



An employee-owned company

September 25, 2001

Mr. Kim Ford, P.E.  
Solid Waste - Southwest District  
Florida Department of Environmental Protection  
3804 Coconut Palm Drive  
Tampa, Florida 33619-8318

**RECEIVED**  
SEP 27 2001

Department of Environmental Protection  
BY SOUTHWEST DISTRICT

**RE: Manatee County Solid Waste Management Facility  
Lena Road Landfill - Stage I and III Site Improvements  
Pending Permit #39884-005-SC**

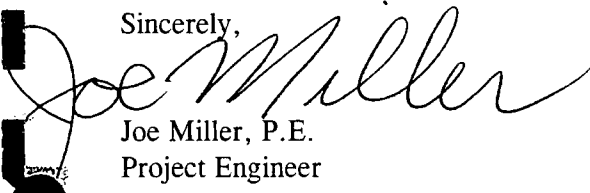
Dear Mr. Ford:

This is in response to your September 18, 2001 letter requesting additional information related to the above pending permit. A copy of your letter is included for reference.

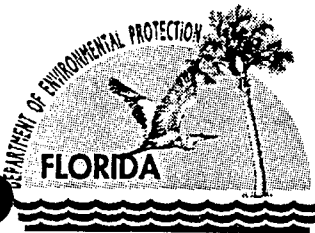
1. Sheet 6 shows the correct elevations for the existing 4-foot diameter CMP manhole and related pipe inverts. The pipe shown entering the manhole from the north at elevation 35.10 is an abandoned toe drain from the adjacent landfill slope. The pipe will not be connected to the new manhole. No revisions to Sheet No. 6 are needed.
2. Proof of publication of notice of application pursuant to Rule 62-110.106 will be sent in a separate letter when available.
3. Specifications for the non-woven geotextile and the clean granular fill are in the quality assurance plan included with this letter.
4. A construction quality assurance plan for all slurry wall crossings and leachate collection system installations is included with this letter.
5. The leachate collection system will be video taped upon completion as required by Note 3 on Drawing L-3. A copy will be sent to FDEP with the certification of the system
6. Four copies of Drawing L-4 for Piezometer PZ-3A installation are included with this letter. The drawing was revised per comments 1 through 10 of John Morris' September 18, 2001 memorandum. The top of the well screen was set at elevation 28, which is one foot below the elevation of the adjacent leachate collection pipe. The leachate collection pipe can lower the leachate level to elevation 29. The top of the screen was set one foot lower so the screen will always be submerged and provide a water seal to keep landfill gas from entering the piezometer.

After Comment 10, John Morris requests additional information concerning documentation related to replacement of Piezometers PZ-14, PZ-15B and PZ-16. These replacement piezometers are not related to this request for a construction permit. Manatee County is addressing this issue separately, and we hope FDEP

Sincerely,

  
Joe Miller, P.E.  
Project Engineer

C: Pete Putman, PBS&J Sarasota Office  
G:\WASTEMAN\Manatee County\SW-2 Leachate Pond Facilities\FordResponse.LTR.doc



# Department of Environmental Protection

Jeb Bush  
Governor

Southwest District  
3804 Coconut Palm Drive  
Tampa, Florida 33619

David B. Struhs  
Secretary

September 18, 2001

Mr. Daniel Gray  
Manatee County Public Works  
4410 - 66th Street West  
Bradenton, FL 34210

RECEIVED	
PBS&J - ORLANDO	
WASTE MANAGEMENT	
SEP 14 2001	
FILE	

Re: Lena Road Landfill - Stages I and III Site Improvements  
Pending Permit No.: #39884-005-SC, Manatee County

Dear Mr. Gray:

This is to acknowledge receipt of the permit application received August 20, 2001 for the construction of a new leachate collection system and other related improvements.

This letter constitutes notice that a permit will be required for your project pursuant to Chapter(s) 403, Florida Statutes.

Your permit application is incomplete. This is the Department's 1st letter requesting additional information. Please provide the information listed below promptly. Evaluation of your proposed project will be delayed until all requested information has been received.

The following information is needed in support of the solid waste applications [Chapters 62-711, Florida Administrative Code (F.A.C.)]. Please provide:

1. 62-701.320(7)(f). Revised Sheet 6- with the corrected elevations for the existing 4-foot diameter CMP manhole and related pipe inverts.
2. 62-701.320(8)(a). Proof of publication of notice of application pursuant to Rule 62-110.106, see attached notice.
3. 62-701.400(4)(a). Specifications for the non-woven geotextile and the clean granular fill.
4. 62-701.400(7). Construction quality assurance plan for all slurry wall crossings and leachate collection system installation.
5. 62-701.500(8)(h). Description of arrangements for water pressure cleaning or inspection of the new leachate collection systems.

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Mr. Daniel Gray  
Manatee County Public Works

September 18, 2001  
Page 2

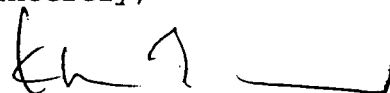
6. 62-701.410. A response to each of Mr. John Morris's comments and concerns expressed in his September 18, 2001 memorandum, attached. You may call Mr. Morris to discuss items in his memorandum at (813) 744-6100, extension 336.

**Please provide all responses that relate to engineering, signed and sealed by a professional engineer.**

"NOTICE! Pursuant to the provisions of Section 120.60, F.S., if the Department does not receive a complete response to this request for information within 30 days of the date of this letter, the Department may issue a final order denying your application. You need to respond within 30 days after you receive this letter, responding to all of the information requests and indicating when a response to any unanswered questions will be submitted. If the response will require longer than 30 days to develop, you should develop a specific time table for the submission of the requested information for Department review and consideration. Failure to comply with a time table accepted by the Department will be grounds for the Department to issue a Final Order of Denial for lack of timely response. A denial for lack of information or response will be unbiased as to the merits of the application. The applicant can reapply as soon as the requested information is available."

Please submit your response to this letter as one complete package. On all future correspondence, please include Robert Butera on distribution. If you have any questions you may call me at (813) 744-6100, extension 382.

Sincerely,



Kim B. Ford, P.E.  
Solid Waste Section  
Division of Waste Management

KBF/ab  
Attachments

cc: Gus DiFonzo, Manatee County  
Joe Miller, P.E., PBS&J  
Pete Putman, P.E., PBS&J  
16 Robert Butera, P.E., FDEP Tampa  
John Morris, P.G., FDEP Tampa

62-110.106(5). Notices: General Requirements.

Each person who files an application for a Department permit or other notice as may publish or be required to publish a notice of application or other notice as set forth below in this section. Except as specifically provided otherwise in this paragraph, each person publishing such a notice under this section shall do so at his own expense in the legal advertisements section a newspaper of general circulation (i.e., one that meets the requirements of sections 50.011 and 50.031 of the Florida Statutes) in the county or counties in which the activity will take place or the effects of the Department's proposed action will occur, and shall provide proof of the publication to the Department within seven days of the publication.

62-110.106(6). If required, the notice shall be published by the applicant one time only within fourteen days after a complete application is filed and shall contain the name of the applicant, a brief description of the project and its location, the location of the application file, and the times when it is available for public inspection. The notice shall be prepared by the Department and shall comply with the following format:

State of Florida  
Department of Environmental Protection  
Notice of Application

The Department announces receipt of an application for permit from Manatee County for the construction of a new leachate collection and removal system and related improvements in Stages I and III of the existing Lena Road Landfill subject to Department rules, located at 3333 Lena Road, Bradenton, Manatee County, Florida.

This application is being processed and is available for public inspection during normal business hours, 8:00 a.m. to 5:00 p.m., Monday through Friday, except legal holidays, at the Department of Environmental Protection, Southwest District Office, 3804 Coconut Palm Drive, Tampa, Florida 33619-8318.

## Memorandum

# Florida Department of Environmental Protection

TO: Kim Ford, P.E.  
FROM: John R. Morris, P.G. JRM  
DATE: September 18, 2001  
SUBJECT: Lena Road Class I Landfill – Gradient Monitoring Location Replacement  
Permit No. 39884-005-SC  
cc: Robert Butera, P.E.

I have reviewed the letter submitted by PBS&J, dated September 5, 2001, received September 7, 2001, that provides information regarding the proposed replacement of existing gradient monitoring piezometer P-3. My review was limited to the piezometer replacement and did not address any other issues associated with the construction permit. Additional information is needed to evaluate the adequacy of the proposed piezometer replacement. Please have the applicant address the following comments:

1. A unique identification number is required for the replacement of existing piezometer P-3. Please submit a modified installation details drawing that includes the selected identification number of the replacement piezometer. To be consistent with the numbering system used at the facility, it is suggested that the replacement piezometer be designated as PZ-3A.
2. Existing piezometer P-3 shall be properly abandoned in accordance with Specific Condition No. 37 of operating permit No. 39884-001-SO issued for the Lena Road Landfill. The proposed abandonment of existing piezometer P-3 by removing the entire well and backfilling the hole with clean sand (item No. 2 on the installation details drawing) must be specifically approved by SWFWMD, otherwise the piezometer shall be abandoned by filling the well bore from the bottom with sufficient grout for visible surface returns. Please verify the method of abandonment of piezometer P-3 that will be/has been approved by SWFWMD and modify the installation details drawing as appropriate.
3. Please modify item No. 3A on the installation details drawing to also reference the submittal of DEP Form No. 62-522.900(3) – Monitor Well Completion Report (attached) to document the construction details of the replacement piezometer.
4. The piezometers that are located inside the slurry wall and used for comparison of water table elevations across the slurry wall are not intended to be included in the semi-annual ground water sampling events. As such, conducting an initial sampling event at the replacement piezometer as described in item No. 3B on the installation details drawing is not required. The Department would not object to the deletion of this note from the installation details drawing.
5. Please submit a revised installation details drawing that indicates piezometer in place of monitor well.
6. Please revise the installation details drawing to specify the material and thickness of the well seal that will be placed above the sand pack in the annular space.
7. Please revise the installation details drawing to show the elevation of the adjacent leachate collection pipe on the piezometer detail cross-section.

