

Green Recycling Solutions LLC

Application for Permit to Construct
Maysville Construction & Demolition
Debris (C&D) Landfill, Phase 1
Maysville, North Carolina

June 2013

As Revised Through 9-30-13

Application for Permit to Construct Proposed Green Recycling Solutions LLC Maysville C&D Landfill Phase 1 Maysville, Jones County, North Carolina

TABLE OF CONTENTS

Cover Letter

Engineer's Certification

Response to Comments Letter – 9/11/13

Regulation & Description

Page

<i>SITE STUDY FOR C&DLF FACILITIES (15A NCAC 13B .0536</i>	<i>1</i>
<i>FACILITY PLAN FOR C&DLFS (15A NCAC 13B .0537)</i>	<i>1</i>
<i>GEOLOGIC AND HYDROGEOLOGIC INVESTIGATIONS (15 NCAC 13B .0538)</i>	<i>1</i>
<i>ENGINEERING PLAN FOR C&DLF FACILITIES (15A NCAC 13B .0539)</i>	<i>2</i>
<i>CONSTRUCTION REQUIREMENTS FOR C&DLF's (15A NCAC 13B .0540)</i>	<i>2</i>
<i>CONSTRUCTION QUALITY ASSURANCE FOR C&DLF's (15A NCAC 13B .0541)</i>	<i>5</i>
<i>OPERATION PLAN AND REQUIREMENTS FOR C&DLF's (15A NCAC 13B .0542)</i>	<i>6</i>
<i>CLOSURE & POST CLOSURE REQUIREMENTS FOR C&DLF's (15A NCAC 13B .0543)</i>	<i>6</i>
<i>MONITORING PLANS AND REQUIREMENTS FOR C&DLF's (15A NCAC 13B .0544)</i>	<i>6</i>
<i>FINANCIAL ASSURANCE REQUIREMENTS FOR C&DLF's (15A NCAC 13B .0546)</i>	<i>7</i>

LIST OF APPENDICES

<i>Appendix 1</i>	<i>Facility Plan</i>
<i>Appendix 2</i>	<i>Site Hydrogeologic Report</i>
<i>Appendix 3</i>	<i>Engineering Plan</i>
<i>Appendix 4</i>	<i>Technical Specifications</i>
<i>Appendix 5</i>	<i>CQA Plan</i>
<i>Appendix 6</i>	<i>Landfill Operations Plan & Recycling & Recovery Facility Operations Plan</i>
<i>Appendix 7</i>	<i>Closure & Post Closure Plan</i>
<i>Appendix 8</i>	<i>Groundwater Monitoring Plan</i>

ERM NC, Inc.

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Charlotte, NC 28226
(704) 541-8345
(704) 541-8416 (fax)

June 19, 2013

NCDENR – Division of Waste Management
1646 Mail Service Center
Raleigh, North Carolina 27699-1646



Attention: Mr. Geoffrey Little

Reference: Application for Permit to Construct
Proposed Green Recycling Solutions LLC – Maysville C&D Landfill, Phase 1
Maysville, Jones County, North Carolina

Mr. Little:

On behalf of Green Recycling Solutions LLC, ERM NC, Inc. (ERM) is submitting the attached Application for Permit to Construct a Construction & Demolition Debris Landfill (CDLF) unit in accordance with NCDENR Division of Waste Management regulations 15A NCAC 13B .0536(a) through .0546 for the referenced project. The proposed C&D landfill site is located within the jurisdictional limits of Maysville, North Carolina approximately one mile north of the intersection of US Highway 17 and NC Route 58 and encompasses approximately 43.5 acres. This proposed C&D Landfill will only receive waste from the proposed neighboring Green Recycling Solutions LLC recycling and recovery facility (Permit 5202-TP-2012 issued February 25, 2013). Site Suitability Approval for this site was issued by Division of Waste Management via a letter dated April 23, 2013.

If you should have any questions or require additional information concerning this Site Suitability Report please contact us at your convenience.

Sincerely,

ERM NC, Inc.

David W. Wasiela, P.E.
Senior Engineer
NC Registration #20770

Thomas M. Wilson, P.G.
Principal

cc: Mr. James Maides – Green Recycling Solutions LLC (1)
Ms. Elizabeth Werner – NCDENR – Division of Waste Management (1)

Engineer's Certification

This plan has been prepared by a Professional Engineer licensed to practice engineering in accordance with G.S. 89C and meet the requirements of Division of Waste Management Rules 15A NCAC 13B .0539

(Signature)

David W Wasiela, PE

NC Registration No. 20770

(Seal)

ERM NC, Inc.

NC License# C-2206



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September 11, 2013

NCDENR – Division of Waste Management
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

Attention: Mr. Geoffrey Little



Reference: Application for Permit to Construct Response to Comments Dated August 26, 2013 - Proposed Green Recycling Solutions LLC – Maysville C&D Landfill, Phase 1 - Maysville, Jones County, North Carolina

Mr. Little:

On behalf of Green Recycling Solutions LLC, ERM NC, Inc. (ERM) is submitting this Response to Comments submittal based on comments received from the Division of Waste Management dated August 26, 2013. For simplicity, each comment is listed with full content followed by the appropriate response and associated attachments referenced as needed. Additionally, a copy of the Revised Groundwater Monitoring Plan is attached to include requested revisions received from Ms. Elizabeth Werner via e-mail on August 1, 2013.

Comment 1. *The total cubic yards of Phases 1 through 6 in drawings 1 through 8 of Appendix 1 addressing the Facility Plan does not equal the total cubic yards listed in Preliminary Facility Sizing chart at the end of Appendix 1.*

The Sizing chart shows a total of 614,723 cubic yards and the drawings and other text reference 602,102 cubic yards.

Response – The capacity of the Landfill is 602,102 cubic yards as stated on the drawings and other portions of the Application. The table listed in the comments at the end of Appendix 1 lists the airspace needed on a cumulative basis through year 30. Based on the Landfill capacity, the landfill would continue operations through year 29 and into year 30 to reach the design capacity of 602,102 cubic yards. The Landfill would not be able to operate through the end of year 30 (requiring 614,723 cubic yards).

Comment 2. *Appendix 1 Facility Plan II Facility Drawings, 2nd paragraph: The text indicates that the Leachate Tanks will be located based on the final permitting conditions. Drawing No. 7 of 21 indicates that the Leachate Tanks will be located following issuance of the final permit for future phases.*

The Leachate Tanks will need to be located before the Permit to Construct Phase 1 Cell 1 can be issued. Please describe the conditions affecting the location of the leachate tanks.

In general, modifications may be requested during construction as necessary, but otherwise, please confirm the tank locations on the construction drawings.

Response – The Leachate Tanks will be located as shown on the Facility Drawings. The text in the Facility Plan has been revised (attached) to reflect as well as the text on the Plan Set Drawings (attached).

Comment 3. *Facility Drawings referencing 200 Feet Compliance Boundary in Call-Outs and General Notes: 15A NCAC 02L .0107 establishes the Compliance Boundary at 250 feet from the waste boundary or 50 feet within the property boundary, whichever point is closer to the source. Since the apparent property boundary to the west of Phase 1 is 200 feet, the Compliance Boundary between Phase 1 and the property boundary will be 150 feet.*

Response – The drawing call outs and notes for compliance boundary have been revised to reflect requirements of 15A NCAC 02L.0107; 250-ft from edge of waste or 50-ft inside of property boundary (attached). This change is reflected in the “Notes” for all applicable plan sheets (attached).

Comment 4. *Appendix 1 Facility Plan III Facility Report: The last paragraph states that tarps will be used if permitted by the NCDENR. If the tarps are requested as alternative cover, please provide a description of usage in the Operations Plan.*

Response – The request to use tarps in lieu of soil cover may be submitted to the Division for approval at a later date. The determination will be made following initial operations of Cell 1 if usage of tarps is viable.

Comment 5. *Appendix 3 Anchor Trench Design, Drawing 19 of 21, and others: NC General Statute §130A-295.6 titled Additional requirements for sanitary landfills, paragraphs (e) requires the base liner system be constructed with flexible membrane liner over two feet of soil with a maximum permeability of 1×10^{-5} centimeters per second. The statute allows an alternative liner system based on modeling that demonstrates an equivalent or greater degree of impermeability. The alternative liner system allowed in the NC Solid Waste Management Rule .1624(b)(1)(A) is acceptable without additional modeling.*

The description of the layer beneath the GCL in the application is described as ‘prepared subgrade soils, with compacted clay liner shown as an ‘Alternate.’ The term ‘Alternate’ must be removed from Specification Section 02275 and the title of Detail 3A of Sheet 19 of 21.

Please note also that Statute § 130A-295.6.(f) requires the base liner be constructed so that the post-settlement bottom elevation of the flexible membrane liner is a minimum of four feet above both the seasonal high groundwater table and the bedrock datum plane

contours. Therefore, the 4-feet of vertical separation may include the prescribed alternative of 18 inches of compacted clay [if that is the chosen alternative layer].

Response – The Design Plans and Application have been revised to reflect a proposed composite liner system consisting of 18-inches of 1×10^{-5} cm/sec compacted soil liner beneath 60-mil HDPE liner in accordance with General Statute 130A-295.6. Revisions have been made on the Detail Sheets 19 and 20 (attached) to reflect.

Comment 6. *Appendix 3 Anchor Trench Design, page 2 of 4: Information appears to be missing on the page after the text 'The proposed anchor trench designs are as follows:' and 'The frictional resistance mobilized by the anchor trench geometry to resist pullout is resolved as follows:'.*

Response – A revised anchor trench design calculation is attached reflecting the change using compacted soil liner in lieu of GCL.

Comment 7. *Appendix 3 Subgrade Settlement and Strain Analysis: For the record, the settlement analysis should be reworked to include the required compacted clay layer [see item 4 above] and the remaining layer necessary to produce a 4-foot separation between the ground water datum plane and the bottom of waste.*

Response – The revised calculations for predicted settlement and liner strain are attached for reference.

Comment 8. *Appendix 3 Leachate Generation Summary: Please revise the table row headings on the introductory page. The headings show Phases 1, 2 and 3, with the Cells described as 1 and 2. The acreage corresponds to Phase 1, Cells 1, 2 and 3, but the cell descriptors appear to be in error.*

Response – A revised Leachate Generation Summary is attached with the headings revised appropriately.

Comment 9. *Appendix 3: Please provide Pipe Deflection calculations for the perforated SDR 17 leachate pipe.*

Response – The calculations pipe crushing and deflection for the proposed SDR 17 HDPE pipe are attached.

Comment 10. *Appendix 5 CQA Plan: A footnote at the bottom of the tables refers to Table 2-2 in the CQA Plan. Should the reference read Table 3.2-2?*

Response – The note at the bottom of Tables 3.2-1A and 3.2-1B of the CQA plan have been revised to reference Table 3.2-2 of the CQA plan and are attached.

Comment 11. *Appendix 6 Operations Plan Section 1.1 Landfill Cell Sequencing: The last paragraph describes initial operations are to begin in the topographically high portion of the cell and progress towards the sump area. Some operators choose to start in the lower elevations and berm around the working area to separate rain water from leachate.*

The small size of Phase 1 Cell 1 is noted [1.0 acres], which may be factor in the decision of where to start operations. Should the decision be changed before a Permit to Operate is issued, please provide an amended Operations Plan. Other than requiring all water that comes in contact with waste to be captured and treated, neither NC Rules nor General Statutes address where in the cell initial operations should begin.

Response - The size of the Cells are too small to effectively segregate storm water from leachate to be of economic benefit.

Comment 12. *Geomembrane Base Liner Testing: NC General Statute § 130A-295.6.(h)(1) Additional requirements for sanitary landfills requires the base liner be tested for leaks and damages. Protocol for the leak detection testing needs to be included in the CQA Plan.*

Response - Section 3.4.2.6 Liner System Certification/Acceptance of the CQA Plan (Page 3-44) has been revised to include the requirement of Leak Detection testing for liner acceptance in accordance with ASTM D 7007-09 (copy attached).

Comment 13. *Cleaning and Remote imaging of Leachate Collection Lines: Protocol for remote camera inspection of the leachate line needs to be included in the CQA Plan and future cleaning and remote viewing needs to be included in the Operations Plan consistent with revised NC General Statute § 130A-295.6.(h)(3)*

Response - Section 3.7.4.3 of the CQA Plan has been revised on Page 60 (attached) to include remote inspection by camera of the completed leachate collection system for final acceptance. Page 3 of the Operations Plan (attached) has been revised to include annual camera inspections of the leachate collection lines in accordance with the requirements of NC General Statute 130A-295.6(h)(3).

Comment 14. *Appendix 6 Operations Plan Section 1.6 Facility Personnel Training: Facility operators will need to be certified through an approved training program in accordance with NC General Statute § 130A-309.25. Please include the solid waste management facility operators training requirements in the text.*

Response - Training requirements in accordance with NC General Statutes has been added in the Operations Plan beginning of Page 6 (attached).

Comment 15. *Appendix 6 Operations Plan Section 1.7 Inspection Procedures: The paragraph states that the C&D landfill will only receive waste from the Recovery*

Facility. Operations may benefit from having the flexibility to accept disposal wastes directly during times when repairs, sickness or unforeseen emergencies render the Recycling/Recovery Facility inoperable.

Response – In accordance with the approved Franchise Agreement and Public Hearings with the Town of Maysville, North Carolina, the C&D Landfill will only receive waste from the Recovery Facility.

Comment 16. *Appendix 6 Operations Plan Section 2.3 Dust, Litter, Odors and Vectors: Please include proactive actions to minimize odors. Odor is often an issue at C&D landfills that accept materials that rot particularly sheetrock and other degradable materials. Spreading such materials into thin layers is helpful along with quickly covering the material to protect it from moisture.*

Response – As stated in the Operations Plan on page 10; “Odor is controlled with the application of weekly cover over disposed waste. If odor continues to be a concern, masking agents may be used or cover applied more vigorously.” In the event that odor is not controlled adequately, soil cover will be applied at a frequency necessary to control odors.

Comment 17. *Appendix 6 Operations Plan Section 2.7 Operation Record and Recordkeeping: Since the facility [recovery and landfill operations] will have several possible waste flow patterns, please provide clarification that wastes and recovered materials loads will be weighed and distinguished at each point of movement, such as entry into recovery operations or bypass entry into landfill, waste from the recovery operation to the landfill, etc.*

Response – In accordance with the approved Franchise Agreement and Public Hearings with the Town of Maysville, North Carolina, the C&D Landfill will only receive waste from the Recovery Facility. Therefore, there will be no bypassing of the Recovery Facility for Recordation. As stated in the Operations Plan, waste being transported from the Recovery Facility to the Landfill will be weighed at the Recovery Facility for recordation.

Comment 18. *Appendix 6 Operations Plan Section 2.8 Explosive Gases Control: Please modify the section to include other explosive gases such as hydrogen sulfide. Hydrogen sulfide, a byproduct typically from the decomposition of gypsum wallboard, is often a problem at C&D landfills.*

Response – The Operations Plan has been revised to include monitoring and detection of Hydrogen Sulfide (attached)

Comment 19. *Appendix 6 Operations Plan Section 2.9 Leachate Management System Design and Maintenance: Please include actions that will address the revised language in NC General Statute § 130A-294.6.(h)(3), which states:*

All leachate collection lines shall be designed and constructed to permanently allow cleaning and remote camera inspection. Remote camera inspections of the leachate collection lines shall occur upon completion of the construction and at least once every five years. Cleaning of leachate collection lines found necessary for proper functioning and to address buildup of leachate over the liner shall occur.

Response – Refer to Response to Comment 13 - Section 3.7.4.3 of the CQA Plan has been revised on Page 60 (attached) to include remote inspection by camera of the completed leachate collection system for final acceptance. Page 3 of the Operations Plan (attached) has been revised to include annual camera inspections of the leachate collection lines in accordance with the requirements of NC General Statute 130A-295.6(h)(3).

If you should have any questions or require additional information concerning this submittal please contact me at your convenience.

Sincerely,

ERM NC, Inc.

David W. Wasiela, P.E.
Senior Engineer
NC Registration #20770

cc: Mr. James Maides – Green Recycling Solutions LLC (1)
Ms. Elizabeth Werner – NCDENR – Division of Waste Management (1)

Attch: Revised Facility Plan Text
Revised Anchor Trench Calculations
Revised Settlement / Liner Strain Calculations
Revised Leachate Generation Summary
Revised Pipe Deflection Calculations
Revised CQA Plan
Revised Operations Plan
Revised Groundwater Monitoring Plan
Revised Plan Sheets (1, 2, 6 – 17, 19, 20)

SITE STUDY FOR C&DLF FACILITIES (15A NCAC 13B .0536)

A Site Suitability Report dated December 16, 2011 was prepared for the Green Recycling Solutions LLC proposed Construction & Demolition Debris (C&D) Landfill site in Maysville, North Carolina and submitted to North Carolina Department of Environment and Natural Resources (NC DENR) Division of Waste Management for review and approval. The Site Suitability Report was approved by Division of Waste Management via a letter dated April 23, 2013. The Site Suitability approval letter was based on several documents prepared throughout the review process. These documents are listed below and adopted into this Application by reference:

- *Site Suitability Report.* Prepared by: ERM NC, Inc., Charlotte, NC. Dated December 16, 2011. [DIN16560]
- *Environmental Assessment.* Prepared by: ERM NC, Inc., Charlotte, NC. Dated February 2012. [DIN16559]
- *Response to Comments.* Prepared by: ERM NC, Inc., Charlotte, NC. Dated November 20, 2012. [DIN17404]
- *Site Suitability Gamelands Update.* Prepared by : ERM NC, Inc., Charlotte, NC. Dated April 4, 2013. [DIN18804]
- *Site Suitability Update.* Prepared by: ERM NC, Inc., Charlotte, NC. Dated April 11, 2013. [DIN18805]

FACILITY PLAN FOR C&DLFS (15A NCAC 13B .0537)

A Franchise Agreement Facility Plan Report dated May 27, 2011 was prepared for Green Recycling Solutions LLC and included in the previously mentioned Site Suitability Report dated December 16, 2011. A Facility Plan to meet the regulatory requirements of 15A NCAC 13B .0537 was developed based on the Franchise Agreement Facility Plan and included in Appendix 1 of this Application. The facility plan drawings included have been modified from the previous Franchise Facility Plan based on adjustments to landfill operational Phases 1 through 6.

GEOLOGIC AND HYDROGEOLOGIC INVESTIGATIONS FOR C&DLF FACILITIES (15 NCAC 13B .0538)

A Site Hydrogeologic Report dated December 16, 2011 was prepared for the Green Recycling Solutions LLC site in Maysville, North Carolina and submitted to NC DENR Division of Waste Management for review and approval for Site Suitability. Based on our

conversations with Division of Waste Management personnel including Ms. Elizabeth Werner, no further subsurface exploration is needed based on the Site Hydrogeologic Report. It is our understanding that the information provided to and reviewed by the Division of Waste Management is sufficient to establish subsurface soil conditions, estimated seasonal high groundwater levels and overall groundwater flow regime for the facility. This Site Hydrogeologic Report is adopted into this application by reference and is used to meet the design and monitoring criteria for the permitting of this facility. For Application completeness, a copy of the Site Hydrogeologic Study is included in Appendix 2.

ENGINEERING PLAN FOR C&DLF FACILITIES (15A NCAC 13B .0539)

The engineering plan must incorporate the detailed plans and specifications relative to the design and performance of the C&DLF's containment and environmental control systems. This plan must set forth the design parameters and construction requirements for the components of the C&DLF's systems and must establish the responsibilities of the design Engineer. The engineering plan must be prepared by a Professional Engineer licensed to practice engineering in accordance with G.S. 89C and must meet the requirements of this Rule. The design Engineer must incorporate a statement certifying this fact and bearing his or her seal of registration.

This Engineering Plan has been prepared for the Green Recycling Solutions LLC, Maysville C&D Landfill, Phase 1, Cells 1, 2 and 3. Phase 1 is not anticipated to remain operational beyond a five (5) year period. The Engineering Plan and supporting calculations are included in Appendix 3 of this Application. A complete set of design drawings is submitted under separate cover as part of this Application for Permit to Construct.

CONSTRUCTION REQUIREMENTS FOR C&DLF FACILITIES (15A NCAC 13B .0540)

This Rule establishes the performance standards and minimum criteria for designing and constructing a C&DLF unit.

Horizontal Separation Requirements

A Site Suitability Report dated December 16, 2011 was prepared for the Green Recycling Solutions LLC proposed Construction & Demolition Debris (C&D) Landfill site in Maysville, North Carolina and submitted to North Carolina Department of Environment and Natural Resources (NC DENR) Division of Waste Management for review and approval. The Site Suitability Report was approved by Division of Waste Management

via a letter dated April 23, 2013. A Summary of the Location Restriction discussion from the Site Suitability Study is included below. The Site Suitability Study should be referenced for further details.

Location Restriction Summary:

- No 100-yr Floodplains are on site
- No surface Waters or Waters of the United State are on site
- A property buffer of 200-ft minimum is maintained between property boundaries and waste disposal limits
- A 100-ft minimum buffer is maintained between jurisdictional wetlands and waste disposal limits
- A minimum 500-ft buffer is maintained between private residences and waste disposal limits
- Site is not within 5-miles of National Wildlife Refuge
- Site is not within 500-ft of a State Managed Game Land (Reference Senate Bill 24 amending G.S. 130A-295.6(d), Approved April 9, 2013)
- There are no public water supply wells within 2,000 feet of the facility
- There are no schools within 2,000-ft of the facility
- Landfill development will not adversely affect areas of archeological or historic significance
- Landfill development will not adversely affect endangered or threatened species or their critical habitat.

Vertical Separation Requirements

A copy of the Hydrogeologic Report is included in Appendix 2. This report was prepared for the Site Suitability Study for this site and previously reviewed by the Division of Waste Management. The Hydrogeologic Report includes the long term seasonal high groundwater table that has served as the basis for landfill grading plan development to achieve a minimum vertical separation of 4-ft between long term seasonal high groundwater level and base liner system. This separation is illustrated on the "Cross Sections" Plan included in the Design Plan Set submitted under separate cover.

In-situ or modified soils making up the upper two feet of separation will consist of the following: SC, SM, ML, CL, MH, or CH soils per Unified Soil Classification System. Due to the high elevation of long term seasonal high water levels, landfill Cell development will require the placement of structural fill soils to achieve base grades.

Survey Control

Survey Control has been established by Parker & Associates, Inc., Jacksonville, North Carolina. The site design drawings have been developed on NC State Plane coordinate system as well as the surveyed wetland boundaries, property boundaries and observation well locations. Locations of these features along with State Plane Coordinate reference are included in the Design Plan Set submitted under separate cover. The approximate center of the proposed Phase 1 Landfill footprint is located at:

Longitude: -77.2479 degrees

Latitude: 34.9328 degrees

NCSP Northing: 434769.5597

NCSP Easting: 2525123.3143

Landfill Subgrade

Due to the high elevation of long term seasonal high water levels, landfill Cell development will require the placement of structural fill soils to achieve base grades. Base grades will be established with a minimum vertical separation of 4-ft between long term seasonal high groundwater levels and bottom of base liner system. Structural fill soils shall be placed in accordance with the Technical Specifications (Appendix 4) and Construction Quality Assurance (CQA) Plan (Appendix 5). No excavation within the landfill footprint is required for landfill development beyond clearing and stripping.

Special Engineering Structures

Special Engineering Features for construction of the Green Recycling Solutions LLC, Maysville C&D Landfill, Phase 1 include:

- Composite Liner System, 60-mil High Density Polyethylene (HDPE) liner above Geosynthetic Clay Liner (GCL)
- Leachate collection system including geocomposite drainage media, perforated leachate collection pipe surrounded by #57 washed stone, a sump area with #57 washed stone, a side wall riser with submersible leachate collection pump, and leachate storage tank for each Cell.

- A 40-mil Linear Low Density Polyethylene (LLDPE) landfill cap liner with geocomposite drainage media.

Technical Specifications and CQA requirements for these items are located in Appendix 4 and 5 respectively.

Sedimentation & Erosion Control

Sedimentation and erosion control design and plans are included in the Design Plan Set submitted under separate cover. Measures are adequate for the 25-yr, 24-hr storm event for Hubert, North Carolina based on NOAA databases. Since the proposed landfill footprint and supporting access roads are small in drainage areas and existing topographic relief is less than 1 percent, the primary erosion control measures include the installation of silt fence along the toes of fill slopes and downstream side of access roads.

A storm water plan is included in the Design Plan Set submitted under separate cover. The landfill will incorporate a series of storm water ditches along the perimeter of the proposed development. For water quality purposes and based on the NCDENR Water Quality BMP Manual, the ditches have been designed to retain the runoff from a 25-yr, 24-hr storm event with no discharge from the ditches.

Construction Quality Assurance Report

A Construction Quality Assurance (CQA) Report will be submitted following the construction of each Cell within the proposed Phase 1 development. The CQA Report will be submitted in accordance with 15A NCAC 13B .0541 and the CQA Plan included in Appendix 5.

CONSTRUCTION QUALITY ASSURANCE FOR C&DLF FACILITIES (15A NCAC 13B .0541)

A Construction Quality Assurance (CQA) Plan has been developed for the construction of Green Recycling Solutions LLC C&D Landfill in Maysville, North Carolina. The CQA Plan includes industry accepted standards, testing procedures and reporting protocols recently permitted for ERM projects in North Carolina. A complete copy of the CQA Plan is included in Appendix 5. The purpose of the CQA Plan is to describe the observations and tests that will be used before, during, and upon completion of construction to ensure that the construction and materials meet the design specifications and the construction and certification requirements. The CQA Plan is also serves as guidance to compile the

CQA report to be submitted to the Division of Waste Management following completion of each Cell construction for a Permit to Operate.

The CQA report contains the results of all the construction quality assurance and construction quality control testing including documentation of any failed test results, descriptions of procedures used to correct the improperly installed material, and results of all retesting performed. The CQA report contains as-built drawings noting any deviation from the approved engineering plans and must also contain a comprehensive narrative including, but not limited to, daily reports from the project engineer, a series of color photographs of major project features, and documentation of proceedings of all progress and troubleshooting meetings.

OPERATION PLAN AND REQUIREMENTS FOR C&DLF FACILITIES (15A NCAC 13B .0542)

A Landfill Operations Plan has been prepared for Green Recycling Solutions LLC, Maysville C&D Landfill, Phase 1 in accordance with 15A NCAC 13B .0542. A copy of the Operations Plan is included in Appendix 6 of this submittal. Waste acceptance, recordation and screening is performed at the permitted Green Recycling Solutions C&D Recycling & Recovery Facility (Permit 5202-TP-2012 issued February 25, 2013), a copy of the approved Operations Plan for the Recycling & Recovery Facility is included in Appendix 7 as part of this submittal.

CLOSURE AND POST CLOSURE REQUIREMENTS FOR C&DLF FACILITIES (15A NCAC 13B .0543)

A Closure and Post Closure Plan has been prepared for Green Recycling Solutions LLC, Maysville C&D Landfill, Phase 1 in accordance with 15A NCAC 13B .0543. A copy of this Plan is located in Appendix 8 of this submittal.

MONITORING PLANS AND REQUIREMENTS FOR C&DLF FACILITIES (15A NCAC 13B .0544)

A Groundwater Monitoring Plan has been prepared for Green Recycling Solutions LLC, Maysville C&D Landfill, Phase 1 in accordance with 15A NCAC 13B .0544. A copy of this

Plan is located in Appendix 9 of this submittal. Monitoring for landfill gases is discussed and presented in the Landfill Operations Plan located in Appendix 6.

**FINANCIAL ASSURANCE REQUIREMENTS FOR C&DLF FACILITIES AND UNITS
(15A NCAC 13B .0546)**

Owners and operators of C&DLF facilities and units must provide proof of financial assurance in accordance with the financial responsibility for landfills adopted pursuant to G.S. 130A-294(b) and 130A-309.27. The amount of Financial Assurance will be adjusted annually based on the volume and surface area of waste that may be in place at any time over the course of that year.

ATTACHMENTS

DESIGN PLAN SET (SUBMITTED UNDER SEPARATE COVER)

APPENDIX

LIST OF APPENDICES

<i>Appendix 1</i>	Facility Plan
<i>Appendix 2</i>	Site Hydrogeologic Report
<i>Appendix 3</i>	Engineering Plan
<i>Appendix 4</i>	Technical Specifications
<i>Appendix 5</i>	CQA Plan
<i>Appendix 6</i>	Landfill Operations Plan
<i>Appendix 7</i>	Recycling & Recovery Facility Operations Plan
<i>Appendix 8</i>	Closure & Post Closure Plan

CONSTRUCTION AND DEMOLITION DEBRIS RECYCLING AND LANDFILL FACILITY PLAN

Prepared for:

Division of Solid Waste Management, NC Dept. of Environment and
Natural Resources
Town of Maysville

Prepared by:

ERM NC, Inc.
8000 Corporate Center Drive
Suite 200
Charlotte, North Carolina 28226

On behalf of:

Green Recycling Solutions LLC
Maysville, North Carolina

Regulatory Authorities:

North Carolina General Statutes – G.S. 130-294
NCDENR Division of Waste Management Rules 15ANCAC 13B .0536 & .0537
Maysville Franchise Ordinance for Construction Debris Landfills

May 27, 2011
Revised for Permitting June 2013
Revised per NCDENR Comments September 2013

I. Introduction

Green Recycling Solutions, LLC ("Green Recycling") proposes to construct and operate a construction and demolition debris recycling and disposal facility on a 58 acre site, on Highway 17 near White Oak River Road, in Maysville, North Carolina. The property was annexed into the Town of Maysville and is shown on the property annexation boundary survey prepared by Parker & Associates, Inc. and attached with this report.

The facility will receive waste from within the limits of Jones County and surrounding counties including Craven, Carteret, Onslow, Duplin and Lenoir. Only waste that is initially received and processed at the recycling center will be disposed of in the proposed C&D Landfill. The recycling and recovery center has been permitted by NCDENR Division of Waste Management; Permit No. 5202-TP-2012 issued February 25, 2013.

II. Facility Drawings (Rule 13B .0537(d)(1)(A-F))

A site plan prepared by ERM NC, Inc. is attached with this report in accordance with NCDENR – Division of Waste Management Rule 15A NCAC .0537(d)(1)(A-F). In accordance with rule requirements, that site plan illustrates aerial limits of landfill units and buffer requirements. The site plan includes limits of grading and proposed borrow areas located on-site. As required, the site plan illustrates the proposed final contours at 2-ft intervals reaching a maximum elevation of 88.0 feet above mean seal level utilizing 4H:1V slopes during landfilling operations. The site plan was developed utilizing topographic data supplied by the North Carolina Flood Plain Mapping Program (2005) and available for public use. The property annexation boundary survey shown on the site plan was performed by Parker & Associates, Inc. A copy of the sealed survey and legal description is attached for reference.

The site plan also includes locations for the proposed recycling/recovery facility and site access to US Highway 17. Leachate storage tanks will be located at each individual leachate collection sump area (1 or 2 Cells) as shown on the design drawings. Scales and scale house will be located at the recycling/recovery center to receive C&D waste.

As shown on the site plans, there are six, 5-year phases of development and use of the landfill, for a total operational life of 30 years. The total operational life is

dependent upon meeting or exceeding the recycling and recovery goals as discussed later in this report.

Floodplains do not encroach on lands within the proposed site property boundary according to the FEMA NC FIRM Panel 5422 dated November 3, 2005. Cultural resources will not be impacted by development of the C&D Landfill as confirmed by NC Department of Cultural Resources letter dated April 11, 2011 (copy attached).

Wetlands located on site will not be impacted by development of the proposed C&D landfill. A wetland delineation was performed by Pittman Soil Consulting, confirmed by United States Army Corp of Engineers and surveyed by Parker & Associates, Inc. as shown on the Facility Plan.

Additionally, US Fish & Wildlife confirmed that project development will not impact endangered or threatened species or their habitat (letter dated April 12, 2011 – attached).

III. Facility Report (Rule 13B .0537(e)(1)(A-E))

The proposed C&D Landfill will receive waste as defined by North Carolina Department of Environment and Natural Resources (NCDENR), Division of Waste Management as Construction & Demolition Debris, Yard Waste and Land Clearing & Inert Debris only. All waste received at the facility will first be processed at the recycling center where it will be determined if it can be recycled or recovered. Waste will be thoroughly inspected by processing through a tipping floor and sorting lines at the recycling center. This will greatly reduce the potential for unacceptable waste to reach the landfill. (The desired recycling recovery rates are discussed below.) Any acceptable waste that is not recycled will be transported from the recycling center to the C&D Landfill. Unacceptable waste, i.e., any waste the facility is not permitted to accept, will be identified at the recycling/recovery center and either returned to the hauler delivering the waste or transported to and disposed of at a permitted facility followed by invoicing the hauler for permitted disposal.

The facility will serve the population, businesses, municipalities and industry within the counties of Jones, Craven, Carteret, Onslow, Duplin and Lenoir.

The C&D Landfill will be operated utilizing a bulldozer for spreading waste in manageable lifts and equipment for delivering cover soils; either a pan excavator

or combination of trackhoe and dump truck. If permitted by NCDENR, the C&D Landfill will utilize a tarp system to reduce the amount of cover soils placed in the landfill.

IV. Facility Report – Landfill Capacity (Rule 13B .0537(e)(2)(A-B))

As noted, the proposed C&D Landfill is anticipated to have an operational life of 30 years operating 6, 5-year phases. A “Preliminary Facility Capacity & Assumptions” is attached with this report for reference. As illustrated in this attachment, the anticipated annual waste for the first year of operations is 105 tons per day reaching a maximum of 500 tons per day for years 7 through 30. As the facility begins operation an anticipated recycling/recovery rate of 70% is utilized based on facility start up. The recycling rate steadily increases to a maximum of 88% of waste received at year 7 (based on well refined processes), and steadily climbs to 94% by year 26 (identifying new markets and technology advancements) and continues through year 30. Therefore, as the waste received increases the efficiency of recycling and recovering materials increases. This study is based on results seen at similar facilities in operation in Florida utilizing the same equipment and recycling facility plan. (The anticipated waste received at the facility is based upon current disposal rates of C&D waste by the larger construction and contracting companies in the proposed service area.)

Based on the results of our analysis, the maximum waste anticipated to be received at the C&D landfill will be 17,100 tons per year (Years 7 through 15). With an operating year consisting of 285 days, this tonnage equates to an average of 60 tons per day. The proposed waste stream is anticipated to be less in the years following initial start-up of the recycling facility. Refer to the “Preliminary Facility Capacity & Assumptions” attachment for detailed information concerning anticipated waste stream.

The proposed C&D landfill as shown on the site plan has a gross capacity of 602,102 cubic yards. Given the recycling component of the operation, waste material delivered to the landfill will lack heavier constituents such as metals, concrete and wood. It is also anticipated that the unrecoverable materials will be compactable. As a result, the density of waste will be less than typically seen at C&D landfills containing the heavier materials. Therefore, we have assumed an in place waste density for this facility of approximately 0.65 tons per cubic yard. This rate also includes the use of soil cover during operations at a rate of 7.9 percent.

Based on our study included in the “Preliminary Facility Capacity & Assumptions”, the landfill will require 318,614 cubic yards of clean fill soils to provide for construction of landfill Phases, cover soils and final cover soil. Borrow soils are available from on-site and adjacent properties owned by Green Co Land, LLC. Additionally, non-select cover soil will be available to the C&D landfill from the recycling facility processes.

Depth to long term seasonal high ground water has been established based on ERM’s Site Hydrogeologic Report. Results indicate that a 4-ft vertical separation from long term seasonal high groundwater and minimum post settlement landfill floor grade of 2 percent may be achieved with minimal site grading.

V. Facility Report – Special Engineering Features (Rule .0537(e)(3)(A-D))

The design plans include leachate storage tanks located at each leachate collection sump area (1 or 2 Cells combined) that would utilize a pump and haul operation for delivery to a permitted waste water treatment plant (Town of Maysville and/or Pollocksville). Each sump area will contain a prefabricated HDPE sidewall riser with a stainless steel submersible pump for transmission of leachate from the sump to each leachate storage tank. By design, the facility will minimize leachate generation by constructing small Cells within each Phase that shall be approximately one acre in size. Each Phase will contain two to three of these Cells. Once a new Cell is constructed, approximately every 18 months, the first waste lift may be quickly placed across the Cell floor and above the surrounding 6-ft perimeter berm height to promote runoff and reduce leachate generation.

There will be a low permeable barrier across the floor of the proposed C&D landfill. A 60-mil HDPE liner placed above a geosynthetic clay liner (GCL) is proposed in the design plans as the base liner system. A geocomposite drainage media will be placed above the 60-mil HDPE liner for leachate collection along with a 6-in diameter perforated leachate collection pipe surrounded by stone for transmission of leachate to the sump area.

The recycling/recovery facility is a special engineering feature. By virtue of this facility, all waste will be inspected to greatly reduce the opportunity for unacceptable waste being deposited in the landfill. The landfill will only receive waste from the recycling/recovery facility.

Once the landfill operating capacity is reached, a low permeable cap will be installed across the entire waste disposal limits. The cap will be designed to meet or exceed the minimum requirements per NCDENR regulations at the time of permitting the landfill. For the purpose of this report, a landfill cap including a 40-mil linear low density polyethylene liner is proposed. Timing of cap installation will be determined during the permitting process.

The C&D landfill facility will include ground water and landfill gas monitoring well networks to meet or exceed the NCDENR regulations at the time of permitting. The number of wells and depths of wells will be determined based on the hydrogeologic study performed during permitting.

Typical operations of the C&D Landfill will include the following (all items will need approval from NCDENR following review of an operations plan):

- Acceptance of waste solely from the Green Recycling Solutions LLC recycling/recovery facility where waste is weighed and recorded at facility's scales.
- Equipment operators will direct hauler where to place load within the operational landfill Cell.
- The delivered waste will be spread evenly in lifts not to exceed 8 feet in vertical height and visually inspected by the equipment operator for unacceptable waste.
- Waste shall be covered with a minimum six-inch thick soil layer weekly at a minimum frequency provided the working face does not exceed 1/3 of an acre requiring cover placement sooner.
- A tarp system may be considered on a routine basis to reduce the amount of cover soils placed in the landfill.

ATTACHMENTS

List of Attachments

Facility Plans

Legal Description of Facility Property

Sealed Survey Plat for Facility Property Boundary

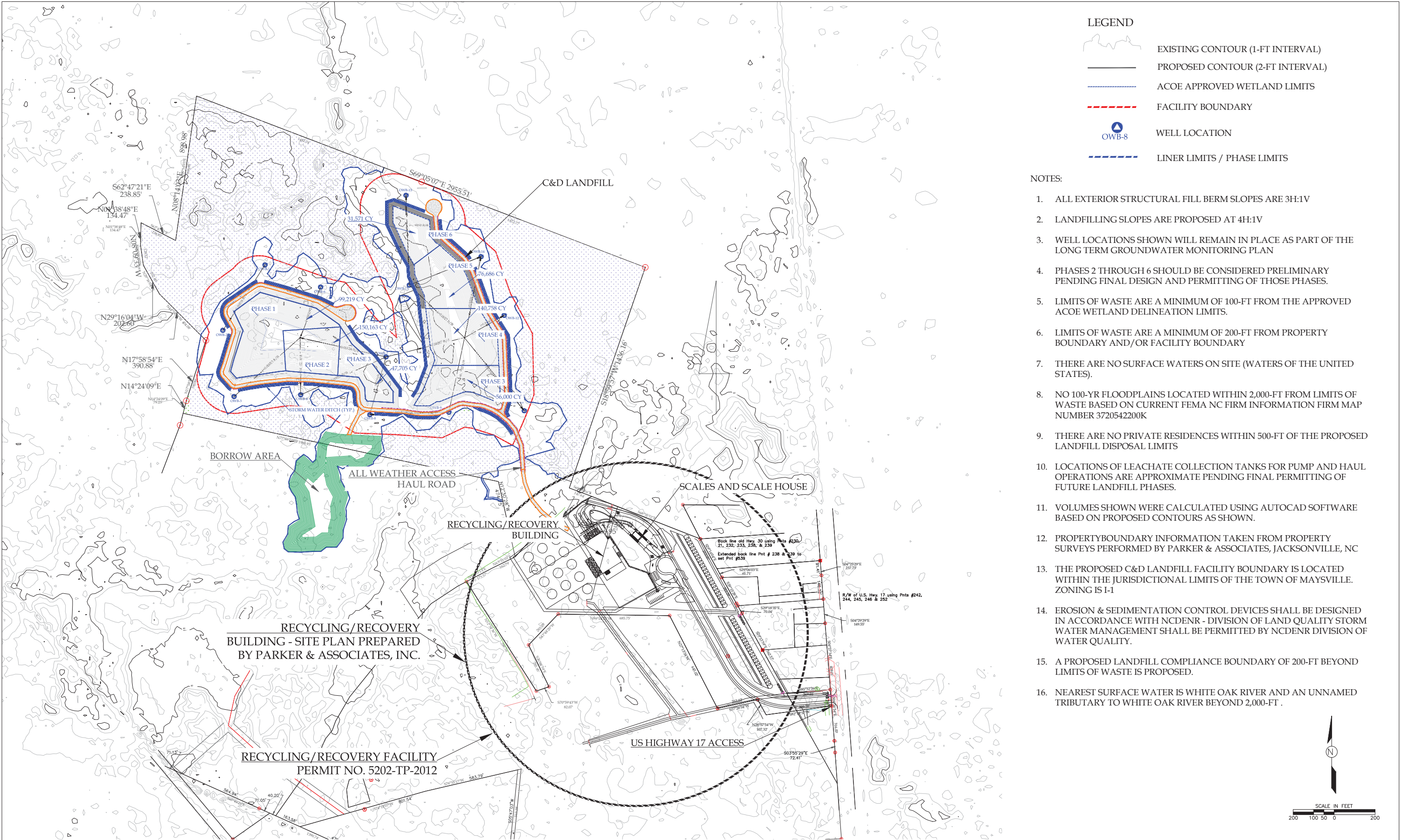
Letter from NC Department of Cultural Resources

Letter from US Fish & Wildlife

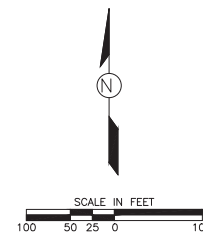
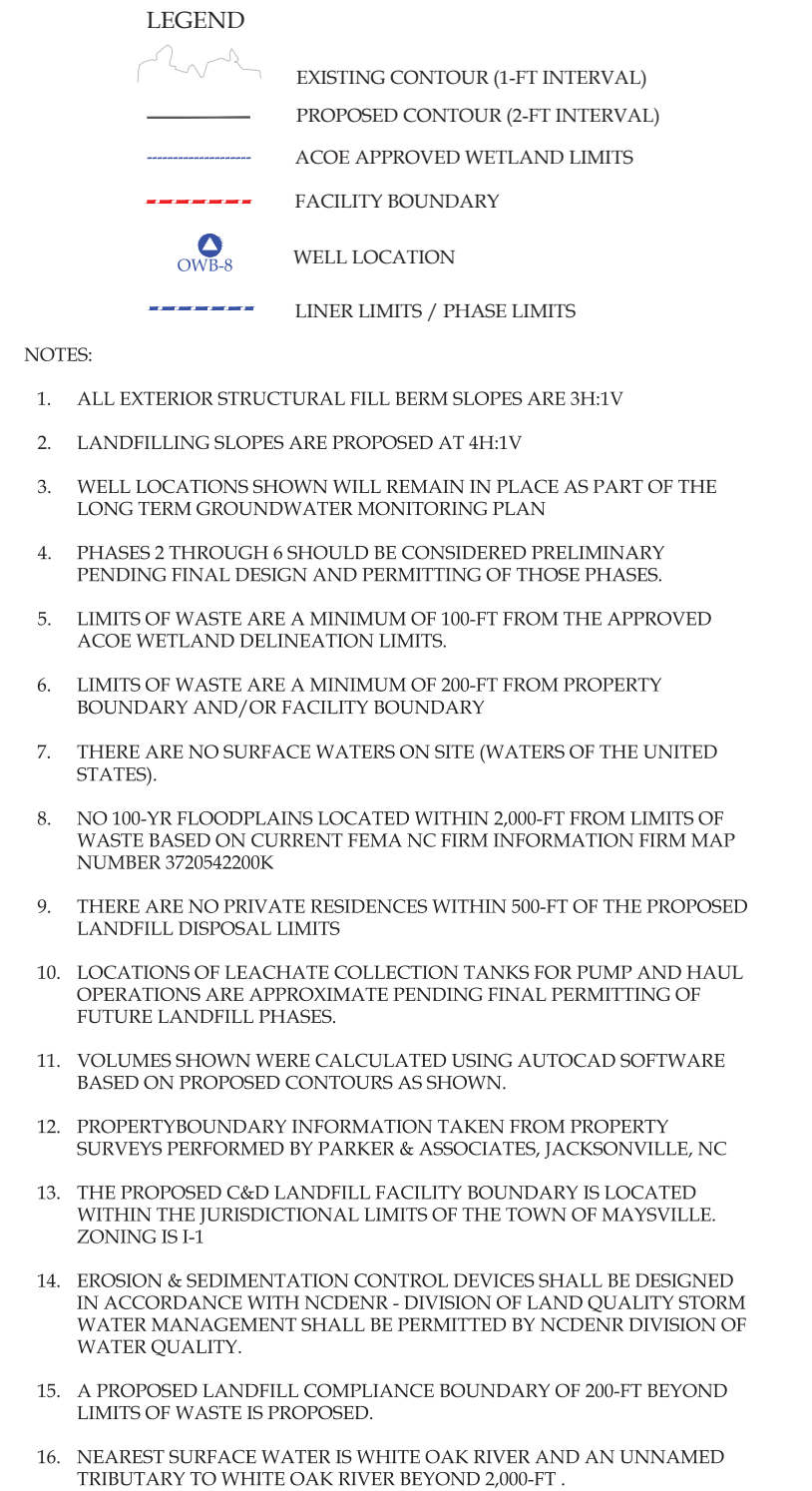
Preliminary Facility Capacity and Assumptions

