A. The Contractor shall submit the following information to Engineer for review and approval in accordance with Section 01300 – Submittal Procedures and as elsewhere specified in this Section 30 days prior to initiating Vegetative Soil Layer activities:
1. List of equipment proposed for the earthwork;

2. Proposed offsite borrow source(s);
 3. Dust control equipment and procedures;
 4. Methods for cover soil placement, grading, and stormwater control;
 5. Coordination of survey requirements for cover soil placement;
 6. Locations of on-site temporary soil stockpile areas;
 7. Coordination of construction activities with surface-water management and erosion and sediment control measures;
 8. Schedule for construction activities; and
 9. Quality Control Workplan.
- B. Additional submittals may be required based on the selected vegetation type. The Contractor shall be responsible for the adequacy and safety of the methods.
- C. Test results as specified herein shall be submitted to the Engineer for review within two (2) working days of receipt of results. The Contractor shall not deliver material to the site prior to submission and approval by the Engineer of the geotechnical and analytical chemistry test results.

1.05 CONSTRUCTION QUALITY CONTROL

- A. The Contractor shall submit a Quality Control (QC) Workplan for review. Once instituted, the Contractor shall use the QC Workplan to ensure that the Work performed under the contract meets the requirements of the Contract Documents.
- B. The Contractor shall submit the name of a qualified Independent Testing Laboratory (ITL) to the Engineer for review.
1. The Contractor shall submit to the Engineer for approval, the company name, address, and qualifications of the selected ITL proposed for use at the project. Included in this submittal will be the names and qualifications of the individuals who are proposed for assignment to the site. The Engineer reserves the right to request other information regarding the qualifications of the ITL for use in the evaluation process.
- C. Sampling
1. The Contractor shall be responsible for collecting samples and conducting tests using a qualified ITL to document material property compliance with the specifications.
 2. The Contractor shall be responsible for collecting samples and conducting tests using a qualified ITL to certify and document that imported material meets the allowable analytical compound concentrations and properties specified in this Section. These samples will be collected and transported in compliance with the QC Workplan. The Engineer reserves the right to observe sampling and testing of the materials. The Contractor shall provide at least 24-hours notice of a sampling event to the Engineer.

3. Representative samples of each specific material type from each specific material source will be obtained by compositing at least five randomly selected individual samples of approximately equal weight. The total composite sample mass shall be at least the minimum size required to conduct all of the required material property and analytical chemistry tests for that material type. Each of the individual samples will be obtained from within the boundaries of the material mass that the composite sample represents. In addition, at least one (1) pound of each individual sample will be retained in a separate, sealed clean glass jar for mercury testing and for additional duplicate testing, if needed.
4. Contractor quality control samples may be obtained from in situ samples for pre-approval of a dedicated borrow source area. The sampling methodology and means for assuring the material dedication to the project shall be submitted to the Engineer for approval prior to the commencement of sampling.
5. Contractor quality control samples may also be obtained from dedicated stockpiles or storage/transportation vessels. The sampling methodology and means for assuring the material dedication to the project shall be submitted to the Engineer for approval prior to the commencement of sampling.

D. Sample Frequency

1. Each imported material type shall be tested at the following batch sizes:
 - a. For the first 25,000 cubic yards of each material type from a specific material source, a representative composite sample will be obtained from each 2,500 cubic yards (in-place volume) batch or part thereof.
 - b. If no unacceptable test results have been obtained on samples representing the first 25,000 cubic yards of each material type and the material continues to be from the same material source with consistent appearance and source area or process, then the batch size can be increased to 5,000 cubic yards for the subsequent material deliveries.
 - c. If no unacceptable test results have been obtained on samples representing the first 75,000 cubic yards of each material type and the material continues to be from the same material source with consistent appearance and source area or process, then the batch size can be increased to 10,000 cubic yards for the subsequent material deliveries.

E. Analytical Chemistry Testing

1. These samples will be sent to an Analytical Chemistry Testing Laboratory (ACTL) selected by the Engineer. Each composite sample for each material shall be tested for the compounds in Table 375-6.8(b) "Restricted Use Soil Cleanup Objectives" in NYSDEC Subpart 375. All test results shall be below the Commercial cleanup objective concentrations provided

in this table. Failure of a single compound test result shall mean that the entire material batch will be rejected unless specifically accepted on a test-by-test basis in writing by the Engineer.