*"Protect, Conserve and Manage Florida's Environment and Natural Resources"*

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8. The installation details drawing indicates a water table elevation of  $\pm 29$  feet, however a review of the Department's files indicates that the water table elevations have been reported to range from 26.35 feet (January 2000) to 34.60 feet (October 1995) at piezometer P-3. Please revise the installation details drawing to show this range.

9. Based on the information provided on the installation details drawing, it appears that the top and bottom elevations of the screen in the replacement piezometer will be about 27.83 and 17.83 feet, respectively. Please verify that this screened interval is appropriate for the proposed leachate collection pipe (item No. 7, above) and historical range of water levels recorded at existing piezometer P-3 (item No. 8, above.)

10. The responses must be signed and sealed by a Florida licensed P.G. or P.E.

Additionally, it appears that the Department's files are incomplete regarding documentation of the abandonment of piezometers PZ-14, PZ-15B and PZ-16, and regarding the construction details of replacement piezometers PZ-14A, PZ-15C and PZ-16A. The Department conditionally approved the abandonment of PZ-14 and PZ-15B in a letter dated August 15, 2000 (attached). Please note the requirement of Specific Condition No. 36 of Permit No. 39884-001-SO that a minor permit modification or written approval must be obtained from the Department prior to the construction of any new wells (including piezometers).

The Department files contain a letter prepared by McKim & Creed, P.A., dated January 23, 2001, received January 24, 2001, that provides incomplete abandonment documentation for PZ-15B and PZ-16. This letter also indicates that supplemental information would be provided by PSI, however no supplemental information has been received regarding piezometer abandonment or replacement. Please submit the outstanding information listed below:

- SWFWMD abandonment records for PZ-14, PZ-15B and PZ-16
- DEP Form No. 62-522.900(3) providing construction details of PZ-14A, PZ-15C and PZ-16A
- Application for minor modification of Permit No. 39884-001-SO to reflect the changes to the gradient monitoring points
- Revised site map (no larger than 11 x 17 inches) that shows the locations of the abandoned and replacement piezometers

Attachments: DEP Form No. 62-522.900(3)  
DEP letter dated August 15, 2000

jrm

Florida Department of Environmental Protection  
Twin Towers Office Bldg. 2600 Blair Stone Road Tallahassee, Florida 32399-2400

DEP Form # 62-522.900(3)
Form Title <u>MONITOR WELL COMPLETION REPORT</u>
Effective Date _____
DEP Application No. _____ (Filled in by DEP)

## MONITOR WELL COMPLETION REPORT

DATE: \_\_\_\_\_

INSTALLATION NAME: \_\_\_\_\_

DEP PERMIT NUMBER: \_\_\_\_\_ GMS NUMBER: \_\_\_\_\_

WELL NUMBER: \_\_\_\_\_ WELL NAME: \_\_\_\_\_

DESIGNATION: Background \_\_\_\_\_ Immediate \_\_\_\_\_ Compliance \_\_\_\_\_

LATITUDE/LONGITUDE: \_\_\_\_\_

AQUIFER MONITORED: \_\_\_\_\_

INSTALLATION METHOD: \_\_\_\_\_

INSTALLED BY: \_\_\_\_\_

TOTAL DEPTH: \_\_\_\_\_ DEPTH OF SCREEN: \_\_\_\_\_ (bls)  
(bls)

SCREEN LENGTH: \_\_\_\_\_ SCREEN SLOT SIZE: \_\_\_\_\_ SCREEN TYPE: \_\_\_\_\_

CASING DIAMETER: \_\_\_\_\_ CASING TYPE: \_\_\_\_\_

LENGTH OF CASING: \_\_\_\_\_ FILTER PACK MATERIAL: \_\_\_\_\_

TOP OF CASING ELEVATION (MSL): \_\_\_\_\_

GROUND SURFACE ELEVATION (MSL): \_\_\_\_\_

COMPLETION DATE: \_\_\_\_\_

DESCRIBE WELL DEVELOPMENT: \_\_\_\_\_

POST DEVELOPMENT WATER LEVER ELEVATION (MSL): \_\_\_\_\_

DATE AND TIME MEASURED: \_\_\_\_\_

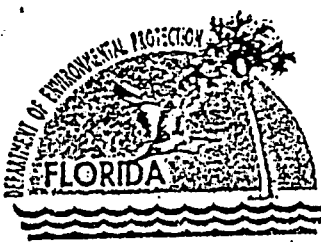
REMARKS: (soils information, stratigraphy, etc.): \_\_\_\_\_

REPORT PREPARED BY: \_\_\_\_\_

(name, company, phone number)

NOTE: PLEASE ATTACH BORING LOG.

(bls)= Below Land Surface



# Department of Environmental Protection

Jeb Bush  
Governor

Southwest District  
3804 Coconut Palm Drive  
Tampa, Florida 33619

David B. Struhs  
Secretary

August 15, 2000

Mr. Len Bramble, P.E., Director  
Manatee County Public Works Department  
4410 66<sup>th</sup> Street West  
Bradenton, FL 34210

Re: Lena Road Class I Landfill, Manatee County  
Operating Permit No. 39884-001-SO

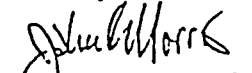
Dear Mr. Bramble:

The Department reviewed the letter submitted by Professional Service Industries, Inc., dated July 11, 2000, received July 14, 2000 regarding replacement of two gradient monitoring piezometers at the referenced facility. The Department has no objection to the implementation of the Work Plan presented in this letter subject to the following conditions:

1. Unique identification numbers shall be used for the replacement piezometers. It is suggested that the replacement piezometers be designated as PZ-14A and PZ-15C.
2. Existing piezometers PZ-14 and PZ-15B shall be properly abandoned in accordance with Specific Condition No. 37 of the referenced permit. The required written abandonment report shall be submitted to the Department within 90 days of completion. The site map to be included in this report shall be modified to show the locations of the abandoned and replacement piezometers. It is requested that the revised site map be no larger than 11 x 17 inches in size.
3. The written report referenced in item No. 2 shall include DEP Form No. 62-522.900(3) completed for each well. A copy of this form is attached.
4. The changes to the gradient monitoring pairs will be reflected in an amended Specific Condition No. 33 when the referenced permit is modified upon certification of construction completion for the leachate collection system.
5. The monthly hydraulic gradient data report shall be modified to reflect the replacement piezometers.

Please contact me at (813) 744-6100 extension 336 if you have questions or comments.

Sincerely,

  
John R. Morris, P.G.  
Solid Waste Section

Attachment

cc: Gus DiFonzo, Manatee County Public Works Department  
David A. Stedje, P.G., Professional Service Industries, Inc.,  
5801 Benjamin Center Drive, Suite 112, Tampa, FL 33634  
Robert Butera, P.E., FDEP  
Kim Ford, P.E., FDEP

"More Protection, Less Process"



**MANATEE COUNTY  
SOLID WASTE MANAGEMENT FACILITY  
LENA ROAD LANDFILL  
STAGE I AND III LANDFILL SITE IMPROVEMENTS**

**CONSTRUCTION QUALITY ASSURANCE PLAN**

**For the  
INSTALLATION OF THE LEACHATE COLLECTION SYSTEM  
and  
INSTALLATION OF THE SLURRY WALL CROSSINGS**

**SEPTEMBER 2001**

**Prepared for:  
MANATEE COUNTY GOVERNMENT  
UTILITY OPERATIONS DEPARTMENT  
SOLID WASTE DIVISION**

**Prepared by:  
PBS&J  
482 South Keller Road  
Orlando, Florida 32810**

**120498.02**

## **Section 1**

# **INTRODUCTION**

### **1.1 PURPOSE AND SCOPE**

This Construction Quality Assurance (CQA) Plan addresses the steps to be taken for the construction quality assurance of the slurry wall crossings and leachate collection system installation. The CQA program developed by the Design Engineer and provided for Manatee County and the Florida Department of Environmental Protection (FDEP), will allow the work to meet or exceed the requirements of the FDEP regulations and contract construction specifications and will form the basis to allow for the long-term integrity for the landfill. The scope of this report is to describe the plan in detail and includes quality assurance applicable to manufacturing, fabrication, transportation, storage, handling, and installation of the system components.

### **1.2 PROJECT PARTY DEFINITIONS AND RESPONSIBILITIES**

The Manatee County project will involve the interaction of several parties including the Owner/Operator, Florida Department of Environmental Regulation, the Design Engineer, the General Contractor, sub-contractors, the Manufacturer/Fabricator, Geosynthetic Installer, and the Construction Quality Assurance Manager (CQAM). The following provides the description, the qualifications required, and the responsibilities of these individual parties, and others who will be involved in the project. The recommended personnel qualifications for individuals comprising the project party are shown in Table 1-1.

#### **1.2.1 Permitting Agency**

It is the responsibility of the Permitting Agency to review the Owner/Operator's permit application including the site-specific CQA plan for compliance with the agency's regulations and to make a decision to issue or deny a permit based on this review. The Permitting Agency also has the responsibility to review all CQA documentation during or after construction of a facility. This includes possible visits to the manufacturing facility and construction site to observe the MQC/CQC and CQA practices to confirm that the accepted CQA plan was followed and that the facility was constructed as specified in the design.