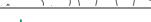
Facility Plans

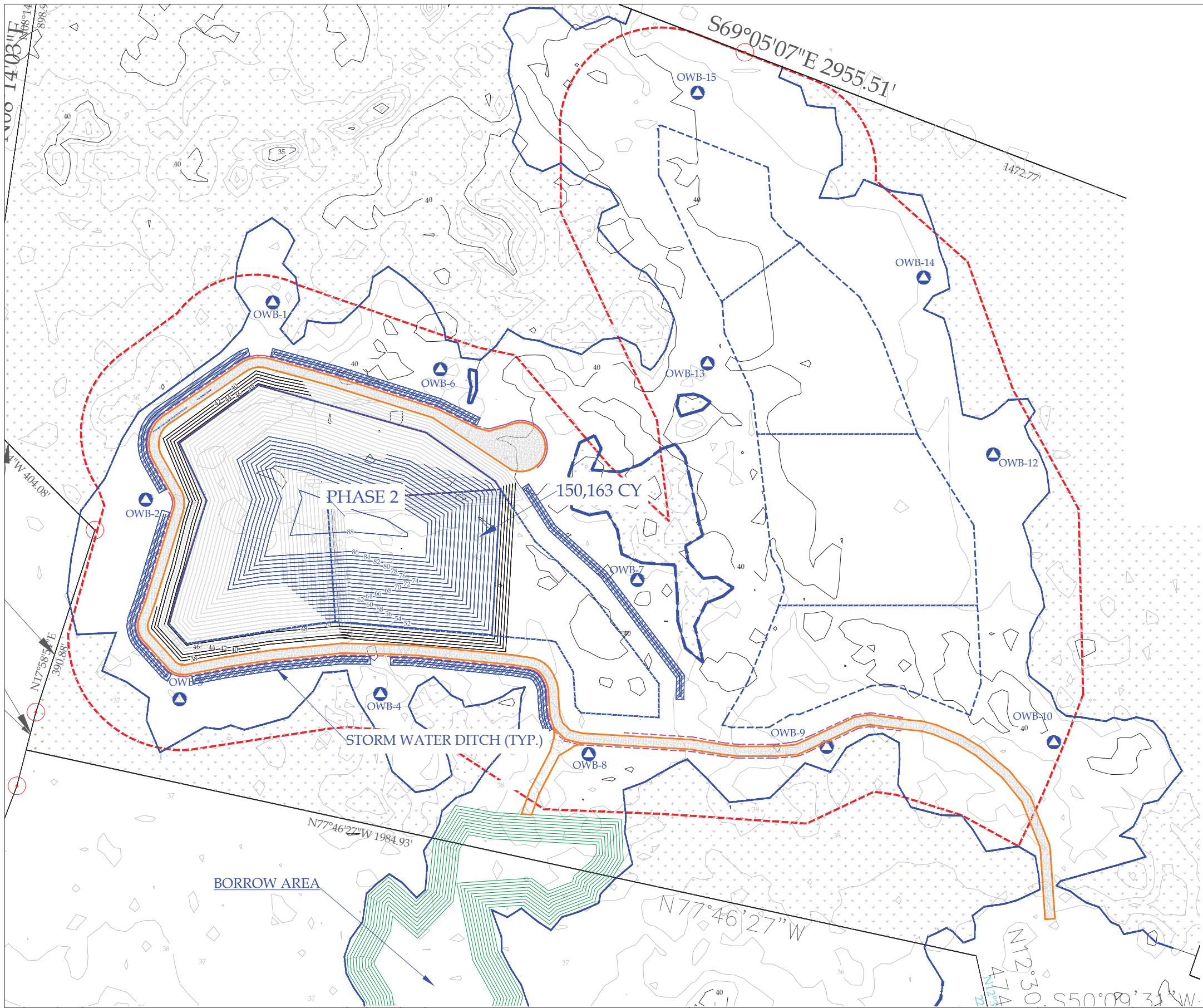
(Larger Scale Plans Included in Design Plan Set)



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												LICENSE #C2205			AutoCAD 2007			SHEET	
												800 CORPORATE CENTER DRIVE, SUITE 200			POTENTIAL FOR CONSTRUCTION			11/04/2013 DIN20046 Page 27 of 627	
												CHARLOTTE, NORTH CAROLINA 28268			0140408				
												(704) 541-5500							



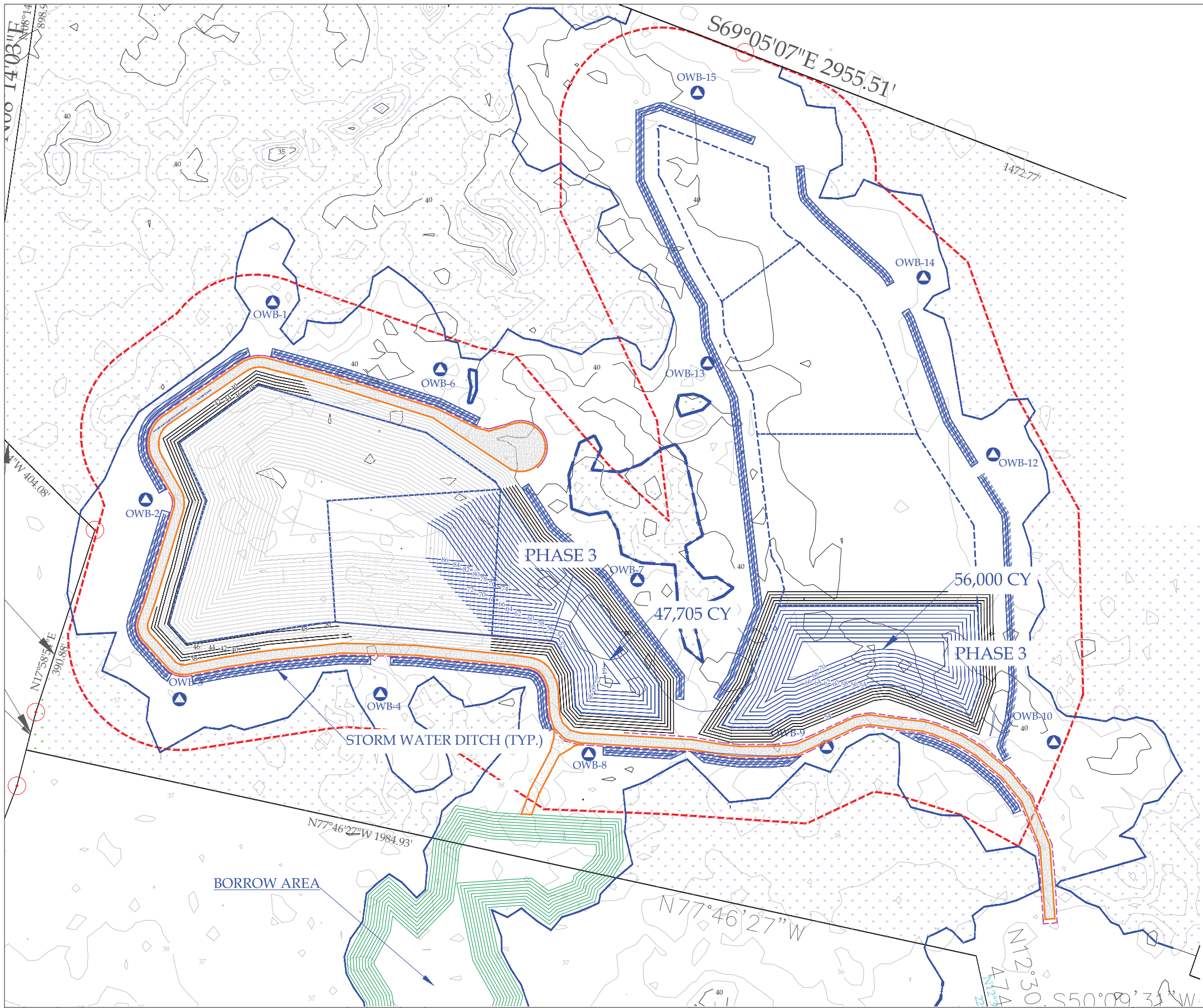
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								DRAWN BY DWV				PROJECT ENGINEER DWV	SCALE 1"=100'	DATE DECEMBER 2011	
								DESIGN ENGINEER DWV				PROJECT MANAGER DWV	PROJECT NO. 0140408	AutoCAD 2007 POTENTIAL RELEASE 10/04/2013	SHEET 29 OF 627



- LEGEND
- EXISTING CONTOUR (1-FT INTERVAL)
 - PROPOSED CONTOUR (2-FT INTERVAL)
 - ACOE APPROVED WETLAND LIMITS
 - FACILITY BOUNDARY
 - WELL LOCATION
 - LINER LIMITS / PHASE LIMITS

- NOTES:
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NO.				DATE				APPR.				REVISION				NO.				DATE				APPR.				REVISION				<div>MAYSVILLE C&D LANDFILL</div> <div>GREEN RECYCLING SOLUTIONS LLC</div> <div>MAYSVILLE, NC</div> <div><div>DRAWN BY</div><div>DWW</div><div>PROJECT ENGINEER</div><div>DWW</div><div>DESIGN ENGINEER</div><div>DWW</div><div>PROJECT MANAGER</div><div>DWW</div></div> <td colspan="4" rowspan="5"><div><div>LICENSE #PC-2245</div><div>ERM NC, INC.</div><div>8000 CORPORATE CENTER DRIVE, SUITE 200</div><div>CHARLOTTE, NORTH CAROLINA 28226</div><div>(704) 581-8500</div></div></td> <td colspan="4" rowspan="5"><div>NOT FOR CONSTRUCTION</div></td> <td colspan="4" rowspan="5"><div>PHASE 2 - FACILITY PLAN</div></td> <td colspan="4" rowspan="5"><div>DRAWING NO.</div><div>4</div><div>REV. NO.</div></td>				<div><div>LICENSE #PC-2245</div><div>ERM NC, INC.</div><div>8000 CORPORATE CENTER DRIVE, SUITE 200</div><div>CHARLOTTE, NORTH CAROLINA 28226</div><div>(704) 581-8500</div></div>				<div>NOT FOR CONSTRUCTION</div>				<div>PHASE 2 - FACILITY PLAN</div>				<div>DRAWING NO.</div> <div>4</div> <div>REV. NO.</div>			
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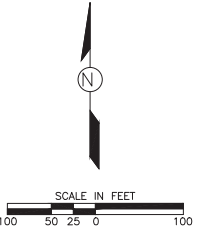


LEGEND

- EXISTING CONTOUR (1-FT INTERVAL)
- PROPOSED CONTOUR (2-FT INTERVAL)
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NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION

MAYSVILLE C&D LANDFILL

GREEN RECYCLING SOLUTIONS LLC

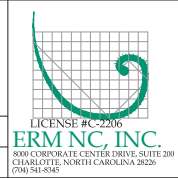
MAYSVILLE, NC

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DWW



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PHASE 3 - FACILITY PLAN

SCALE 1"=100'

DATE DECEMBER 2011

PROJECT NO. 0140408

POTENTIAL FOR LANDFILL

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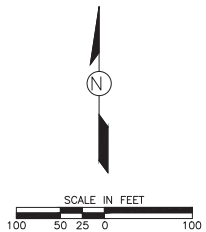
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SHEET 31 OF 627

8



1. ALL EXTERIOR STRUCTURAL FILL BERM SLOPES ARE 3H:1V
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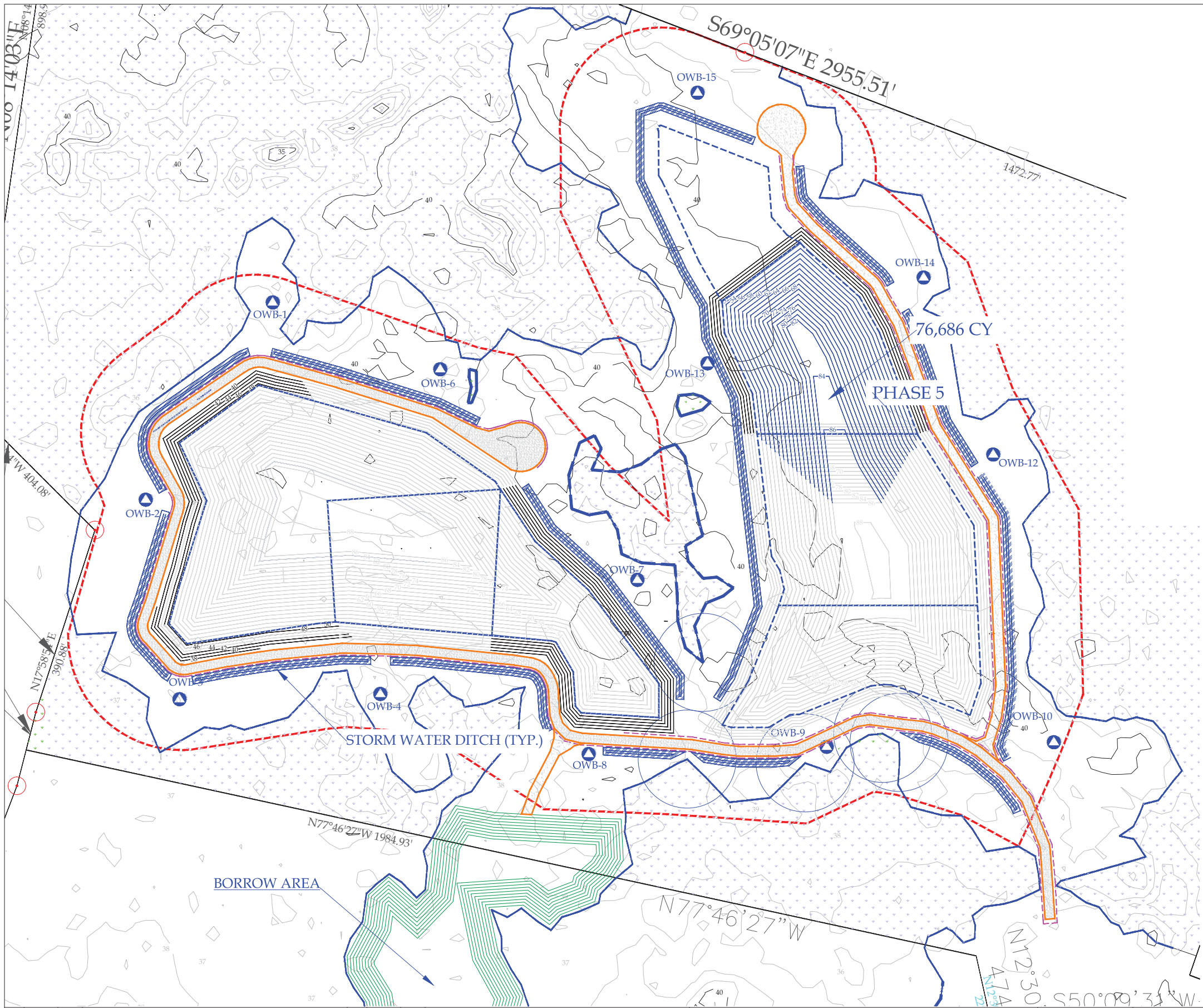
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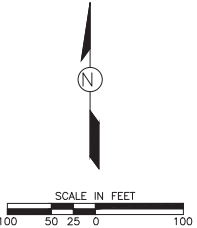
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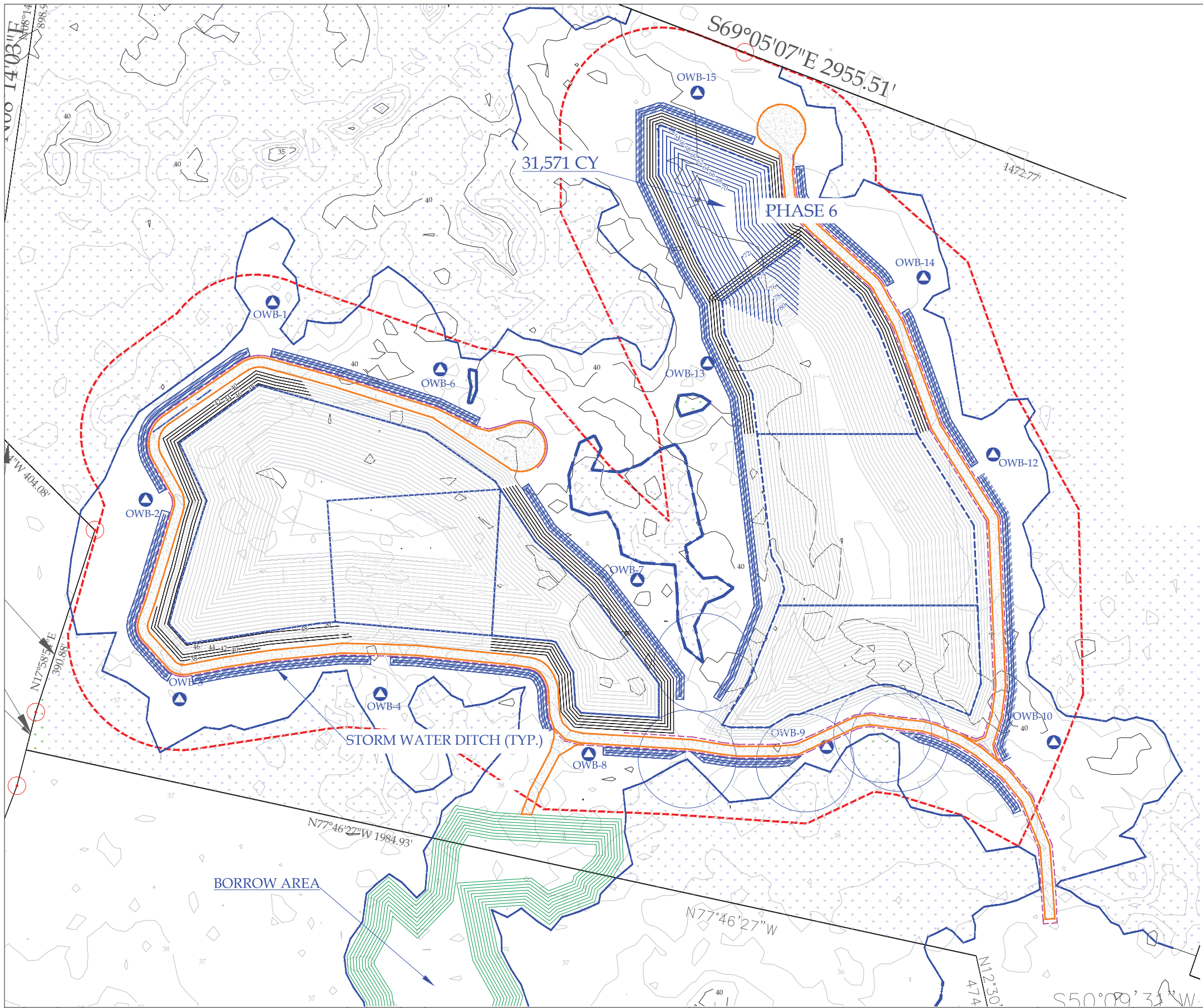


- LEGEND
- EXISTING CONTOUR (1-FT INTERVAL)
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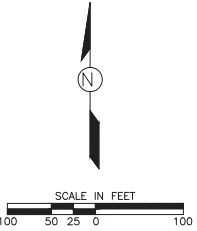


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												Page 33 of 627					



- LEGEND
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 - PROPOSED CONTOUR (2-FT INTERVAL)
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 - VOLUMES SHOWN WERE CALCULATED USING AUTOCAD SOFTWARE BASED ON PROPOSED CONTOURS AS SHOWN.
 - PROPERTYBOUNDARY INFORMATION TAKEN FROM PROPERTY SURVEYS PERFORMED BY PARKER & ASSOCIATES, JACKSONVILLE, NC
 - THE PROPOSED C&D LANDFILL FACILITY BOUNDARY IS LOCATED WITHIN THE JURISDICTIONAL LIMITS OF THE TOWN OF MAYSVILLE. ZONING IS I-1
 - EROSION & SEDIMENTATION CONTROL DEVICES SHALL BE DESIGNED IN ACCORDANCE WITH NCDENR - DIVISION OF LAND QUALITY STORM WATER MANAGEMENT SHALL BE PERMITTED BY NCDENR DIVISION OF WATER QUALITY.
 - A PROPOSED LANDFILL COMPLIANCE BOUNDARY OF 200-FT BEYOND LIMITS OF WASTE IS PROPOSED.
 - NEAREST SURFACE WATER IS WHITE OAK RIVER AND AN UNNAMED TRIBUTARY TO WHITE OAK RIVER BEYOND 2,000-FT .



NO.				NO.				MAYSVILLE C&D LANDFILL				PHASE 6 - FACILITY PLAN				DRAWING NO.	
DATE				DATE				GREEN RECYCLING SOLUTIONS LLC				1"=100'				8	
APPR.				APPR.				MAYSVILLE, NC				DATE				REV. NO.	
REVISION				REVISION				DRAWN BY DWW				PROJECT ENGINEER DWW				8	
								DESIGN ENGINEER DWW				PROJECT MANAGER DWW					
												SCALE					
												PROJECT NO. 0140408					
												DATE					
												AutoCAD 2007					
												POTENTIAL FOR WASTE					

Legal Description of Facility Property

PARKER & ASSOCIATES, INC.

Consulting Engineers - Land Surveyors - Land Planners

306 New Bridge Street - P.O. Box 976
Jacksonville, North Carolina 28541-0976
Phone (910) 455-2414 - Fax (910) 455-3441
Firm License Number F-0108



ANNEXATION DESCRIPTION May 18, 2011

M & M Land Development, Inc.
Tract on US Highway 17 North, Jones County C & D Landfill
White Oak Township, Jones County, NC

A certain tract of land on the West side of US Highway 17 about 1.4 miles North of the intersection with White Oak River Road, NCSR 1118, and being more particularly described as follows:

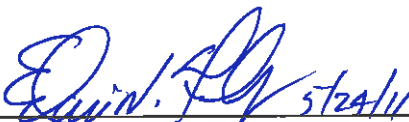
Commencing at an iron pipe found on the Western Right-of-Way Line of US Highway 17, said iron being the Northeastern corner of the Woodrow Lassiter property as recorded in Deed Book 44, Page 377 and recorded in Plat Cabinet "A," Slide 119-A; thence with said Right-of-Way Line, South 04 degrees 26 minutes 54 seconds East, 29.50 feet to a point, the TRUE POINT OF BEGINNING; **THENCE** from said point of beginning and continuing with said Right-of-Way Line, South 04 degrees 26 minutes 54 seconds East, 60.0 feet to a point; thence leaving said Right-of-Way Line, South 85 degrees 32 minutes 26 seconds West, 218.28 feet to a point; thence along the arc of a curve having a radius of 454.52 feet and curving to the Right, 517.39 feet (Chord North 61 degrees 50 minutes 56 seconds West, 489.90 feet) to a point; thence North 29 degrees 14 minutes 19 seconds West, 649.27 feet to a point; thence South 60 degrees 29 minutes 21 seconds West, 386.08 feet to a point; thence North 32 degrees 20 minutes 10 seconds West, 657.69 feet to an iron stake found on the Southern Line of the Woodrow Lassiter property as recorded in Plat Cabinet "B," Slide 334, Page 3, said Southern Line being the Old Buck Savannah Road as shown on said map; thence with said Southern Line, North 50 degrees 09 minutes 31 seconds East, 123.60 feet to a point; thence leaving said Line, North 74 degrees 56 minutes 43 seconds West, 124.47 feet to a point; thence along the arc of a curve having a radius of 323.0 feet and curving to the Right, 394.32 feet (Chord North 39 degrees 58 minutes 19 seconds West, 370.28 feet) to a point; thence North 04 degrees 59 minutes 56 seconds West, 34.33 feet to a point; thence along the arc of a curve having a radius of 297.0 feet and curving to the Left, 105.03 feet (Chord North 15 degrees 07 minutes 48

seconds West, 104.49 feet) to a point; thence North 25 degrees 15 minutes 40 seconds West, 24.49 feet to a point; thence South 90 degrees 00 minutes 00 seconds West, 311.73 feet to a point; thence South 64 degrees 41 minutes 49 seconds West, 136.53 feet to a point; thence North 86 degrees 54 minutes 23 seconds West, 249.06 feet to a point; thence North 86 degrees 21 minutes 09 seconds West, 294.62 feet to a point; thence North 56 degrees 41 minutes 06 seconds West, 276.84 feet to a point; thence North 85 degrees 47 minutes 15 seconds West, 165.72 feet to a point; thence South 85 degrees 08 minutes 26 seconds West, 37.28 feet to a point; thence South 81 degrees 20 minutes 59 seconds West, 324.75 feet to a point; thence along the arc of a curve having a radius of 200.0 feet and curving to the Right, 407.12 feet (Chord North 40 degrees 20 minutes 04 seconds West, 340.38 feet) to a point on the Western boundary of the aforementioned Woodrow Lassiter property; thence with said Western Line, North 17 degrees 58 minutes 54 seconds East, 204.69 feet to an iron stake found; thence leaving said Line, North 17 degrees 58 minutes 54 seconds East, 52.34 feet to a point; thence North 22 degrees 14 minutes 49 seconds East, 78.27 feet to a point; thence along the arc of a curve having a radius of 200.0 feet and curving to the Right, 265.52 feet (Chord North 15 degrees 47 minutes 09 seconds East, 246.45 feet) to a point; thence North 53 degrees 49 minutes 08 seconds East, 96.80 feet to a point; thence North 48 degrees 52 minutes 55 seconds East, 84.45 feet to a point; thence along the arc of a curve having a radius of 200.0 feet and curving to the Right, 211.37 feet (Chord North 79 degrees 09 minutes 31 seconds East, 201.67 feet) to a point; thence South 70 degrees 33 minutes 52 seconds East, 412.60 feet to a point; thence South 78 degrees 17 minutes 26 seconds East, 76.90 feet to a point; thence South 40 degrees 28 minutes 14 seconds East, 295.97 feet to a point; thence South 47 degrees 11 minutes 05 seconds East, 166.17 feet to a point; thence North 06 degrees 42 minutes 34 seconds West, 206.06 feet to a point; thence North 24 degrees 47 minutes 57 seconds West, 468.34 feet to a point; thence North 00 degrees 00 minutes 00 seconds West, 179.77 feet to a point; thence along the arc of a curve having a radius of 200.0 feet and curving to the Right, 387.17 feet (Chord North 55 degrees 27 minutes 27

seconds East, 329.48 feet) to a point on the Northern Line of the aforementioned Lassiter property; thence with said Line, South 69 degrees 05 minutes 07 seconds East, 111.93 feet to an iron stake found; thence South 69 degrees 05 minutes 07 seconds East, 148.98 feet to a point; thence leaving said Line and along the arc of a curve having a radius of 200.0 feet and curving to the Right, 241.15 feet (Chord South 34 degrees 32 minutes 33 seconds East, 226.81 feet) to a point; thence South 00 degrees 00 minutes 00 seconds West, 20.02 feet to a point; thence South 48 degrees 06 minutes 29 seconds East, 251.52 feet to a point; thence South 19 degrees 32 minutes 12 seconds East, 276.38 feet to a point; thence South 28 degrees 47 minutes 13 seconds East, 278.17 feet to a point; thence South 01 degrees 25 minutes 00 seconds East 378.58 feet to a point; thence South 02 degrees 09 minutes 56 seconds West, 88.73 feet to a point; thence South 43 degrees 30 minutes 46 seconds West, 146.39 feet to a point; thence South 25 degrees 15 minutes 40 seconds East, 23.40 feet to a point; thence along the arc of a curve having a radius of 323.0 feet and curving to the Right, 114.23 feet (Chord South 15 degrees 07 minutes 48 seconds East, 113.63 feet) to a point; thence South 04 degrees 59 minutes 56 seconds East, 34.33 feet to a point; thence along the arc of a curve having a radius of 297.0 feet and curving to the Left, 362.58 feet (Chord South 39 degrees 58 minutes 19 seconds East, 340.48 feet) to a point; thence South 74 degrees 56 minutes 43 seconds East, 142.74 feet to a point on the aforementioned Southern Line of the Lassiter property; thence with said Southern Line, North 50 degrees 09 minutes 31 seconds East, 2.21 feet to an iron stake found; thence North 61 degrees 42 minutes 34 seconds East, 14.85 feet to a point; thence leaving said Line, South 74 degrees 56 minutes 43 seconds East, 280.56 feet to a point; thence along the arc of a curve having a radius of 335.0 feet and curving to the Right, 267.24 feet (Chord South 52 degrees 05 minutes 31 seconds East, 260.21 feet) to a point; thence South 29 degrees 14 minutes 19 seconds East, 895.80 feet to a point; thence along the arc of a curve having a radius of 389.50 feet and curving to the Left, 443.37 feet (Chord South 61 degrees 50 minutes 56 seconds East, 419.82 feet) to a point; thence North 85 degrees 32 minutes 26 seconds East, 232.51 feet to the point and place of beginning.

M&M Land Development, Inc.
Tract on U.S. Highway 17 North, Jones County C& D Landfill
Annexation Description
May 18, 2011
Page 4

The described annexation area contains 58.2 acres, more or less, and being a portion of that property as recorded in Deed Book 318, Page 981, and Deed Book 44, Page 377, and Plat Cabinet "A," Slide 119-A, and Plat Cabinet "B," Slide 334, Page 3. All courses are referenced to GPS Grid North, NAD '83, 2007 adjustment. This description being prepared by Parker & Associates, Inc. from survey and computed information and an electronic overlay of Design Plans furnished by ERM NC, PC is for annexation and rezoning purposes only.


Edwin N. Foley, P.L.S., L-2884

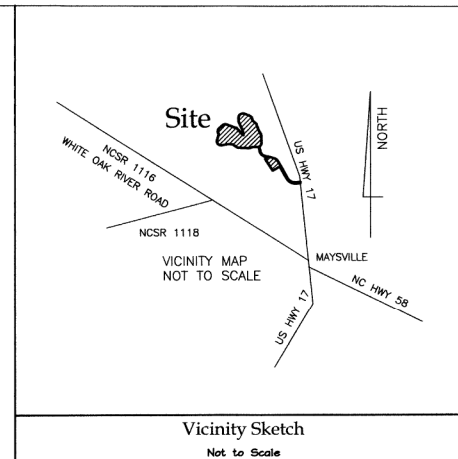


ENF/avk
c1/Forms/LandDescriptions/M&MLandDevelopment_C&DLandfill.(5.17.11)

Sealed Survey Plat for Facility Boundary

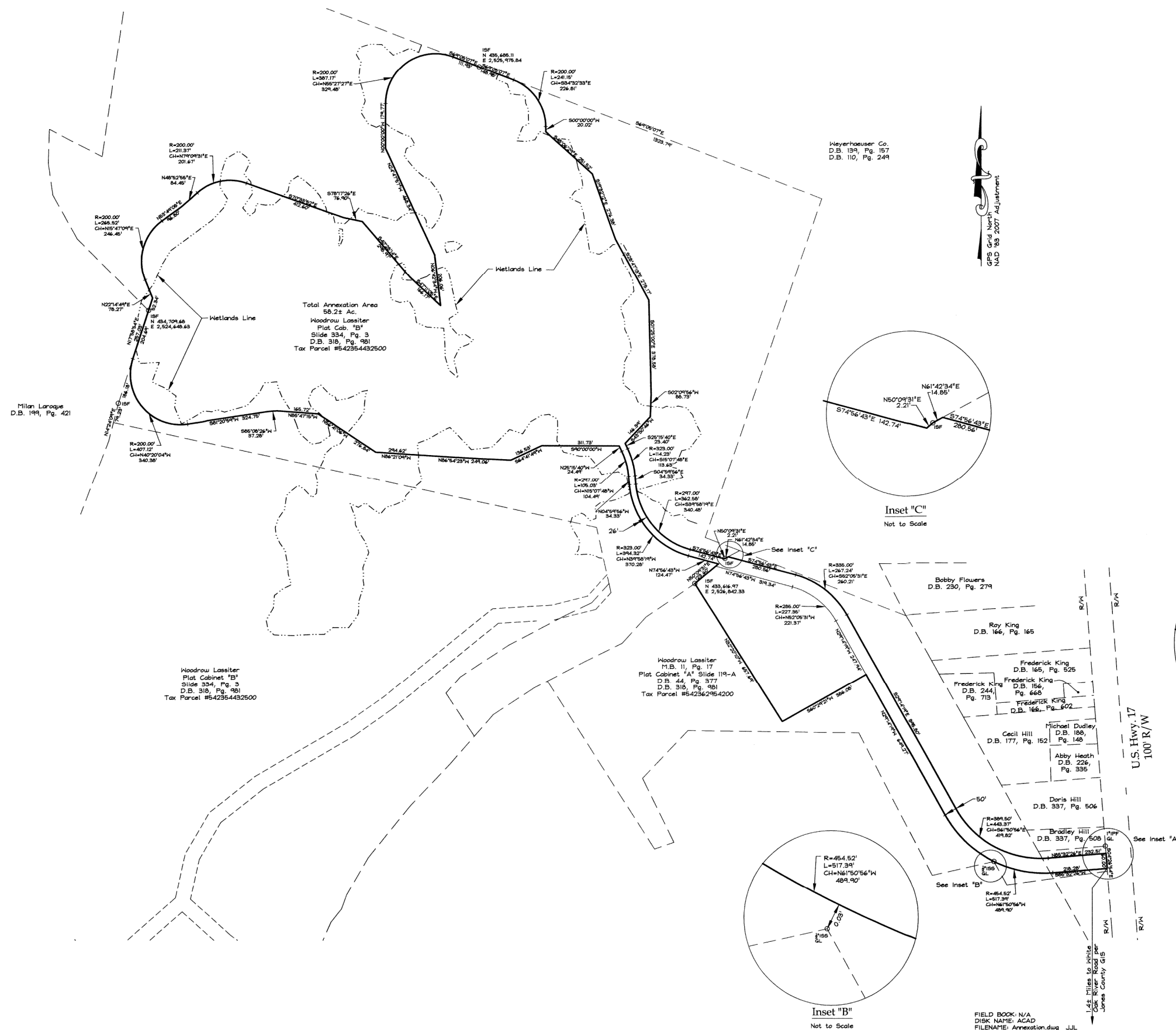
Legend:

IPF - Iron Pipe Found
GL - Ground Level
R/W - Right-of-way
R - Radius
L - Arc Length
CH - Chord



NOTE:

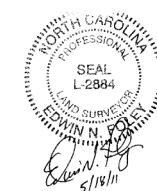
1. This Map prepared from survey data dated May, 2011, Computed information.
2. Wetlands line delineated by Pittman Soil Consulting and surveyed in April, 2011.
3. Computed area for Landfill site taken from an electronic overlay of design work furnished by ERM, NC PC.
4. All distances are horizontal ground, U.S. survey feet.
5. All acreages calculated by coordinates.
6. No Register of Deed search done by or furnished to surveyor regarding Deed or Covenant Restrictions.
7. The GPS portion of the boundary work was performed to third order, Class 1, FGCC specifications. The coordinates were obtained by Real Time Kinematic Differential GPS Observations using Trimble Survey Grade 5800 GPS Unit, NCGS RTK Network Adjustments to NC Grid NAD' 83, 2007 Adjustments with average positional accuracy of 0.04'.



Inset "C"
Not to Scale

Inset "A"
Not to Scale

Inset "B"
Not to Scale



ANNEXATION AND REZONING MAP

Jones County C&D Landfill

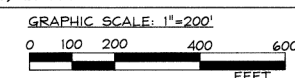
White Oak Twp., Jones Co., North Carolina

M&M Land Development, Inc.

166 Center Street
Jacksonville, North Carolina 28546
(910) 938-5900

DATE: 05/16/11

SCALE: 1"=200'



Parker & Associates, Inc.
Consulting Engineers, Land Surveyors - Land Planners
P.O. Box 978 - 28541-0978
306 New Bridge Street - 28540
Jacksonville, North Carolina
Phone (910) 455-2414 - Fax (910) 455-3441
Firm License Number: F-0108



Letter from NC Department of Cultural Resources



**North Carolina Department of Cultural Resources
State Historic Preservation Office**

Claudia Brown, Acting Administrator

Beverly Eaves Perdue, Governor
Linda A. Carlisle, Secretary
Jeffrey J. Crow, Deputy Secretary

Office of Archives and History
Division of Historical Resources
David Brook, Director

April 11, 2011

David Wasiela
ERM NC, Inc.
800 Corporate Center Drive
Suite 200
Charlotte, NC 28226

Re: Maysville C&D Recycling Center & Landfill, US 17, Maysville, Jones County, ER 11-0456

Dear Mr. Wasiela:


Thank you for your email of March 25, 2011, concerning the above project.

We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, please contact Renee Gledhill-Earley, environmental review coordinator, at 919-807-6579. In all future communication concerning this project, please cite the above-referenced tracking number.

Sincerely,


for Claudia Brown

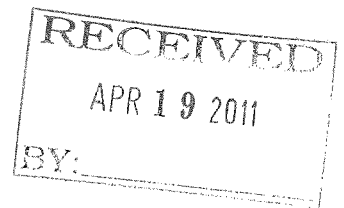
Letter from US Fish & Wildlife



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

April 12, 2011



David Wasiela
ERM NC, Inc.
8000 Corporate Center Drive, Suite 200
Charlotte, NC 28226

Re: Proposed C&D Recycling Center & Landfill Site.

Dear Mr. Wasiela:

This letter is to inform you that a list of all federally-protected endangered and threatened species with known occurrences in North Carolina is now available on the U.S. Fish and Wildlife Service's (Service) web page at <http://www.fws.gov/raleigh>. Therefore, if you have projects that occur within the Raleigh Field Office's area of responsibility (see attached county list), you no longer need to contact the Raleigh Field Office for a list of federally-protected species.

Our web page contains a complete and frequently updated list of all endangered and threatened species protected by the provisions of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)(Act), and a list of federal species of concern¹ that are known to occur in each county in North Carolina.

Section 7 of the Act requires that all federal agencies (or their designated non-federal representative), in consultation with the Service, insure that any action federally authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any federally-listed endangered or threatened species. A biological assessment or evaluation may be prepared to fulfill that requirement and in determining whether additional consultation with the Service is necessary. In addition to the federally-protected species list, information on the species' life histories and habitats and information on completing a biological assessment or evaluation and can be found on our web page at <http://www.fws.gov/raleigh>. Please check the web site often for updated information or changes.

¹ The term "federal species of concern" refers to those species which the Service believes might be in need of concentrated conservation actions. Federal species of concern receive no legal protection and their designation does not necessarily imply that the species will eventually be proposed for listing as a federally endangered or threatened species. However, we recommend that all practicable measures be taken to avoid or minimize adverse impacts to federal species of concern.

If your project contains suitable habitat for any of the federally-listed species known to be present within the county where your project occurs, the proposed action has the potential to adversely affect those species. As such, we recommend that surveys be conducted to determine the species' presence or absence within the project area. The use of North Carolina Natural Heritage program data should not be substituted for actual field surveys.

If you determine that the proposed action may affect (i.e., likely to adversely affect or not likely to adversely affect) a federally-protected species, you should notify this office with your determination, the results of your surveys, survey methodologies, and an analysis of the effects of the action on listed species, including consideration of direct, indirect, and cumulative effects, before conducting any activities that might affect the species. If you determine that the proposed action will have no effect (i.e., no beneficial or adverse, direct or indirect effect) on federally listed species, then you are not required to contact our office for concurrence (unless an Environmental Impact Statement is prepared). However, you should maintain a complete record of the assessment, including steps leading to your determination of effect, the qualified personnel conducting the assessment, habitat conditions, site photographs, and any other related articles.

With regard to the above-referenced project, we offer the following remarks. Our comments are submitted pursuant to, and in accordance with, provisions of the Endangered Species Act.

Based on the information provided and other information available, it appears that the proposed action is not likely to adversely affect any federally-listed endangered or threatened species, their formally designated critical habitat, or species currently proposed for listing under the Act at these sites. We believe that the requirements of section 7(a)(2) of the Act have been satisfied for your project. Please remember that obligations under section 7 consultation must be reconsidered if: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered; (2) this action is subsequently modified in a manner that was not considered in this review; or, (3) a new species is listed or critical habitat determined that may be affected by the identified action.

However, the Service is concerned about the potential impacts the proposed action might have on aquatic species. Aquatic resources are highly susceptible to sedimentation. Therefore, we recommend that all practicable measures be taken to avoid adverse impacts to aquatic species, including implementing directional boring methods and stringent sediment and erosion control measures. An erosion and sedimentation control plan should be submitted to and approved by the North Carolina Division of Land Resources, Land Quality Section prior to construction. Erosion and sedimentation controls should be installed and maintained between the construction site and any nearby down-gradient surface waters. In addition, we recommend maintaining natural, vegetated buffers on all streams and creeks adjacent to the project site.

The North Carolina Wildlife Resources Commission has developed a Guidance Memorandum (a copy can be found on our website at (<http://www.fws.gov/raleigh>) to address and mitigate secondary and cumulative impacts to aquatic and terrestrial wildlife resources and water quality. We recommend that you consider this document in the development of your projects and in completing an initiation package for consultation (if necessary).

We hope you find our web page useful and informative and that following the process described above will reduce the time required, and eliminate the need, for general correspondence for species' lists. If you have any questions or comments, please contact John Ellis of this office at (919) 856-4520 ext. 26.

Sincerely,

A handwritten signature in black ink, appearing to read "Pete Benjamin". The signature is fluid and cursive, with the first name "Pete" being more prominent than the last name "Benjamin".

Pete Benjamin
Field Supervisor

List of Counties in the Service's Raleigh Field Office Area of Responsibility

Alamance	Perquimans
Beaufort	Person
Bertie	Pitt
Bladen	Randolph
Brunswick	Richmond
Camden	Robeson
Carteret	Rockingham
Caswell	Sampson
Chatham	Scotland
Chowan	Tyrrell
Columbus	Vance
Craven	Wake
Cumberland	Warren
Currituck	Washington
Dare	Wayne
Duplin	Wilson
Durham	
Edgecombe	
Franklin	
Gates	
Granville	
Greene	
Guilford	
Halifax	
Harnett	
Hertford	
Hoke	
Hyde	
Johnston	
Jones	
Lee	
Lenoir	
Martin	
Montgomery	
Moore	
Nash	
New Hanover	
Northampton	
Onslow	
Orange	
Pamlico	
Pasquotank	
Pender	

Preliminary Facility Capacity and Assumptions

Proposed Maysville C&D Recovery Facility & C&D Landfill

Preliminary Facility Sizing

Landfill operates 285 days per year

In-place density for C&D Waste

1,300

lbs/cy

0.65

tons/cy

Year	Avg. Daily C&D Waste (Tons)	Total C&D Waste Received (Tons)	Percentage of C&D Waste Recovered	C&D Waste to Landfill (Tons)	C&D Landfill Airspace Required (CY)	Operational Phase	CUMMULATIVE CY
1	105	29,925	0.70	8,978	13,812	Phase 1, Cell 1	13,812
2	200	57,000	0.78	12,540	19,292	Phase 1, Cell 2	33,104
3	250	71,250	0.82	12,825	19,731		52,835
4	300	85,500	0.82	15,390	23,677	Phase 1 Cell 3	76,512
5	350	99,750	0.87	12,968	19,950		96,462
6	400	114,000	0.87	14,820	22,800	Phase 2	119,262
7	500	142,500	0.88	17,100	26,308		145,569
8	500	142,500	0.88	17,100	26,308		171,877
9	500	142,500	0.88	17,100	26,308		198,185
10	500	142,500	0.88	17,100	26,308		224,492
11	500	142,500	0.88	17,100	26,308	Phase 3	250,800
12	500	142,500	0.88	17,100	26,308		277,108
13	500	142,500	0.88	17,100	26,308		303,415
14	500	142,500	0.88	17,100	26,308		329,723
15	500	142,500	0.88	17,100	26,308		356,031
16	500	142,500	0.89	15,675	24,115	Phase 4	380,146
17	500	142,500	0.89	15,675	24,115		404,262
18	500	142,500	0.90	14,250	21,923		426,185
19	500	142,500	0.90	14,250	21,923		448,108
20	500	142,500	0.91	12,825	19,731		467,838
21	500	142,500	0.92	11,400	17,538	Phase 5	485,377
22	500	142,500	0.92	11,400	17,538		502,915
23	500	142,500	0.93	9,975	15,346		518,262
24	500	142,500	0.93	9,975	15,346		533,608
25	500	142,500	0.93	9,975	15,346		548,954
26	500	142,500	0.94	8,550	13,154	Phase 6	562,108
27	500	142,500	0.94	8,550	13,154		575,262
28	500	142,500	0.94	8,550	13,154		588,415
29	500	142,500	0.94	8,550	13,154		601,569
30	500	142,500	0.94	8,550	13,154		614,723
TOTALS		3,877,425		304,095	614,723		

Proposed Maysville C&D Recovery Facility & C&D Landfill
Green Recycling Solutions, LLC

Preliminary Facility Sizing - Soils Required

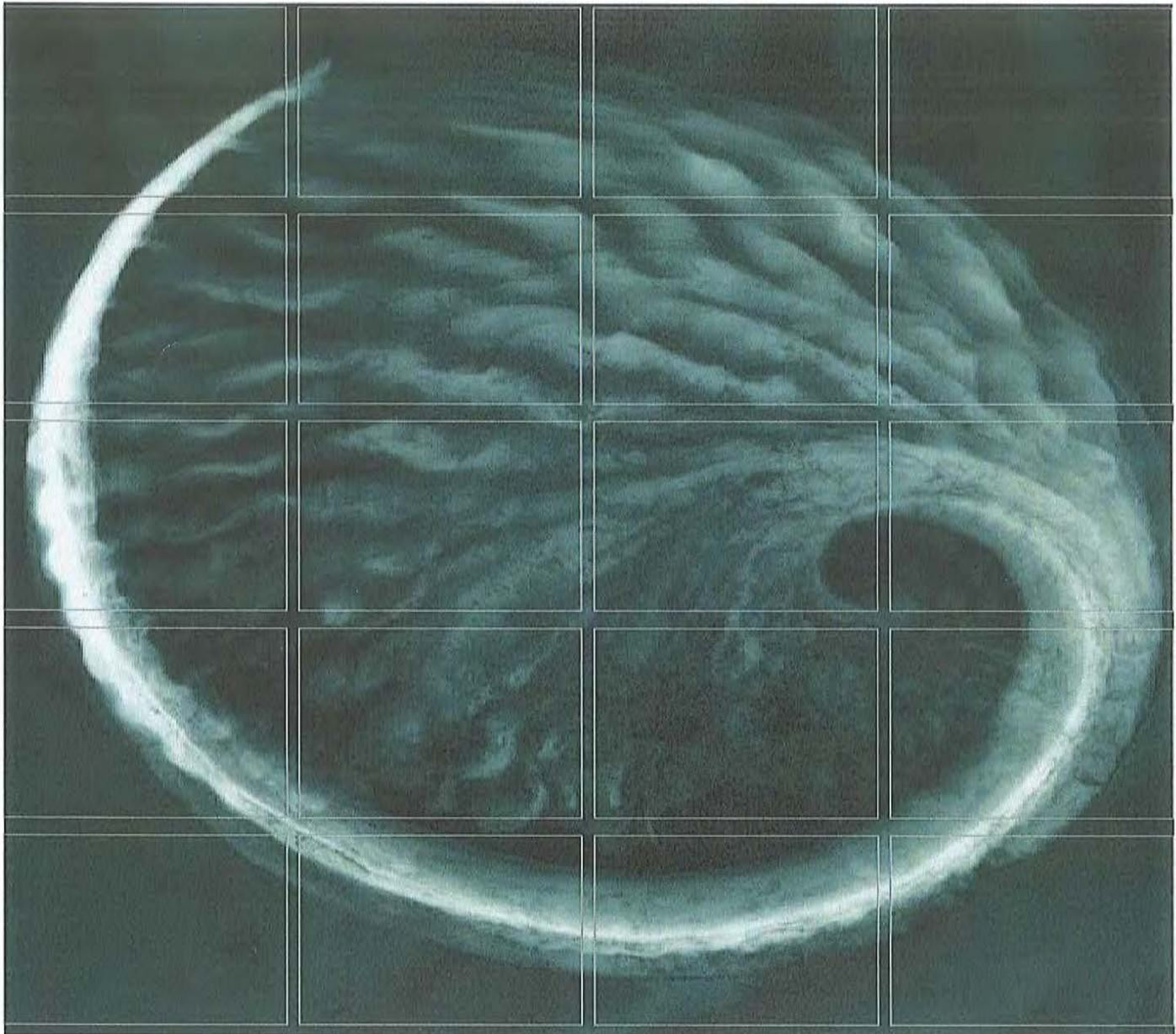
						Construction and Operational Soils Needed (CY)				
Year	Avg. Daily C&D Waste (Tons)	Total C&D Waste Received (Tons)	Percentage of C&D Waste Recovered	C&D Waste to Landfill (Tons)	C&D Landfill Airspace Required (CY)	Operational Phase	Structural Fill	Operational Cover	Weekly Cover	Final Cover
1	105	29,925	0.70	8,978	13,812	Phase 1, Cell 1	8,986	4,356	3,326	4,574
2	200	57,000	0.78	12,540	19,292	Phase 1, Cell 2	10,012	4,356	3,326	4,574
3	250	71,250	0.82	12,825	19,731	Phase 1, Cell 3	9,887	4,356	3,326	4,574
4	300	85,500	0.82	15,390	23,677					
5	350	99,750	0.87	12,968	19,950					
6	400	114,000	0.87	14,820	22,800	Phase 2, Cell 1	7,220	4,356	3,326	4,574
7	500	142,500	0.88	17,100	26,308	Phase 2, Cell 2	8,200	4,356	3,326	4,574
8	500	142,500	0.88	17,100	26,308					
9	500	142,500	0.88	17,100	26,308					
10	500	142,500	0.88	17,100	26,308					
11	500	142,500	0.88	17,100	26,308	Phase 3, Cell 1	6,745	4,356	3,326	4,574
12	500	142,500	0.88	17,100	26,308	Phase 3, Cell 2	11,215	4,356	3,326	4,574
13	500	142,500	0.88	17,100	26,308					
14	500	142,500	0.88	17,100	26,308					
15	500	142,500	0.88	17,100	26,308					
16	500	142,500	0.89	15,675	24,115	Phase 4, Cell 1	6,750	4,356	3,326	4,574
17	500	142,500	0.89	15,675	24,115	Phase 4, Cell 2	6,750	4,356	3,326	4,574
18	500	142,500	0.90	14,250	21,923	Phase 4, Cell 3	6,750	4,356	3,326	4,574
19	500	142,500	0.90	14,250	21,923					
20	500	142,500	0.91	12,825	19,731					
21	500	142,500	0.92	11,400	17,538	Phase 5, Cell 1	6,750	4,356	3,326	4,574
22	500	142,500	0.92	11,400	17,538	Phase 5, Cell 2	6,750	4,356	3,326	4,574
23	500	142,500	0.93	9,975	15,346					
24	500	142,500	0.93	9,975	15,346					
25	500	142,500	0.93	9,975	15,346	Phase 5, Cell 3	6,750	4,356	3,326	4,574
26	500	142,500	0.94	8,550	13,154	Phase 6, Cell 1	6,750	4,356	3,326	4,574
27	500	142,500	0.94	8,550	13,154	Phase 6, Cell 2	6,750	4,356	3,326	4,574
28	500	142,500	0.94	8,550	13,154					
29	500	142,500	0.94	8,550	13,154					
30	500	142,500	0.94	8,550	13,154	Phase 6, Cell 3	6,750	4,356	3,326	4,574
TOTALS		3,877,425		304,095	614,723	TOTALS	123,015	69,696	59,868	73,181

Total Non-Select Structural Fill / Cover Soils Required (CY) =

325,760

Size Near Site Borrow Pit for

358,336 CY



Green Recycling Solutions LLC

Site Hydrogeologic Report
Proposed Construction & Demolition
Debris Landfill
Maysville, North Carolina

December 2011



Delivering sustainable solutions in a more competitive world

December 16, 2011

NCDENR – Division of Waste Management
610 East Center Avenue
Suite 301
Mooresville, NC 28115

Attention: Ms. Elizabeth Werner

Reference: Site Suitability – Site Hydrogeologic Report
Proposed Green Recycling Solutions LLC – C&D Landfill
Maysville, Jones County, North Carolina

Ms. Werner:

On behalf of Green Recycling Solutions LLC, ERM NC, Inc. (ERM) is submitting the attached Site Study – Site Hydrogeologic Report for a Construction & Demolition Debris (C&D) Landfill in accordance with NCDENR Division of Waste Management regulations 15A NCAC 13B .0536(c)(3) and .0538 (a) for the referenced project. The proposed C&D landfill site is located within the jurisdictional limits of Maysville, North Carolina approximately one mile north of the intersection of US Highway 17 and NC Route 58.