2. Each individual sample used to construct the composite sample shall be tested for total mercury. The result for all of the individual samples for a composite sample must be below the Commercial cleanup objective concentrations provided in Table 375-6.8(b) "Restricted Use Soil Cleanup Objective" in NYSDEC Subpart 375. Failure of a single individual sample in a batch shall mean that the entire batch will be rejected unless specifically accepted on a test-by-test basis in writing by the Engineer.

F. Material Property Testing

1. Each composite sample shall be tested for material properties as defined in the specific specification section or sub-section for that material type.

F. General

1. No imported materials shall be delivered to the project site before the required material property and analytical chemistry testing for that batch has been provided to the Engineer and written approval received from the Engineer. Unapproved material shall be removed from the site at the Contractor's expense.
2. Contractor shall be responsible for repairing or reconstructing the deficiencies at his own expense to meet this specification and other Contract Documents.

1.06 CONSTRUCTION QUALITY ASSURANCE

- A. The Engineer shall conduct quality assurance sampling on materials delivered to the site.
1. The Contractor shall provide access and support to the delivered materials in order for representative sampling and testing to be conducted.
 2. The Engineer shall have the right to visit the borrow source at any time during borrow pit working hours to observe mining, manufacturing, stockpiling or loading operations.

1.07 AS-BUILT DOCUMENTATION

- A. The Contractor shall provide as-built revisions to the Project Drawings in accordance with Section —01300 – Submittal Procedures.
- B. In addition to preparation of as-built revisions to the Project Drawings, the Contractor shall provide as-built documentation for the top surface of placed protective soil layer.

PART 2 PRODUCTS

2.01 MATERIALS

- A. The Vegetative Soil Layer shall be free of any metals, roots, trees, stumps, concrete, construction debris, or any other deleterious material.
- B. The Vegetative Soil Layer shall have a maximum particle size of 3 inch and shall not be gap graded.
- C. The Vegetative Soil Layer shall contain not less than 3 percent nor more than 20 percent organic matter as determined by ASTM D2974.
- D. The Vegetative Soil Layer shall be tested by an agricultural analytical testing laboratory to determine the soil's pH (acidity or alkalinity) using ASTM D4972 and to reveal nutrient deficiencies (that could be corrected with appropriate soil amendments. The Vegetative Soil Layer shall be amended by applying fertilizer and lime at rates as recommended by the agricultural analytical testing laboratory.
- E. The Contractor shall perform the following material property tests, prior to material being delivered to the site, at the frequency specified in Section 1.05:
 - 1. Grain size (ASTM D422)
 - 2. Moisture (ASTM D2216)
 - 3. Organic Content (ASTM D2974); and
 - 4. pH (ASTM D 4972) and nutrient evaluation

2.02 EQUIPMENT

- A. Contractor shall furnish equipment to perform the scope of work described in this specification, including haul, place, and spread the Vegetative Soil Layer.

PART 3 – EXECUTION

3.01 MATERIAL PLACEMENT

- A. The Vegetative Soil Layer shall be placed directly on top of the previously placed Protective Soil Layer as shown on the Drawings. The Vegetative Soil Layer shall be placed using a low ground-pressure dozer in accordance with the ground pressure requirements of this Section.
- B. The Vegetative Soil Layer material shall be placed in one loose lift which results in an installed lift thickness of no less than 6 inches.
- C. The underlying Protective Soil Layer surface shall be scarified before the placement of the Vegetative Soil Layer.

- D. The equipment used to spread and compact the Vegetative Soil Layer shall comply with the following:

Maximum Allowable Equipment Ground Pressure (psi)	Thickness of Soil Above Geomembrane (in.)
<5	12
<10	18
<20	24
>20	36

- E. Seeding, mulching, and use of erosion control mats per the Contract Documents and as directed by Engineer.
- F. Contractor shall be responsible for protecting the Vegetative Soil Layer from being washed out during rain events until vegetation is established on the cover.

[END OF SECTION]