#### **1.2.2 Owner/Operator**

The Owner/Operator is responsible for design, construction, and operation of the facility, shall assume all duties and responsibilities for the Manatee County project and will have all the rights and authority assigned to the Owner/Operator in contract documents and in this CQA Plan. The Owner/Operator has the authority to select and dismiss organizations charged with the design and construction and CQA functions. The Owner/Operator is responsible for complying with the requirements of the permitting agency, the submission of CQA data, and assuring the permitting

agency that the facility was constructed as specified in the construction plans and specifications, and as approved by the permitting agency. (The interaction of a state office regulating another state or local organization should have absolutely no impact on procedures, intensity of effort, and ultimate decisions of the MQC/CQC or CQA process as described herein.) The Owner/Operator is also generally responsible for providing--in a timely manner--any available data which pertains to the site, the general area, and the nature of the project, when requested by the Design Engineer. The Owner/Operator shall be responsible for final acceptance of the system with consideration of recommendations made by the Design Engineer and the Owner's/Operator's representative during the installation of the system.

### **1.2.3 Owner's Representative**

The Owner/Operator usually has an official representative who is responsible for coordinating schedules, meetings, and field activities. This responsibility includes communications to other members in the Owner/Operator's organization, permitting agency, material suppliers, general contractor, specialty subcontractors or installers, and CQA Manager.

**Table 1-1**

**RECOMMENDED PERSONNEL QUALIFICATIONS**

<b>Individual</b>	<b>Minimum Personnel Requirements</b>
Design Engineer	Registered Professional Engineer.
Owner's Representative	Registered Professional Engineer, Engineer in Training or Certified CQA Inspector.
Manufacturer/Fabricator	Experience in manufacturing, or fabricating, at least 1,000,000 m <sup>2</sup> (10,000,000 ft <sup>2</sup> ) of similar geosynthetic materials.
MQC Personnel	Manufacturer, or fabricator, trained personnel in charge of quality control of the geosynthetic materials to be used in the specific facility.
MQC Officer	The specific individual designated by a manufacturer or fabricator, in charge of geosynthetic material quality control.
Geosynthetic Installer's Representative	Experience installing at least 1,000,000 m <sup>2</sup> (10,000,000 ft <sup>2</sup> ) of similar geosynthetic materials.
CQC Personnel	Employed by the general contractor, installation contractor, or earthwork contractor involved in similar facilities; certified by NICET.
CQA Manager/Monitor	Employed by an organization that operates separately from the contractor and owner/operator.
CQA Program Manager	Employed by an organization that operates separately from the contractor and owner/operator; registered Professional Engineer and/or approved by permitting agency.
CQA Certifying Engineer	Employed by an organization that operates separately from the contractor and owner/operator; registered Professional Engineer in the state in which the facility is constructed and approved by the permitting agency.

#### **1.2.4 Design Engineer**

The Design Engineer, Post, Buckley, Schuh & Jernigan, Inc. (PBS&J) shall assume all duties and responsibilities and will have the rights and authority assigned to the Engineer in the Contract Documents and in this CQA Plan. Generally, the Design Engineer's primary responsibility is to design a facility that meets the operational requirements of the Owner/Operator, complies with accepted design practices, and meets or exceeds the minimum requirements of the permitting agency. As the Contract Documents will be a product of the Design Engineer, the Design Engineer may be requested to change some aspects of the design if unexpected conditions are encountered during construction (e.g., a change in site conditions, unanticipated logistical problems during construction, or lack of availability of certain materials). Because design changes during construction are not uncommon, the Design Engineer is often involved in the CQA process. However, with respect to the CQA Plan, the Engineer's duties and responsibilities include:

- Attendance at a one-day preconstruction conference to clarify objectives and goals to be achieved during installation of the liner system.
- Review of shop drawings submitted by the General Contractor, and recommendations to the Owner/Operator for acceptance or rejection.
- Construction observation services during the installation and covering of the liner, and providing a Construction Quality Assurance Manager for various stages of construction.

#### **1.2.5 General Contractor**

The General Contractor has overall responsibility for construction of the actual facility, ensuring that it is constructed in accordance with the contract plans and specifications that have been developed by the Design Engineer and approved by the Permitting Agency, and for construction quality control (CQC) during construction. The General Contractor is also responsible for informing the Owner/Operator and the CQA Engineer of the scheduling and occurrence of all construction activities.

The General Contractor shall provide the services of manufacturers, fabricators, installers, and other subcontractors needed to construct the liner system. The General Contractor arranges for purchase of materials that meet specifications, enters into a contract with one or more fabricators (if fabricated materials are needed) to supply those materials, and contracts with an installer (if separate from the General Contractor's organization). The General Contractor shall accept and retain full responsibility for the quality control of all materials and installation and shall be held responsible for ensuring that the materials and the workmanship meet the requirements of the contract plans and specifications.

The General Contractor shall be responsible for the submittal to the Design Engineer, for approval, of all information related to the qualifications of any subcontractors providing services for the placement of the lining system. Any subcontractors to the General Contractor on this installation shall coordinate their activities through and interface with the General Contractor only. Information

to be contained in the qualifications submittal for the geomembrane manufacturer, fabricator, and installer is detailed in the following text.

Transportation, handling, storage, and care of the liner system materials and its components prior to and following installation at the site, is the responsibility of the General Contractor. The geosynthetic materials shall not be off loaded unless a CQA monitor is present to observe the rolls for any possible damage during loading. The General Contractor shall be liable for all damages to the materials incurred prior to final acceptance of the lining system by the Owner/Operator. The General Contractor shall repair or replace at his own expense any defective materials or products which fail to meet the design requirements.

The General Contractor shall guarantee the workmanship of all services supplied as part of this work for a minimum period of one (1) year following acceptance by the Owner/Operator. The General Contractor shall repair or replace at his own expense any defective work which fails to meet the design requirements. Repair or replacement of such defective work shall be completed within thirty (30) calendar days of notification by the Owner/Operator.

Warranty conditions proposed by the manufacturer fabrication/installer concerning limits of liability will be evaluated upon receipt and must be acceptable to the Owner/Operator prior to installation of the liner.

#### **1.2.6 Earthwork Contractor**

The Earthwork Contractor is responsible for grading the site to elevations and grades shown on the plans and for constructing earthen components of the constructed facility, e.g., pipe subgrade and granular drainage layers according to the specifications. The Earthwork Contractor may be hired by the General Contractor or, in some cases, the General Contractor's personnel may serve as the Earthwork Contractor. The Earthwork Contractor is responsible not only for grading the site to proper elevations, but also for obtaining suitable earthen materials, transport and storage of those materials, preprocessing of materials (if necessary), placement and compaction of materials, and protection of materials during and (in some cases) after placement.

#### **1.2.7 Construction Quality Assurance Manager/Monitors (CQAM)**

The CQAM, as Design Engineer's agent at the site, will act as directed by and under the supervision of the Design Engineer and the CQA Program Manager, and will confer with the Design Engineer regarding CQAM's actions. The CQAM's dealings in matters pertaining to the on-site work shall, in general, be with Design Engineer and General Contractor keeping Owner/Operator advised as necessary. The CQAM's dealings with subcontractors shall only be through, or with the full knowledge and approval of, General Contractor. The CQAM shall generally communicate with Owner/Operator with the knowledge of and under the direction of Design Engineer. The CQAM shall also supervise all CQA Monitors (if needed) for the project.

Quality assurance and construction quality assurance personnel (manager/monitors) are responsible

for making observations and performing field tests to ensure that a facility is constructed in accordance with the plans and specifications accepted by the Permitting Agency. CQA personnel are normally employed by the same firm as the CQA Program Manager, or by a firm hired by the firm employing the CQA Program Manager.

#### Duties and Responsibilities of CQA Manager:

1. Schedules: Review the progress schedule, schedule of Shop Drawing submittals, and schedule of values prepared by General Contractor, and consult with Design Engineer concerning acceptability.
2. Conferences and Meetings: Attend meetings with General Contractor, such as preconstruction conferences, progress meetings, job conferences, and other project-related meetings and prepare and circulate copies of minutes.
3. Liaison:
  - a. Serve as Design Engineer's liaison with General Contractor, working principally through General Contractor's Superintendent, and assist in understanding the intent of the Contract Documents; and assist Design Engineer in serving as Owner's liaison with General Contractor when General Contractor's operations affect Owner's on-site operations.
  - b. Assist in obtaining from Owner/Operator additional details or information, when required for proper execution of the Work.
4. Shop Drawings and Samples:
  - a. Receive and record the date Shop Drawings and samples are received, and notify Design Engineer.
  - b. Advise Design Engineer of the commencement of any work requiring a Shop Drawing or sample if the submittal has not been accepted by Design Engineer.
  - c. Receive samples which are furnished at the site by General Contractor, and notify Design Engineer that the samples are available for inspection.
5. Review of Work, Rejection of Defective Work, Inspections and Tests:
  - a. Observe the work in progress on site to assist Design Engineer in determining if the work is proceeding in accordance with the Contract Documents.
  - b. Report to the Design Engineer any work which appears unsatisfactory, defective, or does not conform to the Contract Documents, or does not meet the requirements of

any inspection, test or approval. Advise Design Engineer of work that CQAM believes should be corrected, rejected, uncovered for observation, tested, inspected, or accepted.