ERM submitted a proposed boring location plan for the Maysville site on August 4, 2011 to Division of Waste Management to receive comments or suggestions. The proposed boring location plan included 15 soil test boring locations with installation of temporary observation wells (installed as Type II Monitoring Wells) at each location. The depths of the proposed borings and wells ranged from 15 to 20 feet below ground surface. Ms. Elizabeth Werner responded to ERM on August 15, 2011 with no suggested revisions concerning the locations of the proposed borings or proposed depths. ERM subcontracted Geologic Exploration, Inc. to perform drilling and well installation services and mobilized to the site on August 22, 2011. Representatives from Division of Waste Management; Elizabeth Werner and Ray Williams, visited the site on August 24, 2011 during the installation of soil test borings and observation wells. Field work for the borings and well installation was completed on August 26, 2011. Following installation of the wells, ERM performed field permeability testing for the surficial aquifer and made several site visits to obtain ground water level measurements. The results of our field testing and observations are included in the attached report.

The Site Hydrogeologic Report for the Maysville Green Recycling Solutions site has been compiled to match the order of information requested in regulation 15A NCAC 13B .0538(a). For simplicity purposes, each portion of the regulation is listed prior to the associated discussion of information to illustrate completeness.

ERM NC, Inc.

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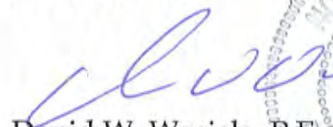


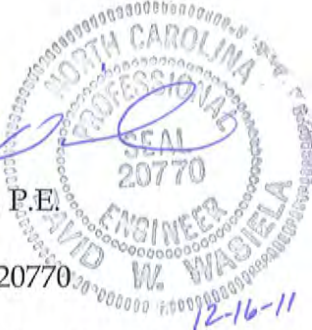
Ms. Elizabeth Werner
December 16, 2011
Page 2


If you should have any questions or require additional information concerning this Site Hydrogeologic Report please contact us at your convenience.

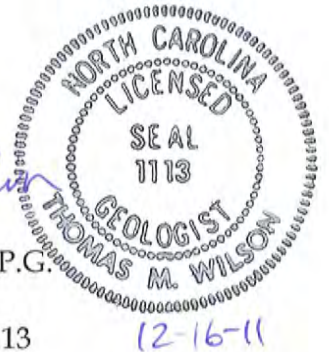
Sincerely,

ERM NC, Inc.


David W. Wasiela, P.E.
Senior Engineer
NC Registration #20770




Thomas M. Wilson, P.G.
Senior Geologist
NC Registration #1113



cc: Mr. James Maides – Green Recycling Solutions LLC

Attch: Site Hydrogeologic Report

**Site Suitability – Site Hydrogeologic Report
Proposed Green Recycling Solutions LLC – C&D Landfill
Maysville, Jones County, North Carolina**

TABLE OF CONTENTS

<u>Regulation & Description</u>	<u>Page</u>
15A NCAC 13B .0538(a) – Report Requirements... ..	1
15A NCAC 13B .0538(a)(1) – Local/Regional Geology... ..	2
15A NCAC 13B .0538(a)(2) – Field Observations... ..	7
15A NCAC 13B .0538(a)(3) – Soil Test Borings... ..	8
15A NCAC 13B .0538(a)(4) – Soil Sampling & Testing... ..	9
15A NCAC 13B .0538(a)(5) – Additional Subsurface Investigation... ..	10
15A NCAC 13B .0538(a)(6) – Subsurface Cross Sections... ..	11
15A NCAC 13B .0538(a)(7) – Water Table Discussion... ..	11
15A NCAC 13B .0538(a)(8) – Ground Water Flow Discussion... ..	14
15A NCAC 13B .0538(a)(9) – Ground Water Contour Map... ..	15
15A NCAC 13B .0538(a)(10) – Topographic Map... ..	15
15A NCAC 13B .0538(a)(11) – Wells & Water Intakes... ..	16
15A NCAC 13B .0538(a)(12) – Geologic & Hydrologic Considerations... ..	17
15A NCAC 13B .0538(a)(13) – Geologic & Hydrogeologic Summary... ..	18

LIST OF APPENDICES

Appendix A	<i>Local and Regional Geology and Hydrology</i>
Appendix B	<i>Site Plan</i>
Appendix C	<i>Investigatory Well Information</i>
Appendix D	<i>Soil Test Results</i>
Appendix E	<i>Preliminary Subsurface Test Pits</i>
Appendix F	<i>Stratigraphic Cross-Sections</i>
Appendix G	<i>Water Level Records</i>
Appendix H	<i>Groundwater Contour Map</i>

Regulation - 15A NCAC 13B .0538(a) GEOLOGIC AND HYDROGEOLOGIC INVESTIGATIONS FOR C&DLF FACILITIES

(a) Site Hydrogeologic Report. A permit applicant must conduct a hydrogeologic investigation and prepare a report. An investigation is required to assess the geologic and hydrogeologic characteristics of the proposed site to determine the suitability of the site for solid waste management activities, which areas of the site are most suitable for C&DLF units, and the general ground-water flow paths and rates for the uppermost aquifer. The report must provide an understanding of the relationship of the site ground-water flow regime to local and regional hydrogeologic features with special emphasis on the relationship of C&DLF units to ground-water receptors (especially drinking water wells) and to ground-water discharge features. Additionally, the scope of the investigation must include the general geologic information necessary to address compliance with the pertinent location restrictions described in Rule .0536 of this Section. The Site Hydrogeologic Report must provide, at a minimum, the following information:

Discussion

This Site Hydrogeologic Report has been prepared to meet or exceed the requirements stipulated in the regulation above. The report contains:

- Regional geologic characteristics as available from research and ERM observations.
- Local geologic & hydrologic information as available from research and ERM observations.
- A subsurface investigation program and results
- A field testing program and results
- A laboratory testing program and results
- Potentiometric Map
- Ground water table discussion
- Ground water flow discussion
- Topographic Map
- Geologic & Hydrologic considerations for permitting
- Geologic & Hydrogeologic Summary

Regulation - 15A NCAC 13B .0538(a)(1)

(1) A report on local and regional geology and hydrogeology based on research of available literature for the area. This information is to be used in planning the field investigation. For sites located in piedmont or mountain regions, this report must include an evaluation of structurally controlled features identified on a topographic map of the area.

Discussion

The proposed Green Recycling Solutions LLC, C&D Landfill is located within the physiographic region of the Inner Coastal Plain. "The Inner Coastal Plain Province consists of stair-step-like planar terraces that dip gently towards the ocean. At higher elevations, the land is dissected to form gently rolling hills and valleys. Elevations range from about 600 feet to 25 feet above mean sea level. The boundary between the Piedmont and Coastal Plain is the Fall Zone. This zone represents the elevational break between the resistant rocks of the Piedmont and the more easily eroded sediments of the Coastal Plain." (Ref: North Carolina Geological Survey, *Physiography of North Carolina*, M.A. Medina, J.C. Reid, and R.H. Carpenter, 2004). The site location is shown on the North Carolina Physiography Map (Figure - 1) for reference.

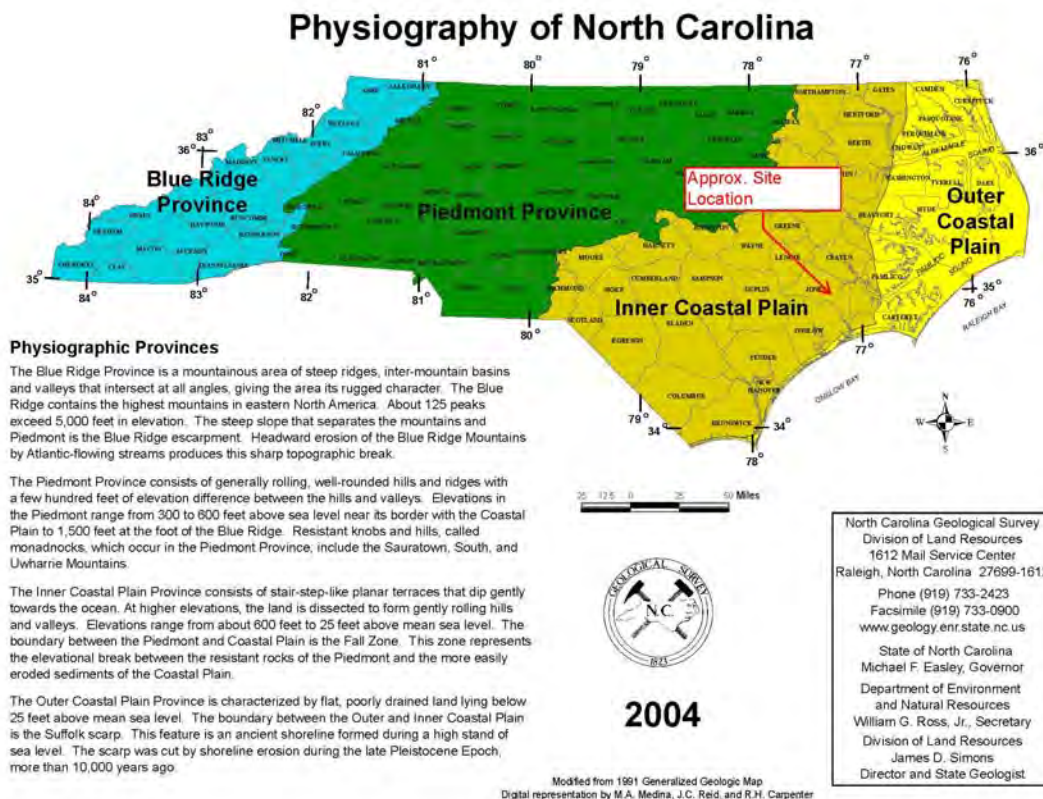


Figure -1

GENERALIZED GEOLOGIC MAP OF NORTH CAROLINA

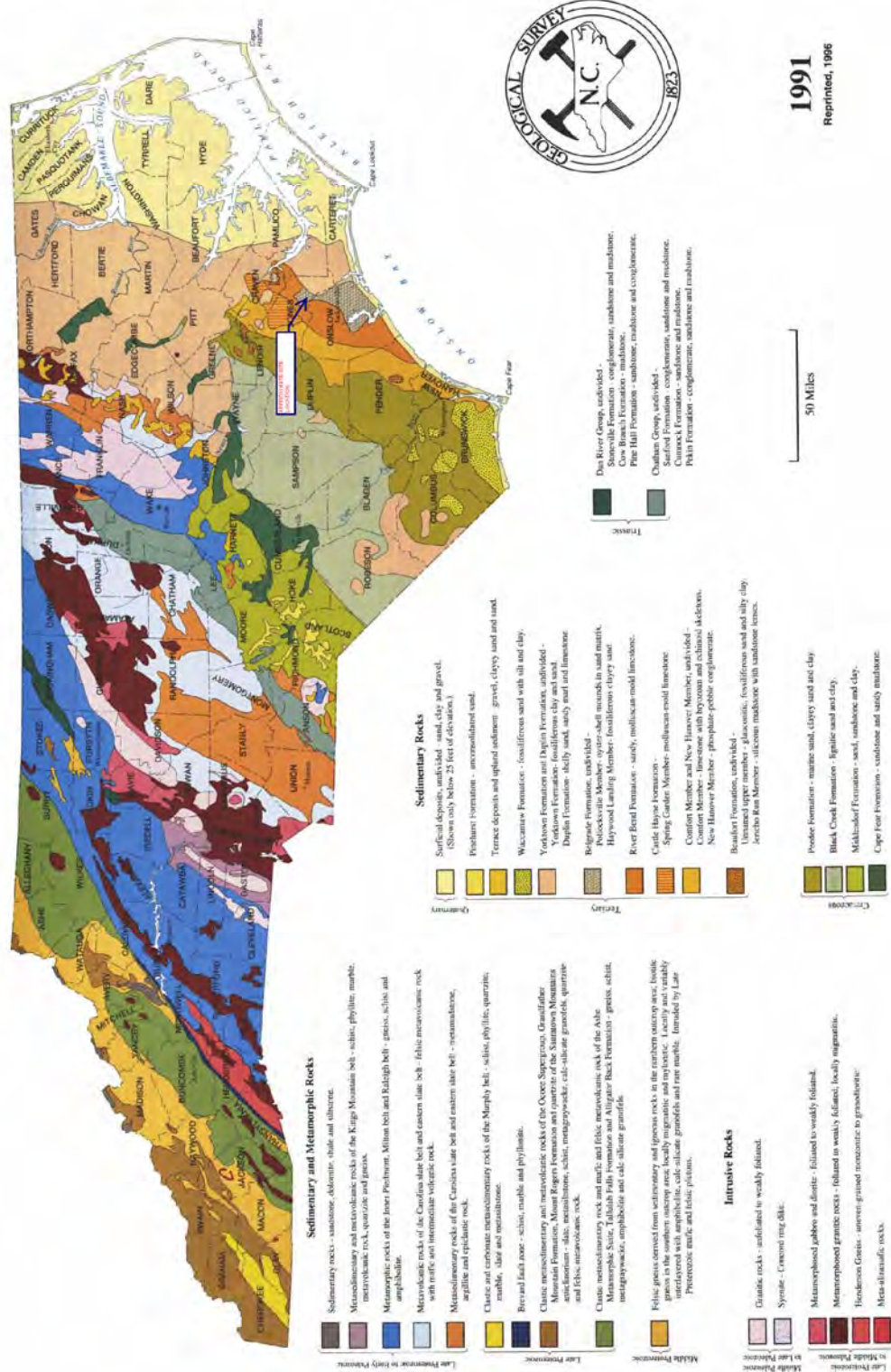


Figure - 2

“The unconfined, surficial aquifer of much of the southeastern North Carolina Coastal Plain typically consists of variably thick, Pliocene, Pleistocene, and Holocene deposits. On the south side of the Neuse River, Pleistocene surficial deposits (sand, mud, shell, gravel) are thin (20 ft thick), and the top of the Cretaceous (Peedee) confining unit occurs at a depth of 132 ft. Between these surfaces is a thick sequence (110 ft) of muddy sand, sand and limestone that includes Paleocene (Beaufort Formation), Eocene (Castle Hayne Formation), and Oligocene (Riverbend/Belgrade Formations) deposits. These formations include a variety of siliciclastic and carbonate facies, some of which form porous and permeable aquifers.” (Reference: *Shallow Aquifers and Confining Units in the Neuse River Basin, Surry to Suffolk Scarp, Fiscal Year 2003 Grant, NC-DENR Contract Number EW04035*).

In Jones County, the Coastal Plain deposits consist primarily of limestone and unconsolidated sands and clays. Geologically, the proposed site is located within the Belgrade Formation (Ref. *North Carolina Geological Survey, Generalized Geologic Map of North Carolina, 1991*) as shown in Figure – 2 on the previous page. Generally, the surficial soils within the site area consist of silty sands and clayey sands with discrete areas of surface clays/silts that typically support wetland areas. Based on the predominance of silty and clayey sands observed in shallow borings advanced at the proposed site, the site is considered to be within the Haywood Landing Member of the Belgrade Formation.

The sandy soils within the upper 20-feet of soil strata includes the uppermost ground water aquifer for this region. The ground water level within the surficial aquifer may vary several feet based on significant rainfall events as this aquifer is primarily recharged by rainfall. Detailed descriptions of the composition and properties of the soils for the proposed landfill site and surrounding area are provided in a Custom Soil Resource Report from the National Cooperative Soil Survey that is presented in **Appendix A**.

Locally, Martin-Marietta operates a quarry in Belgrade, North Carolina (approximately 2.5 miles south of the site) for extraction of sand and rock. Reportedly, a limestone layer is encountered within the quarry at depths ranging from 40 to 60 feet below natural ground surface. The thickness of the limestone varies and is overlying deposits of sands. Similar reports have been identified for the Morton Trucking, US 17 mine located approximately 8 miles south of the site with a limestone layer encountered approximately 70 to 80 feet below natural ground surface approximately 14 to 18 feet thick. This mine also reports that sand deposits are beneath the limestone layer.

ERM utilized the NCDENR – Division of Water Resources data base to locate wells within the vicinity of the proposed site that contain historical water level data. Three wells were identified; one well in Jones County, well ID U26J8 (Figure 3) has a total depth of 15 feet and is located approximately 10 miles west of the site, and two wells in Onslow County, well ID V23X4 with a total depth of 35 feet (Figure 4) and V23X1 with a total depth of 120 feet (Figure 5) both located approximately 5 miles southwest of the site along US Highway 17.

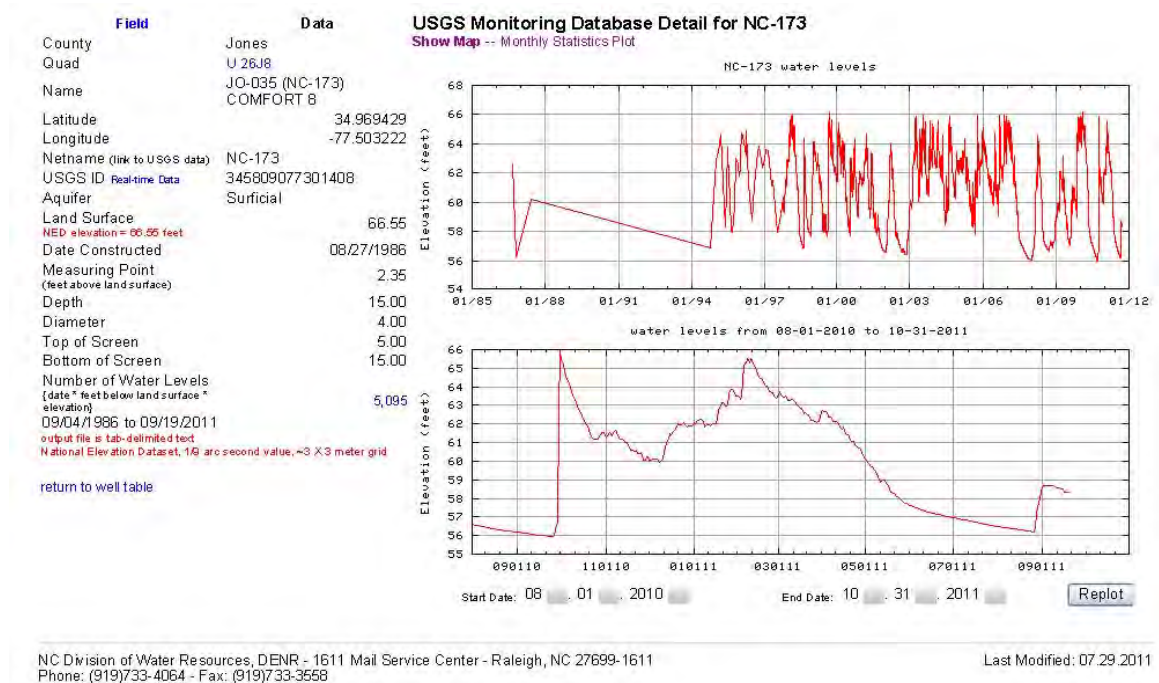


Figure - 3

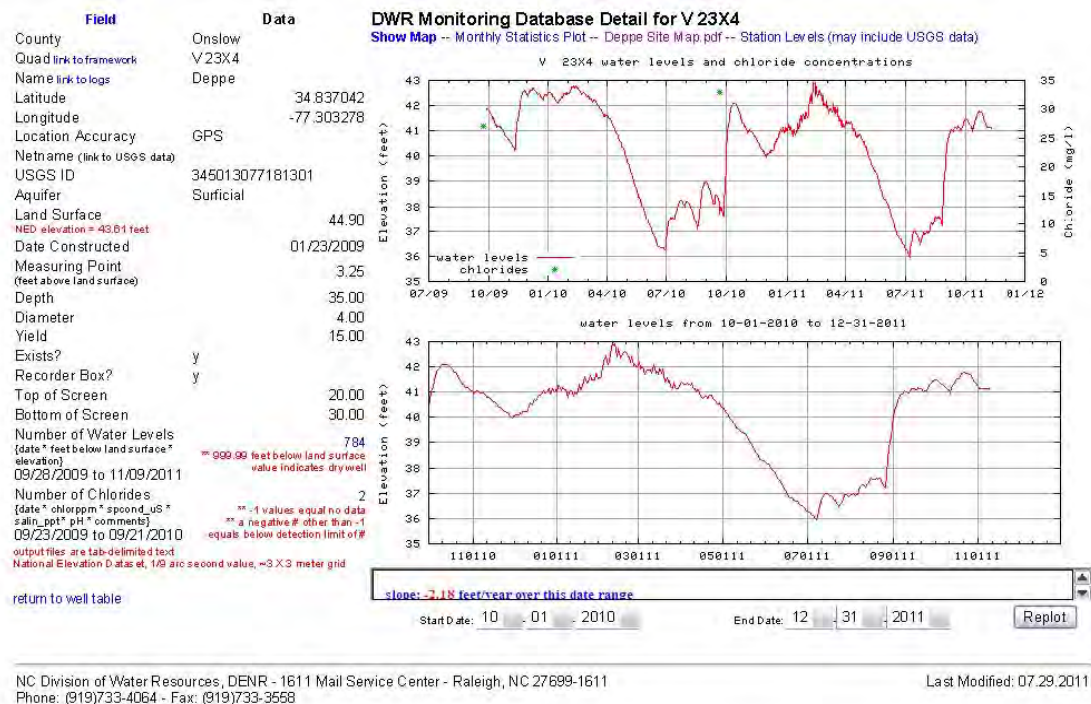


Figure - 4

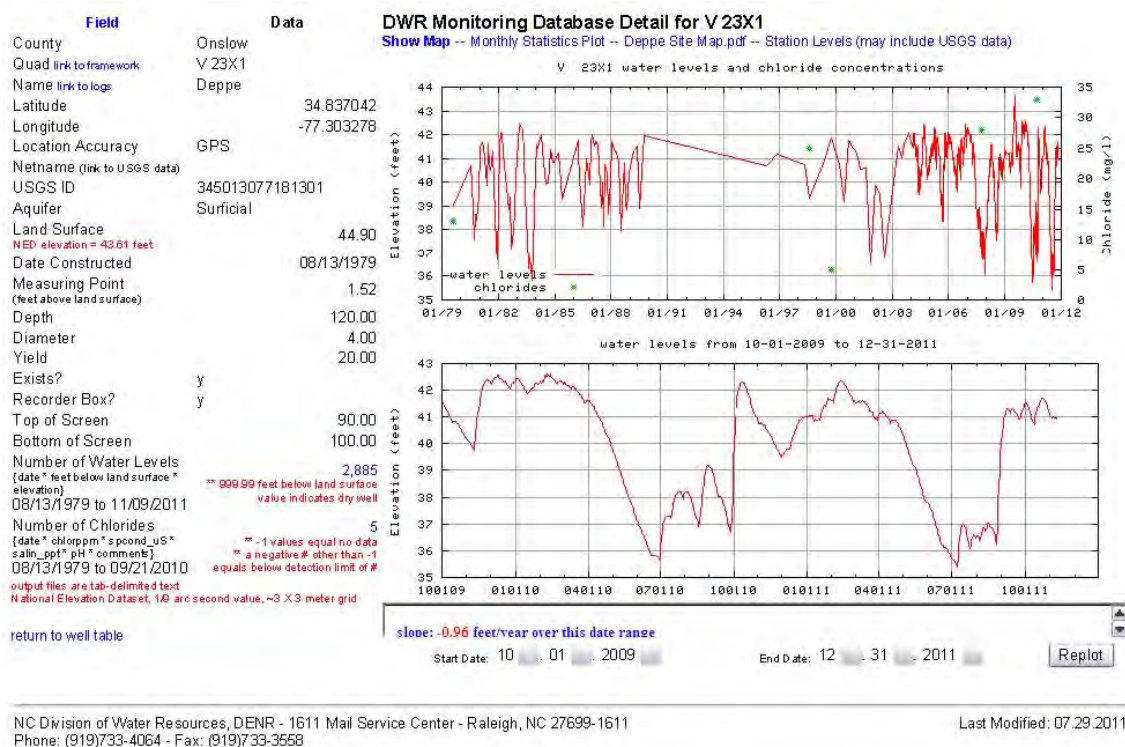


Figure - 5

Based on the historical water level data for the three identified wells in the vicinity of the site, the water table generally occurs within 10 feet of the land

surface and long term seasonal ground water level fluctuations have generally ranged from 7 to 10 feet over a time period in excess of 30 years.

In summary, the general characterization for the local and regional geologic and hydrogeologic conditions in this area of North Carolina includes:

- Near surface ground water table; 4 to 14 feet below ground surface
- Water table fluctuations of 7 to 10 feet
- Silty sands, clayey sands and sands in surficial aquifer
- Potential to encounter limestone at depths of 40 to 80 feet
- Rainfall recharged surficial aquifer

Regulation - 15A NCAC 13B .0538(a)(2)

*(2) A report on field observations of the site that includes information on the following:
(A) topographic setting, springs, streams, drainage features, existing or abandoned wells, rock outcrops, (including trends in strike and dip), and other features that may affect site suitability or the ability to effectively monitor the site; and
(B) ground-water discharge features. For a proposed site where the owner or operator does not control the property from any landfill unit boundary to the controlling, downgradient, ground-water discharge feature(s), additional borings, geophysics or other hydrogeological investigations may be required to characterize the nature and extent of groundwater flow; and
(C) the hydrogeological properties of the bedrock, if the uppermost ground-water flow is predominantly in the bedrock. Bedrock for the purpose of this rule is defined as material below auger refusal.*

Discussion

A site plan is included in **Appendix B** for reference. In general, the proposed site is relatively flat with approximately 3 feet of topographic relief within the approximately 43.5 acres of the area included in the proposed landfill facility. Topographic elevations at the site range from 40.0 to 37.0 feet MSL. There is no predominant direction of topographic relief. Discrete topographically low areas are present within the site and typically contain wetland areas. The site is generally wooded with cleared access roads and roadside ditches. Standing water is typical within the roadside ditches.

There are no natural creeks, streams or rivers within the proposed landfill facility boundary. The nearest natural drainage feature that may receive groundwater discharge is the head waters of an unnamed tributary to the White Oak River located approximately 2,550 feet west of the proposed landfill footprint on the west side of White Oak River Road. Manmade drainage ditches are located to

the north of the proposed site on property owned by Weyerhaeuser and managed as a pine forest.

There are no known existing or abandoned wells or rock outcrops within the proposed landfill facility boundary.

Regulation - 15A NCAC 13B .0538(a)(3)

(3) Borings for which the numbers, locations, and depths are sufficient to provide an adequate understanding of the subsurface conditions and ground-water flow regime of the uppermost aquifer at the site. The number and depths of borings required will depend on the hydrogeologic characteristics of the site. At a minimum, there must be an average of one boring for each 10 acres of the proposed landfill facility unless otherwise authorized by the Division. All borings intersecting the water table must be converted to piezometers or monitoring wells in accordance with 15A NCAC 02C .0108.

Discussion

ERM submitted a proposed boring location plan for the Maysville site on August 4, 2011 to Division of Waste Management to receive comments or suggestions. The proposed boring location plan included 15 soil test boring locations with installation of temporary observation wells (installed as Type II Monitoring Wells) at each location. The depths of the proposed borings and wells ranged from 15 to 35 feet below ground surface. Ms. Elizabeth Werner responded to ERM on August 15, 2011 with no suggested revisions concerning the locations of the proposed borings or proposed depths. ERM subcontracted Geologic Exploration, Inc. to perform drilling and well installation services and mobilized to the site on August 22, 2011. Representatives from Division of Waste Management; Elizabeth Werner and Ray Williams, visited the site on August 24, 2011 during the installation of soil test borings and observation wells. Field work for the borings and well installation was completed on August 26, 2011.

A total of 15 wells were installed within soil test borings for the characterization of the 43.5-acre study area (3.5 wells per 10 acres), which includes the proposed limits of waste placement, and a 200-foot perimeter (Maysville annexation limits). Wells were advanced to penetrate the surficial aquifer ranging in depths from 15 to 35 feet below ground surface.

Surveyed well locations, depths, and lithologic (well construction) logs and NC DENR Division of Water Quality Non-Residential Well Construction Records are presented in **Appendix C**.

Regulation - 15A NCAC 13B .0538(a)(4)

(4) A testing program for the borings which describes the frequency, distribution, and type of samples taken and the methods of analysis (ASTM Standards or test methods approved by the Division) used to obtain, at a minimum, the following information:
(A) standard penetration - resistance (ASTM D 1586);
(B) particle size analysis (ASTM D 422);
(C) soil classification: Unified Soil Classification System (USCS) (ASTM D 2487);
(D) formation descriptions; and
(E) saturated hydraulic conductivity, porosity, effective porosity, and dispersive characteristics for each lithologic unit of the uppermost aquifer including the vadose zone.

Discussion

Wells were constructed using hollow-stem auger, with split spoon sampling, including standard penetration testing (ASTM D 1586) approximately every 5 feet. Standard penetration test results are presented in **Appendix C** as shown on the soil test boring records.

In order to characterize the soil properties of the samples collected in the surficial aquifer, eight (8) bulk samples of soil were collected during drilling operations for laboratory testing. The samples were transported to the geotechnical laboratory at ESP Associates, P.A. in Fort Mill, South Carolina for particle size analysis (ASTM D 422). In general, the testing results indicate that all of the samples classify as a sand with a low sand percentage of 50.3% at OWB-14 to a high percentage of sand of 97.6% at OWB-2. The results of particle size analysis (grain size distribution) are presented in **Appendix D**. USCS classifications were field-determined based on physical inspection of split spoon samples in the field and again in our office. The USCS classifications for each split spoon sample retrieved are presented in **Appendix C** as part of the soil test boring records.

Additionally, ERM retrieved two undisturbed 3-inch diameter Shelby tube samples of near surface clayey soils encountered at OWB-5 and OWB-7. These soils are typical for the majority of the boring locations. ERM transported these samples to ESP Associates, P.A. geotechnical laboratory in Fort Mill, South Carolina for permeability testing (ASTM D 5084). These samples were initially identified in the field as candidate soil liner materials. The permeability testing results are included in **Appendix D** for reference. The sample obtained from OWB-7 (4 to 6 feet below ground surface) has a coefficient of permeability of 2.8×10^{-6} cm/sec whereas the sample from OWB-5 (2 to 4 feet below ground surface) has a coefficient of permeability of 2.8×10^{-4} cm/sec. The laboratory noted that upon extracting the OWB-5 sample that small roots were observed that may impact the test results.

In addition to laboratory testing program, ERM attempted to perform field permeability, rising head field slug test, testing at each of the temporary observation wells (OWB-1 through OWB-15). Due to quickly recharging conditions, our attempts were successful at only 5 of the 15 locations. Testing was achieved at OWB-7, OWB-9, OWB-12, OWB-14 and OWB-15 with results ranging from a low of 8.9×10^{-5} cm/sec (OWB-14) to a high of 6.7×10^{-4} cm/sec (OWB-7). These results are reflective of the laboratory grain size distribution testing results and physical classifications of the soils. With the attempts at 10 wells failing due to inability to drawdown the water table, these results should be considered as "Low" when evaluating the rest of the site. The observations of field slug testing and results are presented in **Appendix D**.

In summary, the site subsurface conditions may be generalized to include a thin topsoil layer of approximately 6 to 10 inches in depth at the surface. Beneath the topsoil, a clay, silt or combination of the two is typically encountered ranging in depths from 3 to 10 feet below ground surface. In some instances, clays and silts are absent from the near surface and sand is encountered beneath the topsoil layer (OWB-5, OWB-11, OWB-12 and OWB-14). All well locations reveal sands located in the water bearing zones in the surficial aquifer. Intermittent layers or lenses of silts and/or clays may be present within these sands but the predominant composition of the surficial aquifer soils are sands.

Regulation - 15A NCAC 13B .0538(a)(5)

(5) In addition to borings, other techniques may be used to investigate the subsurface conditions at the site, including but not limited to: geophysical well logs, surface geophysical surveys, and tracer studies.

Discussion

During preliminary site studies and wetland delineations, preliminary subsurface test pits were installed on March 25, 2011 by Mr. Haywood Pittman, a NC Licensed Soil Scientist, of Pittman Soil Consulting. The purpose of the test pits was to determine the approximate depth to water and classification of near surface soils. Test pits remained open for 24 hours before Mr. Pittman recorded the depth to ground water. Water table elevations stabilized within the open test pits generally ranged from 5 to 7 feet below ground surface. These results were used by ERM to develop our preliminary well installation program submitted to the Division of Waste Management in August 2011. The results of the test pit investigation, a summary table of the results, and a map showing the locations of the test pits overlaying the proposed landfill are presented in **Appendix E**.

Regulation - 15A NCAC 13B .0538(a)(6)

(6) Stratigraphic cross-sections identifying hydrogeologic and lithologic units, and stabilized water table elevations.

Discussion

Stratigraphic cross-sections, including a cross-section location plan are presented in **Appendix F**. Cross sections were developed using field and laboratory test data to group similar soil components together, survey information, soil test boring records and water table elevation records for each well. The subsurface cross sections generally indicate a continuous sand aquifer underlying the proposed site with stabilized water table elevations generally ranging from 4 to 5.5 feet below ground surface. Based on our visits to the site to retrieve water table readings, the results obtained on September 9, 2011 appeared to be the most representative for the highest water table.

The cross sections also illustrate the presence of a near surface clay, silt or combination of the two, layer extending across the majority of the site. It appears that ground water in these areas will reach potentiometric elevations dictated by the regional ground water elevation within the sand aquifer; extending into to silts and clays.

Regulation - 15A NCAC 13B .0538(a)(7)

(7) Water table information, including:

- (A) tabulations of water table elevations measured at the time of boring, 24 hours, and stabilized readings for all borings (measured within a period of time short enough to avoid temporal variations in ground-water flow which could preclude accurate determination of ground-water flow direction and rate);*
- (B) tabulations of stabilized water table elevations over time in order to develop an understanding of seasonal fluctuations in the water table;*
- (C) an estimation of the long-term seasonal high water table based on stabilized water table readings, hydrographs of wells in the area, precipitation and other meteorological data, and streamflow measurements from the site frequent enough to demonstrate infiltration and runoff characteristics, and any other information available; and*
- (D) a discussion of any natural or man-made activities that have the potential for causing water table fluctuations, including but not limited to, tidal variations, river stage changes, flood pool changes of reservoirs, high volume production wells, and injection wells.*

Discussion

Water levels in the temporary observation wells were recorded at termination of boring, approximately 24 hours after termination of boring and several dates

thereafter. Water levels were obtained for all of the wells within the same calendar day. A summary table of water level readings is included on the following page as Table -1 and also included in **Appendix G**.

Following installation of the temporary observation wells on August 26, 2011, Hurricane Irene resulted in over 7 inches of rainfall at the site around August 27, 2011. A significant rise occurred in all wells installed at the site along with the nearby wells in the Division of Water Resources network (Figures 3, 4 & 5). In general water table elevations rose approximately 6 to 7 feet following the storm event. With the transition into colder months and decreasing evapotranspiration, the water levels have remained at or near the levels recorded following Hurricane Irene.

Individual graphs charting the progression of water table elevations along with recorded rainfall over the evaluation period are included in **Appendix G** for reference. Of particular note is that all of the site wells exhibit the same graph shape and very similar groundwater elevations over the study period indicating a laterally continuous, relatively permeable and homogeneous groundwater flow regime within the surficial aquifer zone across the site. These same characteristics are seen in the nearby wells monitored by Division of Water Resources (Figures 3, 4 & 5). As a result, generally the ground water table is located approximately 4 to 6 feet below ground surface across the site.

Based on the nearby wells in the Division of Water Resources monitoring network discussed previously, the water table elevations recorded during our evaluation are near long term seasonal high levels. Historically, the long term seasonal high levels may be an additional 1 foot higher than those recorded.

Table - 1

10/04/2013 DIN20046 Page 68 of 627

ERM will continue to monitor water table elevations throughout the winter months to further evaluate ground water table fluctuations during the design permitting phase of this project. For the purpose of this study, the highest water table elevations are based on readings recorded on September 9, 2011 and are also presented in **Appendix F** as part of the Stratigraphic cross-sections.

Based on our initial investigation, the surficial aquifer appears to be recharged from rainfall infiltration. The surficial aquifer conditions also appear to be consistent beyond the limits of our investigation. Therefore, manmade impacts such as landfilling that may locally reduce the direct rainfall infiltration are not anticipated to significantly affect the behavior of the historic water table fluctuations.

Regulation - 15A NCAC 13B .0538(a)(8)

(8) The horizontal and vertical dimensions of ground-water flow including flow directions, rates, and gradients.

Discussion

The groundwater flow conditions within the surficial aquifer at the site are characterized by very low hydraulic gradients and velocities. The horizontal hydraulic gradient is essentially flat, with a subtle radial groundwater flow pattern occurring in the area around OWB-11 which serves as a local preferential groundwater recharge area. The horizontal gradient can be seen in the stratigraphic cross-section presented in **Appendix F** along with individual hydraulic gradients and ground water velocities from well to well shown on the Potentiometric Map in **Appendix H**. The gradient is most evident in the east-west cross-sections: A-A', B-B' & C-C'. The gradients shown are based on ground water table measurements from September 9, 2011.

Hydraulic gradients and ground water velocities are most pronounced in the vicinity of OWB-11, a local recharge area. Within this area hydraulic gradients range from 0.00563 ft/ft (from west to east) to 0.00218 ft/ft (from south to north). Consequently, the calculated ground water flow velocities at the site are low, ranging from 0.00235 ft/day (west to east) to 0.00091 ft/day (south to north). Velocities were calculated using the hydraulic gradients from well to well and average results of with an average coefficient of permeability of 1×10^{-4} cm/sec determined from the field permeability testing (rising head slug tests). The gradients and velocities decrease in the western portion of the site with increasing distance from the recharge area. Gradients in this area of the site average approximately 0.0005 ft/ft with corresponding ground water flow velocities of .00052 ft/day.

Based on the results of the calculated hydraulic gradients and ground water flow velocities, ground water movement below the site appears to be minimal (approximately 1 foot per year or less) in horizontal directions. Additionally, there does not appear to be a significant vertical gradient present within the surficial aquifer. Water levels within the deepest well OWB-7 at 35 feet are similar to those in the most shallow 15-foot wells.

Regulation - 15A NCAC 13B .0538(a)(9)

(9) Ground-water contour map(s) to show the occurrence and direction of ground-water flow in the uppermost aquifer and any other aquifers identified in the hydrogeologic investigation. The ground-water contours must be superimposed on a topographic map. The location of all borings and rock cores and the water table elevations or potentiometric data at each location used to generate the ground-water contours must be shown on the ground-water contour map(s).

Discussion

A groundwater contour map / potentiometric map of the uppermost aquifer is presented in **Appendix H**. Groundwater contours are based on water level measurements recorded on September 9, 2011, and are intended to be representative of the seasonal high water table. The contour interval chosen is 0.5-ft due to the low hydraulic gradients across the site. The groundwater contours indicate a subtle radial pattern of groundwater flow centered in the vicinity of the well OWB-11 located in the eastern portion of the site. In the western portion of the site, the general groundwater flow direction is southwestward toward the unnamed tributary to the White Oak River located approximately 2,550 feet west.

Regulation - 15A NCAC 13B .0538(a)(10)

(10) A topographic map of the site locating soil borings with accurate horizontal and vertical control, which are tied to a permanent onsite benchmark.

Discussion

The surveyed locations of all borings are presented in the Surveyed Well Location Plan in **Appendix C**. Surveying was performed by Parker & Associates, Inc. of Jacksonville, North Carolina. The well data along with surveyed information is presented on the following page as Table – 2. The topographic information shown on the plan was taken from the North Carolina Floodplain Mapping Program as updated through 2010 based on Lidar data.

MAYSVILLE C&D LANDFILL
SITE SUITABILITY - OBSERVATION WELL DATA
OCTOBER 6, 2011

Well locations survey data supplied by Parker & Associates

Well OWB-#	Date Drilled	Ground Surface Elevation (MSL)	Top of PVC Elevation (MSL)	Well PVC Stick-Up (ft)	Well Depth (ft)	Screened Interval (ft)	NC State Plane Northing	NC State Plane Easting
OWB-1	8/25/11	39.28	42.03	2.75	20.0	20.0 - 7.0	435174.413	2525011.768
OWB-2	8/25/11	38.02	40.89	2.87	20.0	20.0 - 7.0	434771.627	2524752.429
OWB-3	8/25/11	37.61	40.32	2.71	20.0	20.0 - 8.0	434364.284	2524821.444
OWB-4	8/25/11	39.09	41.68	2.59	20.0	20.0 - 8.0	434374.970	2525231.562
OWB-5	8/24/11	39.06	42.29	3.23	15.0	19.0 - 7.0	434726.149	2525228.015
OWB-6	8/24/11	39.25	42.18	2.93	15.0	20.0 - 8.0	435037.893	2525353.817
OWB-7	8/24/11	40.13	42.77	2.64	15.0	34.0 - 21.0	434607.889	2525756.359
OWB-8	8/23/11	39.83	42.83	3.00	20.0	20.0 - 8.0	434252.327	2525656.891
OWB-9	8/23/11	38.72	41.29	2.57	15.0	3.0 - 15.0	434267.169	2526142.940
OWB-10	8/22/11	39.67	42.40	2.73	20.0	20.0 - 8.0	434276.543	2526606.621
OWB-11	8/23/11	40.75	43.41	2.66	15.0	15 - 3.5	434726.217	2526240.239
OWB-12	8/23/11	40.53	43.22	2.69	20.0	20.0 - 8.0	434863.881	2526483.055
OWB-13	8/24/11	41.26	44.19	2.93	20.0	20.0 - 8.0	435049.941	2525899.610
OWB-14	8/23/11	39.63	42.49	2.86	20.0	20.0 - 8.0	435225.240	2526340.903
OWB-15	8/24/11	40.17	43.21	3.04	20.0	20.0 - 8.0	435602.616	2525879.257

Table - 2

Regulation - 15A NCAC 13B .0538(a)(11)

(11) Information for wells and water intakes within the site characterization study area, in accordance with Rule .0536(c) of this Section including:

- (A) boring logs, construction records, field logs and notes, for all onsite borings, piezometers and wells;
- (B) construction records, number and location served by wells, and production rates, for public water wells; and
- (C) available information for all surface water intakes, including use and production rate.