- c. Verify that tests are conducted in presence of appropriate personnel, that all seam weld tests are witnessed under his supervision, and that the General Contractor maintains adequate records thereof; observe, record, and report to Design Engineer appropriate details relative to the test procedures and start-ups.
  - d. Accompany visiting inspectors representing public or other agencies having jurisdiction over the project, record the results of these inspections, and report to Design Engineer.
6. Interpretation of Contract Documents: Report to Design Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to General Contractor clarifications and interpretations as issued by Design Engineer.
7. Modifications: Evaluate General Contractor's suggestions for modifications in drawings or specifications and report recommendations to Design Engineer. Transmit decisions to General Contractor as issued by Design Engineer.
8. Records:
- a. Maintain orderly files at the job site for correspondence, reports of job conferences, Shop Drawings and samples, copies of original Contract Documents including all Work Directive Changes, Addenda, Change Orders, Field Orders, additional Drawings issued subsequent to the execution of the Contract, Design Engineer's clarifications and interpretations of the Contract Documents, progress reports, and other project-related documents.
  - b. Prepare Daily Construction Reports, recording General Contractor hours on the job site, weather conditions, data relative to questions of Work Directive Changes, Change Orders, or changed conditions, list of job site visitors, daily activities, decisions, observations in general, and specific observations in more detail as the case of observing test procedures; and send copies to Design Engineer.
  - c. Record names, addresses, and telephone numbers of all General Contractors, subcontractors, and major suppliers of materials and equipment.
  - d. Ensure that General Contractor maintains record drawings of panel seams, penetrations, and repairs.



9. Reports:
  - a. Furnish Daily Construction Reports to Design Engineer, noting work progress and the General Contractor's compliance with the progress schedule, and schedule of Shop Drawings and sample submittals.
  - b. Draft proposed Change Orders and Work Directive Changes, obtaining backup material from General Contractor and recommend to Design Engineer Change Orders, Work Directive Changes, and Field Orders.
  - c. Immediately report any accidents to Design Engineer and Owner/Operator.
  - d. Report scheduled major tests, inspections, or start of important phases of the work to the Design Engineer in advance.
  - e. Immediately notify the Design Engineer, who will notify the Owner/Operator, of all test failures.
10. Payment Requisitions: Review applications for payment with General Contractor for compliance with the established procedure for their submission and forward with recommendations to Design Engineer, noting particularly the relationship of the payment requested to the schedule of values, work completed and materials and equipment delivered at the site but not incorporated in the work.
11. Certificates: Verify that certificates and other data required to be assembled and furnished by General Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have this material delivered to Design Engineer for review and forwarding to Owner/Operator prior to final payment for the Work.
12. Completion:
  - a. Before Design Engineer issues a Certificate of Substantial Completion, submit to General Contractor a list of items observed to require completion or correction.
  - b. Conduct final inspection in the company of Design Engineer, Owner/Operator, and General Contractor and prepare a final list of items to be completed or corrected.
  - c. Observe that all items on final list have been completed or corrected and make recommendations to Design Engineer concerning acceptance.

13. Limitations of Authority:

The CQAM:

- a. Shall not authorize any deviations from the Contract Documents or substitution of materials or equipment, unless authorized by Design Engineer.
- b. Shall not exceed limitations of Design Engineer's authority as set forth in the Contract Documents.
- c. Shall not undertake any of the responsibilities of General Contractor, subcontractors or General Contractor's superintendent, or expedite the work.
- d. Shall not advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction unless such advise or directions are specifically required by the Contract Documents.
- e. Shall not advise on, issue directions regarding, or assume control over safety precautions and programs in connection with the work.
- f. Shall not accept Shop Drawings or sample submittals from anyone other than General Contractor.
- g. Shall not authorize Owner/Operator to occupy the project in whole or in part.
- h. Shall not participate in specialized field or laboratory tests or inspections conducted by others except as specifically authorized by Design Engineer.

**1.2.8 CQA Program Manager**

The CQA Engineer has overall responsibility for quality assurance and construction quality assurance. The engineer is usually an individual experienced in a variety of activities although particular specialists in soil placement, polymeric materials and geosynthetic placement will invariably be involved in a project. The CQA Program Manager is responsible for reviewing the CQA plan as well as general plans and specifications for the project so that the CQA plan can be implemented with no contradictions for unresolved discrepancies.

Other responsibilities of the CQA Program Manager include education of inspection personnel on CQA requirements and procedures and special steps that are needed on a particular project, scheduling and coordinating of CQA inspection activities, engineering that proper procedures are followed, ensuring that testing laboratories are conforming to CQA requirements and procedures, ensuring that sample custody procedures are followed, confirming that test data are accurately reported and that test data are maintained for later reporting, and preparation of periodic reports.

The most important duty of the CQA Program Manager is overall responsibility for confirming that the facility was constructed in accordance with plans and specifications approved by the permitting agency. The CQA Program Manager is normally hired by the Owner/Operator and functions independently of the contractors and Owner/Operator. The CQA Program Manager must be a registered professional engineer who has shown competency and experience in similar projects and is considered qualified by the permitting agency. The resume of the CQA Program Manager for this project is included as part of this package. The Permitting Agency has the right to request additional information from the prospective CQA Program Manager and his/her associated organization including experience record, education, registry, and ownership details. The Permitting Agency has the right to accept or deny the CQA Program Manager's qualifications based on such data and revelations. If the Permitting Agency requests additional information or denies the CQA Program Manager's qualifications, it should be done prior to construction, so that alternatives can be selected which do not negatively impact on the progress of the work. The CQA Program Manager is sometimes required to be at the construction site during all major construction operations to oversee CQA personnel. The CQA Program Manager is usually the CQA Certifying Engineer who certifies the completed project.

#### **1.2.9 CQA Certifying Engineer**

The CQA Certifying Engineer is responsible for certifying to the Owner/Operator and Permitting Agency that, in his or her opinion, the facility has been constructed in accordance with plans and specifications and CQA documentation approved by the Permitting Agency. The certification statement is normally accompanied by a final CQA report that contains all the appropriate documentation including daily observation reports, sampling locations, test results, as-built drawings or sketches, and other relevant data. The CQA Certifying Engineer may be the CQA Program Manager or someone else in the CQA Program Manager's organization who is a registered professional engineer with experience and competency in certifying like installations.

#### **1.2.10 Independent Testing Laboratory**

A Testing Laboratory shall be retained by the Owner/Operator, under direction of the Design Engineer, to analyze samples obtained by the CQAM or CQAM support staff and to test on-site conditions. The testing laboratory shall have its own internal QA plan to ensure that laboratory procedures conform to the appropriate ASTM standards or other applicable testing standards. The testing laboratory is responsible for ensuring that tests are performed in accordance with the applicable methods and standards, for following internal QC procedures, for maintaining sample chain-of-custody records and for reporting data.

The laboratory must be willing to allow the owner, design engineer, permitting agency, or installer to observe sample preparation and testing procedures, or record-keeping procedures, either announced or unannounced. The laboratory shall issue two copies of all results, certified by an officer of the testing laboratory, directly to the CQAM. Results provided shall include raw measurements and any intermediate calculations required to determine the final test results. The laboratory is also responsible for keeping accurate records of all tests conducted and retain collected

samples for six months after acceptance of construction by the Design Engineer. All independent testing laboratories must be accepted by the Design Engineer prior to testing. They must also submit two certified copies of test results directly to the CQAM as described above.

### **1.3 SITE AND PROJECT CONTROL**

To promote a high degree of quality control during the liner system installation, meetings shall be held prior to and during the liner system installation. Site visits shall also be conducted to ascertain the progress of the project.

#### **1.3.1 Project Coordination Meetings**

The purpose of meetings is to coordinate tasks among the parties of the project, to relate the lines of authority and to provide a method of communication among the parties of the project, and to discuss in detail specifics related to the quality assurance/quality control aspects of the project with parties involved in the project.

Following the completion of the design, plans, specifications, and the selection of the General Contractor, a preconstruction meeting will be held. Weekly progress meetings will also be held.

#### **1.3.2 Site Visits**

Site visits may include visits to manufacturing plants, soil borrow sources, and/or to the construction site. Plant visits may include the resin manufacturing plant, the GCL manufacturing plant, the geomembrane manufacturing plant, the geomembrane fabrication plant, and geotextile manufacturing plant. These plant visit(s) may be conducted by the Owner/Operator and/or by the Owner's representative at the Owner's discretion and by the Design Engineer.

Site visits to the construction site will also be conducted on a weekly basis and as needed by the principal engineer and other parties responsible for quality assurance and quality control. State and local regulatory officials may be informed of the dates of the visits.

#### **1.3.3 Problem Identification and Corrective Measure Reports**

A problem is defined as material workmanship that does not meet the requirements of the plans, specifications or CQA plan for a project or any obvious defect in material or workmanship, even if there is conformance with plans, specifications and the CQA plan. Special meetings shall be held when and if problems or deficiencies are present or are likely to occur which cannot be resolved during weekly progress meetings. At a minimum, the meetings shall be attended by representatives of the Contractor, the Owner and the Engineer. Problem identification and corrective measures reports should contain the information listed below.

- Unique identifying sheet number for cross referencing and document control.

- Note location of the problem.
- Description of the problem (in as much detail as possible and with supporting sketches and photographic information where appropriate).
- Probable cause.
- How and when the problem was located (reference to inspection data sheet or data summary report by inspector).
- Where relevant, estimation of how long the problem has existed.
- Any disagreement noted by the inspector between the inspector and contractor about whether or not a problem exists or the cause of the problem.
- Suggested corrective measure(s).
- Documentation of correction if corrective action was taken and completed prior to finalization of the problem and corrective measures report (reference to inspection data sheet, where applicable).
- Where applicable, suggested methods to prevent similar problems.
- Signature of the CQA inspector and review signature of CQA engineer.

Problem or work deficiency meetings shall be documented by a member of the CQAM support staff.

## **Section 2**

### **LEACHATE COLLECTION AND REMOVAL SYSTEM**

#### **2.1 PERFORATED PIPING**

Perforated leachate collection piping shall be installed on a bed of crushed granite as specified and shown in the construction plans. Prior to covering the leachate collection pipe, pipelines shall be surveyed to ensure that pipe slope is maintained within plus or minus 5 percent of the design slope (e.g., a design slope of 2 percent would need to be between 1.9 and 2.1 percent). No machinery shall be driven over the buried piping until it has been completely installed and the cover is in place.

The cover material shall be compacted by hand or light machinery to avoid damage to the buried pipe. Compaction and tests are as specified in Section 02220.

#### **2.2 GEOTEXTILE**

The geotextile is as specified in Section 02250. Certification, testing and inspection are as described in the specification.

#### **2.3 CRUSHED GRANITE AND CLEAN GRANULAR MATERIAL**

After placing the geotextile, the crushed granite bedding should be placed for the perforated pipe. The crushed granite and clean granular material are specified in specification Section 02220. Testing and compaction are also specified in this section.

#### **2.4 MANHOLE**

Manholes and pump stations shall be constructed in conformance with the contract plans and specifications. Leachate collection manholes do not have to be leak tested.

#### **2.4 INSPECTION OF LEACHATE PIPING SYSTEM**

The leachate collection system will be video taped upon completion as required by Note 3 on the construction drawing L-3. A copy of the video will be sent to FDEP with the certification of the system.

The QA Monitor will collect and make copies of all delivery tickets for pipe, geotextile, sand and crushed granite used for constructing the leachate collection system. Copies will be included with the construction certification.

The QA Monitor will photograph the leachate collection system and include photographs with the certification report.

### **Section 3**

#### **SLURRY WALL PENETRATIONS**

##### **3.1 EXCAVATION OF SLURRY WALL AT PENETRATION**

The contractor shall locate the slurry wall and salvage the excavated material for use in backfilling.

##### **3.2 REPLACEMENT OF SLURRY WALL**

The salvaged material from the slurry wall shall be mixed with sodium bentonite at a ratio of 10% by volume and used for backfill in the area where the pipe penetrates the slurry wall at locations as shown on the drawings. The backfill shall be compacted per the specifications. The QA monitor shall observe and photograph the mixing, backfilling and compacting. A detailed report shall be submitted with documentation for each slurry wall penetration.

##### **3.2 TESTING**

One sample shall be taken at random from the backfill using a Shelby tube or other approved sampling method. The sample shall be tested in the laboratory for permeability. The sample shall have a minimum permeability of  $1 \times 10^{-7}$  cm/sec. Test results shall be submitted to FDEP with the certification.

## Section 4

# DOCUMENTATION

### 4.1 REPORT FORMS AND LOGS

The strength of the installation quality assurance plan depends on recognizing and observing all critical aspects of construction. This can be effectively accomplished by documenting quality assurance activities. The reports and checklists supplied with this quality assurance plan are provided to remind the CQAM of the items to be observed, and will document through required responses and checklist items, that observation activities have been accomplished and that details have not been overlooked.

A Daily Record of Work Progress will be prepared each day by the CQAM. This report will provide the chronological framework for identifying and referencing sampling events and all other attached checklists. All samples taken by the CQAM shall be accompanied by a completed sample tag. All sampling events will be noted in the Daily Field Report.

The checklists which will be completed by the CQAM in the course of construction activities include:

Daily Record of Work Progress  
Daily Field Report  
On-Site Personnel Log  
Photograph Log  
Geotextile Conformance Test  
Certificate of Acceptance

In the event that the CQAM has identified material or workmanship that does not meet the design criteria, plans, or specifications, he shall notify the Engineer who shall notify the Owner. Based on the magnitude of the problem, the Engineer may choose to issue a Field Order.

### 4.2 CONSTRUCTION CERTIFICATION

The CQAM will prepare a Completeness of Construction Report using FDEP form number 62-701.900(2) and applicable CQA information from the installation records, inspection reports, and geotechnical information for submission to FDEP. The report will include the following:

- Certification of Construction Completion (FDER Form 62-701.900).
- Copy of Permit to Construct.



- Construction Specifications.
- CQA Plan.
- Inspection Reports.
- Test Results.
- Geotechnical Testing Results.
- Installation Photographs.
- As-Built
- Video tape of inspection of leachate pipes

Items in the report shall be placed in chronological order.

#### **4.3 FINAL DOCUMENTATION**

The final report, which includes original reports, checklists, laboratory test results, certifications, etc., shall be retained by the Owner. Copies of the final report shall be held by the Engineer, the State permitting agency, and, at the installation site, by the landfill supervisor.

## SECTION 02220

### EXCAVATION, BACKFILLING, AND COMPACTION

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Scope of Work: The work of this section consists of furnishing all necessary labor, equipment, material, and transportation necessary for all required earthwork which incorporates excavation, backfilling, and compaction.
- B. Definitions:
  - 1. Maximum Density: Maximum weight in pounds per cubic foot of a specific material.
  - 2. Optimum Moisture Content: The optimum moisture content shall be determined by ASTM D 1557 specified to determine the maximum dry density for relative compaction. Field moisture content shall be determined on the basis of the fraction passing the 3/4-inch sieve.
  - 3. Rock Excavation: Excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.
  - 4. Suitable: Suitable materials for fills shall be a non-cohesive, non-plastic granular local sand which shall be free from vegetation, organic material, marl, silt or muck. The Contractor shall furnish all additional fill material required.
  - 5. Unsuitable: Unsuitable materials are highly organic soil (peat or muck) classified as A-8 in accordance with AASHTO Designation M 145.
- C. Plan For Earthwork:
  - 1. The Contractor shall be responsible for having determined, prior to the submission of the bid, the conformation of the ground, the character and quality of the substrata, the types and quantities of materials to be encountered, the nature of the groundwater conditions, the prosecution of the Work, the general and local conditions and all other matters which can in any way affect the Work under this Contract according to the General Conditions.

2. Prior to commencing the excavation, the Contractor shall submit a plan of proposed operations to the Engineer for review. The Contractor shall reflect the equipment and methods to be employed in the excavation. Prices established in the Bid Proposal will reflect all costs pertaining to the Work. No claims for extras based on substrata or groundwater table conditions will be allowed.

- D. Trench Safety Act: The Contractor shall comply with all of the requirements of the Florida Trench Safety Act Chapter 553.60, Fla. Administration Code. The Contractor shall acknowledge that included in various items of the Bid Proposal and in the total Bid Price are costs for complying with the provisions of the Act.

#### 1.02 APPLICABLE PUBLICATIONS

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

#### 1.03 QUALITY ASSURANCE

- A. An independent Testing Laboratory employed by the Contractor, and approved by the Owner/Engineer, will make such tests as required by this Section. The Contractor shall schedule work so as to permit reasonable time for testing before placing succeeding lifts and shall keep the laboratory and Engineer informed of progress.

#### 1.04 FEDERAL AND STATE REGULATORY REQUIREMENTS

- A. All trench excavations which exceed 4 feet in depth shall comply with the applicable trench safety standards as stated in the OSHA excavation safety standards 29 CFR S.1926.650 Subpart P as regulated and administered by the Florida Department of Labor and Employment Security as the "Florida Trench Safety Act."

#### 1.05 JOB CONDITIONS

- A. If, in the opinion of the Engineer, conditions encountered during construction warrant a change in the footing elevation or in the depth of removal of unsuitable material, an adjustment will be made in the Contract Price, as provided in the General Conditions.

#### 1.06 PROTECTION

- A. Pre-Construction Survey:

1. Prior to commencing excavation, backfill or dewatering, the Engineer and Contractor shall jointly conduct a survey of those existing structures which, in the

opinion of the Engineer, may be subject to settlement or distress resulting from excavation or dewatering operations.

2. The Engineer will monitor the structures surveyed to ascertain evidence of settlement or distress. If settlement or distress becomes evident the Contractor shall be required to repair the structures to the previous condition to the satisfaction of the Engineer. Costs shall be paid by the Contractor.

#### 1.07 SUBMITTALS

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

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

##### A. General:

1. All fill material from on and off-site sources shall be subject to the acceptance of the Engineer.
2. All fill material shall be free of organic material, trash, or other objectionable material. Excess or unsuitable material as designated by the Engineer shall be removed from the job site by the Contractor, or be provided to the Owner, at the Owner's option.

##### B. Common Fill:

1. Common fill shall be sand not containing stones, rock, concrete or other rubble larger than 2 inches in diameter. It shall have physical properties which allow it to be easily spread and compacted.
2. The Contractor shall utilize as much excavated soil material as possible for reuse in accordance with the Contract Drawings and specifications or as directed by the Engineer. No soil containing or contaminated by solid waste or other similar material will be allowed in Common Fill.
3. The Engineer shall advise the Contractor on the type of material allowed in certain sections of the earthwork operations.

C. Select Common Fill:

1. Select common fill shall consist of common fill material. It shall not contain any sharp or granular rock exceeding 1/4-inch in diameter, and be free from clay, loam, or organic matter. It shall have physical properties which allow it to be easily spread and compacted.
2. The Engineer shall advise the Contractor on the type of material allowed in certain sections of the earthwork operations.