Discussion

Based on ERM's site reconnaissance, data research and correspondence with local government authorities, there are no known drinking water supply wells within the study area (within 2,000 feet of proposed facility boundaries). ERM confirmed the absence of wells with the Jones County Public Works Department. All residences that are located within the study area along US Highway 17 or White Oak River Road receive public water supply from the Town of Maysville or Jones County. The well that provides the public water supply through utility service is located in the Town of Maysville approximately 1.5 miles south of the proposed landfill site. The location of the well is shown on the next page in Figure - 6 provided by Division of Water Resources.

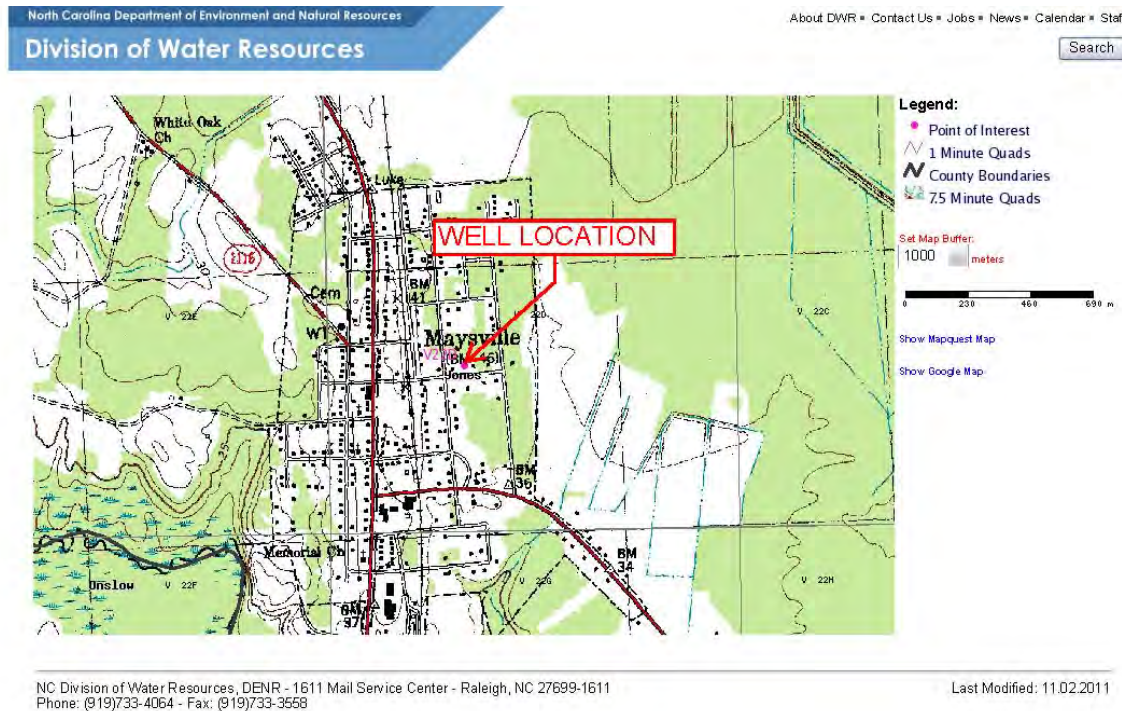


Figure - 6

Regulation - 15A NCAC 13B .0538(a)(12)

(12) Identification of other geologic and hydrologic considerations including but not limited to: slopes, streams, springs, gullies, trenches, solution features, karst terrains, sinkholes, dikes, sills, faults, mines, ground-water discharge features, and ground-water recharge/discharge areas.

Discussion

Based on the results of our subsurface investigation and field observations, the seasonal high water table will be near surface requiring the base grades of the landfill to be elevated above natural ground surface. Additionally, the flow of ground water beneath and surrounding the site appears to be minimal and limited in horizontal direction and velocity. Based on site reconnaissance, the immediate area surrounding the proposed site does not include natural or manmade ground water discharge features. Manmade roadside ditches within the site and surrounding properties may serve as episodic recharge features and intersect the surficial aquifer on a seasonal basis during very wet winter months or following major tropical rain events. The potential affect on the overall groundwater flow pattern is not expected to be significant but will be assessed.

With the availability of public water supply utility in the surrounding area, the potential for a new substantial ground water consumer or intake is minimal.

Regulation - 15A NCAC 13B .0538(a)(13)

(13) A report summarizing the geological and hydrogeological evaluation of the site that includes the following:

- (A) a description of the relationship between the uppermost aquifer of the site to local and regional geologic and hydrogeologic features,*
- (B) a discussion of the ground-water flow regime of the site focusing on the relationship of C&DLF unit(s) to ground-water receptors and to ground-water discharge features,*
- (C) a discussion of the overall suitability of the proposed site for solid waste management activities and which areas of the site are most suitable for C&DLF units, and*
- (D) a discussion of the ground-water flow regime of the uppermost aquifer at the site and the ability to effectively monitor the C&DLF units in order to ensure early detection of any release of constituents to the uppermost aquifer.*

Discussion

The site hydrogeology is characterized by a shallow surficial aquifer within the upper 10 feet of unconsolidated silts, clays and sands of the Inner Coastal Plain deposits. The water table is generally encountered at depths of 2 to 7 feet below land surface at the site. The groundwater flow conditions within the surficial aquifer at the site are characterized by very low hydraulic gradients and groundwater velocities. The groundwater contours indicate a subtle radial pattern of groundwater flow centered in the vicinity of the well OWB-11 located in the eastern portion of the site. The surficial soils in area around well OWB-11 are more sandy than the rest of the site and serve as a local preferential groundwater recharge area. In the western portion of the site, the general groundwater flow direction is southwestward toward the unnamed tributary to the White Oak River located approximately 2,550 feet west. The horizontal hydraulic gradient is essentially flat and the calculated groundwater velocities are on the order of 1 foot per year or less. The wetlands within the site study area do not appear to be connected to the surficial aquifer. Several wells are placed within the immediate vicinity of wetland boundaries; OWB-1, 4, 6, 7, 9 & 14, and reflect water table elevations very similar to those removed from the vicinity of wetland boundaries. The wetland areas contain hydric soils (clays / silts) in localized topographically depressed areas that collect and pool rainfall; not supported by ground water table.

The low gradients and groundwater velocities at the site combine to limit both groundwater movement from the site and discharge to the nearest natural drainage features. The low groundwater flow conditions and relatively consistent surficial aquifer characteristics will allow for effective monitoring and detection of potential releases from the C&DLF units.

There are no known drinking water supply wells, groundwater receptors or groundwater discharge features within 2,000 feet of proposed facility

boundaries. All residences that are located within the study area along US Highway 17 or White Oak River Road are served by public water supply. Based on the lack of groundwater receptors and considering the limited groundwater flow regime at the site, the potential for offsite migration and impacts is considered to be low.

The area within the limits of this hydrogeologic study was pre-determined as the best suited for landfill development based on regulatory requirements beyond hydrogeologic consideration. The abundance of wetland areas within the property boundaries limited the consideration for development footprint. Green Recycling Solutions LLC directed ERM to develop a proposed landfill area with no wetland impacts. Therefore, the study area included in this hydrogeologic study is the best suited for landfill development within this parcel of land.

Based on the results of the subsurface investigation and field observations at the site, the overall suitability of the proposed site for solid waste management activities is good. The seasonal high water table will be near land surface requiring the base grades of the landfill to be elevated above natural ground surface. Other engineering features may require incorporation into the final design based on subsequent investigations throughout the permitting process.

Appendix A

Local and Regional Geology and Hydrogeology



United States
Department of
Agriculture

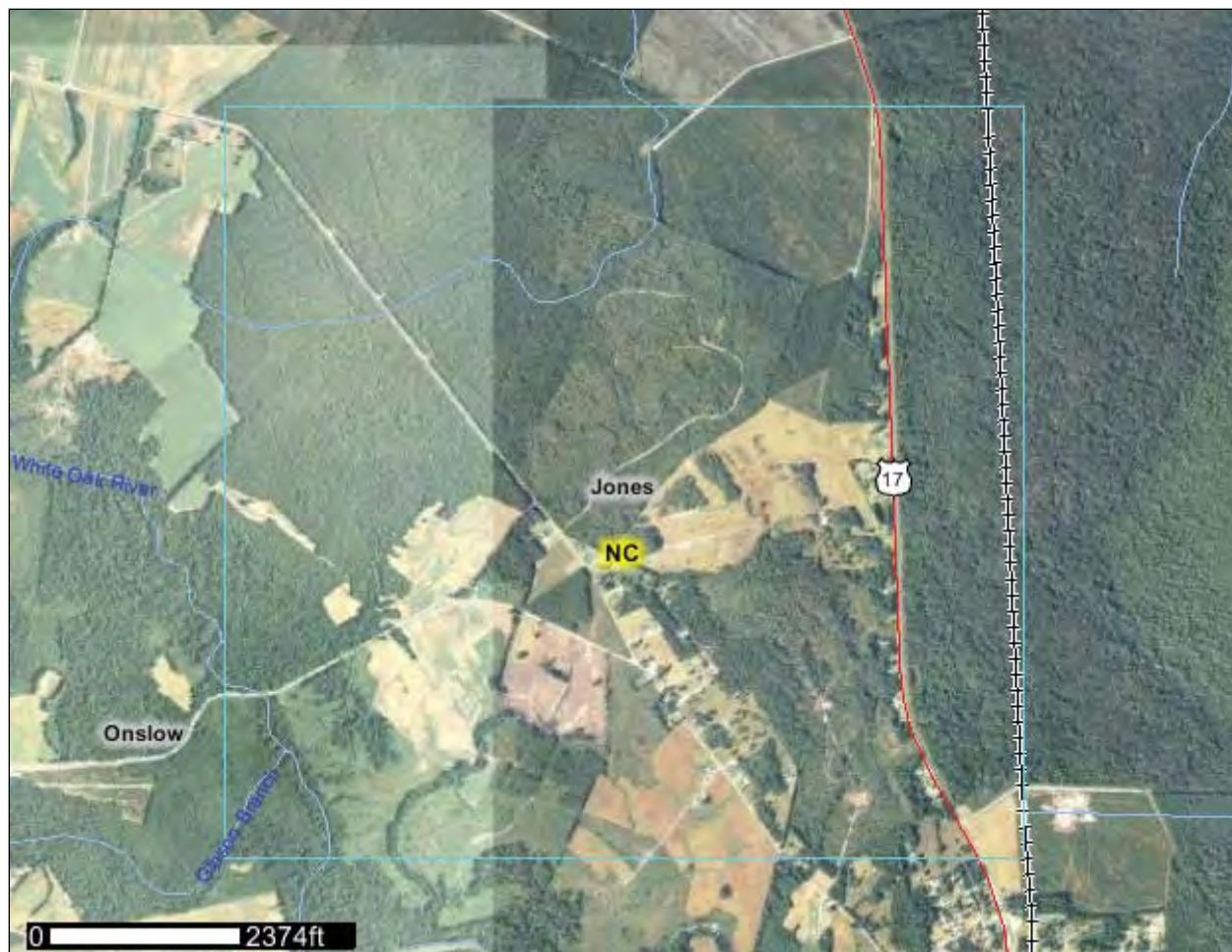


NRCS

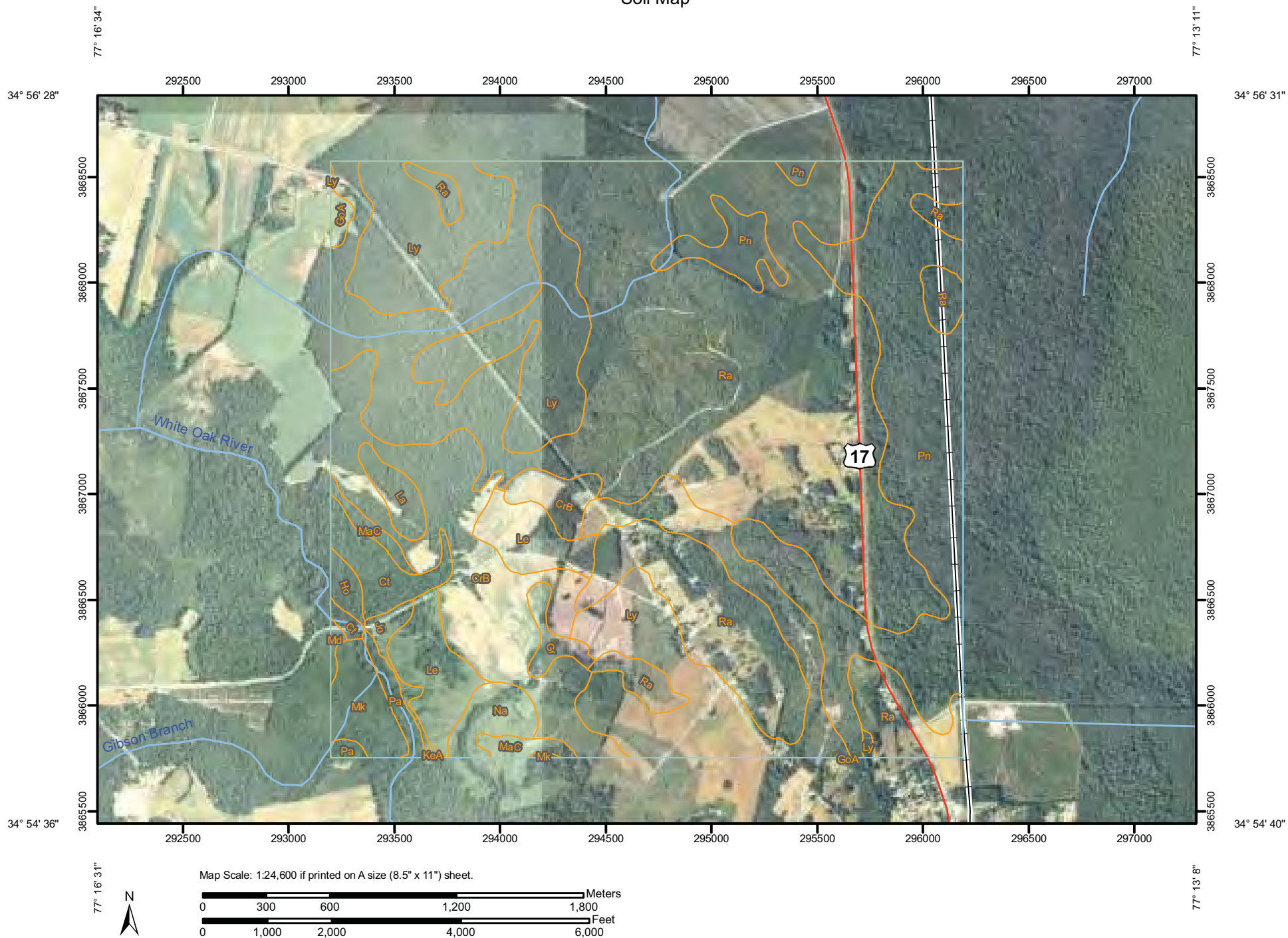
Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Jones County, North Carolina, and Onslow County, North Carolina Maysville




Custom Soil Resource Report Soil Map



Custom Soil Resource Report

MAP LEGEND






















Area of Interest (AOI)




 Area of Interest (AOI)

Soils




 Soil Map Units

Special Point Features

-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot
-  Spoil Area
-  Stony Spot

-  Very Stony Spot
-  Wet Spot
-  Other


Special Line Features

-  Gully
-  Short Steep Slope
-  Other






Political Features

-  Cities

Water Features

-  Streams and Canals

Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

MAP INFORMATION

Map Scale: 1:24,600 if printed on A size (8.5" x 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: UTM Zone 18N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jones County, North Carolina
Survey Area Data: Version 15, Oct 17, 2008

Soil Survey Area: Onslow County, North Carolina
Survey Area Data: Version 11, Jun 5, 2009

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Date(s) aerial images were photographed: 7/10/2006; 10/14/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Jones County, North Carolina (NC103)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CrB	Craven very fine sandy loam, 1 to 4 percent slopes	198.8	9.5%
Ct	Croatan muck	30.5	1.5%
GoA	Goldsboro loamy sand, 0 to 2 percent slopes	5.1	0.2%
Gr	Grantham loam	12.9	0.6%
Ho	Hobonny muck	8.5	0.4%
Jo	Johns fine sandy loam	10.3	0.5%
KeA	Kenansville loamy fine sand, 0 to 3 percent slopes	0.8	0.0%
La	Leaf silt loam	16.5	0.8%
Le	Lenoir loam	75.4	3.6%
Ly	Lynchburg fine sandy loam	362.8	17.4%
MaC	Marvyn loamy sand, 6 to 15 percent slopes	17.0	0.8%
Mk	Muckalee loam	0.6	0.0%
Na	Nahunta loam	23.8	1.1%
Pn	Pantego loam	303.9	14.6%
Ra	Rains fine sandy loam	964.0	46.3%
Subtotals for Soil Survey Area		2,031.0	97.5%
Totals for Area of Interest		2,083.7	100.0%

Onslow County, North Carolina (NC133)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ct	Croatan muck	3.8	0.2%
Md	Masontown mucky fine sandy loam	2.5	0.1%
Mk	Muckalee loam	32.5	1.6%
Pa	Pactolus fine sand	13.8	0.7%
Subtotals for Soil Survey Area		52.6	2.5%
Totals for Area of Interest		2,083.7	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named

according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or

anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Jones County, North Carolina

CrB—Craven very fine sandy loam, 1 to 4 percent slopes

Map Unit Setting

Elevation: 20 to 160 feet

Mean annual precipitation: 40 to 55 inches

Mean annual air temperature: 59 to 70 degrees F

Frost-free period: 200 to 280 days

Map Unit Composition

Craven and similar soils: 85 percent

Minor components: 6 percent

Description of Craven

Setting

Landform: Flats on marine terraces, ridges on marine terraces

Landform position (two-dimensional): Shoulder, summit

Landform position (three-dimensional): Crest

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Clayey marine deposits

Properties and qualities

Slope: 1 to 4 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: About 24 to 36 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Moderate (about 8.2 inches)

Interpretive groups

Land capability (nonirrigated): 3e

Typical profile

0 to 7 inches: Fine sandy loam

7 to 9 inches: Fine sandy loam

9 to 54 inches: Clay

54 to 80 inches: Sandy loam

Minor Components

Bibb, undrained

Percent of map unit: 3 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Down-slope shape: Concave

Across-slope shape: Linear

Johnston, undrained

Percent of map unit: 2 percent

Landform: Flood plains

Down-slope shape: Concave

Across-slope shape: Linear

Muckalee, undrained

Percent of map unit: 1 percent

Landform: Flood plains

Down-slope shape: Concave

Across-slope shape: Linear

Ct—Croatan muck

Map Unit Setting

Elevation: 20 to 160 feet

Mean annual precipitation: 40 to 55 inches

Mean annual air temperature: 59 to 70 degrees F

Frost-free period: 200 to 280 days

Map Unit Composition

Croatan, undrained, and similar soils: 80 percent

Croatan, drained, and similar soils: 10 percent

Description of Croatan, Undrained

Setting

Landform: Pocosins

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Woody organic material

Properties and qualities

Slope: 0 to 1 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Very poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 1.98 in/hr)

Depth to water table: About 0 to 6 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Very high (about 16.1 inches)

Interpretive groups

Land capability (nonirrigated): 7w

Typical profile

0 to 28 inches: Muck

28 to 33 inches: Mucky sandy loam

33 to 60 inches: Sandy clay loam

60 to 80 inches: Loamy sand

Description of Croatan, Drained

Setting

Landform: Pocosins
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Woody organic material

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 1.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very high (about 16.1 inches)

Interpretive groups

Land capability (nonirrigated): 4w

Typical profile

0 to 28 inches: Muck
28 to 33 inches: Mucky sandy loam
33 to 60 inches: Sandy clay loam
60 to 80 inches: Loamy sand

GoA—Goldsboro loamy sand, 0 to 2 percent slopes

Map Unit Setting

Elevation: 20 to 330 feet
Mean annual precipitation: 38 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 200 to 280 days

Map Unit Composition

Goldsboro and similar soils: 90 percent
Minor components: 6 percent

Description of Goldsboro

Setting

Landform: Flats on marine terraces, broad interstream divides on marine terraces
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy marine deposits

Properties and qualities

Slope: 0 to 2 percent

Custom Soil Resource Report

Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 1.98 in/hr)

Depth to water table: About 24 to 36 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Moderate (about 7.7 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 10 inches: Loamy fine sand

10 to 13 inches: Fine sandy loam

13 to 72 inches: Sandy clay loam

72 to 80 inches: Clay loam

Minor Components

Rains, undrained

Percent of map unit: 5 percent

Landform: Flats on marine terraces, carolina bays on marine terraces, broad interstream divides on marine terraces

Landform position (two-dimensional): Summit

Down-slope shape: Linear

Across-slope shape: Linear

Muckalee, undrained

Percent of map unit: 1 percent

Landform: Flood plains

Down-slope shape: Concave

Across-slope shape: Linear

Gr—Grantham loam

Map Unit Setting

Elevation: 20 to 160 feet

Mean annual precipitation: 40 to 55 inches

Mean annual air temperature: 59 to 70 degrees F

Frost-free period: 200 to 280 days

Map Unit Composition

Grantham, drained, and similar soils: 80 percent

Grantham, undrained, and similar soils: 10 percent

Description of Grantham, Drained

Setting

Landform: Broad interstream divides on depressions, broad interstream divides on flats

Custom Soil Resource Report

Down-slope shape: Concave
Across-slope shape: Concave, linear
Parent material: Loamy and silty marine deposits

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.6 inches)

Interpretive groups

Land capability (nonirrigated): 3w

Typical profile

0 to 14 inches: Loam
14 to 17 inches: Loam
17 to 72 inches: Loam
72 to 80 inches: Loam

Description of Grantham, Undrained

Setting

Landform: Broad interstream divides on depressions, broad interstream divides on flats
Down-slope shape: Concave
Across-slope shape: Concave, linear
Parent material: Loamy and silty marine deposits

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.6 inches)

Interpretive groups

Land capability (nonirrigated): 6w

Typical profile

0 to 14 inches: Loam
14 to 17 inches: Loam
17 to 72 inches: Loam
72 to 80 inches: Loam

Ho—Hobonny muck

Map Unit Setting

Elevation: 20 to 160 feet

Mean annual precipitation: 40 to 55 inches

Mean annual air temperature: 59 to 70 degrees F

Frost-free period: 200 to 280 days

Map Unit Composition

Hobonny, tidal, and similar soils: 80 percent

Description of Hobonny, Tidal

Setting

Landform: Tidal marshes

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Herbaceous organic material

Properties and qualities

Slope: 0 to 1 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Very poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 1.98 in/hr)

Depth to water table: About 0 to 6 inches

Frequency of flooding: Very frequent

Frequency of ponding: Frequent

Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)

Available water capacity: Very high (about 13.8 inches)

Interpretive groups

Land capability (nonirrigated): 8w

Typical profile

0 to 16 inches: Muck

16 to 30 inches: Muck

30 to 80 inches: Muck

Jo—Johns fine sandy loam

Map Unit Setting

Elevation: 20 to 160 feet

Mean annual precipitation: 40 to 55 inches

Mean annual air temperature: 59 to 70 degrees F

Frost-free period: 200 to 280 days

Map Unit Composition

Johns and similar soils: 85 percent

Minor components: 6 percent

Description of Johns

Setting

Landform: Stream terraces

Landform position (three-dimensional): Tread

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Loamy alluvium over sandy alluvium

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification

Drainage class: Moderately well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: About 18 to 36 inches

Frequency of flooding: Rare

Frequency of ponding: None

Available water capacity: Low (about 5.1 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 7 inches: Fine sandy loam

7 to 11 inches: Fine sandy loam

11 to 37 inches: Sandy clay loam

37 to 80 inches: Sand

Minor Components

Lumbee, undrained

Percent of map unit: 5 percent

Landform: Backswamps on stream terraces

Down-slope shape: Concave

Across-slope shape: Linear

Muckalee, undrained

Percent of map unit: 1 percent

Landform: Flood plains

Down-slope shape: Concave

Across-slope shape: Linear

KeA—Kenansville loamy fine sand, 0 to 3 percent slopes

Map Unit Setting

Elevation: 20 to 160 feet

Mean annual precipitation: 40 to 55 inches

Mean annual air temperature: 59 to 70 degrees F

Frost-free period: 200 to 280 days

Map Unit Composition

Kenansville and similar soils: 90 percent

Description of Kenansville

Setting

Landform: Stream terraces

Landform position (three-dimensional): Tread

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Loamy alluvium over sandy alluvium

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Low (about 4.2 inches)

Interpretive groups

Land capability (nonirrigated): 2s

Typical profile

0 to 8 inches: Loamy sand

8 to 24 inches: Loamy sand

24 to 36 inches: Sandy loam

36 to 42 inches: Loamy sand

42 to 84 inches: Sand

La—Leaf silt loam

Map Unit Setting

Elevation: 20 to 160 feet

Mean annual precipitation: 40 to 55 inches

Custom Soil Resource Report

Mean annual air temperature: 59 to 70 degrees F

Frost-free period: 200 to 280 days

Map Unit Composition

Leaf, drained, and similar soils: 80 percent

Leaf, undrained, and similar soils: 10 percent

Description of Leaf, Drained

Setting

Landform: Flats on broad interstream divides, terraces

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Clayey marine deposits

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)

Depth to water table: About 0 to 12 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Very high (about 12.0 inches)

Interpretive groups

Land capability (nonirrigated): 4w

Typical profile

0 to 6 inches: Silt loam

6 to 67 inches: Clay

67 to 80 inches: Clay loam

Description of Leaf, Undrained

Setting

Landform: Flats on broad interstream divides, terraces

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Clayey marine deposits

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)

Depth to water table: About 0 to 12 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Very high (about 12.0 inches)

Interpretive groups

Land capability (nonirrigated): 6w

Typical profile

0 to 6 inches: Silt loam

6 to 67 inches: Clay
67 to 80 inches: Clay loam

Le—Lenoir loam

Map Unit Setting

Elevation: 20 to 160 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 200 to 280 days

Map Unit Composition

Lenoir, drained, and similar soils: 80 percent
Lenoir, undrained, and similar soils: 10 percent
Minor components: 8 percent

Description of Lenoir, Drained

Setting

Landform: Flats on broad interstream divides, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey marine deposits

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 12 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.6 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 3 inches: Loam
3 to 8 inches: Loam
8 to 63 inches: Clay
63 to 80 inches: Sandy clay

Description of Lenoir, Undrained

Setting

Landform: Flats on broad interstream divides, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey marine deposits

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 12 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.6 inches)

Interpretive groups

Land capability (nonirrigated): 3w

Typical profile

0 to 3 inches: Loam
3 to 8 inches: Loam
8 to 63 inches: Clay
63 to 80 inches: Sandy clay

Minor Components

Leaf, undrained

Percent of map unit: 5 percent
Landform: Flats on broad interstream divides, terraces
Down-slope shape: Linear
Across-slope shape: Linear

Bethera, undrained

Percent of map unit: 2 percent
Landform: Flats, depressions
Down-slope shape: Concave
Across-slope shape: Concave

Tomotley, undrained

Percent of map unit: 1 percent
Landform: Depressions on marine terraces, flats on marine terraces
Down-slope shape: Linear
Across-slope shape: Linear

Ly—Lynchburg fine sandy loam

Map Unit Setting

Elevation: 20 to 330 feet
Mean annual precipitation: 38 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 200 to 280 days

Map Unit Composition

Lynchburg and similar soils: 85 percent

Minor components: 7 percent

Description of Lynchburg

Setting

Landform: Flats on marine terraces, broad interstream divides on marine terraces

Landform position (two-dimensional): Summit

Down-slope shape: Concave

Across-slope shape: Linear

Parent material: Loamy marine deposits

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.20 to 1.98 in/hr)

Depth to water table: About 6 to 18 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Moderate (about 7.4 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 9 inches: Fine sandy loam

9 to 14 inches: Sandy loam

14 to 65 inches: Sandy clay loam

65 to 80 inches: Clay

Minor Components

Rains, undrained

Percent of map unit: 5 percent

Landform: Flats on marine terraces, carolina bays on marine terraces, broad interstream divides on marine terraces

Landform position (two-dimensional): Summit

Down-slope shape: Linear

Across-slope shape: Linear

Woodington, undrained

Percent of map unit: 2 percent

Landform: Flats on marine terraces, depressions on marine terraces, broad interstream divides on marine terraces

Down-slope shape: Linear

Across-slope shape: Concave

MaC—Marvyn loamy sand, 6 to 15 percent slopes

Map Unit Setting

Elevation: 20 to 160 feet

Custom Soil Resource Report

Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 200 to 280 days

Map Unit Composition

Marvyn and similar soils: 80 percent
Minor components: 5 percent

Description of Marvyn

Setting

Landform: Ridges on marine terraces
Landform position (two-dimensional): Shoulder, backslope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy and clayey marine deposits

Properties and qualities

Slope: 6 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.7 inches)

Interpretive groups

Land capability (nonirrigated): 4e

Typical profile

0 to 4 inches: Loamy fine sand
4 to 12 inches: Loamy fine sand
12 to 45 inches: Sandy clay loam
45 to 80 inches: Sandy clay loam

Minor Components

Muckalee, undrained

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Linear

Mk—Muckalee loam

Map Unit Setting

Elevation: 20 to 160 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 59 to 70 degrees F

Frost-free period: 200 to 280 days

Map Unit Composition

Muckalee, undrained, and similar soils: 80 percent

Description of Muckalee, Undrained

Setting

Landform: Flood plains

Down-slope shape: Concave

Across-slope shape: Linear

Parent material: Sandy and loamy alluvium

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

*Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 1.98 in/hr)*

Depth to water table: About 0 to 12 inches

Frequency of flooding: Frequent

Frequency of ponding: None

Available water capacity: Moderate (about 6.5 inches)

Interpretive groups

Land capability (nonirrigated): 5w

Typical profile

0 to 24 inches: Loam

24 to 80 inches: Sandy loam

Na—Nahunta loam

Map Unit Setting

Elevation: 20 to 160 feet

Mean annual precipitation: 40 to 55 inches

Mean annual air temperature: 59 to 70 degrees F

Frost-free period: 200 to 280 days

Map Unit Composition

Nahunta, drained, and similar soils: 80 percent

Nahunta, undrained, and similar soils: 10 percent

Minor components: 5 percent

Description of Nahunta, Drained

Setting

Landform: Flats on marine terraces, broad interstream divides on marine terraces

Down-slope shape: Concave

Across-slope shape: Linear

Parent material: Loamy and silty marine deposits

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.8 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 6 inches: Loam
6 to 80 inches: Clay loam

Description of Nahunta, Undrained

Setting

Landform: Flats on marine terraces, broad interstream divides on marine terraces
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy and silty marine deposits

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.8 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 6 inches: Loam
6 to 80 inches: Clay loam

Minor Components

Grantham, undrained

Percent of map unit: 5 percent
Landform: Broad interstream divides on depressions, broad interstream divides on flats
Down-slope shape: Concave
Across-slope shape: Concave, linear

Pn—Pantego loam

Map Unit Setting

Elevation: 20 to 160 feet

Mean annual precipitation: 40 to 55 inches

Mean annual air temperature: 59 to 70 degrees F

Frost-free period: 200 to 280 days

Map Unit Composition

Pantego, drained, and similar soils: 80 percent

Pantego, undrained, and similar soils: 10 percent

Description of Pantego, Drained

Setting

Landform: Flats on marine terraces, broad interstream divides on marine terraces

Down-slope shape: Linear

Across-slope shape: Concave

Parent material: Loamy marine deposits

Properties and qualities

Slope: 0 to 1 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Very poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 1.98 in/hr)

Depth to water table: About 0 to 12 inches

Frequency of flooding: Rare

Frequency of ponding: None

Available water capacity: High (about 10.2 inches)

Interpretive groups

Land capability (nonirrigated): 3w

Typical profile

0 to 18 inches: Loam

18 to 27 inches: Sandy clay loam

27 to 80 inches: Sandy clay loam

Description of Pantego, Undrained

Setting

Landform: Flats on marine terraces, broad interstream divides on marine terraces

Down-slope shape: Linear

Across-slope shape: Concave

Parent material: Loamy marine deposits

Properties and qualities

Slope: 0 to 1 percent

Depth to restrictive feature: More than 80 inches

Custom Soil Resource Report

Drainage class: Very poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 1.98 in/hr)

Depth to water table: About 0 to 12 inches

Frequency of flooding: Rare

Frequency of ponding: None

Available water capacity: High (about 10.2 inches)

Interpretive groups

Land capability (nonirrigated): 6w

Typical profile

0 to 18 inches: Loam

18 to 27 inches: Sandy clay loam

27 to 80 inches: Sandy clay loam

Ra—Rains fine sandy loam

Map Unit Setting

Elevation: 20 to 160 feet

Mean annual precipitation: 40 to 55 inches

Mean annual air temperature: 59 to 70 degrees F

Frost-free period: 200 to 280 days

Map Unit Composition

Rains, drained, and similar soils: 80 percent

Rains, undrained, and similar soils: 10 percent

Description of Rains, Drained

Setting

Landform: Flats on marine terraces, carolina bays on marine terraces, broad interstream divides on marine terraces

Landform position (two-dimensional): Summit

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Loamy marine deposits

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.20 to 1.98 in/hr)

Depth to water table: About 0 to 12 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: High (about 9.4 inches)

Interpretive groups

Land capability (nonirrigated): 3w

Typical profile

0 to 7 inches: Fine sandy loam
7 to 12 inches: Fine sandy loam
12 to 20 inches: Sandy loam
20 to 62 inches: Sandy clay loam
62 to 85 inches: Sandy clay loam

Description of Rains, Undrained

Setting

Landform: Flats on marine terraces, carolina bays on marine terraces, broad interstream divides on marine terraces
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy marine deposits

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 9.4 inches)

Interpretive groups

Land capability (nonirrigated): 4w

Typical profile

0 to 7 inches: Fine sandy loam
7 to 12 inches: Fine sandy loam
12 to 20 inches: Sandy loam
20 to 62 inches: Sandy clay loam
62 to 85 inches: Sandy clay loam

Onslow County, North Carolina

Ct—Croatan muck

Map Unit Setting

Elevation: 20 to 160 feet

Mean annual precipitation: 40 to 55 inches

Mean annual air temperature: 59 to 70 degrees F

Frost-free period: 200 to 280 days

Map Unit Composition

Croatan, undrained, and similar soils: 80 percent

Croatan, drained, and similar soils: 10 percent

Description of Croatan, Undrained

Setting

Landform: Pocosins

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Woody organic material

Properties and qualities

Slope: 0 to 1 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Very poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 1.98 in/hr)

Depth to water table: About 0 to 6 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Very high (about 16.1 inches)

Interpretive groups

Land capability (nonirrigated): 7w

Typical profile

0 to 28 inches: Muck

28 to 33 inches: Mucky sandy loam

33 to 60 inches: Sandy clay loam

60 to 80 inches: Loamy sand

Description of Croatan, Drained

Setting

Landform: Pocosins

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Woody organic material

Properties and qualities

Slope: 0 to 1 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Very poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 1.98 in/hr)

Custom Soil Resource Report

Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very high (about 16.1 inches)

Interpretive groups

Land capability (nonirrigated): 4w

Typical profile

0 to 28 inches: Muck
28 to 33 inches: Mucky sandy loam
33 to 60 inches: Sandy clay loam
60 to 80 inches: Loamy sand

Md—Masontown mucky fine sandy loam

Map Unit Setting

Elevation: 0 to 20 feet
Mean annual precipitation: 42 to 58 inches
Mean annual air temperature: 61 to 64 degrees F
Frost-free period: 190 to 270 days

Map Unit Composition

Masontown, undrained, and similar soils: 85 percent

Description of Masontown, Undrained

Setting

Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Sandy and loamy alluvium

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Available water capacity: Moderate (about 9.0 inches)

Interpretive groups

Land capability (nonirrigated): 7w

Typical profile

0 to 27 inches: Mucky loam
27 to 32 inches: Fine sandy loam
32 to 80 inches: Sand

Mk—Muckalee loam

Map Unit Setting

Elevation: 20 to 160 feet

Mean annual precipitation: 40 to 55 inches

Mean annual air temperature: 59 to 70 degrees F

Frost-free period: 200 to 280 days

Map Unit Composition

Muckalee, undrained, and similar soils: 80 percent

Description of Muckalee, Undrained

Setting

Landform: Flood plains

Down-slope shape: Concave

Across-slope shape: Linear

Parent material: Sandy and loamy alluvium

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 1.98 in/hr)

Depth to water table: About 0 to 12 inches

Frequency of flooding: Frequent

Frequency of ponding: None

Available water capacity: Moderate (about 6.5 inches)

Interpretive groups

Land capability (nonirrigated): 5w

Typical profile

0 to 24 inches: Loam

24 to 80 inches: Sandy loam

Pa—Pactolus fine sand

Map Unit Setting

Elevation: 0 to 20 feet

Mean annual precipitation: 42 to 58 inches

Mean annual air temperature: 61 to 64 degrees F

Frost-free period: 190 to 270 days

Map Unit Composition

Pactolus and similar soils: 85 percent

Minor components: 5 percent

Description of Pactolus

Setting

Landform: Ridges on marine terraces

Down-slope shape: Concave

Across-slope shape: Linear

Parent material: Eolian sands and/or sandy fluviomarine deposits

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: About 18 to 36 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Low (about 3.9 inches)

Interpretive groups

Land capability (nonirrigated): 3s

Typical profile

0 to 6 inches: Fine sand

6 to 30 inches: Loamy sand

30 to 80 inches: Loamy sand

Minor Components

Leon

Percent of map unit: 5 percent

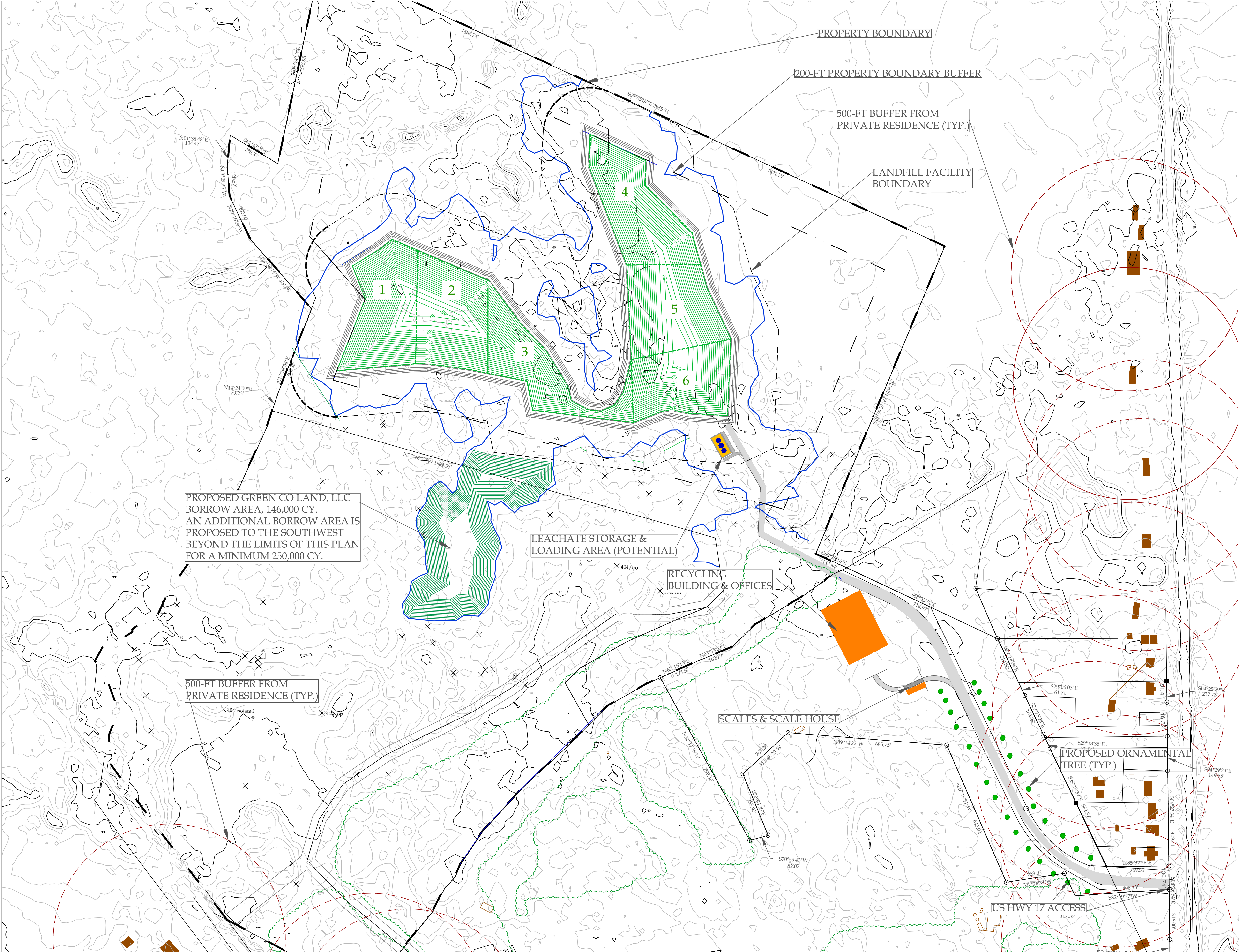
Landform: Flats on marine terraces

Down-slope shape: Linear

Across-slope shape: Concave

Appendix B

Site Plan



LEGEND

- PROPERTY LINE
- 200' PROPERTY BUFFER
- PROPOSED PHASE LIMITS
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- 404 WETLANDS
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED LANDFILL PHASE

NOTES:

1. PROPOSED LANDFILL DISPOSAL LIMITS, PHASES 1 THROUGH 6, IS APPROXIMATELY 20.3 ACRES, 30-YEARS OF OPERATIONS.
2. EACH PROPOSED PHASE IS APPROXIMATELY 3.4 ACRES
3. PHASE ACREAGE MAY VARY PENDING FINAL DESIGN BUT WILL NOT EXCEED 5-YEARS OF OPERATIONAL LIFE.
4. BASED ON PRELIMINARY CALCULATIONS, EACH PHASE WILL BE FILLED WITHIN 5 YEARS.
5. TOTAL LANDFILL DISPOSAL CAPACITY IS APPROXIMATELY 850,000 CY OR 413,378 TONS.
6. DISPOSAL CAPACITY FOR EACH PHASE IS APPROXIMATELY 68,900 TONS.

GENERAL NOTES:

1. TOPOGRAPHIC INFORMATION TAKEN FROM LIDAR DATA FROM NORTH CAROLINA FLOODPLAIN MAPPING PROGRAM.
2. LIMITS OF WETLANDS ARE BASED ON SURVEY DATA FOLLOWING USACOE APPROVED WETLAND DELINEATION PERFORMED BY PITTMAN SOIL CONSULTING.
3. PARCEL BOUNDARY INFORMATION SUPPLIED BY PARKER & ASSOCIATES, INC.
4. LOCATIONS OF STRUCTURES AND ROADS TAKEN FROM JONES COUNTY GIS.
5. PROPOSED CONTOURS AND GRADES ARE PRELIMINARY PENDING FINAL DESIGN AND PERMITTING.
6. MINIMUM BUFFER BETWEEN PRIVATE RESIDENCE AND EDGE OF WASTE IS 500-FT.
7. MINIMUM BUFFER BETWEEN PROPOSED EDGE OF WASTE AND PROPERTY BOUNDARY IS 200 FT.
8. MINIMUM BUFFER BETWEEN PROPOSED EDGE OF WASTE AND WETLAND LIMITS IS 50 FT.
9. PROPOSED LANDFILL FINAL SLOPES AS SHOWN ARE 4H:1V.
10. EROSION & SEDIMENTATION CONTROL DEVICES SHALL BE DESIGNED IN ACCORDANCE WITH NCDENR - DIVISION OF LAND QUALITY.
11. STORMWATER MANAGEMENT SHALL BE PERMITTED IN ACCORDANCE WITH NCDENR - DIVISION OF WATER QUALITY.
12. THE PROPOSED C&D LANDFILL, RECYCLING CENTER AND APPURTENANCES SHALL BE PERMITTED IN ACCORDANCE WITH NCDENR - DIVISION OF WASTE MANAGEMENT.
13. A PROPOSED LANDFILL COMPLIANCE BOUNDARY OF 200-FT BEYOND LIMITS OF WASTE IS PROPOSED.
14. 100-YR FLOODPLAIN IS NOT PRESENT ON-SITE ACCORDING TO NC FLOODPLAIN MAPPING PROGRAM.
15. NC DEPARTMENT OF CULTURAL RESOURCES CONFIRMED THEY "are aware of no historic resources which would be affected by the project", APRIL 11, 2011.

THIS PLAN IS FOR FRANCHISE PURPOSES ONLY IN ACCORDANCE WITH NC GENERAL STATUTES AND NCDENR DIVISION OF WASTE MANAGEMENT RULES. THIS PLAN IS NOT FOR CONSTRUCTION. THIS PLAN IS NOT FOR FINAL ENGINEERING DESIGN PURPOSES.

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION

MAYSVILLE C&D RECYCLING CENTER & C&D LANDFILL			
GREEN RECYCLING SOLUTIONS, LLC		MAYSVILLE, NC	
DRAWN BY	CJM	PROJECT ENGINEER	DWW
DESIGN ENGINEER	DWW	PROJECT MANAGER	DWW

LICENSE # C-2206
ERM NC, Inc.
8000 CORPORATE CENTER DR.
SUITE 200
CHARLOTTE, NC 28226
(704) 541-8345

NOT
FOR
CONSTRUCTION

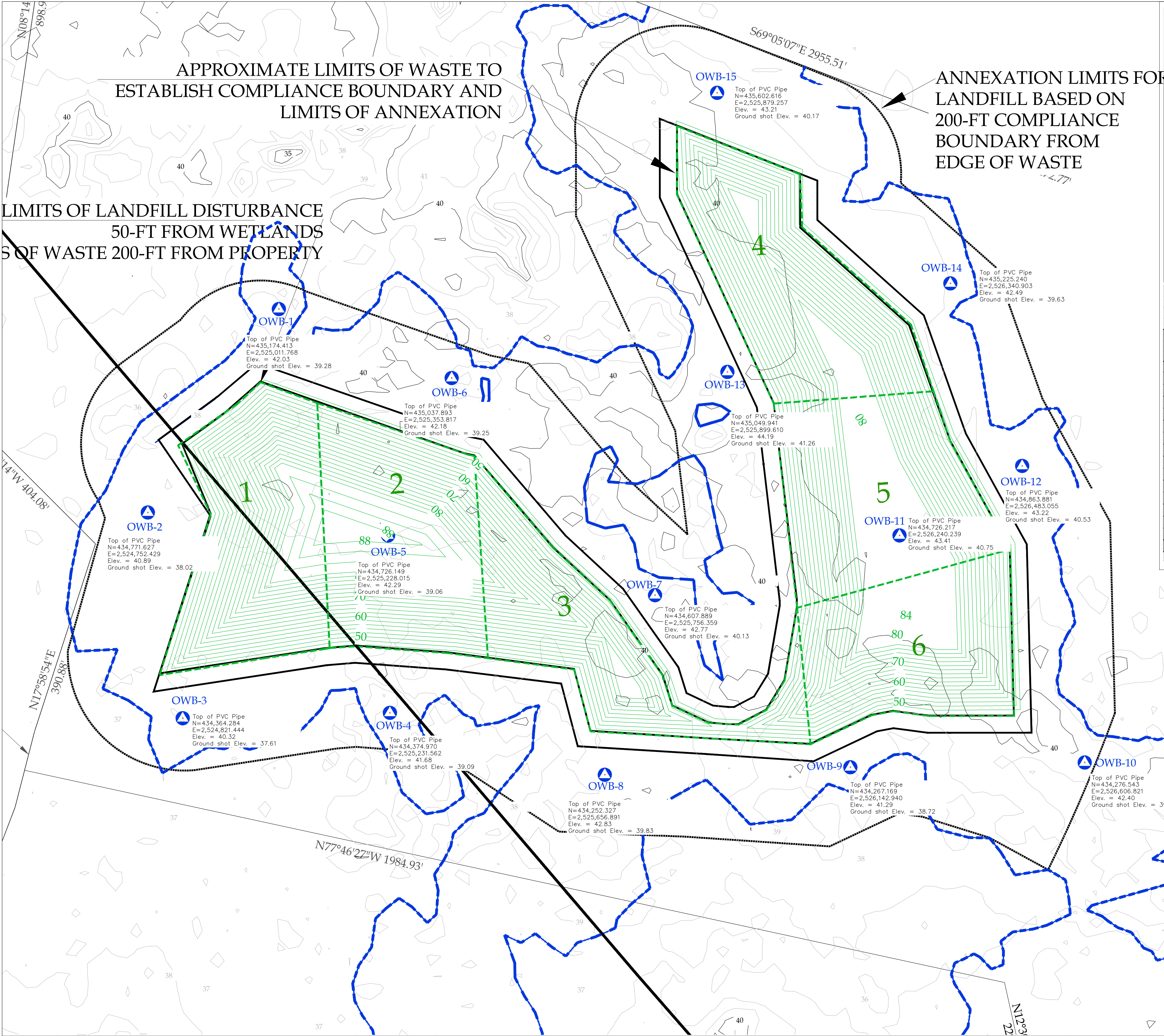
FACILITY PLAN	
SCALE	AS SHOWN
DATE	MAY 27, 2011
PROJECT NO.	0140408
AutoCAD 2007	FACILITY PLANS AND PHASING.DWG

DRAWING NO.	1
REV. NO.	
SHEET	1 OF 1

Appendix C

Investigatory Well Information

Surveyed Well Location Plan



MAYSVILLE C&D LANDFILL									
SITE SUITABILITY - OBSERVATION WELL DATA									
OCTOBER 6, 2011									
Well locations survey data supplied by Parker & Associates									
Well	Date	Ground Surface	Top of PVC	Well PVC	Well	Screened	NC State Plane		
OWB-#	Drilled	Elevation (MSL)	Elevation (MSL)	Stick-Up (ft)	Depth (ft)	Interval (ft)	North	East	
OWB-1	8/25/11	39.28	42.03	2.75	20.0	20.0 - 7.0	435174.413	2525011.768	
OWB-2	8/25/11	38.02	40.89	2.87	20.0	20.0 - 7.0	434771.627	2524752.429	
OWB-3	8/25/11	37.61	40.32	2.71	20.0	20.0 - 8.0	434364.284	2524821.444	
OWB-4	8/25/11	39.09	41.68	2.59	20.0	20.0 - 8.0	434374.970	2525231.562	
OWB-5	8/24/11	39.06	42.29	3.23	15.0	19.0 - 7.0	434726.149	2525228.015	
OWB-6	8/24/11	39.25	42.18	2.93	15.0	20.0 - 8.0	435037.893	2525353.817	
OWB-7	8/24/11	40.13	42.77	2.64	15.0	34.0 - 21.0	434607.889	2525756.359	
OWB-8	8/23/11	39.83	42.83	3.00	20.0	20.0 - 8.0	434252.327	2525656.891	
OWB-9	8/23/11	38.72	41.29	2.57	15.0	3.0 - 15.0	434267.169	2526142.940	
OWB-10	8/22/11	39.67	42.40	2.73	20.0	20.0 - 8.0	434276.543	2526606.821	
OWB-11	8/23/11	40.75	43.41	2.66	15.0	15 - 3.5	434726.217	2526240.239	
OWB-12	8/23/11	40.53	43.22	2.69	20.0	20.0 - 8.0	434863.881	2526483.055	
OWB-13	8/24/11	41.26	44.19	2.93	20.0	20.0 - 8.0	435049.941	2525899.610	
OWB-14	8/23/11	39.63	42.49	2.86	20.0	20.0 - 8.0	435225.240	2526340.903	
OWB-15	8/24/11	40.17	43.21	3.04	20.0	20.0 - 8.0	435602.616	2525879.257	

Proposed Maysville C&D Landfill
Water Table Elevations - Through 11-22-11

Well	Top of PVC	Groundwater Level Elevations															
		T.O.B.		24-Hr.		8/26/11		9/9/11		9/9/11		10/10/11		11/22/11			
		Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.
OWB-1	42.03	13.55	28.48	13.92	28.11	13.92	28.11	7.21	34.82	6.82	35.21	7.80	34.23	7.11	34.92		
OWB-2	40.89	13.62	27.27	13.62	27.27	13.62	27.27	6.33	34.56	5.86	35.03	7.02	33.87	6.23	34.66		
OWB-3	40.32	12.75	27.57	12.79	27.53	12.79	27.53	5.79	34.53	5.38	34.94	6.54	33.78	5.80	34.52		
OWB-4	41.68	13.93	27.75	13.86	27.82	13.86	27.82	6.89	34.79	6.53	35.15	7.68	34.00	6.92	34.76		
OWB-5	42.29	15.05	27.24	15.00	27.29	14.30	27.99	7.52	34.77	7.36	34.93	8.22	34.07	7.44	34.85		
OWB-6	42.18	13.70	28.48	13.78	28.40	13.82	28.36	7.31	34.87	6.94	35.24	7.91	34.27	7.10	35.08		
OWB-7	42.77	15.55	27.22	14.85	27.92	14.75	28.02	7.69	35.08	7.17	35.60	8.58	34.19	7.79	34.98		
OWB-8	42.83	15.05	27.78	14.97	27.86	14.99	27.84	7.93	34.90	7.62	35.21	8.68	34.15	7.83	35.00		
OWB-9	41.29	13.89	27.40	13.10	28.19	13.11	28.18	5.58	35.71	5.30	35.99	5.22	36.07	7.50	33.79		
OWB-10	42.40	13.68	28.72	13.70	28.70	13.70	28.70	6.68	35.72	5.71	36.69	7.15	35.25	6.20	36.20		
OWB-11	43.41	13.62	29.79	13.65	29.76	13.64	29.77	6.93	36.48	6.38	37.03	7.61	35.80	6.75	36.66		
OWB-12	43.22	16.25	26.97	15.13	28.09	15.15	28.07	8.07	35.15	7.76	35.46	8.40	34.82	7.86	35.36		
OWB-13	44.19	15.15	29.04	15.34	28.85	15.37	28.82	8.51	35.68	8.23	35.96	9.27	34.92	8.40	35.79		
OWB-14	42.49	14.40	28.09	14.09	28.40	14.06	28.43	6.86	35.63	6.57	35.92	7.65	34.84	6.74	35.75		
OWB-15	43.21	14.61	28.60	14.56	28.65	14.65	28.56	7.40	35.81	7.23	35.98	8.59	34.62	7.83	35.38		
Average W.T. Elevation		28.03		28.19		28.23		35.23		35.62		34.59		35.18			

LEGEND

- EXISTING CONTOUR (1-FT INTERVAL)
- ACOE APPROVED WETLAND LIMITS
- GROUND WATER CONTOUR (0.5-FT INTERVAL)
- TEST PIT LOCATION
- PROPOSED SOIL TEST BORING & WELL LOCATION

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION

MAYSVILLE C&D LANDFILL

GREEN RECYCLING SOLUTIONS LLC

DRAWN BY
DWW

DESIGN ENGINEER
DWW

MAYSVILLE, NC

PROJECT ENGINEER
DWW

PROJECT MANAGER
DWW

8000 CORPORATE CENTER DRIVE, SUITE 200
CHARLOTTE, NORTH CAROLINA 28226
(704) 541-5300

NOT FOR CONSTRUCTION

SCALE
1"=100'

PROJECT NO.
0140408

DATE
NOVEMBER 2011

AutoCAD 2007
SURVEYED WELL LOCATION PLAN.DWG

DRAWING NO.
1

REV. NO.

SHEET 1 OF 1

Surveyed Well Location Data

MAYSVILLE C&D LANDFILL
SITE SUITABILITY - OBSERVATION WELL DATA
OCTOBER 6, 2011

Well locations survey data supplied by Parker & Associates

Well OWB-#	Date Drilled	Ground Surface Elevation (MSL)	Top of PVC Elevation (MSL)	Well PVC Stick-Up (ft)	Well Depth (ft)	Screened Interval (ft)	NC State Plane Northing	NC State Plane Easting
OWB-1	8/25/11	39.28	42.03	2.75	20.0	20.0 - 7.0	435174.413	2525011.768
OWB-2	8/25/11	38.02	40.89	2.87	20.0	20.0 - 7.0	434771.627	2524752.429
OWB-3	8/25/11	37.61	40.32	2.71	20.0	20.0 - 8.0	434364.284	2524821.444
OWB-4	8/25/11	39.09	41.68	2.59	20.0	20.0 - 8.0	434374.970	2525231.562
OWB-5	8/24/11	39.06	42.29	3.23	15.0	19.0 -7.0	434726.149	2525228.015
OWB-6	8/24/11	39.25	42.18	2.93	15.0	20.0 - 8.0	435037.893	2525353.817
OWB-7	8/24/11	40.13	42.77	2.64	15.0	34.0 - 21.0	434607.889	2525756.359
OWB-8	8/23/11	39.83	42.83	3.00	20.0	20.0 - 8.0	434252.327	2525656.891
OWB-9	8/23/11	38.72	41.29	2.57	15.0	3.0 - 15.0	434267.169	2526142.940
OWB-10	8/22/11	39.67	42.40	2.73	20.0	20.0 - 8.0	434276.543	2526606.821
OWB-11	8/23/11	40.75	43.41	2.66	15.0	15 -3.5	434726.217	2526240.239
OWB-12	8/23/11	40.53	43.22	2.69	20.0	20.0 - 8.0	434863.881	2526483.055
OWB-13	8/24/11	41.26	44.19	2.93	20.0	20.0 - 8.0	435049.941	2525899.610
OWB-14	8/23/11	39.63	42.49	2.86	20.0	20.0 - 8.0	435225.240	2526340.903
OWB-15	8/24/11	40.17	43.21	3.04	20.0	20.0 - 8.0	435602.616	2525879.257

Soil Test Boring Records

PROJECT: Proposed Maysville C&D Landfill		OWB-1	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/25/11	DATE FINISHED: 8/25/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 20	SCREEN INTERVAL (ft.): 10-20
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 13.55	FIRST: 13.92 COMPL. 2" Sch.40PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0					Above Grade Well Monument
1	4-4-5	N/A	Dark grey/Dark Brown, fine sandy SILT, dry		
2					10" diameter borehole Neat cement grout.
3					2" diameter Schedule 40 PVC casing
4					
5	2-6-8		Light/medium brown, clayey medium SAND, dry/slightly moist		Bentonite Chip Seal
6					
7					#2 filter pack sand
8					
9			SM - Light brown, coarse SAND with very little clay with a few rounded quartz pieces, very moist		
10	3-3-3				
11			Light brown, silty CLAY, slightly moist		
12					
13					
14					
15	4-4-3		SM - Black, clayey coarse SAND with small well rounded quartz pieces, wet		2" diameter, 0.010" slot, Schedule 40 PVC screen
16					
17					
18					
19			SP - Dark grey, clayey coarse SAND, wet		2" diameter Schedule 40 PVC end cap
20	woh-woh-woh				Slough
21					

PROJECT: Proposed Maysville C&D Landfill		OWB-2	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/25/11	DATE FINISHED: 8/25/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 20	SCREEN INTERVAL (ft.): 10-20
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 13.62	FIRST: 13.62 COMPL. 13.62 CASING: 2" Sch.40PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0					Above Grade Well Monument
1	4-4-4	N/A	Medium brown, clayey SILT, dry		
2					10" diameter borehole Neat cement grout.
3					2" diameter Schedule 40 PVC casing
4					
5	5-5-4		Light/medium brown, silty CLAY, dry/slightly moist		Bentonite Chip Seal
6					
7					#2 filter pack sand
8					
9					
10	3-3-3		SM - Medium brown, coarse SAND, very moist		
11					
12					
13					
14					
15	2-1-1				2" diameter, 0.010" slot, Schedule 40 PVC screen
16					
17			SP - Dark grey, clayey coarse SAND, very wet, small clay lenses		
18					
19					
20	wor-wor-1				2" diameter Schedule 40 PVC end cap
21					Slough

PROJECT: Proposed Maysville C&D Landfill		OWB-3	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/25/11	DATE FINISHED: 8/25/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 20	SCREEN INTERVAL (ft.): 10-20
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 12.75	FIRST: 12.79 COMPL. 12.79 CASING: 2" Sch.40PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0					Above Grade Well Monument
1	2-3-4	N/A	Dark/medium brown, silty CLAY, dry, tight		
2					10" diameter borehole Neat cement grout.
3					2" diameter Schedule 40 PVC casing
4					
5	3-3-3		Light/medium brown, fine sandy CLAY, slightly moist, very fine sand		
6					
7					Bentonite Chip Seal
8			Black, silty CLAY, moist		#2 filter pack sand
9					
10	2-2-3		SM - Light/medium brown, coarse SAND, very moist		
11					
12					
13					
14					
15	woh-woh-1				2" diameter, 0.010" slot, Schedule 40 PVC screen
16					
17			SP - Dark grey, clayey SAND, wet, small intermittent clay lenses		
18					
19					
20	woh-woh-woh				2" diameter Schedule 40 PVC end cap
21					Slough

PROJECT: Proposed Maysville C&D Landfill			OWB-4		
BORING LOCATION: Proposed Maysville C&D Landfill			GROUND SURFACE ELEVATION AND DATUM: TBD		
DRILLING CONTRACTOR: Geologic Exploration			DATE STARTED: 8/25/11		DATE FINISHED: 8/25/11
DRILLING METHOD: Hollow-stem auger			TOTAL DEPTH (ft.): 20		SCREEN INTERVAL (ft.): 10-20
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig			DEPTH TO WATER:	FIRST: 13.93	COMPL. 13.86
SAMPLING METHOD: Split Spoon			LOGGED BY: Chris Means		
HAMMER WEIGHT: 142 Lbs.			DROP: 32"		
			DRILLER: Mike McConahey		REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0			Dark grey, fine sandy SILT, dry		Above Grade Well Monument
1	4-5-5	N/A			
2			Light/medium grey, silty CLAY, slightly moist, tight		10" diameter borehole Neat cement grout.
3					
4					2" diameter Schedule 40 PVC casing
5	5-9-8		Light brown, clayey medium SAND, slightly moist		
6					
7					Bentonite Chip Seal
8					#2 filter pack sand
9					
10	2-3-3		SM - Light/medium brown, silty SAND, moist		
11					
12					
13					
14					
15	wor-wor-wor				2" diameter, 0.010" slot, Schedule 40 PVC screen
16					
17			SP - Dark grey, clayey coarse SAND, wet, small intermittent clay lenses		
18					
19					
20	wor-wor-wor				2" diameter Schedule 40 PVC end cap
21					Slough

PROJECT: Proposed Maysville C&D Landfill		OWB-5	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/24/11	DATE FINISHED: 8/24/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 19	SCREEN INTERVAL (ft.): 9-19
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 15.05	FIRST: 15.00 COMPL. 15.00 CASING: 2" Sch.40PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0	4-5-5	N/A			Above Grade Well Monument
1			Dark grey, silty fine SAND, dry		
2					10" diameter borehole Neat cement grout.
3	3-4-4		Light grey, silty CLAY (mostly clay), slightly moist		
4			SM - Light grey/light brown, silty coarse SAND, slightly moist		2" diameter Schedule 40 PVC casing
5					
6			SM - Light grey/medium brown, silty coarse SAND, slightly moist		Bentonite Chip Seal
7	1-1-1				
8					#2 filter pack sand
9			SM - Light brown, fine clayey SAND, moist		
10					
11	1-1-1				
12					
13			SM - Black, clayey coarse SAND, wet, small intermittent clay lenses and small well rounded pieces of quartz		2" diameter, 0.010" slot, Schedule 40 PVC screen
14					
15	woh-woh-2				
16			SM - Black, clayey SAND, wet, small well rounded quartz pieces		2" diameter Schedule 40 PVC end cap
17					
18					Slough
19					
20					
21					

PROJECT: Proposed Maysville C&D Landfill		OWB-6	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/24/11	DATE FINISHED: 8/24/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 20	SCREEN INTERVAL (ft.): 10-20
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 13.70	FIRST: 13.78 COMPL. 13.78 CASING: 2" Sch.40PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0					Above Grade Well Monument
1	3-3-3	N/A			
2			Medium grey, fine sandy SILT, dry		10" diameter borehole Neat cement grout.
3					
4					2" diameter Schedule 40 PVC casing
5	2-1-3		Light grey, silty CLAY, slightly moist		
6					
7					Bentonite Chip Seal
8					
9					#2 filter pack sand
10	3-2-3		SP - Black, silty coarse SAND, with a few well rounded pieces of quartz		
11					
12					
13					
14					
15	2-8-9		SP-SM - Light/medium grey, silty coarse SAND, with some shell material, wet		2" diameter, 0.010" slot, Schedule 40 PVC screen
16					
17					
18					
19			SP - Dark grey, fine sandy SILT with a small amount of clay, wet		2" diameter Schedule 40 PVC end cap
20	woh-woh-6				
21			Light grey, shell material, SAND with some gravel		Slough

PROJECT: Proposed Maysville C&D Landfill		OWB-7	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/23/11	DATE FINISHED: 8/24/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 34	SCREEN INTERVAL (ft.): 24-34
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 15.55	COMPL. 14.85 CASING: 2" Sch.40PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0	4-1-2	N/A			Above Grade Well Monument
2			Medium/dark brown, clayey SILT, 90% silt, dry		
4					
6	Shelby Tube		Light grey, silty fat CLAY, slightly moist		10" diameter borehole
8			White/light grey, coarse SAND, slightly moist		
10	2-2-2		Light/medium brown, coarse SAND, moist		Neat cement grout.
12			SP - Dark grey, clayey SAND, wet		
14					2" diameter Schedule 40 PVC casing
16	woh-woh-2				
18					
20	1-2-2				Bentonite Chip Seal
22			SP - Dark grey, clayey SAND, wet, small intermittent clay layers with small well rounded pieces of quartz at 20 feet		#2 filter pack sand
24					
26	2-1-1				
28					2" diameter, 0.010" slot, Schedule 40 PVC screen
30	4-5-6				
32			SP - Dark grey, clayey SAND, with a dark brown, clay seam that is vertical		
34					2" diameter Schedule 40 PVC end cap
	7-11-26		SM - Light/medium grey, silty CLAY, with very little fine sand, limestone material, wet		Slough

PROJECT: Proposed Maysville C&D Landfill		OWB-8	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/23/11	DATE FINISHED: 8/23/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 20	SCREEN INTERVAL (ft.): 10-20
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 15.05	FIRST: 14.97 COMPL. 2" Sch.40PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0	4-5-6	N/A			Above Grade Well Monument
1					
2			Light/medium brown, clayey SILT, dry,		10" diameter borehole Neat cement grout.
3	2-3-4				2" diameter Schedule 40 PVC casing
4					
5			Light grey, silty CLAY, slightly moist		
6	3-4-6				Bentonite Chip Seal
7					
8			Light/medium brown, silty CLAY, moist		#2 filter pack sand
9	1-1-2				
10					
11			SM - Medium brown, SAND, wet		
12	woh-woh-woh				
13					
14			SM - Black, clayey coarse SAND, very wet		2" diameter, 0.010" slot, Schedule 40 PVC screen
15					
16					
17			SM - Black, clayey coarse SAND, very wet, smaller amount of clay than above		2" diameter Schedule 40 PVC end cap
18					
19					
20					Slough
21					

PROJECT: Proposed Maysville C&D Landfill			OWB-9		
BORING LOCATION: Proposed Maysville C&D Landfill			GROUND SURFACE ELEVATION AND DATUM: TBD		
DRILLING CONTRACTOR: Geologic Exploration			DATE STARTED: 8/23/11		DATE FINISHED: 8/23/11
DRILLING METHOD: Hollow-stem auger			TOTAL DEPTH (ft.): 15		SCREEN INTERVAL (ft.): 5-15
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig			DEPTH TO WATER:	FIRST: 13.89	COMPL. 13.10
SAMPLING METHOD: Split Spoon			LOGGED BY: Chris Means		
HAMMER WEIGHT: 142 Lbs.		DROP: 32"	DRILLER: Mike McConahey		REG. NO. 2402
DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0					Above Grade Well Monument
1	3-3-3	N/A			Neat cement grout.
2			Light/medium grey, clayey SILT, dry,		Bentonite Chip Seal
3					
4					
5	2-2-2		Light/medium grey, silty CLAY, slightly moist		#2 filter pack sand
6					
7					
8					
9			Medium grey, silty CLAY, slightly moist, very tight		
10	2-1-2		SM - Light brown, SAND, very moist, loose		2" diameter, 0.010" slot, Schedule 40 PVC screen
11					
12					
13			SM - Black, medium/coarse SAND, wet		
14					
15	woh-woh-woh				2" diameter Schedule 40 PVC end cap
16					Slough

PROJECT: Proposed Maysville C&D Landfill		OWB-10	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/22/11	DATE FINISHED: 8/23/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 20	SCREEN INTERVAL (ft.): 10-20
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 13.68	FIRST: 13.70 COMPL. 2" Sch.40PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0	N/A	N/A			Above Grade Well Monument
1					
2			Dark grey/black, silty CLAY, dry		10" diameter borehole Neat cement grout.
3					
4	9-5-4				2" diameter Schedule 40 PVC casing
5			Light/medium brown, SILT with some rock fragments, dry		
6					
7					Bentonite Chip Seal
8	10-7-4		SM - Light grey, silty medium SAND, very moist		#2 filter pack sand
9					
10			SM - Dark tan, coarse SAND, wet		
11					
12	2-1-1				
13					
14					
15					
16	wor-woh-2		SM - Black, medium/coarse SAND, wet		2" diameter, 0.010" slot, Schedule 40 PVC screen
17					
18					
19					
20					2" diameter Schedule 40 PVC end cap
21					Slough

PROJECT: Proposed Maysville C&D Landfill				OWB-11			
BORING LOCATION: Proposed Maysville C&D Landfill				GROUND SURFACE ELEVATION AND DATUM: TBD			
DRILLING CONTRACTOR: Geologic Exploration				DATE STARTED: 8/23/11		DATE FINISHED: 8/23/11	
DRILLING METHOD: Hollow-stem auger				TOTAL DEPTH (ft.): 15		SCREEN INTERVAL (ft.): 5-15	
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig				DEPTH TO WATER:	FIRST: 13.62	COMPL. 13.65	CASING: 2" Sch.40PVC
SAMPLING METHOD: Split Spoon				LOGGED BY: Chris Means			
HAMMER WEIGHT: 142 Lbs.			DROP: 32"	DRILLER: Mike McConahey			REG. NO. 2402
DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS			
	Blows/ 6 Inches						
0	5-6-8	N/A					Above Grade Well Monument
1							Neat cement grout.
2							Bentonite Chip Seal
3	2-3-3		Medium/dark grey, silty SAND, hard, dry				
4							#2 filter pack sand
5							
6							
7	2-1-1		Black, clayey SILT with some fine sand, slightly moist				
8							
9							
10	2-1-1		SM - Light/medium grey, silty SAND, moist				
11							2" diameter, 0.010" slot, Schedule 40 PVC screen
12							
13	wor-woh-2		SM - Light brown, coarse SAND, moist, loose				
14							
15							
16							
			SM - Black, medium/coarse SAND, wet				
							2" diameter Schedule 40 PVC end cap
							Slough

ERM NC Inc.























Project # 0140408

Page 1 of 1

PROJECT: Proposed Maysville C&D Landfill		OWB-12	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/23/11	DATE FINISHED: 8/23/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 20	SCREEN INTERVAL (ft.): 10-20
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 16.25	FIRST: 15.13 COMPL. 2" Sch.40PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0	7-6-5	N/A			Above Grade Well Monument
1					
2			Medium/dark grey, silty fine SAND, dry		10" diameter borehole Neat cement grout.
3					
4	2-3-3				2" diameter Schedule 40 PVC casing
5			Light grey, silty CLAY, tight, slightly moist, fat clay		
6					
7					Bentonite Chip Seal
8	woh-woh-woh				
9					#2 filter pack sand
10			SM - Light grey, clayey SAND, very moist		
11					
12	3-4-5				
13					
14			Dark grey, silty CLAY, moist		
15					2" diameter, 0.010" slot, Schedule 40 PVC screen
16	1-woh-woh		SP - Dark grey, medium/coarse SAND, wet		
17					
18					
19			SP - Dark grey, clayey SAND, wet		
20					2" diameter Schedule 40 PVC end cap
21					Slough

PROJECT: Proposed Maysville C&D Landfill		OWB-13	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/24/11	DATE FINISHED: 8/24/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 20	SCREEN INTERVAL (ft.): 10-20
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 15.15	FIRST: 15.34 COMPL. 2" Sch.40PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0	3-3-3	N/A	Black, clayey SILT, dry		Above Grade Well Monument
1					
2			Light brown, silty CLAY, dry		
3	2-2-2				10" diameter borehole Neat cement grout.
4					2" diameter Schedule 40 PVC casing
5			Light grey, CLAY with very little silt, slightly moist		
6					Bentonite Chip Seal
7	2-1-2				#2 filter pack sand
8			SM - Light brown, coarse SAND with a small amount of clay, very moist		
9					
10					
11	1-1-woh				2" diameter, 0.010" slot, Schedule 40 PVC screen
12					
13			SM - Black, clayey medium/coarse SAND, wet		
14					
15	3-4-5				2" diameter Schedule 40 PVC end cap
16					
17					
18					
19					
20			Light grey, medium sandy CLAY, wet, 4 inch interval of shell at 19.5 feet		
21					Slough

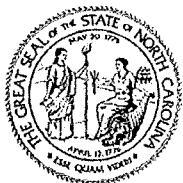
PROJECT: Proposed Maysville C&D Landfill		OWB-14	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/23/11	DATE FINISHED: 8/23/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 20	SCREEN INTERVAL (ft.): 10-20
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 14.40	FIRST: 14.09 COMPL. 14.09 CASING: 2"Sch. 40 PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0					Above Grade Well Monument
1	3-3-2	N/A			
2			Dark grey, silty SAND, dry		10" diameter borehole Neat cement grout.
3					
4					2" diameter Schedule 40 PVC casing
5	2-3-3				
6			SM - Light grey, clayey fine SAND, slightly moist		
7					Bentonite Chip Seal
8					
9					#2 filter pack sand
10	woh-woh-woh				
11			Medium/dark grey, SILT, very moist		
12					
13					
14			SP - Medium/dark grey, coarse SAND, loose, wet		
15	woh-2-3				
16			Medium/dark grey, silty SAND, moist		2" diameter, 0.010" slot, Schedule 40 PVC screen
17					
18					
19			Medium/dark grey, fine sandy CLAY, wet, and small to large pieces of well rounded quartz located at 20 feet		
20	2-1-woh				2" diameter Schedule 40 PVC end cap
21					Slough

PROJECT: Proposed Maysville C&D Landfill		OWB-15	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/24/11	DATE FINISHED: 8/24/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 20	SCREEN INTERVAL (ft.): 10-20
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 14.56	FIRST: 14.61 COMPL. 14.61 CASING: 2" Sch.40PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0	6-5-6	N/A			Above Grade Well Monument
1			Light/medium brown, fine sandy SILT, dry		
2					10" diameter borehole Neat cement grout.
3	2-4-5				2" diameter Schedule 40 PVC casing
4			Medium brown, fine sandy CLAY, very moist		
5					
6					Bentonite Chip Seal
7	woh-woh-woh		Light grey, silty CLAY, very moist		
8					#2 filter pack sand
9			SM - Medium brown, clayey coarse SAND, very moist		
10					
11	5-8-12		SP - Black, clayey coarse SAND, wet		
12					
13					
14			SP - Dark grey, clayey SAND with some shell material, very moist		
15					2" diameter, 0.010" slot, Schedule 40 PVC screen
16					
17	27-22-25				
18			SW-SM - Light grey, gravelly SAND, Shell material, wet		
19					2" diameter Schedule 40 PVC end cap
20					Slough
21					

Well Construction Records



NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID # (if applicable) OBW-1

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/25/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE ° ' " DMS OR DD

LONGITUDE ° ' " DMS OR DD

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL N/A

Facility Name

Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()

Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 20.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING: Depth	Diameter	Thickness/Weight	Material
Top 0.0 Bottom 10.0 Ft.	2 INCH	SCH 40	PVC

Top Bottom Ft.

Top Bottom Ft.

8. GROUT: Depth	Material	Method
Top 0.0 Bottom 5.0 Ft.	PORTLAND BENTONITE	SLURRY

Top Bottom Ft.

Top Bottom Ft.

9. SCREEN: Depth	Diameter	Slot Size	Material
Top 10.0 Bottom 20.0 Ft.	2.0 in.	.010 in.	PVC

Top Bottom Ft. in. in.

Top Bottom Ft. in. in.

10. SAND/GRAVEL PACK: Depth	Size	Material
Top 8.0 Bottom 20.0 Ft.	20-40	FINE SILICA SAND

Top Bottom Ft.

Top Bottom Ft.

11. DRILLING LOG	Formation Description
Top Bottom	

0.0 / 1.0 WOOD/WEEDS/TOPSOIL

1.0 / 10.0 TAN/WHITE SILTY CLAY

10.0 / 15.0 BLACK SILTY SAND/SHELL

15.0 / 20.0 GRAY/GREEN CLAY SILT SAND/SHELL

12. REMARKS:

BENTONITE SEAL FROM 5.0 TO 8.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR 08/29/11 DATE

MIKE MCCONAHEY
PRINTED NAME OF PERSON CONSTRUCTING THE WELL



Non RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) OBW-2

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/25/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE " DMS OR DD

LONGITUDE " DMS OR DD

Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL N/A

Facility Name Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()

Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 20.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING: Depth	Diameter	Thickness/Weight	Material
Top <u>0.0</u> Bottom <u>10.0</u> Ft.	<u>2 INCH</u>	<u>SCH 40</u>	<u>PVC</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>

8. GROUT: Depth	Material	Method
Top <u>0.0</u> Bottom <u>5.0</u> Ft.	<u>PORTLAND BENTONITE</u>	<u>SLURRY</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>

9. SCREEN: Depth	Diameter	Slot Size	Material
Top <u>10.0</u> Bottom <u>20.0</u> Ft.	<u>2.0 in.</u>	<u>.010 in.</u>	<u>PVC</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>

10. SAND/GRAVEL PACK: Depth	Size	Material
Top <u>8.0</u> Bottom <u>20.0</u> Ft.	<u>20-40</u>	<u>FINE SILICA SAND</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>

11. DRILLING LOG	Formation Description
Top <u>0.0</u> Bottom <u>1.0</u>	<u>WOOD/WEEDS/TOPSOIL</u>
<u>1.0</u> / <u>10.0</u>	<u>TAN/WHITE SILTY CLAY</u>
<u>10.0</u> / <u>15.0</u>	<u>BLACK SILTY SAND/SHELL</u>
<u>15.0</u> / <u>20.0</u>	<u>GRAY/GREEN CLAY SILT SAND/SHELL</u>
<u> </u> / <u> </u>	<u> </u>
<u> </u> / <u> </u>	<u> </u>
<u> </u> / <u> </u>	<u> </u>
<u> </u> / <u> </u>	<u> </u>
<u> </u> / <u> </u>	<u> </u>
<u> </u> / <u> </u>	<u> </u>

12. REMARKS:

BENTONITE SEAL FROM 5.0 TO 8.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR 08/29/11 DATE

MIKE MCCONAHEY
PRINTED NAME OF PERSON CONSTRUCTING THE WELL



Non RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) OBW-3

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/25/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE ° ' " DMS OR DD

LONGITUDE ° ' " DMS OR DD

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL

N/A

Facility Name

Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()

Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 20.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING: Depth Diameter Thickness/Weight Material

Top 0.0 Bottom 10.0 Ft. 2 INCH SCH 40 PVC

Top Bottom Ft. SCH 40 PVC

Top Bottom Ft. SCH 40 PVC

8. GROUT: Depth Material Method

Top 0.0 Bottom 5.0 Ft. PORTLAND BENTONITE SLURRY

Top Bottom Ft. SLURRY

Top Bottom Ft. SLURRY

9. SCREEN: Depth Diameter Slot Size Material

Top 10.0 Bottom 20.0 Ft. 2.0 in. .010 in. PVC

Top Bottom Ft. in. in.

Top Bottom Ft. in. in.

10. SAND/GRAVEL PACK:

Depth Size Material

Top 8.0 Bottom 20.0 Ft. 20-40 FINE SILICA SAND

Top Bottom Ft.

Top Bottom Ft.

11. DRILLING LOG

Top Bottom

Formation Description

0.0 / 1.0 WOOD/WEEDS/TOPSOIL

1.0 / 10.0 TAN/WHITE SILTY CLAY

10.0 / 15.0 BLACK SILTY SAND/SHELL

15.0 / 20.0 GRAY/GREEN CLAY SILT SAND/SHELL

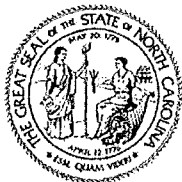
12. REMARKS:

BENTONITE SEAL FROM 5.0 TO 8.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR 08/29/11 DATE

MIKE MCCONAHEY
PRINTED NAME OF PERSON CONSTRUCTING THE WELL



***Non RESIDENTIAL* WELL CONSTRUCTION RECORD**

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) OBW-4

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/25/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE ° ' " DMS OR ° ' " DD

LONGITUDE ° ' " DMS OR ° ' " DD

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL

N/A

Facility Name

Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()

Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 20.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING: Depth	Diameter	Thickness/Weight	Material
Top <u>0.0</u> Bottom <u>10.0</u> Ft. <u>2 INCH</u>		<u>SCH 40</u>	<u>PVC</u>
Top <u> </u> Bottom <u> </u> Ft. <u> </u>			
Top <u> </u> Bottom <u> </u> Ft. <u> </u>			

8. GROUT: Depth	Material	Method
Top <u>0.0</u> Bottom <u>5.0</u> Ft. <u>PORTLAND BENTONITE</u>		<u>SLURRY</u>
Top <u> </u> Bottom <u> </u> Ft. <u> </u>		
Top <u> </u> Bottom <u> </u> Ft. <u> </u>		

9. SCREEN: Depth	Diameter	Slot Size	Material
Top <u>10.0</u> Bottom <u>20.0</u> Ft. <u>2.0 in.</u> <u>.010 in.</u>			<u>PVC</u>
Top <u> </u> Bottom <u> </u> Ft. <u> </u> <u> </u>			
Top <u> </u> Bottom <u> </u> Ft. <u> </u> <u> </u>			

10. SAND/GRAVEL PACK: Depth	Size	Material
Top <u>8.0</u> Bottom <u>20.0</u> Ft. <u>20-40</u>		<u>FINE SILICA SAND</u>
Top <u> </u> Bottom <u> </u> Ft. <u> </u>		
Top <u> </u> Bottom <u> </u> Ft. <u> </u>		

11. DRILLING LOG	Formation Description
Top <u>0.0</u> Bottom <u>1.0</u>	<u>WOOD/WEEDS/TOPSOIL</u>
<u>1.0</u> / <u>10.0</u>	<u>TAN/WHITE SILTY CLAY</u>
<u>10.0</u> / <u>15.0</u>	<u>BLACK SILTY SAND/SHELL</u>
<u>15.0</u> / <u>20.0</u>	<u>GRAY/GREEN CLAY SILT SAND/SHELL</u>
<u> </u> / <u> </u>	
<u> </u> / <u> </u>	
<u> </u> / <u> </u>	
<u> </u> / <u> </u>	
<u> </u> / <u> </u>	
<u> </u> / <u> </u>	
<u> </u> / <u> </u>	

12. REMARKS:

BENTONITE SEAL FROM 5.0 TO 8.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C . WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR Mike McConahey DATE 08/29/11

MIKE MCCONAHEY
PRINTED NAME OF PERSON CONSTRUCTING THE WELL



Non RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) OBW-5

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/24/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE : ° ' " DMS OR DD

LONGITUDE ° ' " DMS OR DD

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL

N/A

Facility Name

Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()

Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 20.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.

(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING: Depth Diameter Thickness/Weight Material

Top 0.0 Bottom 10.0 Ft. 2 INCH SCH 40 PVC

Top Bottom Ft.

Top Bottom Ft.

8. GROUT: Depth Material Method

Top 0.0 Bottom 5.0 Ft. PORTLAND BENTONITE SLURRY

Top Bottom Ft.

Top Bottom Ft.

9. SCREEN: Depth Diameter Slot Size Material

Top 10.0 Bottom 20.0 Ft. 2.0 in. .010 in. PVC

Top Bottom Ft. in. in.

Top Bottom Ft. in. in.

10. SAND/GRAVEL PACK:

Depth Size Material

Top 8.0 Bottom 20.0 Ft. 20-40 FINE SILICA SAND

Top Bottom Ft.

Top Bottom Ft.

11. DRILLING LOG

Top Bottom

Formation Description

0.0 / 1.0

WOOD/WEEDS/TOPSOIL

1.0 / 10.0

TAN/WHITE SILTY CLAY

10.0 / 15.0

BLACK SILTY SAND/SHELL

15.0 / 20.0

GRAY/GREEN CLAY SILT SAND/SHELL

12. REMARKS:

BENTONITE SEAL FROM 5.0 TO 8.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR

08/29/11

DATE

MIKE MCCONAHEY

PRINTED NAME OF PERSON CONSTRUCTING THE WELL



Non RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID # (if applicable) OBW-6

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/24/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE ° ' " DMS OR DD

LONGITUDE ° ' " DMS OR DD

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL

N/A

Facility Name

Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()

Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 20.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING: Depth	Diameter	Thickness/Weight	Material
Top <u>0.0</u> Bottom <u>10.0</u> Ft.	<u>2 INCH</u>	<u>SCH 40</u>	<u>PVC</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>

8. GROUT: Depth	Material	Method
Top <u>0.0</u> Bottom <u>5.0</u> Ft.	<u>PORTLAND BENTONITE</u>	<u>SLURRY</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>

9. SCREEN: Depth	Diameter	Slot Size	Material
Top <u>10.0</u> Bottom <u>20.0</u> Ft.	<u>2.0 in.</u>	<u>.010 in.</u>	<u>PVC</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> in.</u>	<u> in.</u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> in.</u>	<u> in.</u>	<u> </u>

10. SAND/GRAVEL PACK: Depth	Size	Material
Top <u>8.0</u> Bottom <u>20.0</u> Ft.	<u>20-40</u>	<u>FINE SILICA SAND</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>

11. DRILLING LOG	Formation Description
Top <u>0.0</u> Bottom <u>1.0</u>	<u>WOOD/WEEDS/TOPSOIL</u>
<u>1.0</u> / <u>10.0</u>	<u>TAN/WHITE SILTY CLAY</u>
<u>10.0</u> / <u>15.0</u>	<u>BLACK SILTY SAND/SHELL</u>
<u>15.0</u> / <u>20.0</u>	<u>GRAY/GREEN CLAY SILT SAND/SHELL</u>
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12. REMARKS:

BENTONITE SEAL FROM 5.0 TO 8.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C. WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR Mike McConahey DATE 08/29/11

MIKE MCCONAHEY
PRINTED NAME OF PERSON CONSTRUCTING THE WELL



Non RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) OBW-8

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/23/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE ° ' " DMS OR DD

LONGITUDE ° ' " DMS OR DD

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL

N/A

Facility Name

Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()

Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 20.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING: Depth	Diameter	Thickness/Weight	Material
Top <u>0.0</u> Bottom <u>10.0</u> Ft.	<u>2 INCH</u>	<u>SCH 40</u>	<u>PVC</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>

8. GROUT: Depth	Material	Method
Top <u>0.0</u> Bottom <u>5.0</u> Ft.	<u>PORTLAND BENTONITE</u>	<u>SLURRY</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>

9. SCREEN: Depth	Diameter	Slot Size	Material
Top <u>10.0</u> Bottom <u>20.0</u> Ft.	<u>2.0 in.</u>	<u>.010 in.</u>	<u>PVC</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>

10. SAND/GRAVEL PACK: Depth	Size	Material
Top <u>8.0</u> Bottom <u>20.0</u> Ft.	<u>20-40</u>	<u>FINE SILICA SAND</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>

11. DRILLING LOG

Top Bottom

Formation Description

0.0 / 1.0

WOOD/WEEDS/TOPSOIL

1.0 / 10.0

TAN/WHITE SILTY CLAY

10.0 / 15.0

BLACK SILTY SAND/SHELL

15.0 / 20.0

GRAY/GREEN CLAY SILT SAND/SHELL

12. REMARKS:

BENTONITE SEAL FROM 5.0 TO 8.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR

08/29/11

DATE

MIKE MCCONAHEY

PRINTED NAME OF PERSON CONSTRUCTING THE WELL



Non RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) OBW-9

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/23/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE ° ' " DMS OR DD

LONGITUDE ° ' " DMS OR DD

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL

N/A

Facility Name

Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()

Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 15.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING: Depth		Diameter	Thickness/Weight	Material
Top <u>0.0</u>	Bottom <u>5.0</u>	Ft. <u>2 INCH</u>	<u>SCH 40</u>	<u>PVC</u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>	<u> </u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>	<u> </u>

8. GROUT: Depth		Material	Method
Top <u>0.0</u>	Bottom <u>1.0</u>	Ft. <u>PORTLAND BENTONITE</u>	<u>SLURRY</u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>

9. SCREEN: Depth		Diameter	Slot Size	Material
Top <u>5.0</u>	Bottom <u>15.0</u>	Ft. <u>2.0 in.</u>	<u>.010 in.</u>	<u>PVC</u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>	<u> </u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>	<u> </u>

10. SAND/GRAVEL PACK: Depth		Size	Material
Top <u>3.0</u>	Bottom <u>15.0</u>	Ft. <u>20-40</u>	<u>FINE SILICA SAND</u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>

11. DRILLING LOG

Top Bottom

Formation Description

0.0 / 1.0

WOOD/WEEDS/TOPSOIL

1.0 / 10.0

TAN/WHITE SILTY CLAY

10.0 / 15.0

BLACK SILTY SAND/SHELL

/

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/

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12. REMARKS:

BENTONITE SEAL FROM 1.0 TO 3.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR

08/29/11
DATE

MIKE MCCONAHEY

PRINTED NAME OF PERSON CONSTRUCTING THE WELL



Non RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) OBW-10

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/23/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE ° ' " DMS OR DD

LONGITUDE ° ' " DMS OR DD

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL

N/A

Facility Name

Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()

Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 20.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.

(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING: Depth Diameter Thickness/Weight Material

Top 0.0 Bottom 10.0 Ft. 2 INCH SCH 40 PVC

Top Bottom Ft.

Top Bottom Ft.

8. GROUT: Depth Material Method

Top 0.0 Bottom 5.0 Ft. PORTLAND BENTONITE SLURRY

Top Bottom Ft.

Top Bottom Ft.

9. SCREEN: Depth Diameter Slot Size Material

Top 10.0 Bottom 20.0 Ft. 2.0 in. .010 in. PVC

Top Bottom Ft. in. in.

Top Bottom Ft. in. in.

10. SAND/GRAVEL PACK:

Depth Size Material

Top 8.0 Bottom 20.0 Ft. 20-40 FINE SILICA SAND

Top Bottom Ft.

Top Bottom Ft.