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

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

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

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

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

F. Clean Granular Material: Clean granular material, or drainage sand, shall be well graded, clean quartz base sand, free from clay, loam or organic matter. The sand shall not contain any sharp or angular rock greater than 3/8-inch in diameter with maximum percentage of carbonates of calcium and magnesium of 3 percent with particle size limits as follows:

<u>U.S. Sieve Size</u>	<u>Percent Passing By Weight</u>
3/8 inch	100
No. 4	95 - 100
No. 100	0 - 7
No. 200	Maximum 3

The saturated hydraulic conductivity of the in-place sand shall be a minimum  $1 \times 10^{-3}$  cm/sec. This material shall come from off-site borrow sources and adequate quantities shall be stockpiled prior to any placement.

The Contractor shall identify borrow sources and submit site specific soils analyses which confirm compliance of the borrow source with the material specification requirements before delivery of material to the site. Samples will be taken by the Contractor's testing laboratory during delivery of the material to assure continuous compliance with the specifications. Frequency of testing shall be at Engineer's discretion.

- G. Crushed Granite: Coarse aggregate for the leachate collection trench shall be produced from the crushing of granites and shall be sound and durable. The crushed granite shall meet the following physical properties requirement:

Los Angeles Abrasion (FM 1-T 096)..... Maximum loss 45%

Soundness (Sodium Sulphate) (FM 1-T 104)..... Maximum loss 12 %

Flat or elongated pieces..... Maximum 10%

A flat or elongated particle is defined as one having a ratio between the maximum and the minimum dimensions of a circumscribing prism exceeding five to one.

The crushed granite shall be standard size #5 per FDOT 901-1.4 Table 1 as follows:

<u>U.S. Sieve Size</u>	<u>Percent Passing By Weight</u>
1 ½ inch	100
1 inch	90-100
¾ inch	20-55
½ inch	0-10
3/8 inch	0-5

- H. Other Material: All other material, not specifically described, but required for proper completion of the work shall be selected by the Contractor and reviewed by the Engineer for conformance with the Contract Documents prior to installation.

## PART 3 - EXECUTION

### 3.01 PROTECTION

#### A. Sheeting and Bracing:

1. Furnish, put in place, and maintain sheeting and bracing as required to support the sides of excavations, to prevent movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures, and to protect workers from hazardous conditions or other damage. Such support shall consist of braced steel sheet piling, braced wood lagging and soldier beams or other accepted methods. Care shall be taken to prevent voids beside the sheeting, but if voids are formed, they shall be immediately filled and compacted. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill at no additional expense to the Owner or Engineer.
2. The Contractor shall construct sheeting outside the neat lines of the foundation unless deemed desired otherwise for his method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall withstand all pressure to which the structure or trench will be subjected. Any deformation shall be corrected by the Contractor at no additional expense to Owner or Engineer so as to provide the necessary clearances and dimensions.
3. Where sheeting and bracing is required to support the sides of excavations for structures, the Contractor shall engage a professional geotechnical engineer, registered in the State of Florida, to design the sheeting and bracing. The sheeting and bracing installed shall conform with the design, and certification of this shall be provided by the professional geotechnical engineer.
4. The installation of sheeting, particularly by driving or vibrating, may cause distress to existing structures. The Contractor shall evaluate the potential for such distress and, if necessary, take all precautions to prevent distress of existing structures because of sheeting installation.
5. The Contractor shall leave in place to be embedded in the backfill, all sheeting and bracing not shown on the Drawings, but which the Owner directs Contractor in writing to leave in place at any time during the progress of the Work for the purpose of preventing injury to structures, utilities, or property, whether public or private. The Owner may direct that timber used for sheeting and bracing be cut off at any specified elevation.
6. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction, or other structures, utilities, or property. All voids left or

caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted for that purpose, or otherwise directed by the Owner.

7. The right of the Owner to order sheeting and bracing left in place shall not be construed as creating any obligation on its part to issue such orders, and Owner's failure to exercise the right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the Work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.
8. No wood sheeting is to be withdrawn if driven below mid-diameter of any pipe, and under no circumstances shall any wood sheeting be cut off at a level lower than 1 foot above the top of any pipe.

B. Pumping and Drainage:

1. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. The Contractor shall engage a Professional Geotechnical Engineer registered in the State of Florida, to design the dewatering systems for all structures. The Contractor shall submit to the Engineer for review a plan for dewatering systems prior to commencing Work. The Professional Geotechnical Engineer shall be required to monitor the performance of the dewatering systems during the progress of the Work and require such modifications as may be required to assure that the systems are performing satisfactorily.
2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the bottom of the excavation and to preserve the integrity of adjacent structures. Well or sump installations shall be constructed with proper sand filters to prevent intermixing of finer grained soil from the surrounding ground.
3. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.
4. The Contractor shall take all additional precautions to prevent buoyant uplift of any structure during construction.
5. The conveying of dewatered liquids in open ditches or trenches will not be allowed. Permission to use any storm sewers, or drains, for water disposal purposes shall be



obtained from the authority having jurisdiction. Any requirements and costs for such use shall be the responsibility of the Contractor. The Contractor shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and he shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored as directed by the Owner or the authority having jurisdiction, at no cost to the Owner or Engineer.

6. Flotation shall be prevented by the Contractor by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.
7. Removal of dewatering equipment shall be accomplished after the system is no longer required; the material and equipment constituting the system, shall be removed by the Contractor.
8. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, etc. in order to prevent adverse effects on soil or groundwater quality.

### 3.02 EXCAVATION

#### A. Excavating for Structures and Utilities:

1. Excavation work shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards. Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.
2. Excavation shall be made to such dimensions as will give suitable room for bracing and supporting, for pumping and draining, for installing the pipelines, and for all other work required.
  - a) Excavation for precast or prefabricated structures shall be carried to an elevation 2 feet lower than the proposed outside bottom of the structure to provide space for the structural backfill material.
  - b) Excavation for structures constructed or cast-in-place in dewatered excavations shall be carried down to the bottom of the structure where dewatering methods are such that a dry excavation bottom is exposed and the naturally occurring material at this elevation leveled and left ready to receive construction. Material disturbed below the founding elevation in dewatered excavations shall be replaced with Class B concrete.

3. Immediately document the location, elevation, size, material type and function of all new subsurface installations, and utilities encountered during the course of construction.
4. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Drawings and should anticipate the encounter of unknown obstructions during the course of the Work.
5. Encounters with subsurface obstructions shall be hand excavated.
6. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. Subgrade soils which become soft, loose, "quick" or otherwise unsatisfactory for support of structures as a result of inadequate dewatering or other construction methods, shall be removed and replaced by crushed stone as required by the Engineer at the Contractor's expense.
7. The bottom of excavations shall be rendered firm and dry before placing any structure or pipe. Excavated material not suitable for backfill shall be removed from the site and disposed of by the Contractor.
8. Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered.
9. All structure and pipe locations and elevations as required herein must be permanently documented by the Contractor, on the Record Drawings prior to the Engineer's recommendation of the Application for Payment for that work.
10. Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered. No excavated material or other construction material shall be placed within 30 feet of the edge of pavement of any public road.

### 3.03 DRAINAGE

- A. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition. The dewatering method used shall prevent disturbance of earth below grade.
- B. All water pumped or drained from the excavated area shall be disposed of in a suitable manner without undue interference with other work, without damage to surrounding property, and in accordance with pertinent rules and regulations.

- C. No construction, including pipe laying, shall be allowed in water. Groundwater shall be maintained at least 12 inches below excavation. No water shall be allowed to come into contact with masonry or concrete within 24 hours after being placed. The Contractor shall constantly guard against damage due to water and take full responsibility for all damage resulting from failure to do so.
- D. The Contractor will be required at no additional expense to Owner or Engineer to excavate below grade and refill with accepted fill material if the Owner determines that adequate drainage has not been provided.

#### 3.04 UNDERCUT

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

#### 3.05 STABILIZATION

- A. Subgrades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact.
- B. Subgrades for concrete structures or trench bottoms which are otherwise solid, but which becomes mucky on top due to construction operations, shall be reinforced with one or more layers of crushed rock or gravel. Not more than ½ inch depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon. The finished elevation of stabilized subgrades for concrete structures shall not be above subgrade elevations shown on the Drawings.
- C. All stabilization work shall be performed by and at the expense of the Contractor.

#### 3.06 FILL AND COMPACTION

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

3. Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of the Engineer. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials be in any backfill, fill or embankment.

B. Placement and Compaction:

1. Backfill materials shall be placed in approximately horizontal layers not to exceed 12 inches in loose thickness. Material deposited in piles or windrows by excavating and hauling equipment shall be spread and leveled before compaction.
2. Each layer of material being compacted shall have the best practicable uniform moisture content to ensure satisfactory compaction. The Contractor will be required to add water and harrow, disc, blade, or otherwise work the material in each layer to ensure uniform moisture content and adequate compaction. Each layer shall be thoroughly compacted by rolling or other method acceptable to the Engineer as indicated in Table 02220-A.
3. Whenever a trench passes through a backfill or embankment, material shall be placed and compacted to an elevation 12 inches above the top of the pipe before the trench is compacted.

C. Compact and backfill excavations and construct embankments for structures according to the schedule listed in Table 02220-A. Backfill schedule for pipes is listed in Table 02220-B.