11. DRILLING LOG

Top Bottom

Formation Description

0.0 / 1.0

WOOD/WEEDS/TOPSOIL

1.0 / 10.0

TAN/WHITE SILTY CLAY

10.0 / 15.0

BLACK SILTY SAND/SHELL

15.0 / 20.0

GRAY/GREEN CLAY SILT SAND/SHELL

12. REMARKS:

BENTONITE SEAL FROM 5.0 TO 8.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

SIGNATURE OF CERTIFIED WELL CONTRACTOR

08/29/11

DATE

MIKE MCCONAHEY

PRINTED NAME OF PERSON CONSTRUCTING THE WELL



Non RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) OBW-11

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/23/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE ° ' " DMS OR DD

LONGITUDE ° ' " DMS OR DD

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL N/A

Facility Name

Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()
Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 15.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING: Depth	Diameter	Thickness/Weight	Material
Top <u>0.0</u> Bottom <u>5.0</u> Ft.	<u>2 INCH</u>	<u>SCH 40</u>	<u>PVC</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>

8. GROUT: Depth	Material	Method
Top <u>0.0</u> Bottom <u>1.0</u> Ft.	<u>PORTLAND BENTONITE</u>	<u>SLURRY</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>

9. SCREEN: Depth	Diameter	Slot Size	Material
Top <u>5.0</u> Bottom <u>15.0</u> Ft.	<u>2.0 in.</u>	<u>.010 in.</u>	<u>PVC</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> in.</u>	<u> in.</u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> in.</u>	<u> in.</u>	<u> </u>

10. SAND/GRAVEL PACK: Depth	Size	Material
Top <u>3.0</u> Bottom <u>15.0</u> Ft.	<u>20-40</u>	<u>FINE SILICA SAND</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>

11. DRILLING LOG
Top Bottom Formation Description

0.0 / 1.0	WOOD/WEEDS/TOPSOIL
1.0 / 10.0	TAN/WHITE SILTY CLAY
10.0 / 15.0	BLACK SILTY SAND/SHELL

12. REMARKS:

BENTONITE SEAL FROM 1.0 TO 3.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR Mike McConahey DATE 08/29/11

MIKE MCCONAHEY
PRINTED NAME OF PERSON CONSTRUCTING THE WELL



Non RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) OBW-12

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/23/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE ° ' " DMS OR DD

LONGITUDE ° ' " DMS OR DD

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL

N/A

Facility Name

Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()
Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 20.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING: Depth	Diameter	Thickness/Weight	Material
Top <u>0.0</u> Bottom <u>10.0</u> Ft.	<u>2 INCH</u>	<u>SCH 40</u>	<u>PVC</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>

8. GROUT: Depth	Material	Method
Top <u>0.0</u> Bottom <u>5.0</u> Ft.	<u>PORTLAND BENTONITE</u>	<u>SLURRY</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>

9. SCREEN: Depth	Diameter	Slot Size	Material
Top <u>10.0</u> Bottom <u>20.0</u> Ft.	<u>2.0 in.</u>	<u>.010 in.</u>	<u>PVC</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>

10. SAND/GRAVEL PACK: Depth	Size	Material
Top <u>8.0</u> Bottom <u>20.0</u> Ft.	<u>20-40</u>	<u>FINE SILICA SAND</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>

11. DRILLING LOG	Formation Description
Top <u>0.0</u> Bottom <u>1.0</u>	<u>WOOD/WEEDS/TOPSOIL</u>
<u>1.0</u> / <u>10.0</u>	<u>TAN/WHITE SILTY CLAY</u>
<u>10.0</u> / <u>15.0</u>	<u>BLACK SILTY SAND/SHELL</u>
<u>15.0</u> / <u>20.0</u>	<u>GRAY/GREEN CLAY SILT SAND/SHELL</u>
/	
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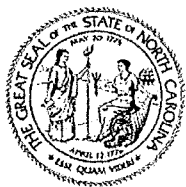
12. REMARKS:

BENTONITE SEAL FROM 5.0 TO 8.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR Mike McConahey 08/29/11
DATE

MIKE MCCONAHEY
PRINTED NAME OF PERSON CONSTRUCTING THE WELL



Non RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) OBW-14

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/24/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE ° ' " DMS OR DD

LONGITUDE ° ' " DMS OR DD

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL N/A

Facility Name

Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()

Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 20.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING: Depth Diameter Thickness/Weight Material

Top 0.0 Bottom 10.0 Ft. 2 INCH SCH 40 PVC

Top Bottom Ft.

Top Bottom Ft.

8. GROUT: Depth Material Method

Top 0.0 Bottom 5.0 Ft. PORTLAND BENTONITE SLURRY

Top Bottom Ft.

Top Bottom Ft.

9. SCREEN: Depth Diameter Slot Size Material

Top 10.0 Bottom 20.0 Ft. 2.0 in. .010 in. PVC

Top Bottom Ft.

Top Bottom Ft.

10. SAND/GRAVEL PACK:

Depth Size Material

Top 8.0 Bottom 20.0 Ft. 20-40 FINE SILICA SAND

Top Bottom Ft.

Top Bottom Ft.

11. DRILLING LOG

Top Bottom Formation Description

0.0 / 1.0 WOOD/WEEDS/TOPSOIL

1.0 / 10.0 TAN/WHITE SILTY CLAY

10.0 / 15.0 BLACK SILTY SAND/SHELL

15.0 / 20.0 GRAY/GREEN CLAY SILT SAND/SHELL

12. REMARKS:

BENTONITE SEAL FROM 5.0 TO 8.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

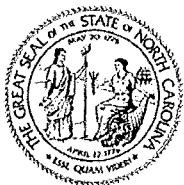
SIGNATURE OF CERTIFIED WELL CONTRACTOR

08/29/11

DATE

MIKE MCCONAHEY

PRINTED NAME OF PERSON CONSTRUCTING THE WELL



Non RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) OBW-15

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/24/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE ° ' " DMS OR DD

LONGITUDE ° ' " DMS OR DD

Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL

N/A

Facility Name

Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()
Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 20.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING:	Depth	Diameter	Thickness/ Weight	Material
Top <u>0.0</u>	Bottom <u>10.0</u>	Ft. <u>2 INCH</u>	<u>SCH 40</u>	<u>PVC</u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>	<u> </u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>	<u> </u>

8. GROUT:	Depth	Material	Method
Top <u>0.0</u>	Bottom <u>5.0</u>	Ft. <u>PORTLAND BENTONITE</u>	<u>SLURRY</u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>

9. SCREEN:	Depth	Diameter	Slot Size	Material
Top <u>10.0</u>	Bottom <u>20.0</u>	Ft. <u>2.0</u> in.	<u>.010</u> in.	<u>PVC</u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u> in.	<u> </u> in.	<u> </u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u> in.	<u> </u> in.	<u> </u>

10. SAND/GRAVEL PACK:	Depth	Size	Material
Top <u>8.0</u>	Bottom <u>20.0</u>	Ft. <u>20-40</u>	<u>FINE SILICA SAND</u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>

11. DRILLING LOG	Top	Bottom	Formation Description
<u>0.0</u>	<u>/</u>	<u>1.0</u>	<u>WOOD/WEEDS/TOPSOIL</u>
<u>1.0</u>	<u>/</u>	<u>10.0</u>	<u>TAN/WHITE SILTY CLAY</u>
<u>10.0</u>	<u>/</u>	<u>15.0</u>	<u>BLACK SILTY SAND/SHELL</u>
<u>15.0</u>	<u>/</u>	<u>20.0</u>	<u>GRAY/GREEN CLAY SILT SAND/SHELL</u>
<u> </u>	<u>/</u>	<u> </u>	<u> </u>
<u> </u>	<u>/</u>	<u> </u>	<u> </u>
<u> </u>	<u>/</u>	<u> </u>	<u> </u>
<u> </u>	<u>/</u>	<u> </u>	<u> </u>
<u> </u>	<u>/</u>	<u> </u>	<u> </u>
<u> </u>	<u>/</u>	<u> </u>	<u> </u>

12. REMARKS:

BENTONITE SEAL FROM 5.0 TO 8.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR Mike McConahey 08/29/11 DATE

MIKE MCCONAHEY
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Appendix D

Soil Test Results

Grain Size Analysis Testing



September 30, 2011

ERM NC, P.C.
800 Corporate Center Drive
Suite 200
Charlotte, North Carolina 28226

Attention: Mr. Dave Wasiela, PE

Reference: **SUMMARY OF LABORATORY TESTING SERVICES**
Maysville C&D Landfill
Maysville, North Carolina
ESP Project No. E4-XH01.302 (Report #2)

Dear Dave:

ESP Associates, P.A. (ESP) is providing laboratory testing services for the referenced project. Eight (8) bag samples were delivered to ESP's laboratory by you on September 1, 2011. ESP personnel performed Grain Size Distribution Analysis (ASTM D422) on the referenced samples. The results of the Grain Size Distribution tests performed are attached.

ESP appreciates the opportunity to assist you during this phase of the project. If you should have any questions concerning this report, or if we may be of further assistance, please contact us.

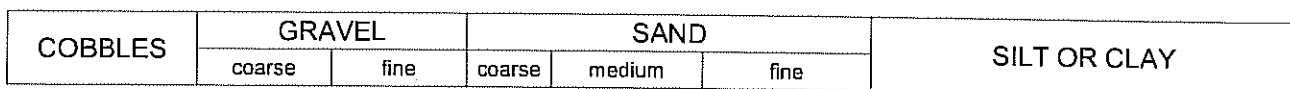
Sincerely,

ESP Associates, P.A.


Marty J. Smith, PE
Department Manager

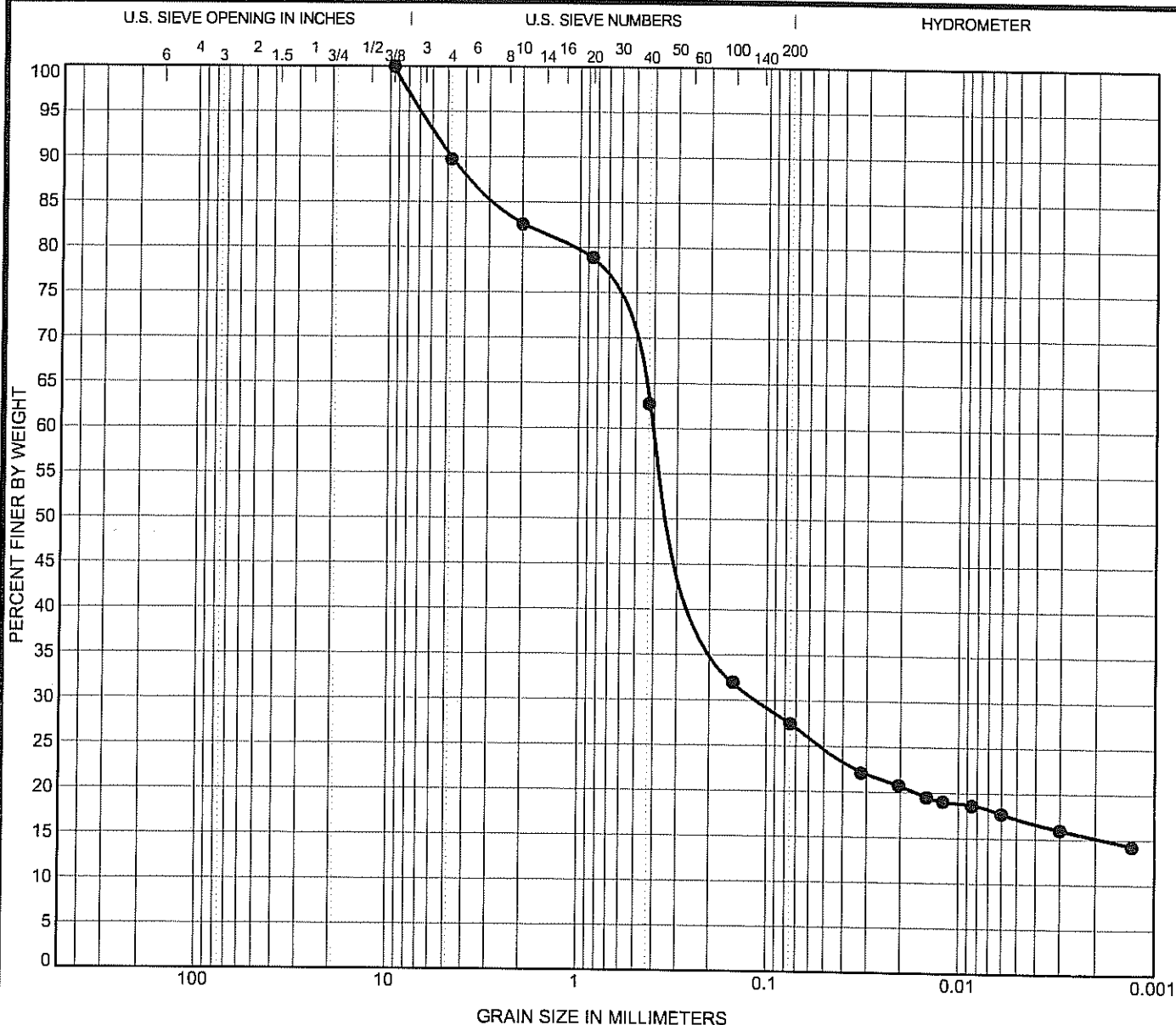
MJS/mb

Attachments: Grain Size Distribution (S-3 through S-10)



GRAIN SIZE DISTRIBUTION





COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification					LL	PL	PI	Cc	Cu
● S-4										
OWB-5 (9.5'-11')										

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● S-4	9.5	0.388	0.111		10.3	62.3	12.3	15.1



3475 Lakemont Boulevard
Fort Mill, South Carolina
Telephone: 803.802.2440
Fax: 803.802.2515

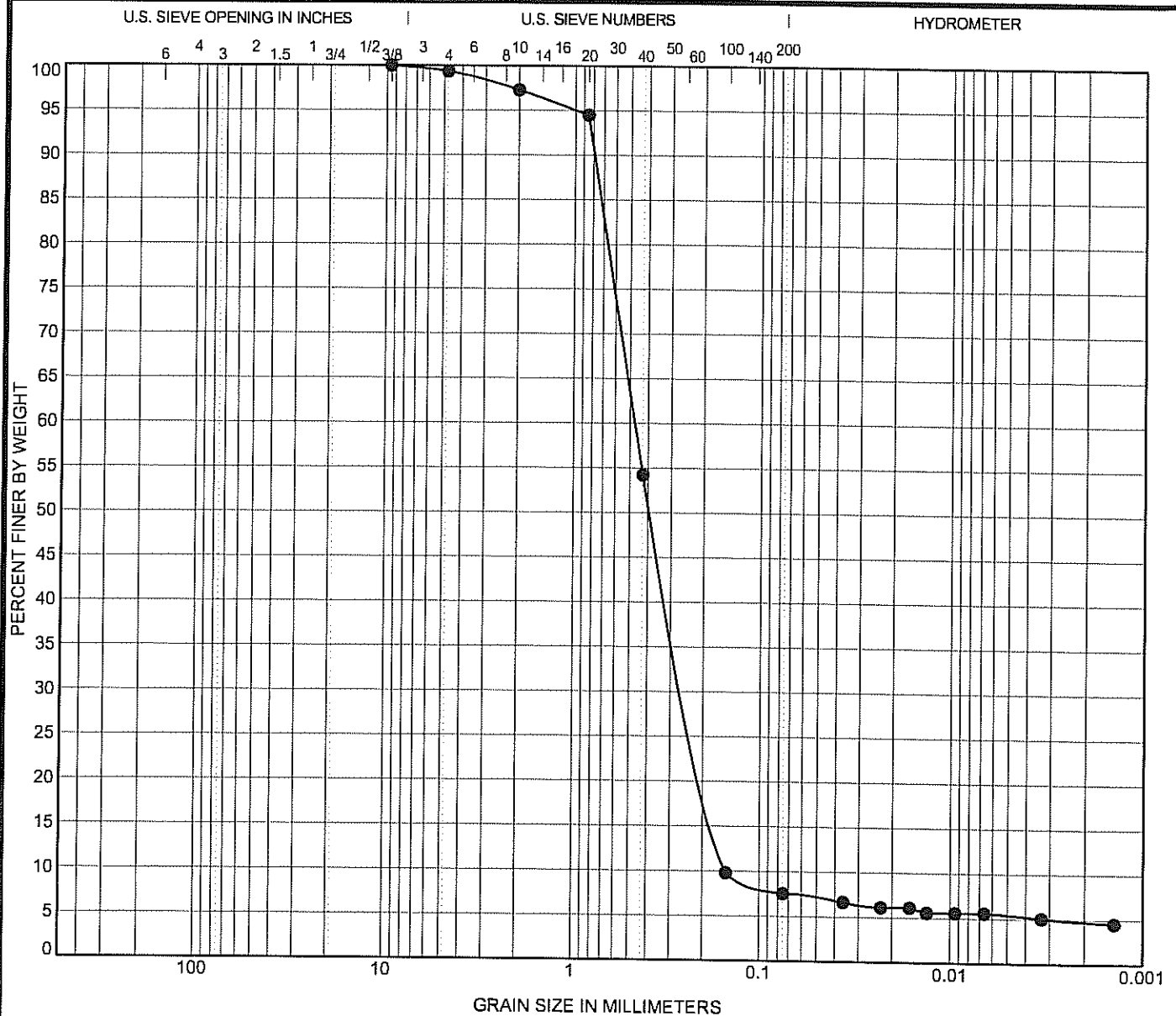
GRAIN SIZE DISTRIBUTION

Project: Mayesville C&D Landfill

Location: Mayesville, North Carolina

Number: XH01302

10022013 DIN20046 Page 147 of 627



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification					LL	PL	PI	Cc	Cu
●	S-5									0.82	3.12
	OWB-6 (14.5'-16')										
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay		
●	S-5	9.5	0.469	0.241	0.151	0.6	91.8	2.8	4.8		



3475 Lakemont Boulevard
Fort Mill, South Carolina
Telephone: 803.802.2440
Fax: 803.802.2515

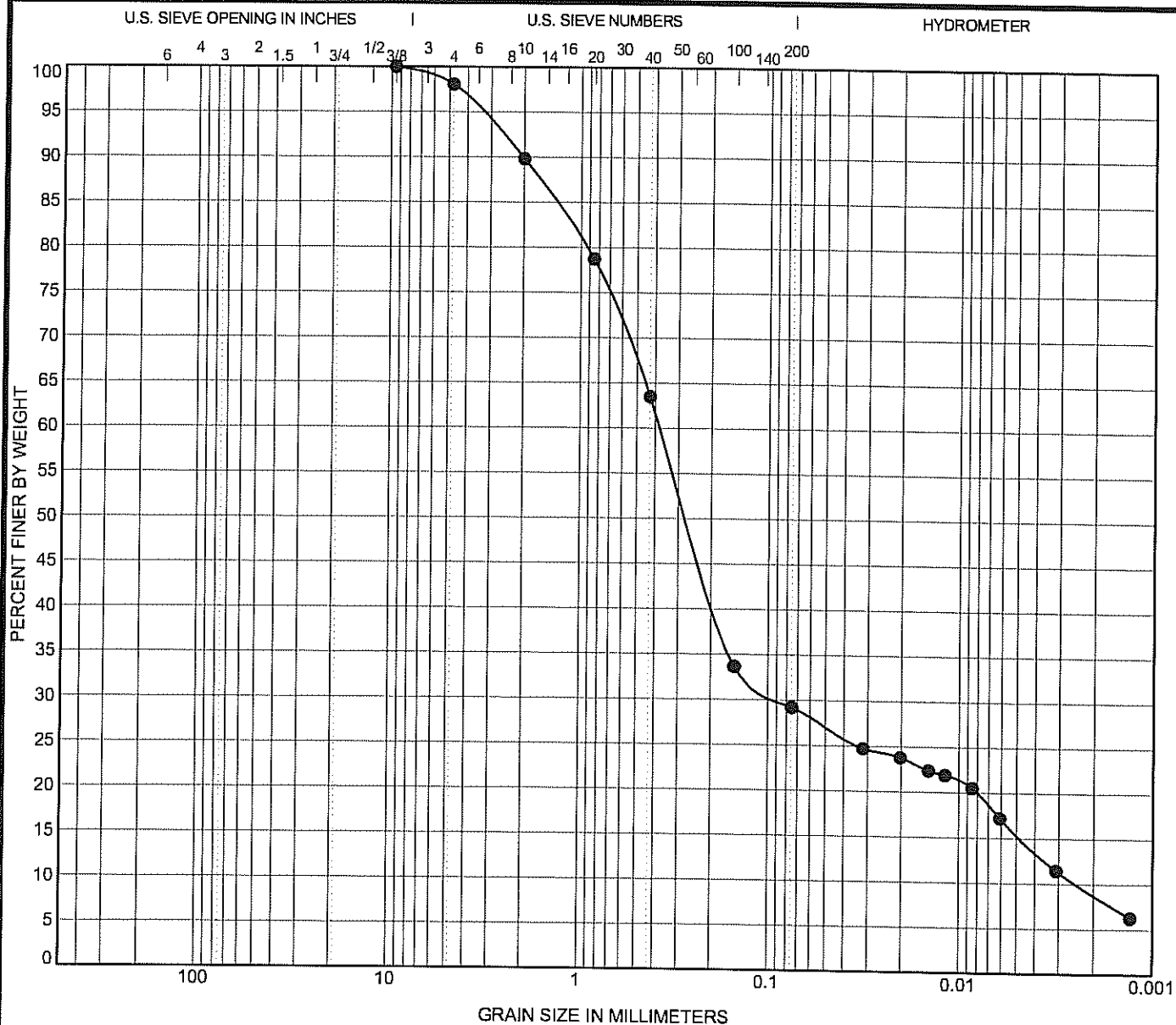
GRAIN SIZE DISTRIBUTION

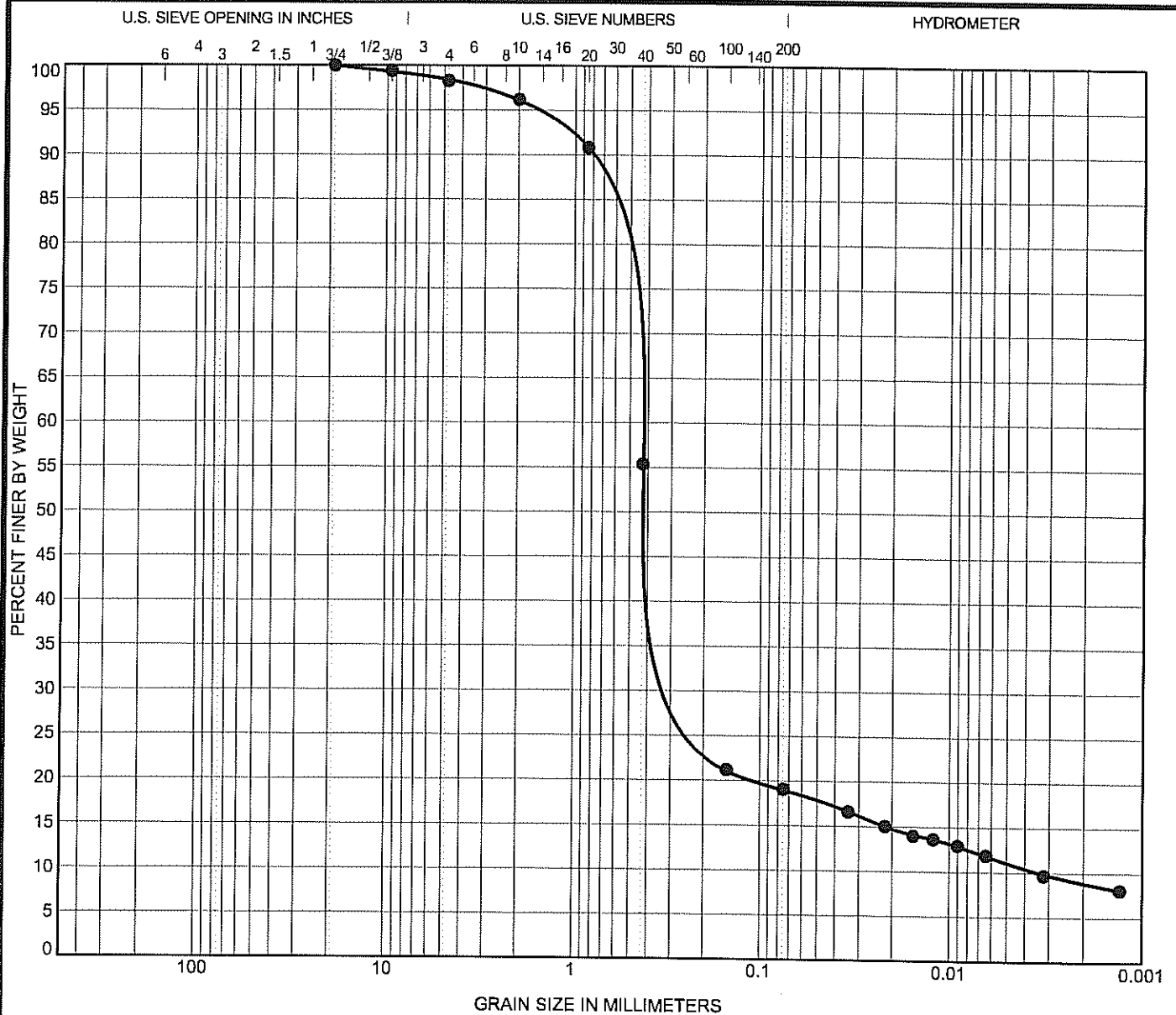
Project: Mayesville C&D Landfill

Location: Mayesville, North Carolina

Number: XH01.302

10/04/2013 DIN20046 Page 148 of 627





COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification					LL	PL	PI	Cc	Cu
● S-7									23.41	131.68
OWB-9 (14.5'-16')										

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● S-7	19	0.465	0.196	0.004	1.7	79.2	10.2	8.9



3475 Lakemont Boulevard
Fort Mill, South Carolina
Telephone: 803.802.2440
Fax: 803.802.2515

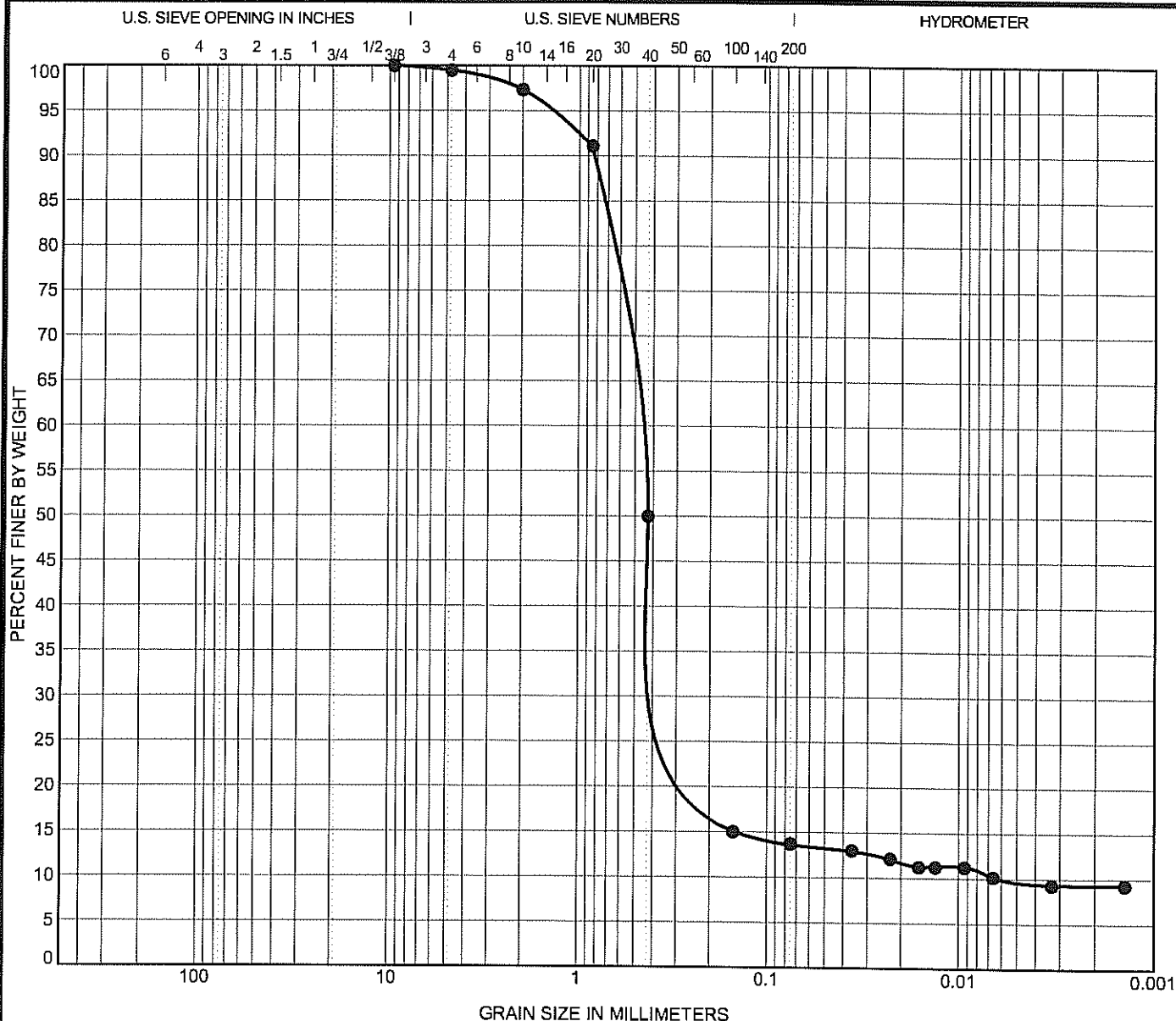
GRAIN SIZE DISTRIBUTION

Project: Mayesville C&D Landfill

Location: Mayesville, North Carolina

Number: XH01302

1002/2013 DIN20046 Page 150 of 627



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification					LL	PL	PI	Cc	Cu
● S-8									18.90	87.11
OWB-11 (14.5'-16')										

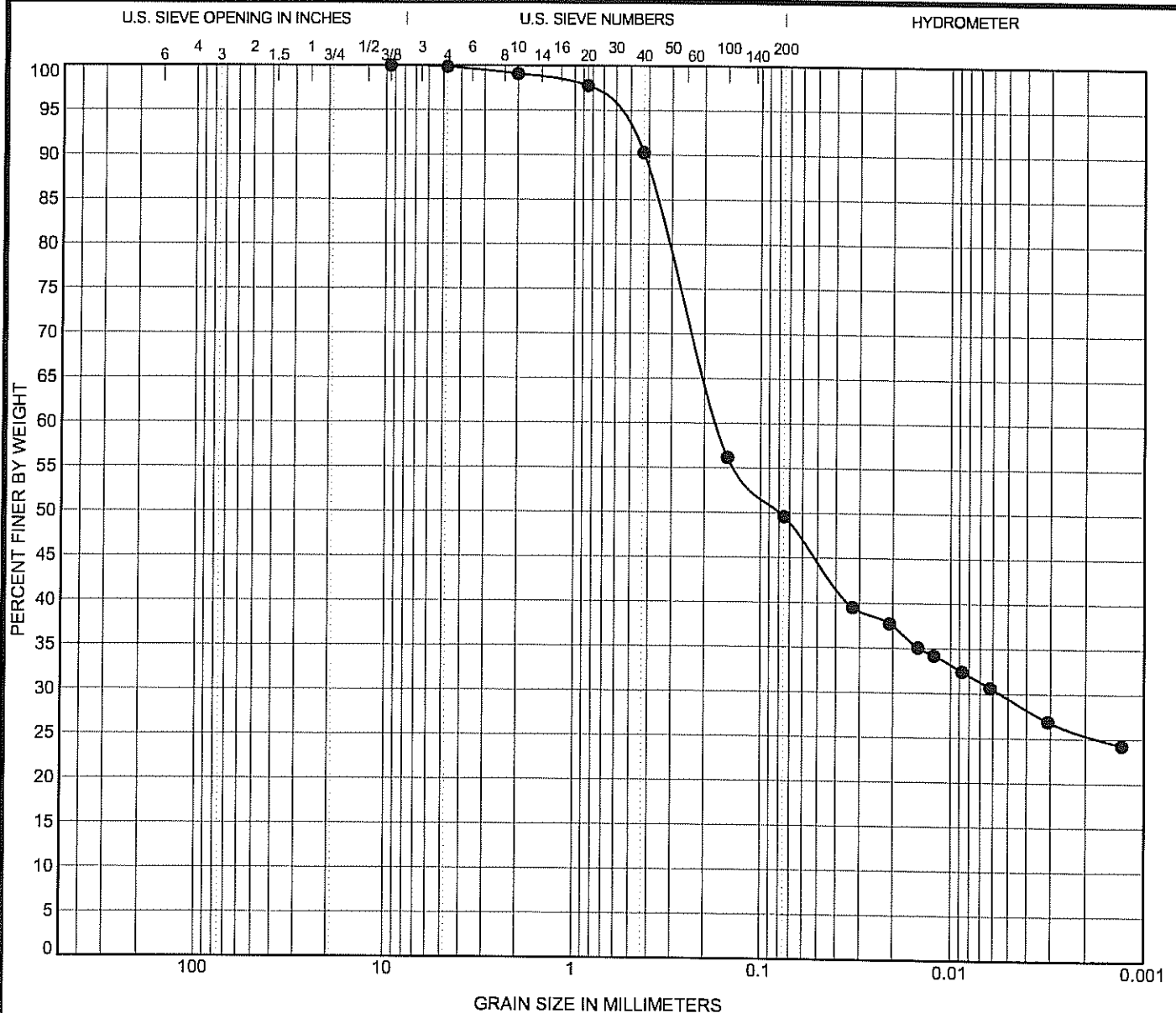
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● S-8	9.5	0.503	0.234	0.006	0.5	85.8	4.4	9.3



3475 Lakemont Boulevard
Fort Mill, South Carolina
Telephone: 803.802.2440
Fax: 803.802.2515

GRAIN SIZE DISTRIBUTION

Project: Mayesville C&D Landfill
Location: Mayesville, North Carolina
Number: XH01.302



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification					LL	PL	PI	Cc	Cu
●	S-9										
	OWB-14 (9.5'-11')										
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay		
●	S-9	9.5	0.169	0.005		0.1	50.3	24.0	25.6		



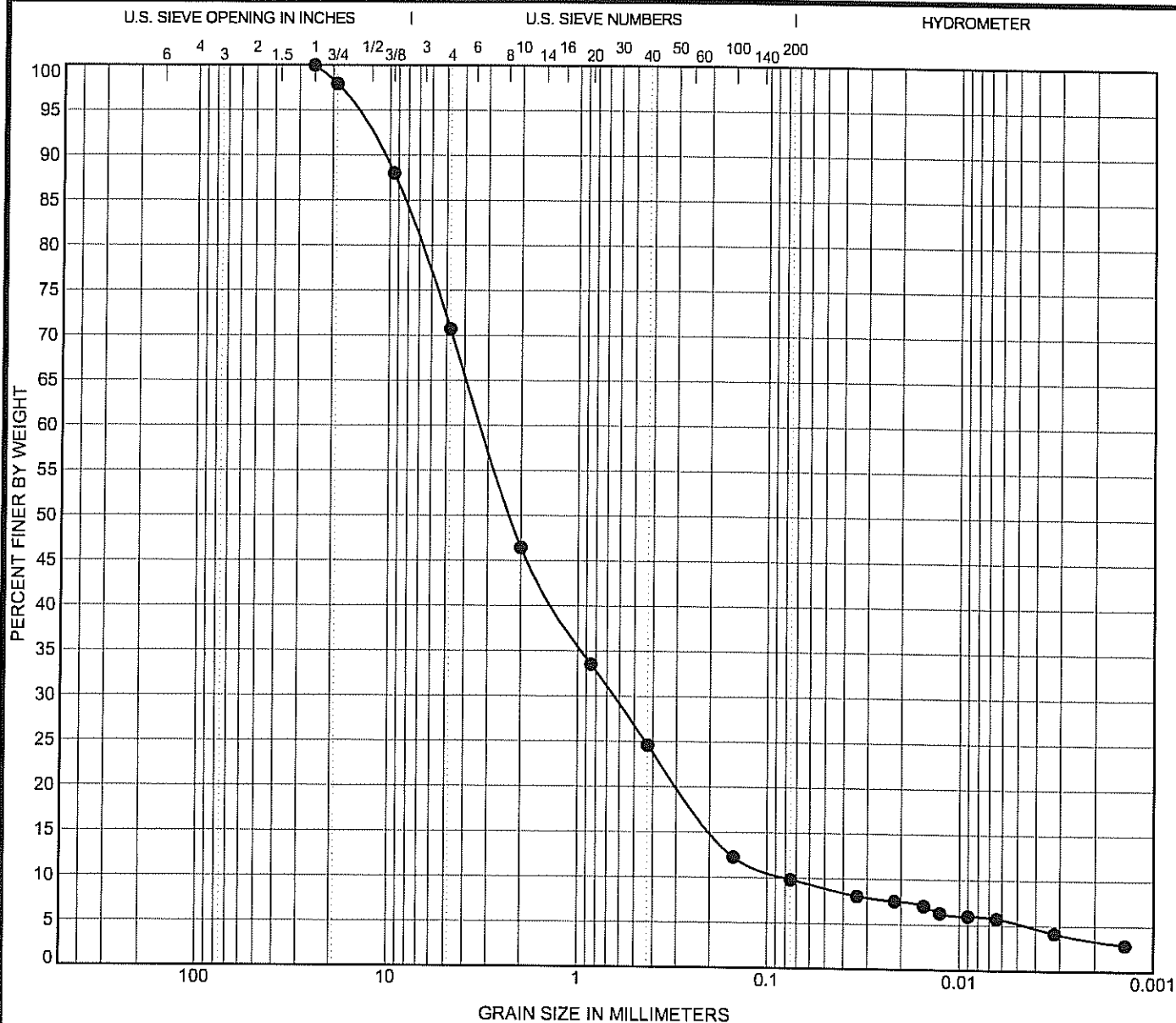
3475 Lakemont Boulevard
Fort Mill, South Carolina
Telephone: 803.802.2440
Fax: 803.802.2515

GRAIN SIZE DISTRIBUTION

Project: Mayesville C&D Landfill

Location: Mayesville, North Carolina

Number: XH01302



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification					LL	PL	PI	Cc	Cu
● S-10									1.64	41.28
OWB-15 (19.5'-21')										

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● S-10	25	3.242	0.646	0.079	29.3	60.9	6.4	3.4



3475 Lakemont Boulevard
Fort Mill, South Carolina
Telephone: 803.802.2440
Fax: 803.802.2515

GRAIN SIZE DISTRIBUTION

Project: Mayesville C&D Landfill

Location: Mayesville, North Carolina

Number: XH01.302

10/04/2013 DIN20046 Page 153 of 627

Laboratory Permeability Testing

ESP appreciates the opportunity to assist you during this phase of the project. If you should have any questions concerning this report, or if we may be of further assistance, please contact us.

Sincerely,

ESP Associates, P.A.



David C. Pelfrey, PE
Project Manager



Brian F. Welch, PE
Division Manager

DGP/BFW/mb

Attachments: Permeability Test Results (OWB-5 and OWB-7)

Project No:	XH01.302	Project Name:	Date:	9/13/2011
Lab No:	3618	Mayesville C&D Landfill	Tech:	T Summers
Sample No:	S-1			



General Sample Information

Sample Type:	Undisturbed
Liquid Limit:	N/A
Plastic Limit:	N/A
Plasticity Index:	N/A
Percent Fines:	N/A
Specific Gravity:	2.65 (assumed)

Sample Description:

Orange and Dark Gray Fine Sandy
Clayey SILT with rootlets
OWB-5 (2 to 4 feet)

Initial Specimen Data

Sample Length, L (in)	3.218
Sample Diameter (in)	2.871
Sample Area (in ²)	6.4738
Sample Volume (ft ³)	0.0121
Weight Sample (g)	630.27
Tare Weight (g)	51.39
Wet sample + tare (g)	121.21
Dry sample + tare (g)	107.37
Moisture content (%)	24.7
Wet density (pcf)	115.3
Dry density (pcf)	92.4
Saturation (%)	83.0

Final Specimen Data

Sample Length, L (in)	3.279
Sample Diameter (in)	2.834 (sample diameter adjusted for strain from removal)
Sample Area (in ²)	6.3080
Sample Volume (ft ³)	0.0120
Weight Sample (g)	662.23
Tare Weight (g)	86.53
Wet sample + tare (g)	748.56
Dry sample + tare (g)	604.07
Moisture content (%)	27.9
Wet density (pcf)	122.0
Dry density (pcf)	95.3
Saturation (%)	100.0

Test Parameters

Cell Pressure (psi)	73.0	Sample Length, L (cm)	8.330
Back Pressure (psi)	70.0	Sample Diameter (cm)	7.198
Eff. Consol. Stress (psi)	3.0	Sample Area (cm ²)	40.696
Permeant Liquid = De-aired water		Burette Area (cm ²)	0.2

Notes: 1 mL = 1 cm³

Test Time (sec)	Inflow Burette (Top)			Outflow Burette (Base)			Temp, °C	Cumulative Inflow (cm ³)	Cumulative Outflow (cm ³)	Ratio Out/In	Head at T ₁ , (cm)	Head at T ₂ , (cm)	Gradient, I = h/L	Temperature Correction, R _T	k (cm/s)
	Pressure (psi)	Initial Burette Reading, mL	Final Burette Reading, mL	Pressure (psi)	Initial Burette Reading, mL	Final Burette Reading, mL									
19	70.5	0.46	2.72	70.0	9.82	7.54	22.0	2.26	2.28	1.01	81.954	59.254	8.476	0.96	3.35E-04
22	70.5	2.72	4.54	70.0	7.54	5.76	22.0	1.82	1.78	0.98	59.254	41.254	6.033	0.96	3.23E-04
20	70.5	4.54	5.60	70.0	5.76	4.68	22.0	1.06	1.08	1.02	41.254	30.554	4.310	0.96	2.95E-04
20	70.5	5.60	6.34	70.0	4.68	3.92	22.0	0.74	0.76	1.03	30.554	23.054	3.218	0.96	2.77E-04
21	70.5	6.34	6.88	70.0	3.92	3.40	22.0	0.54	0.52	0.96	23.054	17.754	2.450	0.96	2.44E-04
20	70.5	6.88	7.22	70.0	3.40	3.04	22.0	0.34	0.36	1.06	17.754	14.254	1.921	0.96	2.16E-04

Comments: During sample extrusion visible seams were observed in sample.

Average k = 2.82E-04

Project No:	XH01.302	Project Name:	Date:	9/12/2011
Lab No:	3619	Mayesville C&D Landfill	Tech:	T Summers
Sample No:	S-2			



General Sample Information

Sample Type:	Undisturbed
Liquid Limit:	N/A
Plastic Limit:	N/A
Plasticity Index:	N/A
Percent Fines:	N/A
Specific Gravity:	2.65 (assumed)

Sample Description:

Orangeish Gray Silty CLAY
OWB-7 (4 to 6 feet)

Initial Specimen Data

Sample Length, L (in)	3.240
Sample Diameter (in)	2.799
Sample Area (in ²)	6.1546
Sample Volume (ft ³)	0.0115
Weight Sample (g)	637.69
Tare Weight (g)	50.19
Wet sample + tare (g)	208.85
Dry sample + tare (g)	187.91
Moisture content (%)	15.2
Wet density (pcf)	121.8
Dry density (pcf)	105.7
Saturation (%)	71.5

Final Specimen Data

Sample Length, L (in)	3.261
Sample Diameter (in)	2.880 (sample diameter adjusted for strain from removal)
Sample Area (in ²)	6.5144
Sample Volume (ft ³)	0.0123
Weight Sample (g)	663.14
Tare Weight (g)	80.12
Wet sample + tare (g)	741.53
Dry sample + tare (g)	593.35
Moisture content (%)	28.9
Wet density (pcf)	118.9
Dry density (pcf)	92.3
Saturation (%)	96.6

Test Parameters

Cell Pressure (psi)	73.0
Back Pressure (psi)	70.0
Eff. Consol. Stress (psi)	3.0
Permeant Liquid = De-aired water	

Sample Length, L (cm)	8.283
Sample Diameter (cm)	7.315
Sample Area (cm ²)	42.028
Burette Area (cm ²)	0.2

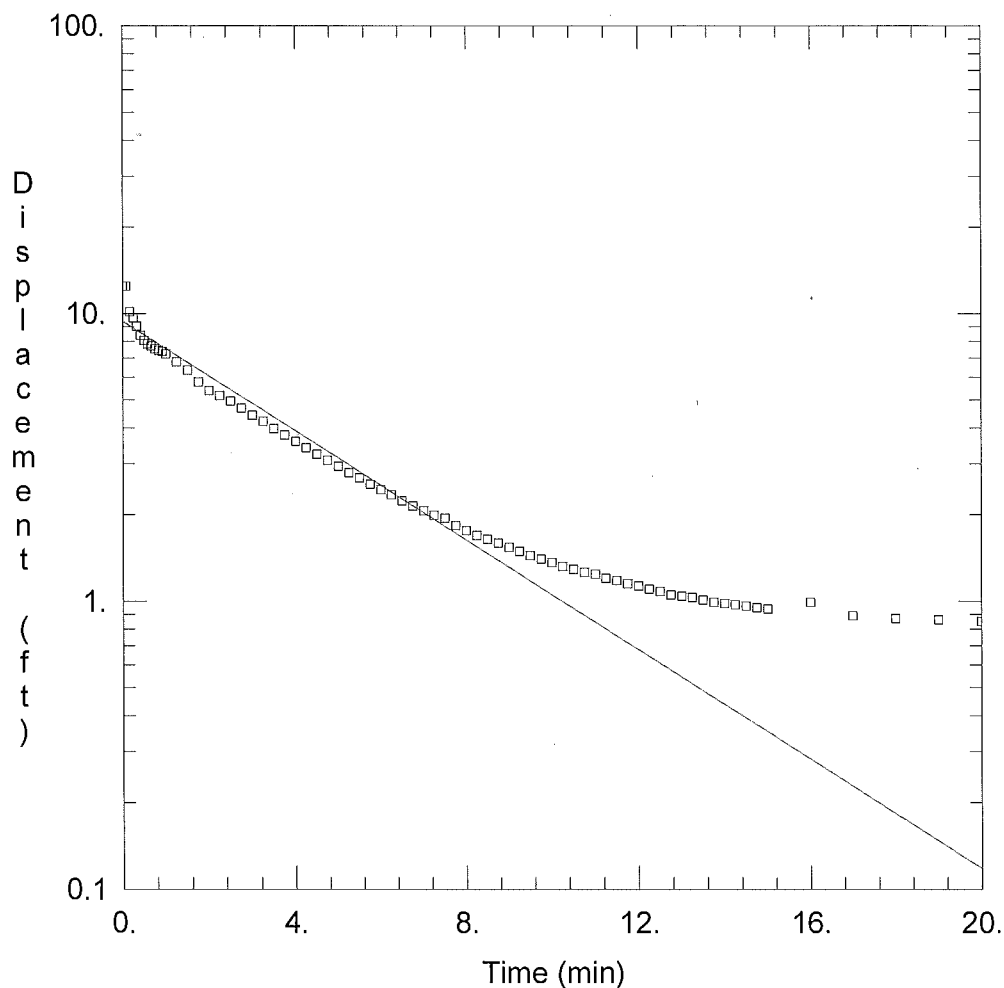
Notes: 1 mL = 1 cm³

Test Time (sec)	Inflow Burette (Top)			Outflow Burette (Base)			Temp, °C	Cumulative Inflow (cm ³)	Cumulative Outflow (cm ³)	Ratio Out/In	Head at T ₁ , (cm)	Head at T ₂ , (cm)	Gradient, I = h/L	Temperature Correction, R _T	k (cm/s)
	Pressure (psi)	Initial Burette Reading, mL	Final Burette Reading, mL	Pressure (psi)	Initial Burette Reading, mL	Final Burette Reading, mL									
372	71.5	0.36	1.26	70.0	10.00	9.20	22.0	0.90	0.80	0.89	153.662	145.162	18.039	0.96	2.89E-06
262	71.5	1.26	1.84	70.0	9.20	8.64	22.0	0.58	0.56	0.97	145.162	139.462	17.181	0.96	2.89E-06
300	71.5	1.84	2.46	70.0	8.64	8.04	22.0	0.62	0.60	0.97	139.462	133.362	16.469	0.96	2.82E-06
268	71.5	2.46	3.00	70.0	8.04	7.50	22.0	0.54	0.54	1.00	133.362	127.962	15.775	0.96	2.92E-06
308	71.5	3.00	3.60	70.0	7.50	6.94	22.0	0.60	0.56	0.93	127.962	122.162	15.099	0.96	2.85E-06
291	71.5	3.60	4.10	70.0	6.94	6.40	22.0	0.50	0.54	1.08	122.162	116.962	14.435	0.96	2.83E-06
301	71.5	4.10	4.62	70.0	6.40	5.90	22.0	0.52	0.50	0.96	116.962	111.862	13.813	0.96	2.80E-06
299	71.5	4.62	5.10	70.0	5.90	5.42	22.0	0.48	0.48	1.00	111.862	107.062	13.215	0.96	2.77E-06
674	71.5	5.10	6.06	70.0	5.42	4.46	22.0	0.96	0.96	1.00	107.062	97.462	12.346	0.96	2.64E-06

Comments:

Average k = 2.80E-06

Field Permeability Testing



OWB-14

Data Set: T:\...\OWB-14 (EH).agt
 Date: 10/17/11

Time: 10:16:53

PROJECT INFORMATION

Company: ERM
 Client: Morton Trucking
 Project: 0140408
 Location: Maysville, NC
 Test Well: OWB-14
 Test Date: 9-8-2011

AQUIFER DATA

Saturated Thickness: 28.14 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OWB-14)

Initial Displacement: 12.44 ft
 Total Well Penetration Depth: 13.14 ft
 Casing Radius: 0.083 ft

Static Water Column Height: 6.86 ft
 Screen Length: 10. ft
 Wellbore Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined
 K = 8.906E-5 cm/sec

Solution Method: Bouwer-Rice
 y0 = 9.397 ft

Data Set: T:\Projects A to M\Morton Trucking\Maysville\Site Suitability Study\Hydrogeologic Study\Monitor Well D
 Title: OWB-14
 Date: 10/17/11
 Time: 10:20:18

PROJECT INFORMATION

Company: ERM
 Client: Morton Trucking
 Project: 0140408
 Location: Maysville, NC
 Test Date: 9-8-2011
 Test Well: OWB-14

AQUIFER DATA

Saturated Thickness: 28.14 ft
 Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : OWB-14

X Location: 0. ft
 Y Location: 0. ft

Initial Displacement: 12.44 ft
 Static Water Column Height: 6.86 ft
 Casing Radius: 0.083 ft
 Wellbore Radius: 0.33 ft
 Well Skin Radius: 0.33 ft
 Screen Length: 10. ft
 Total Well Penetration Depth: 13.14 ft

No. of Observations: 73

Observation Data			
Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.08	12.44	7.5	1.94
0.17	10.14	7.75	1.83
0.25	9.67	8.	1.76
0.33	9.04	8.25	1.69
0.42	8.4	8.5	1.64
0.5	8.06	8.75	1.59
0.58	7.84	9.	1.54
0.66	7.72	9.25	1.49
0.75	7.54	9.5	1.44
0.83	7.45	9.75	1.4
0.92	7.39	10.	1.36
1.	7.24	10.25	1.32
1.25	6.79	10.5	1.29
1.5	6.35	10.75	1.26
1.75	5.77	11.	1.24
2.	5.39	11.25	1.2
2.25	5.17	11.5	1.18
2.5	4.96	11.75	1.15
2.75	4.68	12.	1.13
3.	4.43	12.25	1.1
3.25	4.22	12.5	1.08
3.5	3.98	12.75	1.05
3.75	3.78	13.	1.04
4.	3.59	13.25	1.03
4.25	3.41	13.5	1.01
4.5	3.24	13.75	0.99
4.75	3.09	14.	0.98
5.	2.94	14.25	0.97
5.25	2.79	14.5	0.96
5.5	2.68	14.75	0.95

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
5.75	2.55	15.	0.94
6.	2.44	16.	0.99
6.25	2.34	17.	0.89
6.5	2.23	18.	0.87
6.75	2.14	19.	0.86
7.	2.06	20.	0.85
7.25	1.99		

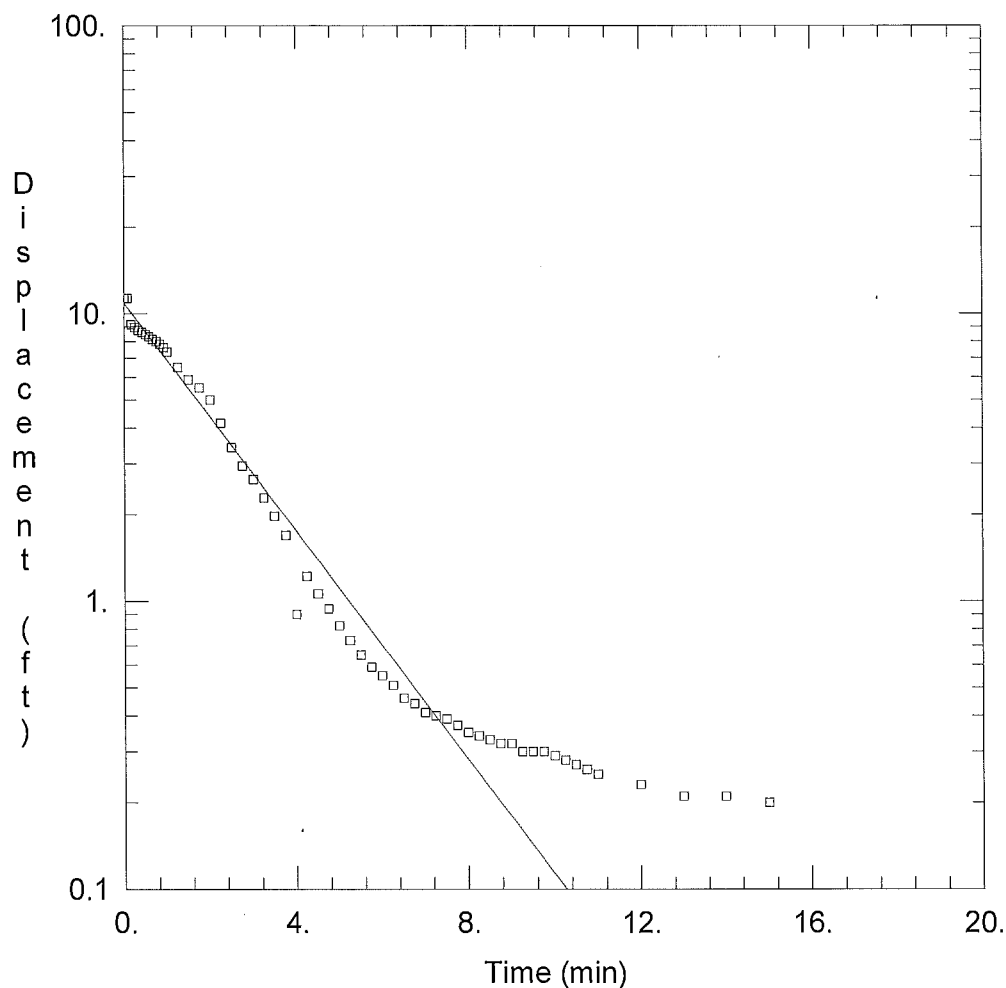
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.327

VISUAL ESTIMATION RESULTS

Estimated Parameters

<u>Parameter</u>	<u>Estimate</u>	
K	8.906E-5	cm/sec
y0	9.397	ft



OWB-15

Data Set: T:\...\OWB-15 (EH).aqt

Date: 10/17/11

Time: 10:17:02

PROJECT INFORMATION

Company: ERM

Client: Morton Trucking

Project: 0140408

Location: Maysville, NC

Test Well: OWB-15

Test Date: 9-8-2011

AQUIFER DATA

Saturated Thickness: 27.6 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OWB-15)

Initial Displacement: 11.3 ft

Static Water Column Height: 7.4 ft

Total Well Penetration Depth: 12.6 ft

Screen Length: 10. ft

Casing Radius: 0.083 ft

Wellbore Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

K = 0.0002722 cm/sec

y0 = 10.85 ft

Data Set: T:\Projects A to M\Morton Trucking\Maysville\Site Suitability Study\Hydrogeologic Study\Monitor Well D
 Title: OWB-15
 Date: 10/17/11
 Time: 10:16:11

PROJECT INFORMATION

Company: ERM
 Client: Morton Trucking
 Project: 0140408
 Location: Maysville, NC
 Test Date: 9-8-2011
 Test Well: OWB-15

AQUIFER DATA

Saturated Thickness: 27.6 ft
 Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : OWB-15

X Location: 0. ft
 Y Location: 0. ft

Initial Displacement: 11.3 ft
 Static Water Column Height: 7.4 ft
 Casing Radius: 0.083 ft
 Wellbore Radius: 0.33 ft
 Well Skin Radius: 0.33 ft
 Screen Length: 10. ft
 Total Well Penetration Depth: 12.6 ft

No. of Observations: 56

Observation Data			
Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.08	11.3	5.25	0.73
0.17	9.15	5.5	0.65
0.25	8.94	5.75	0.59
0.33	8.75	6.	0.55
0.42	8.6	6.25	0.51
0.5	8.45	6.5	0.46
0.58	8.3	6.75	0.44
0.66	8.14	7.	0.41
0.75	7.99	7.25	0.4
0.83	7.83	7.5	0.39
0.92	7.61	7.75	0.37
1.	7.35	8.	0.35
1.25	6.5	8.25	0.34
1.5	5.88	8.5	0.33
1.75	5.52	8.75	0.32
2.	5.	9.	0.32
2.25	4.15	9.25	0.3
2.5	3.42	9.5	0.3
2.75	2.95	9.75	0.3
3.	2.65	10.	0.29
3.25	2.28	10.25	0.28
3.5	1.97	10.5	0.27
3.75	1.69	10.75	0.26
4.	0.9	11.	0.25
4.25	1.22	12.	0.23
4.5	1.06	13.	0.21
4.75	0.94	14.	0.21
5.	0.82	15.	0.2

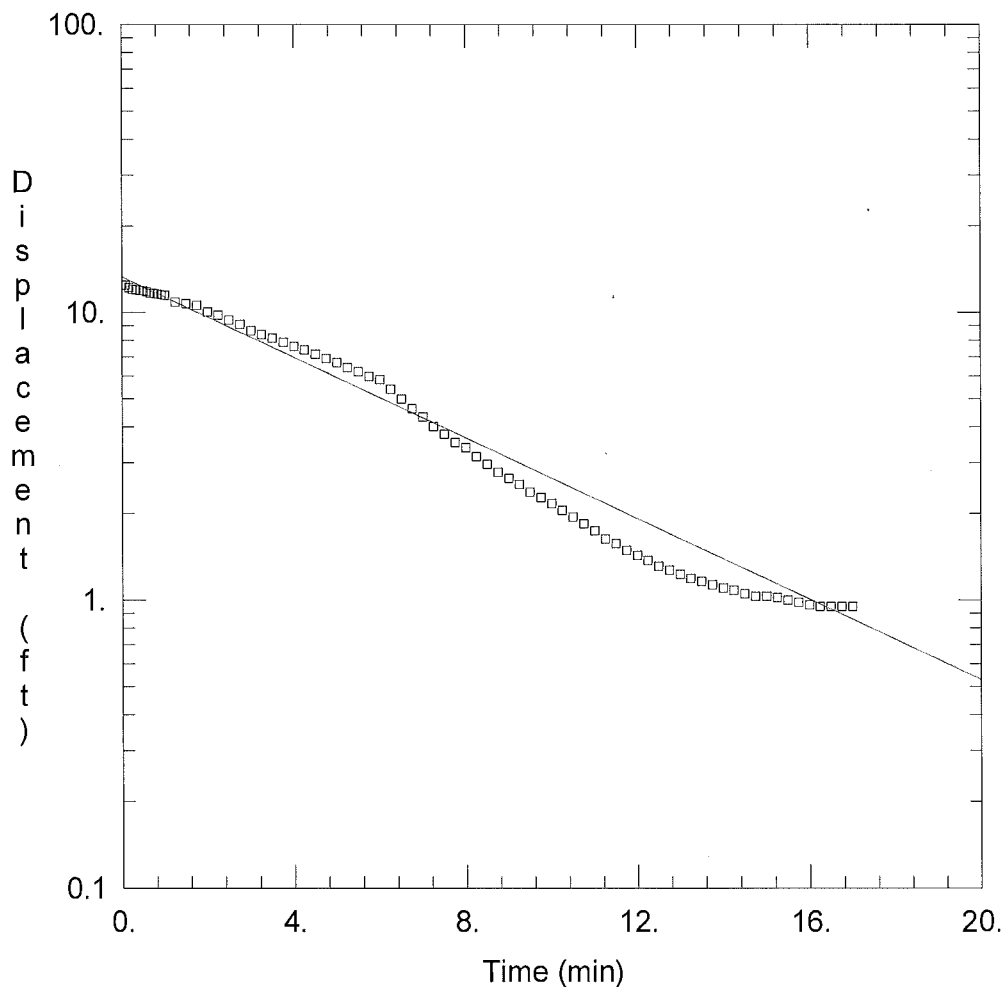
SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
Shape Factor: 3.412

VISUAL ESTIMATION RESULTS

Estimated Parameters

<u>Parameter</u>	<u>Estimate</u>	
K	0.0002722	cm/sec
y0	10.85	ft



OWB-12

Data Set: T:\...\OWB-12 (EH).aqt

Date: 10/17/11

Time: 10:15:47

PROJECT INFORMATION

Company: ERM

Client: Morton Trucking

Project: 0140408

Location: Maysville, NC

Test Well: OWB-12

Test Date: 9-8-2011

AQUIFER DATA

Saturated Thickness: 26.93 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OWB-12)

Initial Displacement: 12.45 ft

Static Water Column Height: 8.07 ft

Total Well Penetration Depth: 20. ft

Screen Length: 10. ft

Casing Radius: 0.083 ft

Wellbore Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

K = 9.619E-5 cm/sec

y0 = 13.3 ft

Data Set: T:\Projects A to M\Morton Trucking\Maysville\Site Suitability Study\Hydrogeologic Study\Monitor Well D
 Title: OWB-12
 Date: 10/17/11
 Time: 10:16:01

PROJECT INFORMATION

Company: ERM
 Client: Morton Trucking
 Project: 0140408
 Location: Maysville, NC
 Test Date: 9-8-2011
 Test Well: OWB-12

AQUIFER DATA

Saturated Thickness: 26.93 ft
 Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : OWB-12

X Location: 0. ft
 Y Location: 0. ft

Initial Displacement: 12.45 ft
 Static Water Column Height: 8.07 ft
 Casing Radius: 0.083 ft
 Wellbore Radius: 0.33 ft
 Well Skin Radius: 0.33 ft
 Screen Length: 10. ft
 Total Well Penetration Depth: 20. ft

No. of Observations: 76

Observation Data			
Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.08	12.45	7.75	3.53
0.17	12.18	8.	3.38
0.25	12.03	8.25	3.15
0.33	11.97	8.5	2.96
0.42	11.93	8.75	2.78
0.5	11.87	9.	2.65
0.58	11.78	9.25	2.52
0.66	11.68	9.5	2.37
0.75	11.63	9.75	2.27
0.83	11.58	10.	2.16
0.92	11.53	10.25	2.05
1.	11.48	10.5	1.94
1.25	10.87	10.75	1.84
1.5	10.74	11.	1.74
1.75	10.58	11.25	1.63
2.	10.03	11.5	1.57
2.25	9.79	11.75	1.49
2.5	9.41	12.	1.43
2.75	9.09	12.25	1.37
3.	8.63	12.5	1.31
3.25	8.37	12.75	1.27
3.5	8.13	13.	1.23
3.75	7.88	13.25	1.19
4.	7.62	13.5	1.16
4.25	7.41	13.75	1.13
4.5	7.14	14.	1.1
4.75	6.91	14.25	1.08
5.	6.69	14.5	1.05
5.25	6.43	14.75	1.03
5.5	6.22	15.	1.03

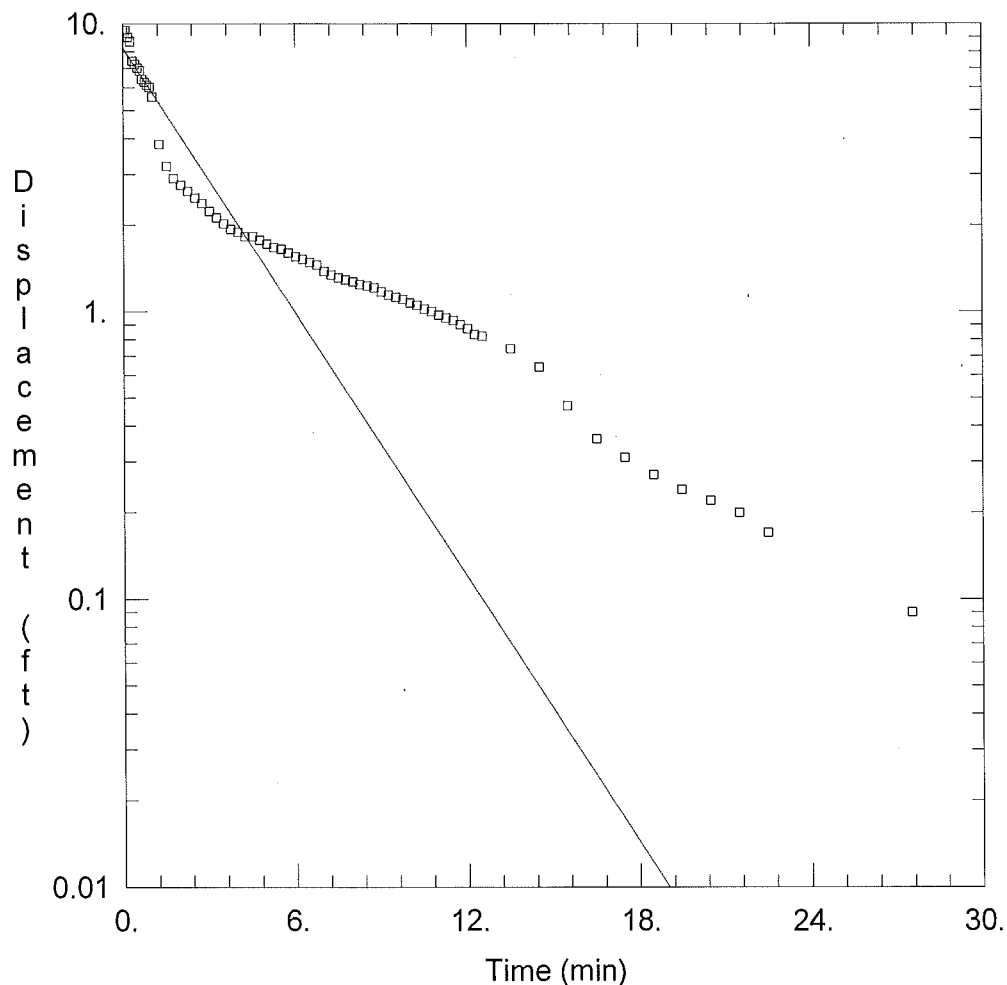
<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
5.75	5.98	15.25	1.02
6.	5.84	15.5	1.
6.25	5.41	15.75	0.98
6.5	4.99	16.	0.96
6.75	4.62	16.25	0.95
7.	4.33	16.5	0.95
7.25	4.01	16.75	0.95
7.5	3.77	17.	0.95

SOLUTION

Aquifer Model: Unconfined
 Solution Method: Hvorslev
 Shape Factor: 3.412

VISUAL ESTIMATION RESULTSEstimated Parameters

<u>Parameter</u>	<u>Estimate</u>	
K	9.619E-5	cm/sec
y0	13.3	ft



OWB-9

Data Set: T:\...\OWB-9 (EH).aqt

Date: 10/17/11

Time: 10:16:41

PROJECT INFORMATION

Company: ERM

Client: Morton Trucking

Project: 0140408

Location: Maysville, NC

Test Well: OWB-9

Test Date: 9-8-2011

AQUIFER DATA

Saturated Thickness: 29.42 ft

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (OWB-9)

Initial Displacement: 9.46 ft

Static Water Column Height: 5.58 ft

Total Well Penetration Depth: 9.46 ft

Screen Length: 10. ft

Casing Radius: 0.083 ft

Wellbore Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 0.0002107$ cm/sec

$y_0 = 8.224$ ft

Data Set: T:\Projects A to M\Morton Trucking\Maysville\Site Suitability Study\Hydrogeologic Study\Monitor Well D
 Title: OWB-9
 Date: 10/17/11
 Time: 10:15:39

PROJECT INFORMATION

Company: ERM
 Client: Morton Trucking
 Project: 0140408
 Location: Maysville, NC
 Test Date: 9-8-2011
 Test Well: OWB-9

AQUIFER DATA

Saturated Thickness: 29.42 ft
 Anisotropy Ratio (K_z/K_r): 1.

SLUG TEST WELL DATA

Test Well: : OWB-9

X Location: 0. ft
 Y Location: 0. ft

Initial Displacement: 9.46 ft
 Static Water Column Height: 5.58 ft
 Casing Radius: 0.083 ft
 Wellbore Radius: 0.33 ft
 Well Skin Radius: 0.33 ft
 Screen Length: 10. ft
 Total Well Penetration Depth: 9.46 ft

No. of Observations: 69

Observation Data			
Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.08	9.46	7.	1.38
0.17	8.98	7.25	1.34
0.25	8.65	7.5	1.31
0.33	7.42	7.75	1.29
0.42	7.23	8.	1.27
0.5	7.02	8.25	1.24
0.58	6.87	8.5	1.23
0.66	6.42	8.75	1.21
0.75	6.27	9.	1.17
0.83	6.12	9.25	1.14
0.92	6.02	9.5	1.12
1.	5.57	9.75	1.1
1.25	3.82	10.	1.07
1.5	3.2	10.25	1.05
1.75	2.9	10.5	1.02
2.	2.75	10.75	1.
2.25	2.62	11.	0.97
2.5	2.48	11.25	0.95
2.75	2.38	11.5	0.93
3.	2.23	11.75	0.9
3.25	2.12	12.	0.87
3.5	2.02	12.25	0.83
3.75	1.93	12.5	0.82
4.	1.89	13.5	0.74
4.25	1.82	14.5	0.64
4.5	1.82	15.5	0.47
4.75	1.77	16.5	0.36
5.	1.72	17.5	0.31
5.25	1.67	18.5	0.27
5.5	1.65	19.5	0.24

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
5.75	1.6	20.5	0.22
6.	1.55	21.5	0.2
6.25	1.52	22.5	0.17
6.5	1.48	27.5	0.09
6.75	1.45		

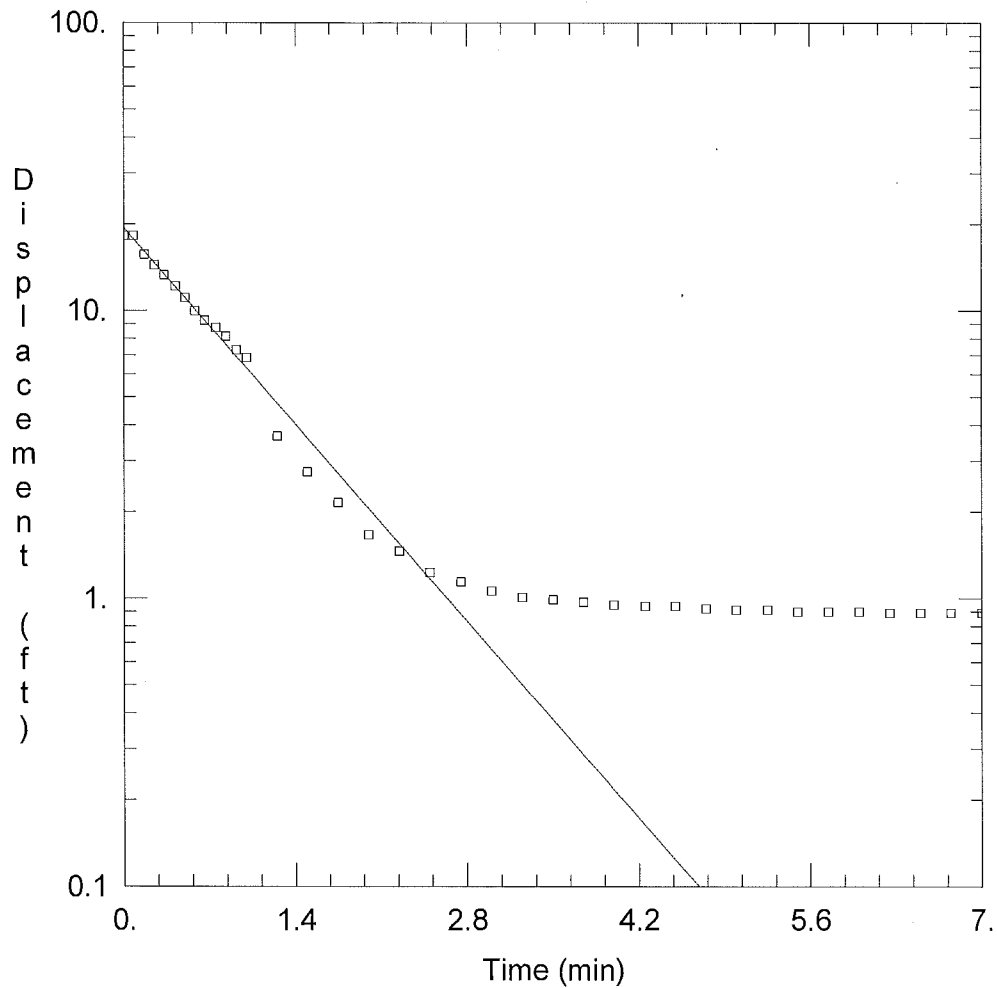
SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
Shape Factor: 3.412

VISUAL ESTIMATION RESULTS

Estimated Parameters

<u>Parameter</u>	<u>Estimate</u>	
K	0.0002107	cm/sec
y0	8.224	ft



OWB-7

Data Set: T:\...\OWB-7 (EH).aqt

Date: 10/17/11

Time: 10:16:31

PROJECT INFORMATION

Company: ERM

Client: Morton Trucking Maysville

Project: 0140408

Location: Maysville, NC

Test Well: OWB-7

Test Date: 9-8-2011

AQUIFER DATA

Saturated Thickness: 27.31 ft

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (OWB 7)

Initial Displacement: 18.24 ft

Static Water Column Height: 7.69 ft

Total Well Penetration Depth: 26.31 ft

Screen Length: 10. ft

Casing Radius: 0.083 ft

Wellbore Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 0.0006708$ cm/sec

$y_0 = 19.43$ ft

10/04/2013 DIN20046 Page 172 of 627

Data Set: T:\Projects A to M\Morton Trucking\Maysville\Site Suitability Study\Hydrogeologic Study\Monitor Well D
 Title: OWB-7
 Date: 10/17/11
 Time: 10:15:26

PROJECT INFORMATION

Company: ERM
 Client: Morton Trucking Maysville
 Project: 0140408
 Location: Maysville, NC
 Test Date: 9-8-2011
 Test Well: OWB-7

AQUIFER DATA

Saturated Thickness: 27.31 ft
 Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : OWB 7

X Location: 0. ft
 Y Location: 0. ft

Initial Displacement: 18.24 ft
 Static Water Column Height: 7.69 ft
 Casing Radius: 0.083 ft
 Wellbore Radius: 0.33 ft
 Well Skin Radius: 0.33 ft
 Screen Length: 10. ft
 Total Well Penetration Depth: 26.31 ft

No. of Observations: 36

Observation Data			
Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.08	18.24	2.75	1.14
0.17	15.67	3.	1.06
0.25	14.41	3.25	1.01
0.33	13.29	3.5	0.99
0.42	12.16	3.75	0.97
0.5	11.1	4.	0.95
0.58	9.96	4.25	0.94
0.66	9.26	4.5	0.94
0.75	8.71	4.75	0.92
0.83	8.14	5.	0.91
0.92	7.29	5.25	0.91
1.	6.86	5.5	0.9
1.25	3.66	5.75	0.9
1.5	2.75	6.	0.9
1.75	2.15	6.25	0.89
2.	1.66	6.5	0.89
2.25	1.46	6.75	0.89
2.5	1.23	7.	0.89

SOLUTION

Aquifer Model: Unconfined
 Solution Method: Hvorslev
 Shape Factor: 3.412

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate
-----------	----------

**Morton Trucking C& D Landfill Maysville
Slug Test Data Summary**

Input Parameters

Well	OWB-7
Well Depth (ft)	34
Effective Well Radius (ft)	0.333
Casing Radius (ft)	0.083
Screen Length (ft)	10
Aquifer Thickness (ft)	35
Depth to top of Screen (ft)	24
Initial DTW (ft)	7.69
Initial Displacement	21.67

Test Wells

OWB-9
20
0.333
0.083
10
35
10
5.58
9.05

OWB-12
20
0.333
0.083
10
35
10
8.07
11.66

OWB-14
20
0.333
0.083
10
35
10
6.86
12.67

OWB-15
20
0.333
0.083
10
35
10
7.4
12.24

Observations

Time/Min	Displacement	Time/Min	Displacement	Time/Min	Displacement	Time/Min	Displacement	Time/Min	Displacement
0	21.67	0	9.05	0	11.66	0	12.67	0	12.24
0.08	17.24	0.08	8.46	0.08	11.45	0.08	11.44	0.08	11.30
0.17	14.67	0.17	7.98	0.17	11.18	0.17	9.14	0.17	9.15
0.25	13.41	0.25	7.65	0.25	11.03	0.25	8.67	0.25	8.94
0.33	12.29	0.33	6.42	0.33	10.97	0.33	8.04	0.33	8.75
0.42	11.16	0.42	6.23	0.42	10.93	0.42	7.40	0.42	8.60
0.5	10.10	0.5	6.02	0.5	10.87	0.5	7.06	0.5	8.45
0.58	8.96	0.58	5.87	0.58	10.78	0.58	6.84	0.58	8.30
0.66	8.26	0.66	5.42	0.66	10.68	0.66	6.72	0.66	8.14
0.75	7.71	0.75	5.27	0.75	10.63	0.75	6.54	0.75	7.99
0.83	7.14	0.83	5.12	0.83	10.58	0.83	6.45	0.83	7.83
0.92	6.29	0.92	5.02	0.92	10.53	0.92	6.39	0.92	7.61
1	5.86	1	4.57	1	10.48	1	6.24	1	7.35
1.25	2.66	1.25	2.82	1.25	9.87	1.25	5.79	1.25	6.50
1.5	1.75	1.5	2.20	1.5	9.74	1.5	5.35	1.5	5.88
1.75	1.15	1.75	1.90	1.75	9.58	1.75	4.77	1.75	5.52
2	0.66	2	1.75	2	9.03	2	4.39	2	5.00
2.25	0.46	2.25	1.62	2.25	8.79	2.25	4.17	2.25	4.15
2.5	0.23	2.5	1.48	2.5	8.41	2.5	3.96	2.5	3.42
2.75	0.14	2.75	1.38	2.75	8.09	2.75	3.68	2.75	2.95
3	0.06	3	1.23	3	7.63	3	3.43	3	2.65
3.25	0.01	3.25	1.12	3.25	7.37	3.25	3.22	3.25	2.28
3.5	-0.01	3.5	1.02	3.5	7.13	3.5	2.98	3.5	1.97
3.75	-0.03	3.75	0.93	3.75	6.88	3.75	2.78	3.75	1.69
4	-0.05	4	0.89	4	6.62	4	2.59	4	0.90
4.25	-0.06	4.25	0.82	4.25	6.41	4.25	2.41	4.25	1.22
4.5	-0.06	4.5	0.82	4.5	6.14	4.5	2.24	4.5	1.06
4.75	-0.08	4.75	0.77	4.75	5.91	4.75	2.09	4.75	0.94
5	-0.09	5	0.72	5	5.69	5	1.94	5	0.82
5.25	-0.09	5.25	0.67	5.25	5.43	5.25	1.79	5.25	0.73
5.5	-0.10	5.5	0.65	5.5	5.22	5.5	1.68	5.5	0.65
5.75	-0.10	5.75	0.60	5.75	4.98	5.75	1.55	5.75	0.59
6	-0.10	6	0.55	6	4.84	6	1.44	6	0.55
6.25	-0.11	6.25	0.52	6.25	4.41	6.25	1.34	6.25	0.51
6.5	-0.11	6.5	0.48	6.5	3.99	6.5	1.23	6.5	0.46

**Morton Trucking C& D Landfill Maysville
Slug Test Data Summary**

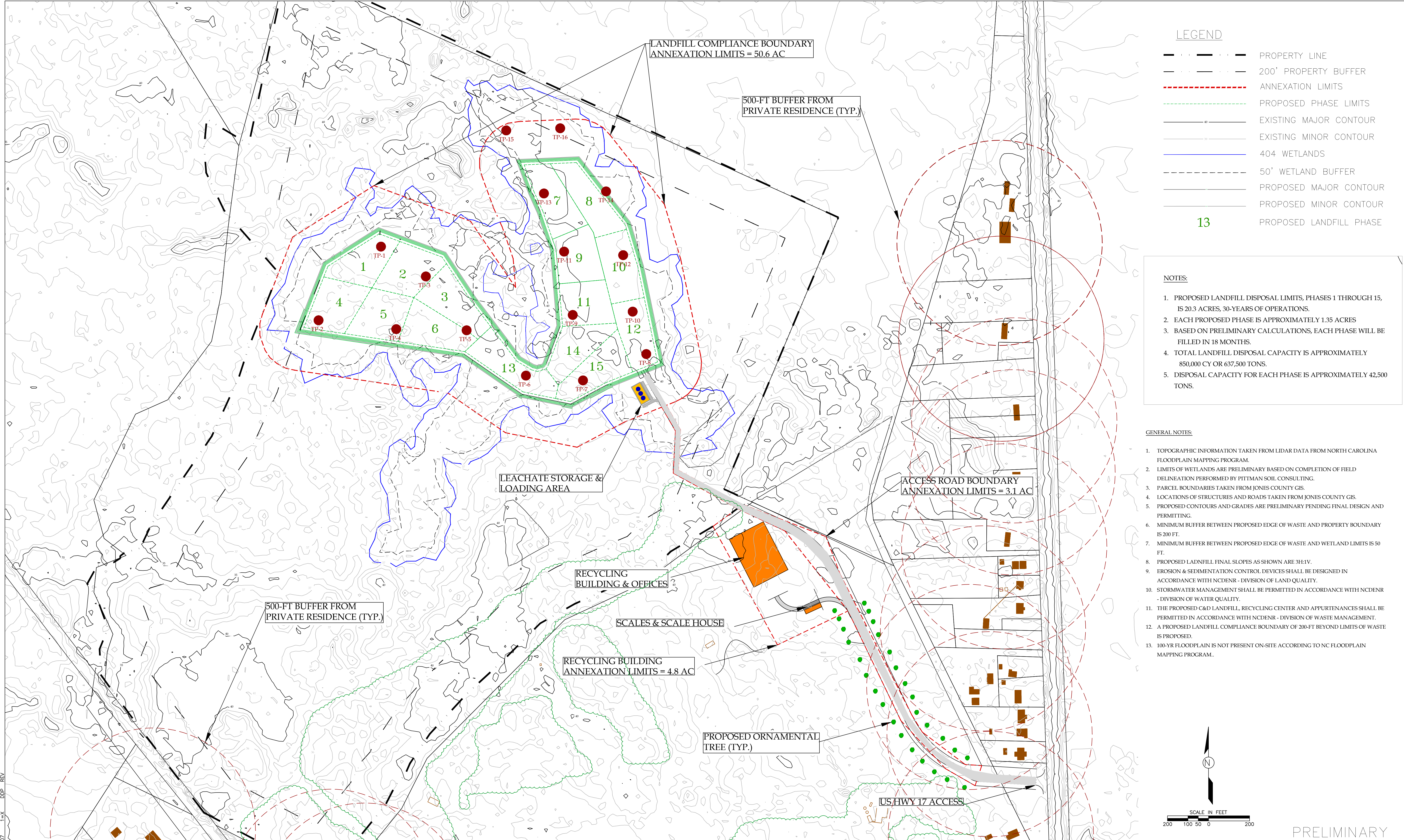
Input Parameters

Test Wells

Well		OWB-7		OWB-9		OWB-12		OWB-14		OWB-15	
Observations	6.75	-0.11	6.75	0.45	6.75	3.62	6.75	1.14	6.75	0.44	
	7	-0.11	7	0.38	7	3.33	7	1.06	7	0.41	
			7.25	0.34	7.25	3.01	7.25	0.99	7.25	0.40	
			7.5	0.31	7.5	2.77	7.5	0.94	7.5	0.39	
			7.75	0.29	7.75	2.53	7.75	0.83	7.75	0.37	
			8	0.27	8	2.38	8	0.76	8	0.35	
			8.25	0.24	8.25	2.15	8.25	0.69	8.25	0.34	
			8.5	0.23	8.5	1.96	8.5	0.64	8.5	0.33	
			8.75	0.21	8.75	1.78	8.75	0.59	8.75	0.32	
			9	0.17	9	1.65	9	0.54	9	0.32	
			9.25	0.14	9.25	1.52	9.25	0.49	9.25	0.30	
			9.5	0.12	9.5	1.37	9.5	0.44	9.5	0.30	
			9.75	0.10	9.75	1.27	9.75	0.40	9.75	0.30	
			10	0.07	10	1.16	10	0.36	10	0.29	
			10.25	0.05	10.25	1.05	10.25	0.32	10.25	0.28	
			10.5	0.02	10.5	0.94	10.5	0.29	10.5	0.27	
			10.75	0.00	10.75	0.84	10.75	0.26	10.75	0.26	
			11	-0.03	11	0.74	11	0.24	11	0.25	
			11.25	-0.05	11.25	0.63	11.25	0.20	12	0.23	
			11.5	-0.07	11.5	0.57	11.5	0.18	13	0.21	
			11.75	-0.10	11.75	0.49	11.75	0.15	14	0.21	
			12	-0.13	12	0.43	12	0.13	15	0.20	
			12.25	-0.17	12.25	0.37	12.25	0.10			
			12.5	-0.18	12.5	0.31	12.5	0.08			
			13.5	-0.26	12.75	0.27	12.75	0.05			
			14.5	-0.36	13	0.23	13	0.04			
			15.5	-0.53	13.25	0.19	13.25	0.03			
			16.5	-0.64	13.5	0.16	13.5	0.01			
			17.5	-0.69	13.75	0.13	13.75	-0.01			
			18.5	-0.73	14	0.10	14	-0.02			
			19.5	-0.76	14.25	0.08	14.25	-0.03			
			20.5	-0.78	14.5	0.05	14.5	-0.04			
		21.5	-0.80	14.75	0.03	14.75	-0.05				
		22.5	-0.83	15	0.03	15	-0.06				
		27.5	-0.91	15.25	0.02	16	-0.01				
				15.5	0.00	17	-0.11				
				15.75	-0.02	18	-0.13				
				16	-0.04	19	-0.14				
				16.25	-0.05	20	-0.15				
				16.5	-0.05						
				16.75	-0.05						
				17	-0.05						

Appendix E

Preliminary Subsurface Test Pits



NO.	DATE	APPR.	NO.	DATE	APPR.	REVISION

MAYSVILLE C&D RECYCLING CENTER
MAYSVILLE, NORTH CAROLINA

ERM NC, INC.
8000 Corporate Center Drive, Suite 200
Charlotte, NC 28226
(704) 541-8345

LICENSE #C-2206
ERM NC, INC.
8000 CORPORATE CENTER DRIVE, SUITE 200
CHARLOTTE, NORTH CAROLINA 28226
(704) 541-8345

CHECKED	DATE
PROJECT DESIGNER C. MATTINGLY	2/14/11
PROJECT ENGINEER D. WASIELA	
PROJECT MANAGER D. WASIELA	
APPROVED	
APPROVED	

DRAWN CJM	DATE 2/14/11	CLIENT APPROVAL
SCALE AS NOTED	W.O. NO. 0120968	ISSUED FOR

TEST PIT LOCATION PLAN
MAYSVILLE C&D LANDFILL

1

0

1 OF 16

MAYSVILLE C&D LANDFILL
PRELIMINARY SUBSURFACE TEST PITS
MARCH 25, 2011

*Test pits were performed and recorded by Pittman Soil Consulting on 3/25/11
 by Mr. Haywood Pittman, NC Licensed Soil Scientist
 Test pits remained open for a 24-hour period to record depth to ground water*

Test Pit #	Elevation (MSL)	Depth to Ground Water (ft)	Ground Water Elevation (MSL)
TP-1	39.8	4.3	35.5
TP-2	37.2	4.5	32.7
TP-3	39.4	4.6	34.8
TP-4	38.2	4.1	34.1
TP-5	39.8	6.2	33.6
TP-6	39.2	4.7	34.5
TP-7	38.1	4.4	33.7
TP-8	40.0	4.1	35.9
TP-9	40.0	4.3	35.7
TP-10	39.2	3.8	35.4
TP-11	40.0	4.5	35.5
TP-12	39.1	3.8	35.3
TP-13	40.0	5.7	34.3
TP-14	39.4	5.2	34.2
TP-15	40.1	4.6	35.5
TP-16	38.8	5.7	33.1

NOTES: *Elevations of test pits are taken from LIDAR topographic information from
 NC Floodplain Mapping Program.
 Measured depth to ground water is relative to existing ground surface*

Pittman Soil Consulting

1073-1 Gregory Fork Road

Richlands, NC 28574

Phone (910)324-2892

Fax (910) 324-6162

pittmansoil@yahoo.com

March 24, 2011

James Maides
166 Center Street
Jacksonville, NC 28540

Ref: C & D Landfill Maysville

Dear Mr. Maides,

On March 25, 2011 excavation pits were dug in the proposed cells of the C & D Landfill, located off White Oak River Road in Maysville, NC. The purpose of this was to determine the water table in the cells.

The pits were allowed to equalize for a period of 24 hours prior to evaluation. The evaluation results are as follows:

- TP 1- Rains soil 52" Cell 1
- TP 2-Rains soil 54" Cell 4
- TP 3-Goldsboro soil 55" Cell 2
- TP 4-Rains soil 49" Cell 5
- TP 5-Rains soil 74" Cell 3 & 6
- TP 6-Rains soil 56" Cell 13
- TP 7-Rains soil 53" Cell 15
- TP 8-Rains soil 49" Cell 12
- TP 9-Rains soil 52" Cell 11
- TP 10-Rains soil 46" Cell 12
- TP 11-Rains soil 54" Cell 9
- TP 12-Rains soil 46" Cell 10
- TP 13-Goldsboro soil 68" Cell 7

TP 14-Rains soil 62" Cell 8

TP 15-Rains soil 55"

TP 16-Goldsboro soil 68"

If you have any questions please feel free to contact me at 910-330-2784. Thank You.