**TABLE 02220-A****COMPACTION AND BACKFILL SCHEDULE**

Area	Material	Compaction
Pipe and liner trenches, not directly over the liner	Common Fill (Para. 2.01 B)	8 inch lifts, compacted to 95% Modified Proctor maximum dry density. Fill should not be placed over any in-place soils until those layers have been compacted to 95% Modified Proctor maximum dry density.
Beneath all structures and foundations	Common Fill (Para 2.01 B)	8 inch lifts, compacted to 95% Modified Proctor maximum dry density. Fill should not be placed over any in-place soils until those layers have been compacted to 95% Modified Proctor maximum dry density.
Beneath pavements not over the liner	Common Fill (Para 2.01 B)	8 inch lifts, compacted to 98% Modified Proctor maximum dry density. Fill should not be placed over any in-place soils until those layers have been compacted to 98% Modified Proctor maximum dry density.
Protective Cover Soil, directly over the liner	Select Common Fill (Para. 2.01 C)	12-inch lifts, compacted to 95% Standard Proctor density. On slopes greater than 6:1, place in 12-inch lifts compacted to 90% Standard Proctor density.
From cleared existing surface to stabilized subgrade for paved and gravel roadway surfaces	Common Fill (Para 2.01 B)	12 inch lifts, compacted to 95% Modified Proctor maximum dry density.
Clay Backfill, at liner tie-in	Clay from excavation	12 inch lifts, compacted to 90% Standard Proctor density.
Containment Berms	Common Fill (Oara 2,01 B)	12 inch lifts, compacted to 90% Standard Proctor maximum density.

**Notes:**

Standard Proctor shall be ASTM D-698.

Modified Proctor shall be ASTM -1557.

Table 02220-B

### BACKFILL SCHEDULE FOR GRAVITY AND PRESSURE PIPING

Pipe Material	Pipe Size	Trench Condition	BEDDING Material	PIPE ENVELOPE				Others
				PRIMARY ZONE		SECONDARY ZONE		
				Material	Depth <sup>c</sup>	Material	Depth	
Ductile Iron, Stainless Steel, Culvert Pipe and Prestressed Concrete Cylinder Pipe	<16"	Normal <sup>a</sup>	Compacted Common Fill Class I	Filter Aggregate	0.5 O.D.	Filter Aggregate	0.5 O.D.+12"	Class II Material should not have stones size >2". Organic content <1.1% by wt.
		Special <sup>b</sup>		Filter Aggregate	0.5 O.D.	Filter Aggregate	0.5 O.D.+12"	
	≥16"	Normal <sup>a</sup>	Class II	Common Fill	0.25 O.D.	Common Fill	-	
		Special <sup>b</sup>	Class I	Common Fill	0.25 O.D.	Common Fill	-	
Fiberglass, PVC and Other Plastic Pipe	<6"	Normal <sup>a</sup>	Filter Aggregate	Filter Aggregate	0.7 O.D.	Filter Aggregate	0.3 O.D.+12"	
		Special <sup>b</sup>	Class I	Filter Aggregate	0.7 O.D.	Filter Aggregate	0.3 O.D.+12"	
	≥6"	Normal <sup>a</sup>	Class II	Class II	0.7 O.D.	Class II	0.3 O.D.+12"	
		Special <sup>b</sup>	Class I	Class II	0.7 O.D.	Class II	0.3 O.D.+12"	
R.C.P.	<48"	Normal <sup>a</sup>	Class II	Class II	0.5 O.D.	Common Fill	-	
and		Special <sup>b</sup>	Class I	Class II	0.5 O.D.	Common Fill	-	
C.C.P.	≥48"	Normal <sup>a</sup>	Class II	Class II	0.25 O.D.	Common Fill with max. stone size ≤2	0.75 O.D.+12"	
		Special <sup>b</sup>	Class I	Class II	0.25 O.D.	Common Fill with max. stone size ≤2	0.75 O.D.+12"	

Table 02220-B (Continued)

### BACKFILL SCHEDULE FOR GRAVITY AND PRESSURE PIPING

Pipe Material	Pipe Size	Trench Condition	BEDDING Material	PIPE ENVELOPE				Others
				PRIMARY ZONE		SECONDARY ZONE		
				Material	Depth <sup>c</sup>	Material	Depth	
Pipe laid in rock (min. trench requirements) except for fiberglass and PVC pipe		Rock	Class I	Class II	0.5 O.D.	Common Fill with max. stone size ≤2"	0.5 O.D.+12"	
Gravity pipe (not specified above)		Normal	Filter Aggregate	Filter Aggregate	0.5 O.D.	Common Fill	0.50 O.D.+12"	
Pressure pipe (not specified above)		Normal	Suitable Undisturbed Earth or Compacted Common Fill	Common Fill with max. stone size ≤2"	0.5 O.D.	Common Fill with max. stone size ≤2"	0.5 O.D.+12"	

NOTE: SEE DRAWINGS FOR LEACHATE COLLECTION PIPING MATERIAL INFORMATION

- a Dry soils.  
b Saturated soils.  
c Outside Diameter of pipe = O.D.

Notes:

- No special bedding shall be required in case of suitable undisturbed earth type trench bottom.
- Bedding thickness shall be 12 inches unless specified otherwise.
- The backfill shall be compacted to 95% Modified Proctor maximum dry density and shall be placed in 6-inch lifts for pipe envelope and in 12-inch lifts from secondary zone to grade. Common fill shall be used as final backfill material.
- It is intended that additional excavation be conducted to remove unsuitable material below the pipe bedding level which prevents bedding compaction as required herein and replace such materials with suitable materials. Over excavation, geotextile fabric, gravel blanket, granular fill and other acceptable stabilization method shall be placed within 4 feet of the bedding level or within 10 feet of the existing ground (whichever is greater depth) at no additional cost to the Owner. Construction required beyond these limits shall be executed in accordance with the General Conditions. When indicated on the Drawings, the Contractor shall remove unsuitable material below bedding level to the limits indicated and replace with coarse sand or other acceptable stabilization method up to the bedding level without any additional cost to the Owner.

- D. Pipe shall be laid in open trenches unless otherwise indicated on the Drawings or elsewhere in the Contract Documents.
- E. Excavations shall be backfilled to the original grade or as indicated on the Drawings. Deviation from this grade because of settling shall be corrected. Backfill operation shall be performed to comply with all rules and regulations and in such a manner that it does not create a nuisance or safety hazard.
- F. Embankments shall be constructed true to lines, grades and cross sections shown on the plans or ordered by the Owner. Embankments shall be placed in successive layers of not more than 12 inches in thickness, loose measure, for the full width of the embankment. As far as practicable, traffic over the work during the construction phase shall be distributed so as to cover the maximum surface area of each layer.
- G. If the Contractor requests acceptance to backfill material utilizing lifts and/or methods other than those specified herein, such request shall be in writing to the Engineer. Acceptance will be considered only after the Contractor has performed tests, at the Contractor's expense, to identify the material used and density achieved throughout the backfill area utilizing the method of backfill requested. The Engineer's acceptance will be in writing.
- H. Foundation Preparation
  - 1. The existing ground beneath building foundations and equipment base slabs and slabs on grade shall be removed and the area proof-rolled. Proof-rolling the buildings and containment areas should consist of at least 10 passes of a self-propelled vibratory compactor capable of delivering a minimum impact force of at least 36,000 pounds per drum to the soils. Each pass should overlap the preceding pass by 30 percent to insure complete coverage. Backfilled areas shall be compacted in 8-inch layers to a density of not less than 95 percent of Modified Proctor Dry Density as determined by ASTM D1557 for a depth of not less than 2 feet below the bottom of the foundations or concrete slabs. Any unsuitable foundation material shall be removed and replaced with suitable material.
  - 2. Slabs On Grade: Subgrades for concrete slabs shall be removed, backfilled, and compacted to the required grade. The top 2 feet of concrete slab subgrade in cut sections and all fill material shall be compacted in 8-inch layers to a density of not less than 95 percent of Modified Proctor Dry Density as determined by ASTM D1557.

### 3.07 TRENCH EXCAVATION

- A. The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite the Work. The maximum length of open trench under construction shall be 400 feet. All trench excavation shall be open cut from the surface.



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

B. Limiting Trench Widths:

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

<u>Pipe Size</u>	<u>Minimum Sidewall Clearance</u>
60"	24"
54"	21"
48"	19"
36" or smaller	12"

2. Stipulated minimum sidewall clearances are not minimum average clearances, but are minimum clear distances which will be required.

C. Mechanical Excavation:

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

between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

D. Pavement Cutting:

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

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

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

3.08 TESTS

A. All tests required for preliminary review of materials prior to installation shall be made by an accepted independent testing laboratory at the expense of the Contractor. A summary of the tests required in this Section is provided in Table 02220-C.

**TABLE 02220-C**

**TESTING SCHEDULE**

Property	Material	Units	Frequency	Value	Test Method
Compaction	See Table 02220-A	percent (%)	one/acre/lift (see Note 1)	See Table 02220-A	ASTM D2922
Field Density					ASTM D1557
Modified Proctor					ASTM D5084
Moisture Content			one/acre/lift (see Note 1)		
Gradation	See Paragraph 2.01.D, F, G	N/A	2 initial and 1 per 500 tons	See Paragraph 2.01.D, F, G	ASTM D2487
Permeability	See Paragraph 2.01.F.	cm/sec	1 per every 500 feet of trench	See Paragraph 2.01.F.	ASTM D5084

### 3.09 DRAINAGE MAINTENANCE

- A. Bridges and other temporary structures required to maintain traffic across unfilled trenches shall be constructed and maintained by the Contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches. All material deposited in roadway ditches or other water courses crossed by the line of trench shall be removed immediately after backfilling is completed and the original sections, grades, and contours of ditches or water courses shall be restored. Surface drainage shall not be obstructed longer than necessary.

### 3.10 SITE GRADING

- A. The construction tolerance for grading shall be  $\pm 0.1$  feet at the indicated elevations, slopes and contours as shown on the drawing. Final grades shall be brought to grade with the tolerance of  $\pm 0.1$  feet at the indicated elevations, slopes, and contours.
- B. Use of graders or other power equipment will be permitted for final grading and dressing of slopes as allowed within these specifications provided the result is uniform and equivalent to hand work. All surfaces shall be graded to secure effective drainage. Unless otherwise shown, a slope of at least 1 percent shall be provided.
- C. Grading and surfacing shall be completed to the satisfaction of the Engineer.

### 3.11 EXCESS EXCAVATED MATERIALS

- A. Insofar as needed, suitable excavated materials shall be used in fills and embankments shown on the Drawings. All suitable excess excavated material shall be stockpiled at an on-site location determined by the Owner or Engineer.
- B. The Contractor shall segregate excavated materials (i.e. common fill, select common fill). All debris, junk, stones, logs, stumps, roots, and other unsuitable materials may be disposed of by the Contractor in the sanitary landfill, but first must be weighed on the truck scales.
- C. The Contractor should slope and compact the stockpile with a light roller type vehicle to maintain stability. The Contractor shall maintain proper soil and erosion control measures.

### 3.12 SETTLEMENT

- A. The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur prior to acceptance by the Owner.
- B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from the Engineer or Owner.

END OF SECTION

## SECTION 02550

### GEOTEXTILE

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

###### A. Scope of Work:

1. Furnish all transportation, labor, materials, tools, installation equipment and supervision necessary for the manufacturing, storage, delivery, installation and testing of the geotextile as herein specified and as shown on the Drawings.
2. The installation of geotextile shall be performed in conjunction with installation of the leachate collection system.

##### 1.02 QUALITY ASSURANCE

- ###### A. Manufacturer Qualifications:
- Prequalified manufacturer shall be a company, corporation, or firm regularly engaged in the development and manufacture of geotextile with a history of successful production for a minimum period of five (5) years. The manufacturer shall have supplied geotextile to a minimum of six (6) projects during the past five (5) years of similar size and scope totaling a minimum of ten million (10,000,000) square feet.

##### 1.03 DEFINITIONS AND RESPONSIBILITY

- ###### A. The Contractor shall provide the services of a geotextile system manufacturer who shall meet the following qualifications. The Contractor shall accept and retain full responsibility for all materials and installation and shall be held responsible for any defects in the completed geotextile system.
- ###### B. Manufacture of Geotextiles:
- The geotextile manufacturer shall be responsible for the production and delivery of rolls of the products and shall be a well established firm with more than five years experience in the manufacture of geotextiles. The Contractor shall submit a statement on behalf of the geotextile manufacturer to the Engineer listing the manufacturer's certified minimum property values of the geotextile and the tests used to determine those properties.
- ###### C. Installation:
- The Contractor shall be responsible for transportation, field handling, storing, deploying, seaming, temporary restraining (against wind), anchoring and

other site aspects of the geotextiles. The Contractor shall be trained and qualified to install geotextile and shall be approved and/or licensed by the manufacturer.

## PART 2 - PRODUCTS

### 2.01 GEOTEXTILES

#### A. General Requirements:

1. The material shall be furnished by a single geotextile manufacturer.
2. Unless otherwise noted on the Drawings, geotextile manufacturers shall furnish materials whose minimum average roll values for geotextile materials, as defined by the Federal Highway Administration (FHWA), Task Force 25 Guidelines shall meet or exceed the criteria listed below under Geotextile Properties. The geotextiles provided by the supplier shall meet or exceed the property values specified and shall be stock products.
3. The non-woven material shall be comprised of yarns of polypropylene or polyester fibers, oriented into a stable network by needle punching which retains its structure during handling, placement, and long-term service. Geotextiles shall be capable of withstanding direct exposure to sunlight for 30 days with no measurable deterioration. The geotextiles shall be chemically compatible with the leachate from a typical sanitary landfill, and inert to commonly encountered chemicals, hydrocarbons, mildew and rot resistant, and be insect and rodent resistant. The geotextile products shall conform to the properties of Table 02550-A.
4. During shipment and storage, the geotextile shall be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions. During storage, the geotextile shall be raised off the floor/ground. The manufacturers shall furnish complete written instructions for the storage, handling and installation of the geotextile in compliance with this Specification and the conditions of the warranty.

#### B. Labeling:

1. Geotextiles shall be supplied in rolls wrapped in impermeable and opaque protective covers. Geotextile and rolls shall be marked or tagged with the following information:

- a) Manufacturer's name.
- b) Product identification.
- c) Lot number.
- d) Roll number.
- e) Roll dimensions.
- f) Mass expressed in oz/yd<sup>2</sup>

2. Additionally, if any special handling is required, it shall be so marked on the geotextile itself, e.g., "This Side Up" or "This Side Against Liner".

C. Manufacturers: The geotextile manufacturers and model numbers are indicated on Table 02550-A.

## 2.02 TRANSPORTATION, HANDLING AND STORAGE

A. Transportation, handling, storage, and care of the geotextile materials prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall be liable for all damages to the materials incurred prior to final acceptance of the lining system by the Owner.

## 2.03 MANUFACTURING QUALITY CONTROL

A. Geotextiles:

- 1. The geotextile shall be manufactured with a high degree of quality control and shall contain no needles from the manufacturing process. In most cases, however, sampling can be carried out on sacrificial portions of the material. Consequently, repair of sampled locations should not be required as long as the rest of requirements are met in this Specification. The following criteria are necessary for these components.
- 2. Rolls:
  - a) All materials shall be tested, at a minimum, once every lot or once every 40,000 square feet, whichever is least, to evaluate the pertinent characteristics for quality control. This testing shall be performed and certified by the Contractor to show that the material samples meet the specifications described herein. Samples not satisfying the specifications shall result in the rejection of the applicable rolls. At the Contractor's discretion and expense, additional testing of individual rolls may be performed to more closely identify the noncomplying rolls and/or to qualify individual rolls.

- b) The Contractor shall provide to the Engineer the geotextile manufacturer's certification on the quality of the rolls of geotextiles. As a minimum, the certifications shall include quality control certificates for each shift's production and shall be signed by responsible parties employed by the manufacturer (such as the production manager), shall be notarized and supplied to the Engineer.
- c) The quality control certificate shall include:
  - 1) Roll numbers and identification.
  - 2) Sampling procedures.
  - 3) Results of quality control tests, including a description of test methods used.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION OF GEOTEXTILES

- A. Handling and Placement: The Contractor shall handle all geotextiles in such a manner as to ensure they are not damaged in any way, and the following shall be complied with:
  - 1. The geotextile shall be installed as shown on the plans with the required overlap of a minimum of 24 inches. The surface on which the geotextile is placed shall be free of sharp protruding objects that might puncture the geotextile. Care should be taken during installation to prevent damage to the geotextile. The geotextile shall be loosely laid to prevent unnecessary stretching of the material.
  - 2. On slopes, the geotextiles shall be securely anchored in the anchor trench and then rolled down the slope in such a manner as to continually keep the geotextile sheet in sufficient tension to preclude folds and wrinkles.
  - 3. In the presence of wind, geotextiles shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain until replaced with earth cover material. Where noted on the drawings, the geotextile shall be staked.
  - 4. Geotextiles shall be cut using a tool capable of obtaining a clean cut, unstressed sample. If in place, special care must be taken to protect other materials from damage which could be caused by the cutting of the geotextiles.



Table 02550-A

**REQUIRED PROPERTY VALUES NON-WOVEN GEOTEXTILE <sup>2</sup>**

Property	Units	Value <sup>1</sup>	Test
Mass per unit area	oz/sy	8	ASTM D 5261
Coefficient of Permeability	gal/min/sf	80	ASTM D 4491
Apparent Opening Size (AOS)	U.S. Std. Sieve	100	ASTM D 4751
Grab tensile strength	lb	203	ASTM D 4632
Grab tensile elongation to break	%	50	ASTM D 4632
Trapezoidal tear strength	lb	80	ASTM D 4533
Puncture strength	lb	130	ASTM D 4833
Mullen burst strength	psi	450	ASTM D 3786
Resistance Range	pH	2-12	-

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<sup>1</sup>Values represent minimum average roll values as defined by the Federal Highway Administration.

<sup>3</sup>Manufacturers: AMOCO 4508 or approved equal.

C. Repair:

1. Any holes or tears in the geotextile shall be repaired as follows:
  - a) On slopes a patch made from the same geotextile shall be thermally bonded into place with a 24-inch overlap in all directions. Should any tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced.
  - b) On non-slopes a patch made from the same geotextile shall be thermally bonded into place with a 24-inch overlap in all directions. Should any tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced.
2. Care shall be taken to remove any soil or other material which may have penetrated the torn geotextile.

3.02 PLACEMENT OF SOIL MATERIALS

- A. The Contractor shall place all soil materials located on top of a geotextile, in such a manner as to ensure:
  1. No damage of the geotextile.
  2. Minimal slippage of the geotextile on underlying layers.
  3. No excess tensile stresses in the geotextile.
- B. Care shall be taken during filling operations to ensure that the geotextile is not damaged by earth-moving or other equipment. Any damage to the geotextile caused by the Contractors equipment shall be repaired at no cost to the Owner.

END OF SECTION

G:\WASTEMAN\MANATE~1\SW-2LE~1\02550 September 20, 2001