Sincerely,

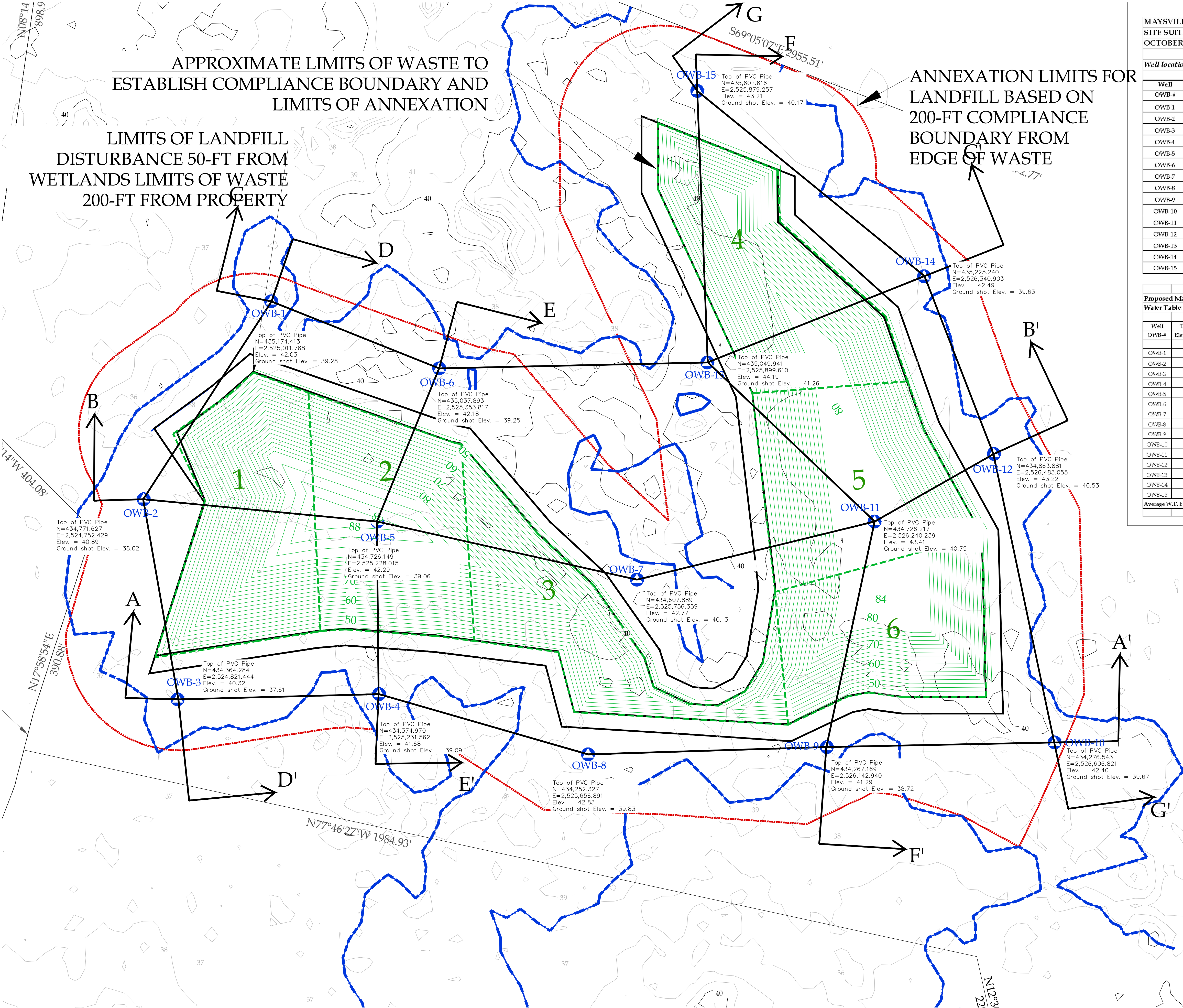


R. Haywood Pittman II
NC Licensed Soil Scientist



Appendix F

Stratigraphic Cross-Sections



MAYSVILLE C&D LANDFILL											
SITE SUITABILITY - OBSERVATION WELL DATA											
OCTOBER 6, 2011											
Well locations survey data supplied by Parker & Associates											
Well	Date	Ground Surface	Top of PVC	Well PVC	Well	Screened	NC State Plane	NC State Plane			
OWB-#	Drilled	Elevation (MSL)	Elevation (MSL)	Stick-Up (ft)	Depth (ft)	Interval (ft)	Northing	Easting			
OWB-1	8/25/11	39.28	42.03	2.75	20.0	20.0 - 7.0	435174.413	2525011.768			
OWB-2	8/25/11	38.02	40.89	2.87	20.0	20.0 - 7.0	434771.627	2524752.429			
OWB-3	8/25/11	37.61	40.32	2.71	20.0	20.0 - 8.0	434364.284	2524821.444			
OWB-4	8/25/11	39.09	41.68	2.59	20.0	20.0 - 8.0	434374.970	2525231.562			
OWB-5	8/24/11	39.06	42.29	3.23	15.0	19.0 - 7.0	434276.149	2525228.015			
OWB-6	8/24/11	39.25	42.18	2.93	15.0	20.0 - 8.0	435037.893	2525353.817			
OWB-7	8/24/11	40.13	42.77	2.64	15.0	34.0 - 21.0	434607.889	2525756.359			
OWB-8	8/23/11	39.83	42.83	3.00	20.0	20.0 - 8.0	434252.327	2525656.891			
OWB-9	8/23/11	38.72	41.29	2.57	15.0	3.0 - 15.0	434267.169	2526142.940			
OWB-10	8/22/11	39.67	42.40	2.73	20.0	20.0 - 8.0	434276.543	2526066.821			
OWB-11	8/23/11	40.75	43.41	2.66	15.0	15 - 3.5	434726.217	2526240.239			
OWB-12	8/23/11	40.53	43.22	2.69	20.0	20.0 - 8.0	434863.881	2526483.055			
OWB-13	8/24/11	41.26	44.19	2.93	20.0	20.0 - 8.0	435049.941	2525899.610			
OWB-14	8/23/11	39.63	42.49	2.86	20.0	20.0 - 8.0	435225.240	2526340.903			
OWB-15	8/24/11	40.17	43.21	3.04	20.0	20.0 - 8.0	435602.616	2525879.257			

Proposed Maysville C&D Landfill											
Water Table Elevations - Through 11-22-11											
Well	Top of PVC	Groundwater Level Elevations									
		T.O.B.		24-Hr.		8/26/11		9/6/11		10/10/11	
OWB-#	Elevation (MSL)	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.
OWB-1	42.03	13.55	28.48	13.92	28.11	13.92	28.11	7.21	34.82	6.82	35.21
OWB-2	40.89	13.62	27.27	13.62	27.27	13.62	27.27	6.33	34.56	5.86	35.03
OWB-3	40.32	12.75	27.57	12.79	27.53	12.79	27.53	5.79	34.53	5.38	34.94
OWB-4	41.68	13.93	27.75	13.86	27.82	13.86	27.82	6.89	34.79	6.53	35.15
OWB-5	42.29	15.05	27.24	15.00	27.29	14.30	27.99	7.52	34.77	7.36	34.93
OWB-6	42.18	13.70	28.48	13.78	28.40	13.82	28.36	7.31	34.87	6.94	35.24
OWB-7	42.77	15.55	27.22	14.85	27.92	14.75	28.02	7.69	35.08	7.17	35.60
OWB-8	42.83	15.05	27.78	14.97	27.86	14.99	27.84	7.93	34.90	7.62	35.21
OWB-9	41.29	13.89	27.40	13.10	28.19	13.11	28.18	5.58	35.71	5.30	35.99
OWB-10	42.40	13.68	28.72	13.70	28.70	13.70	28.70	6.68	35.72	5.71	36.69
OWB-11	43.41	13.62	29.79	13.65	29.76	13.64	29.77	6.93	36.48	6.39	37.03
OWB-12	43.22	16.25	26.97	15.13	28.09	15.15	28.07	8.07	35.15	7.76	35.46
OWB-13	44.19	15.15	29.04	15.34	28.85	15.37	28.82	8.51	35.68	8.23	35.96
OWB-14	42.49	14.40	28.09	14.09	28.40	14.06	28.43	6.86	35.63	6.57	35.92
OWB-15	43.21	14.61	28.60	14.56	28.65	14.65	28.56	7.40	35.81	7.23	35.98
Average W.T. Elevation			28.03		28.19		28.23		35.23		35.62
											34.69
											35.18

- LEGEND
- EXISTING CONTOUR (1-FT INTERVAL)

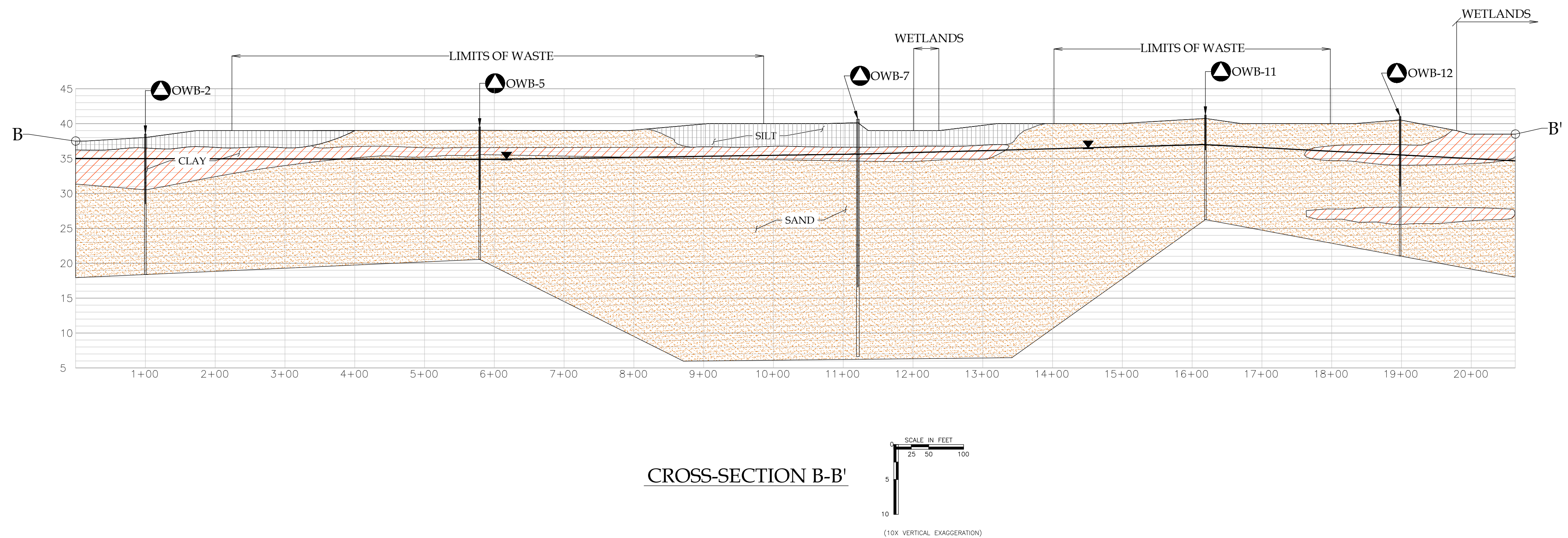
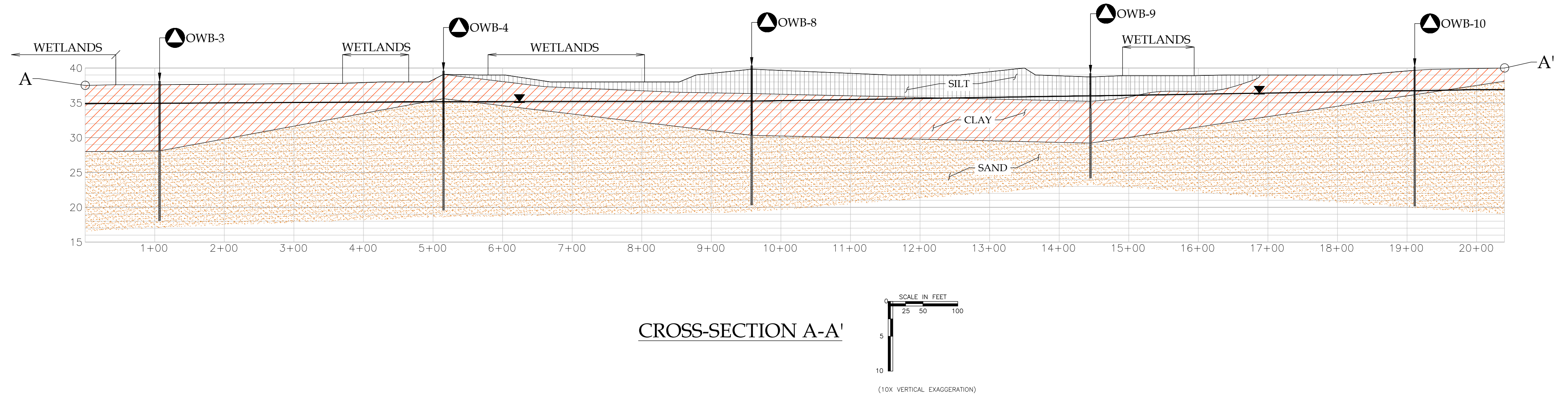
ACOE APPROVED WETLAND LIMITS

GROUND WATER CONTOUR (0.5-FT INTERVAL)

TEST PIT LOCATION

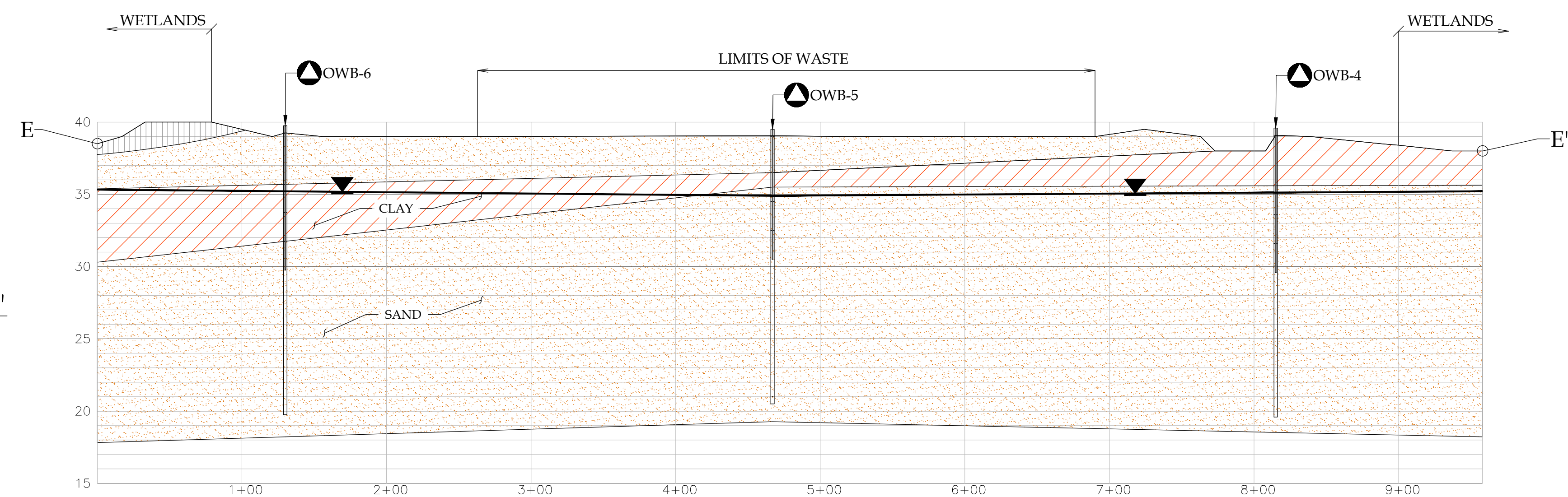
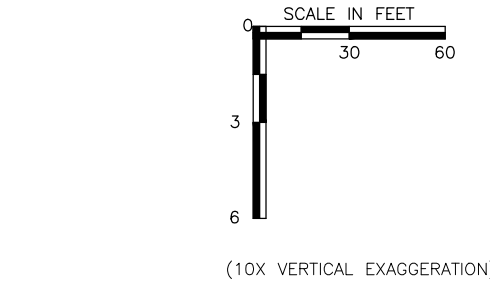
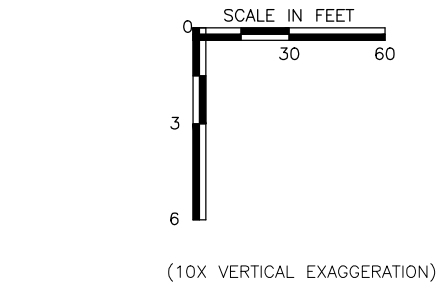
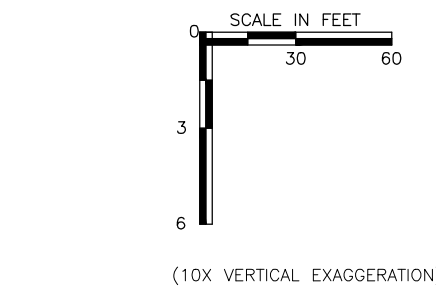
PROPOSED SOIL TEST BORING & WELL LOCATION

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION	MAYSVILLE C&D LANDFILL				NOT FOR CONSTRUCTION				CROSS SECTION LOCATION PLAN				DRAWING NO.	
								GREEN RECYCLING SOLUTIONS LLC				MAYSVILLE, NC								1	
								DRAWN BY CJM				PROJECT ENGINEER DW				SCALE AS SHOWN				REV. NO.	
								DESIGN ENGINEER CJM				PROJECT MANAGER DW				PROJECT NO. 0140408				SHEET 1 OF 4	
												LICENSE # C-2206				DATE OCTOBER 2011					
												ERM NC, INC.				AutoCAD 2007					
												8000 CORPORATE CENTER DRIVE, SUITE 200				CROSS SECTIONS.DWG					
												CHARLOTTE, NORTH CAROLINA 28226									
												(704) 541-4543									

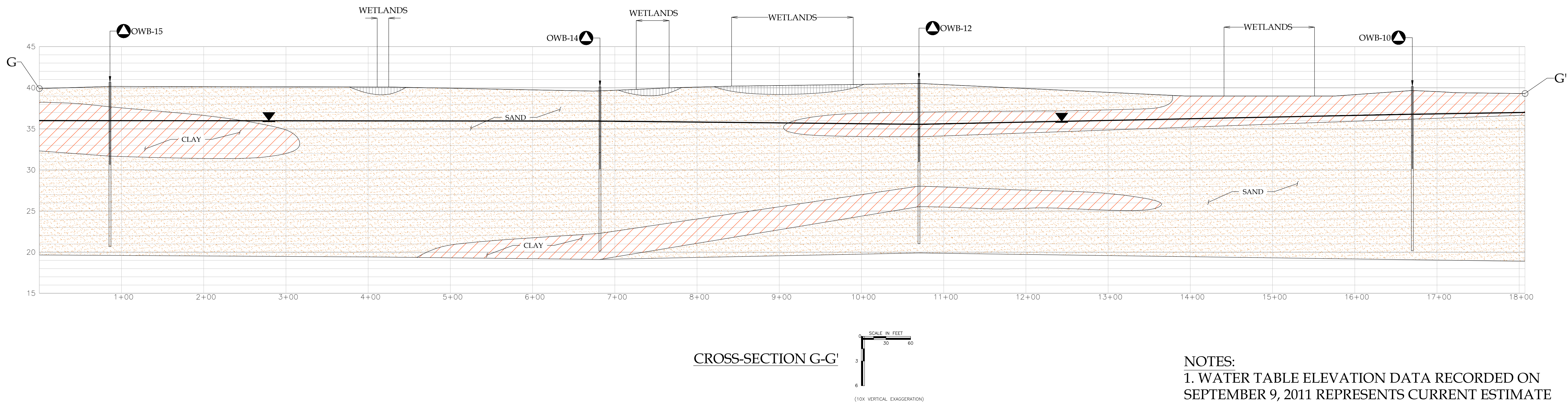
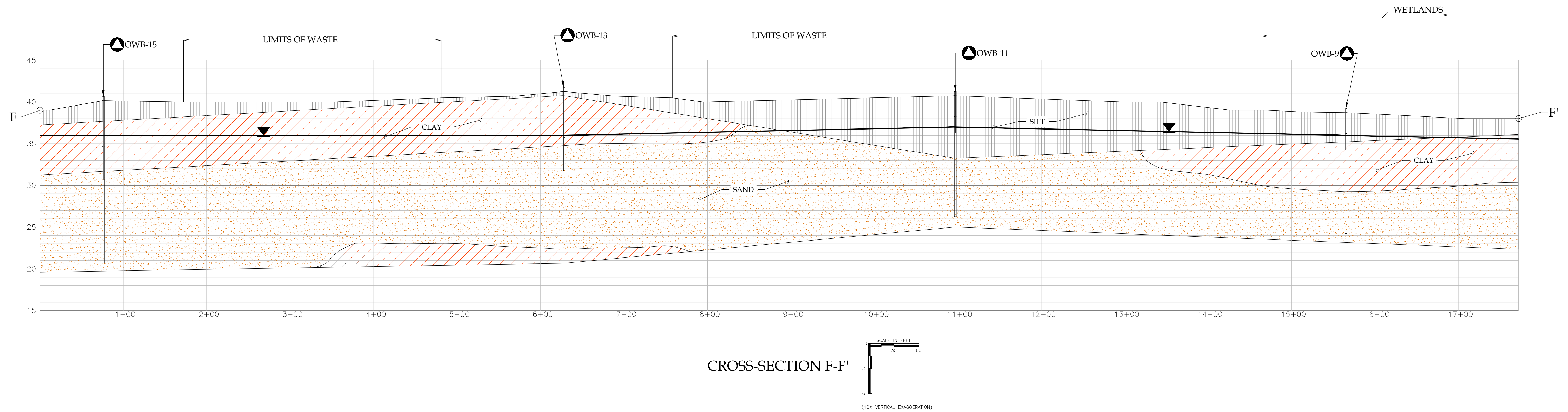


NOTES:
1. WATER TABLE ELEVATION DATA RECORDED ON SEPTEMBER 9, 2011 REPRESENTS CURRENT ESTIMATE OF LONG-TERM SEASONAL HIGH GROUNDWATER TABLE.

REVISION				REVISION				MAYSVILLE C&D LANDFILL				CROSS SECTIONS				DRAWING NO.	
NO.	DATE	APPR.		NO.	DATE	APPR.										2	
								GREEN RECYCLING SOLUTIONS LLC				MAYSVILLE, NC				REV. NO.	
																SHEET 2 OF 4	
								DRAWN BY	CJM	PROJECT ENGINEER	DWW	NOT FOR CONSTRUCTION				SCALE	
								DESIGN ENGINEER	CJM	PROJECT MANAGER	DWW					DATE	
								ERM NC, INC.				8000 CORPORATE CENTER DRIVE, SUITE 200 CHARLOTTE, NORTH CAROLINA 28226 (704) 541-4343				PROJECT NO.	
																0140408	
								CROSS SECTIONS.DWG				OCTOBER 2011				AutoCAD 2007	



NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION	<div>MAYSVILLE C&D LANDFILL</div> <div>GREEN RECYCLING SOLUTIONS LLC</div> <div>MAYSVILLE, NC</div> <div><div>DRAWN BYCJMDWJ</div><div>DESIGN ENGINEERCJMDWJ</div></div>	<div><div>LICENSE #C-2206</div><div>ERM NC, INC.</div><div>200 CORPORATE CENTER DRIVE, SUITE 200</div><div>CHARLOTTE, NORTH CAROLINA 28206</div><div>704.364.9400</div></div>	<div>NOT FOR CONSTRUCTION</div>	<div>CROSS SECTIONS</div> <div><div>SCALEAS SHOWN</div><div>DATEOCTOBER 2011</div><div>PROJECT NO.0140408</div><div>AutoCAD 2007CROSS SECTIONS.DWG</div></div>	<div>DRAWING NO. 3</div> <div>REV. NO.</div> <div>SHEET3OF4</div>



NOTES:
1. WATER TABLE ELEVATION DATA RECORDED ON
SEPTEMBER 9, 2011 REPRESENTS CURRENT ESTIMATE
OF LONG-TERM SEASONAL HIGH GROUNDWATER
TABLE.

REVISION				REVISION				MAYSVILLE C&D LANDFILL				CROSS SECTIONS				DRAWING NO.	
NO.	DATE	APPR.		NO.	DATE	APPR.										4	
								GREEN RECYCLING SOLUTIONS LLC				MAYSVILLE, NC				REV. NO.	
																SHEET 4 OF 4	
								DRAWN BY	CJM	PROJECT ENGINEER	DWW	LICENSE #C-2206 ERM NC, INC. 8000 CORPORATE CENTER DRIVE, SUITE 200 CHARLOTTE, NORTH CAROLINA 28226 (704) 541-4545				SCALE	
								DESIGN ENGINEER	CJM	PROJECT MANAGER	DWW					AS SHOWN	
												NOT FOR CONSTRUCTION				DATE	
																OCTOBER 2011	
												PROJECT NO.				AutoCAD 2007	
																CROSS SECTIONS.DWG	
												0140408					

Appendix G

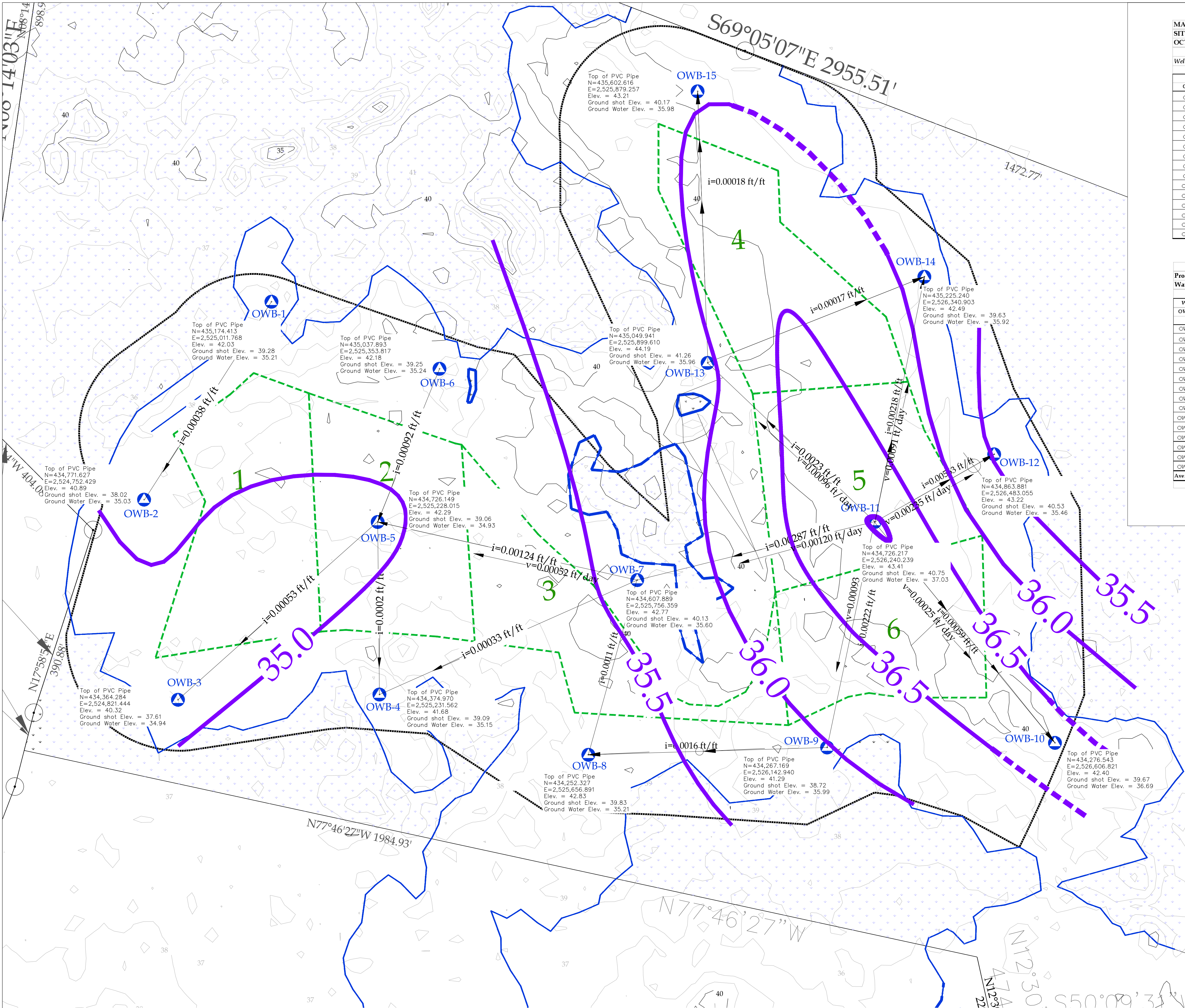
Water Level Records

Proposed Maysville C&D Landfill
Water Table Elevations

Well OWB-#	Top of PVC Elevation (MSL)	Groundwater Level Elevations											
		T.O.B.		24-Hr.		8/26/11		9/6/11		9/9/11		10/10/11	
		Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.
OWB-1	42.03	13.55	28.48	13.92	28.11	13.92	28.11	7.21	34.82	6.82	35.21	7.80	34.23
OWB-2	40.89	13.62	27.27	13.62	27.27	13.62	27.27	6.33	34.56	5.86	35.03	7.02	33.87
OWB-3	40.32	12.75	27.57	12.79	27.53	12.79	27.53	5.79	34.53	5.38	34.94	6.54	33.78
OWB-4	41.68	13.93	27.75	13.86	27.82	13.86	27.82	6.89	34.79	6.53	35.15	7.68	34.00
OWB-5	42.29	15.05	27.24	15.00	27.29	14.30	27.99	7.52	34.77	7.36	34.93	8.22	34.07
OWB-6	42.18	13.70	28.48	13.78	28.40	13.82	28.36	7.31	34.87	6.94	35.24	7.91	34.27
OWB-7	42.77	15.55	27.22	14.85	27.92	14.75	28.02	7.69	35.08	7.17	35.60	8.58	34.19
OWB-8	42.83	15.05	27.78	14.97	27.86	14.99	27.84	7.93	34.90	7.62	35.21	8.68	34.15
OWB-9	41.29	13.89	27.40	13.10	28.19	13.11	28.18	5.58	35.71	5.30	35.99	5.22	36.07
OWB-10	42.40	13.68	28.72	13.70	28.70	13.70	28.70	6.68	35.72	5.71	36.69	7.15	35.25
OWB-11	43.41	13.62	29.79	13.65	29.76	13.64	29.77	6.93	36.48	6.38	37.03	7.61	35.80
OWB-12	43.22	16.25	26.97	15.13	28.09	15.15	28.07	8.07	35.15	7.76	35.46	8.40	34.82
OWB-13	44.19	15.15	29.04	15.34	28.85	15.37	28.82	8.51	35.68	8.23	35.96	9.27	34.92
OWB-14	42.49	14.40	28.09	14.09	28.40	14.06	28.43	6.86	35.63	6.57	35.92	7.65	34.84
OWB-15	43.21	14.61	28.60	14.56	28.65	14.65	28.56	7.40	35.81	7.23	35.98	8.59	34.62

Appendix H

Groundwater Contour / Potentiometric Map



MAYSVILLE C&D LANDFILL
SITE SUITABILITY - OBSERVATION WELL DATA
OCTOBER 6, 2011

Well locations survey data supplied by Parker & Associates

Well	Date	Ground Surface Elevation (MSL)	Top of PVC Elevation (MSL)	Well PVC Stack-Up (ft)	Well Depth (ft)	Screened Interval (ft)	NC State Plane Northing	NC State Plane Easting
OWB-1	8/25/11	39.28	42.03	2.75	20.0	20.0 - 7.0	435174.413	2525011.768
OWB-2	8/25/11	38.02	40.89	2.87	20.0	20.0 - 7.0	434771.627	2524752.429
OWB-3	8/25/11	37.61	40.32	2.71	20.0	20.0 - 8.0	434364.284	2524821.444
OWB-4	8/25/11	39.09	41.68	2.59	20.0	20.0 - 8.0	434374.970	2525231.562
OWB-5	8/24/11	39.06	42.29	3.23	15.0	19.0 - 7.0	434726.149	2525228.015
OWB-6	8/24/11	39.25	42.18	2.93	15.0	20.0 - 8.0	435037.893	2525353.817
OWB-7	8/24/11	40.13	42.77	2.64	15.0	34.0 - 21.0	434607.889	2525756.359
OWB-8	8/23/11	39.83	42.83	3.00	20.0	20.0 - 8.0	434252.327	2525656.891
OWB-9	8/23/11	38.72	41.29	2.57	15.0	3.0 - 15.0	43467.169	2526142.940
OWB-10	8/22/11	39.67	42.40	2.73	20.0	20.0 - 8.0	434276.543	2526066.821
OWB-11	8/23/11	40.75	43.41	2.66	15.0	15 - 3.5	434726.217	2526240.239
OWB-12	8/23/11	40.53	43.22	2.69	20.0	20.0 - 8.0	434863.881	2526480.055
OWB-13	8/24/11	41.26	44.19	2.93	20.0	20.0 - 8.0	435049.941	2525899.610
OWB-14	8/23/11	39.63	42.49	2.86	20.0	20.0 - 8.0	435225.240	2526340.903
OWB-15	8/24/11	40.17	43.21	3.04	20.0	20.0 - 8.0	435602.816	2525879.257

Proposed Maysville C&D Landfill
Water Table Elevations - Through 11-22-11

Well	Top of PVC Elevation (MSL)	Groundwater Level Elevations													
		T.O.B.		24-Hr.		8/26/11		9/6/11		9/9/11		10/10/11		11/22/11	
		Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.
OWB-1	42.03	13.55	28.48	13.92	28.11	13.92	28.11	7.21	34.82	6.82	35.21	7.80	34.23	7.11	34.92
OWB-2	40.89	13.62	27.27	13.62	27.27	13.62	27.27	6.33	34.56	5.86	35.03	7.02	33.87	6.23	34.66
OWB-3	40.32	12.75	27.57	12.79	27.53	12.79	27.53	5.79	34.53	5.38	34.94	6.54	33.78	5.80	34.52
OWB-4	41.68	13.93	27.75	13.86	27.82	13.86	27.82	6.89	34.79	6.53	35.15	7.68	34.00	6.92	34.76
OWB-5	42.29	15.05	27.24	15.00	27.29	14.30	27.99	7.52	34.77	7.36	34.93	8.22	34.07	7.44	34.85
OWB-6	42.18	13.70	28.48	13.78	28.40	13.82	28.36	7.31	34.87	6.94	35.24	7.91	34.27	7.30	35.08
OWB-7	42.77	15.55	27.22	14.85	27.92	14.75	28.02	7.69	35.08	7.17	35.60	8.58	34.19	7.79	34.98
OWB-8	42.83	15.05	27.78	14.97	27.86	14.99	27.84	7.93	34.90	7.62	35.21	8.68	34.15	7.83	35.00
OWB-9	41.29	13.89	27.40	13.10	28.19	13.11	28.18	5.58	35.71	5.30	35.99	5.22	36.07	7.50	33.79
OWB-10	42.40	13.68	28.72	13.70	28.70	13.70	28.70	6.88	35.72	5.71	36.69	7.15	35.25	6.20	36.20
OWB-11	43.41	13.62	29.79	13.65	29.76	13.64	29.77	6.93	36.48	6.38	37.03	7.61	35.80	6.75	36.66
OWB-12	43.22	16.25	26.97	15.13	28.09	15.15	28.07	8.07	35.15	7.76	35.46	8.40	34.82	7.86	35.26
OWB-13	44.19	15.15	29.04	15.34	28.85	15.37	28.82	8.51	35.68	8.23	35.96	9.27	34.92	8.40	35.79
OWB-14	42.49	14.40	28.09	14.09	28.40	14.06	28.43	6.86	35.63	6.57	35.92	7.65	34.84	6.74	35.75
OWB-15	43.21	14.61	28.60	14.56	28.65	14.65	28.56	7.40	35.81	7.23	35.98	8.59	34.62	7.93	35.38
Average W.T. Elevation			28.03		28.19		28.23		35.23		35.62		34.59		35.18

LEGEND

- EXISTING CONTOUR (1-FT INTERVAL)
- ACOE APPROVED WETLAND LIMITS
- LANDFILL LIMITS AND PHASE BOUNDARIES
- WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR

i = GROUNDWATER GRADIENT
v = GROUNDWATER VELOCITY

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION

MAYSVILLE C&D LANDFILL

GREEN RECYCLING SOLUTIONS LLC

MAYSVILLE, NC

LICENSE #C-2206

ERM NC, INC.

800 CORPORATE CENTER DRIVE SUITE 200

CHARLOTTE, NORTH CAROLINA 28226

(704) 581-8345

NOT FOR CONSTRUCTION

GROUNDWATER POTENTIOMETRIC MAP

SCALE 1"=100'

PROJECT NO. 0140408

DATE DECEMBER 2011

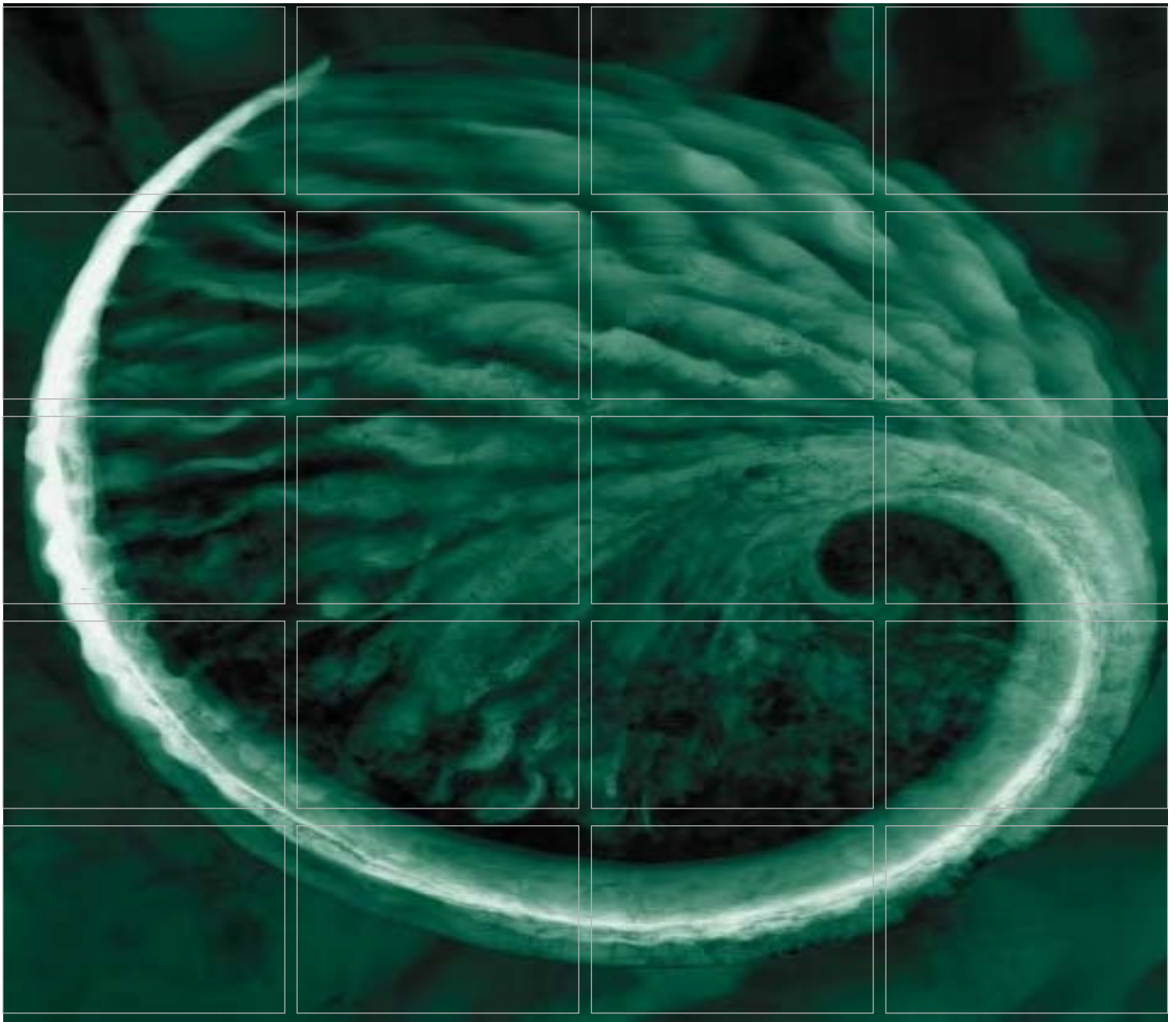
AutoCAD 2007

POTENTIOMETRIC MAP.DWG

DRAWING NO. 1

REV. NO.

SHEET 1 OF 1



Green Recycling Solutions LLC

Engineering Plan

Maysville Construction & Demolition

Debris (C&D) Landfill, Phase 1

Maysville, North Carolina

June 2013

Engineer's Certification

This plan has been prepared by a Professional Engineer licensed to practice engineering in accordance with G.S. 89C and meet the requirements of Division of Waste Management Rules 15A NCAC 13B .0539

(Signature)

David W Wasiela, PE

NC Registration No. 20770

(Seal)

ERM NC, Inc.

NC License# C-2206



ENGINEERING PLAN

GREEN RECYCLING SOLUTIONS LLC,

MAYSVILLE C&D LANDFILL PHASE 1

ENGINEERING PLAN FOR C&DLF FACILITIES (15A NCAC 13B .0539)

Summary of Facility Design

The Green Recycling Solutions LLC, Maysville C&D Landfill, Phase 1 is proposed to only receive waste from the Green Recycling Solutions LLC, C&D Recycling / Recovery Facility (Permit 5202-TP-2012 issued February 25, 2013). The recycling/recovery facility is a special engineering feature. By virtue of this facility, all waste will be inspected to greatly reduce the opportunity for unacceptable waste being deposited in the landfill. The landfill will only receive waste from the recycling/recovery facility.

The design plans include leachate storage tanks located at each leachate collection sump area (1 or 2 Cells combined) that would utilize a pump and haul operation for delivery to a permitted waste water treatment plant (Town of Maysville and/or Pollocksville). Each sump area will contain a prefabricated HDPE sidewall riser with a stainless steel submersible pump for transmission of leachate from the sump to each leachate storage tank. By design, the facility will minimize leachate generation by constructing small Cells within each Phase that shall be approximately one acre in size. Each Phase will contain two to three of these Cells. Once a new Cell is constructed, approximately every 18 months, the first waste lift may be quickly placed across the Cell floor and above the surrounding 6-ft perimeter berm height to promote runoff and reduce leachate generation.

There will be a low permeable barrier across the floor of the proposed C&D landfill. A 60-mil HDPE liner placed above a geosynthetic clay liner (GCL) is proposed in the design plans as the base liner system. A geocomposite drainage media will be placed above the 60-mil HDPE liner for leachate collection along with a 6-in diameter perforated leachate collection pipe surrounded by stone for transmission of leachate to the sump area.

Once the landfill operating capacity is reached, a low permeable cap will be installed across the entire waste disposal limits. The cap will be designed to meet or exceed the minimum requirements per NCDENR regulations at the time of permitting the landfill. For the purpose of this report, a landfill cap including a 40-mil linear low density polyethylene liner is proposed. Timing of cap installation will be determined during the permitting process.

The C&D landfill facility will include ground water and landfill gas monitoring well networks to meet or exceed the NCDENR regulations at the time of permitting.

The design has been based on Site Suitability Studies previously performed for this site and approved by Division of Waste Management April 23, 2013. These studies included a comprehensive hydrogeologic study (Appendix 2) with the long term seasonal high groundwater table. Since this area of coastal North Carolina has a high seasonal water table, no excavation is proposed for landfill development. Specific calculations to support landfill design are attached at the end of this Engineering Plan. Leachate calculations are supported by running various simulations using the HELP model Version 3. A summary along with copies of HELP model output simulation files is attached with this Engineering Report. References are included with each individual calculation.

Design Plan Set

A complete Design Plan Set has been submitted with the Application for Permit to Construct dated June 19, 2013 under separate cover. The Design Plan Set includes all of the design elements listed within Rule 15A NCAC 13B .0539.

Location Restrictions

A Site Suitability Report dated December 16, 2011 was prepared for the Green Recycling Solutions LLC proposed Construction & Demolition Debris (C&D) Landfill site in Maysville, North Carolina and submitted to North Carolina Department of Environment and Natural Resources (NC DENR) Division of Waste Management for review and approval. The Site Suitability Report was approved by Division of Waste Management via a letter dated April 23, 2013. A Summary of the Location Restriction discussion from the Site Suitability Study is included below. The Site Suitability Study should be referenced for further details.

Location Restriction Summary:

- No 100-yr Floodplains are on site
- No surface Waters or Waters of the United State are on site
- A property buffer of 200-ft minimum is maintained between property boundaries and waste disposal limits
- A 100-ft minimum buffer is maintained between jurisdictional wetlands and waste disposal limits
- A minimum 500-ft buffer is maintained between private residences and waste disposal limits
- Site is not within 5-miles of National Wildlife Refuge
- Site is not within 500-ft of a State Managed Game Land (Reference Senate Bill 24 amending G.S. 130A-295.6(d), Approved April 9, 2013)
- There are no public water supply wells within 2,000 feet of the facility
- There are no schools within 2,000-ft of the facility
- Landfill development will not adversely affect areas of archeological or historic significance
- Landfill development will not adversely affect endangered or threatened species or their critical habitat.

Engineering Plan Supporting Calculations



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions C&D Landfill Phase 1

PROJECT NO. 0104048 SHEET 1 OF 8

DESCRIPTION Liner System Stability

OBJECTIVE:

Evaluate the stability during construction of the proposed liner system on the slopes with respect to thermal stress and stress due to placement of protective cover.

METHODOLOGY:

The liner system consists of the following components (from top to bottom):

- 24 inches Protective Cover;
- Geotextile-Geonet-Geotextile Drainage Composite;
- 60-mil Textured HDPE Geomembrane;
- Geosynthetic Clay Liner (GCL); and
- Prepared subgrade

The maximum slope of the liner system is 3 horizontal to 1 vertical (3H:1V). The liner system must be designed to withstand waste induced loads and thermal stress. This calculation brief addresses stability of the composite liner system proposed for the sideslopes during construction and placement of overlying protective cover.

During construction, the temperature of the geomembrane can vary greatly over the course of a 24-hour period. The strain caused by this temperature change was estimated using the coefficient of liner thermal expansion.

The theoretical tension that may be introduced into the protective cover system along 3H:1V slopes was estimated using the method of analysis developed by Giroud and Beech (1989) (Reference 1). This theoretical tension was compared to the allowable tension for the liner system to determine that excessive straining or stressing of the liner system does not occur.

The resulting stresses and strains caused by these phenomena are not necessarily independent of each other and their respective intensities will vary accordingly depending on the stage or the life of the landfill.

REFERENCES:

1. Lindenburg, Michael R., Civil Engineering Reference Manual, Sixth Edition, Professional Publications, Inc., Belmont, CA, 1992.
2. Koerner, Robert M., Designing with Geosynthetics, Third Edition, Prentice-Hall, Inc., NJ, 1994.



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions C&D Landfill Phase 1

PROJECT NO. 0104048 SHEET 2 OF 8

DESCRIPTION Liner System Stability

3. "1998 Specifier's Guide, Geotechnical Fabrics Report", Industrial Fabrics Association International (IFAI), Roseville, MN, December 1997.
4. Giroud, J.P., and Beech, J.F., "Stability of Soil Layers on Geosynthetic Lining Systems", Proceedings, Geosynthetics '89 Conference, San Diego, CA, 1989.

CALCULATION:

THERMAL STRESS:

Strain created by changes in temperature can be evaluated by use of the following formula (Reference 1):

$$\varepsilon = \frac{\Delta L}{L}$$

Where:

- ε = strain in liner system (percent)
 ΔL = change in length of liner due to change in temperature (ft)
 L = length of liner before temperature change (ft)

The change in length of the liner system due to a change in temperature was estimated using the following formula (Reference 1):

$$\Delta L = \alpha * L * \Delta T$$



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions C&D Landfill Phase 1

PROJECT NO. 0104048 SHEET 3 OF 8

DESCRIPTION Liner System Stability

Where:

- ΔL = change in length of liner due to change in temperature (ft)
 α = coefficient of linear thermal expansion ($^{\circ}\text{F}^{-1}$)
 L = length of liner before temperature change (ft)
 ΔT = change in temperature ($^{\circ}\text{F}$)

Through substitution, the formula for strain is as follows:

$$\varepsilon = \frac{(\alpha * L * \Delta T)}{L} = \alpha * \Delta T$$

It is estimated that HDPE geomembranes can experience a temperature change of up to 100°F during the course of a 24-hour period. For example, if a liner is being installed on a hot, sunny day, the maximum temperature may rise to 130°F in the liner itself at mid-day and could drop to 30°F at night. Although this assumption is a worst-case scenario, it must be considered for this analysis. Thus, the maximum change in temperature, ΔT , is equal to 100°F.

For a textured HDPE geomembrane, the coefficient of linear thermal expansion, α , typically ranges from $6 \times 10^{-5} \text{ }^{\circ}\text{F}^{-1}$ to $7 \times 10^{-5} \text{ }^{\circ}\text{F}^{-1}$ (Reference 2). To be conservative, α equal to $7 \times 10^{-5} \text{ }^{\circ}\text{F}^{-1}$ was used for this calculation. The strain is calculated as follows.

$$\begin{aligned}\varepsilon &= 7 \times 10^{-5} \text{ }^{\circ}\text{F}^{-1} * 100^{\circ}\text{F} \\ &= 7 \times 10^{-3} * 100\% \\ &= 0.7\%\end{aligned}$$

The allowable strain in textured geomembrane is 13% (Reference 3). As shown above, the calculated strain of 0.7%, for the worst-case scenario of a ΔT of 100°F, is well below the yield strain of a textured HDPE geomembrane. Therefore, the resulting strain is minimal and it can be concluded that temperature induced stress and strain is not considered of primary importance in the stability of the composite liner system.

PROTECTIVE COVER INDUCED STRESS:

The liner system will be comprised of a number of components including geotextile-geonet-geotextile drainage composites, geomembranes, GCL, and soil, which have different mechanical and physical properties. The stability of the liner system depends on the shear strength and strain properties of the components used in its construction along with the characteristics of the overlying waste. This stability



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions C&D Landfill Phase 1

PROJECT NO. 0104048 SHEET 4 OF 8

DESCRIPTION Liner System Stability

is limited to the amount of stability afforded by the weakest component of the liner system. Thus, the design of the liner system was based upon limiting stress and strain to within a range tolerable for the "weakest" liner system component for each condition.

In order to evaluate the stability of the liner system, it was necessary to determine the various shear strength properties and design parameters for each of the liner system components. These properties were obtained through a number of sources including actual laboratory testing performed for Municipal Solid Waste (MSW) landfill facilities in the State of Pennsylvania, references from literature and manufacturer's brochures and from site- (soil) specific laboratory testing. Furthermore, many of the geosynthetic properties are presented as minimum average roll (MAR) values. MAR values are based on a statistical interpretation of laboratory testing data for the various geosynthetic properties. Specifically, the MAR is the minimum value bounded by the 95 percent confidence interval. Consequently, the values used in the design of the geosynthetic components are very conservative, and, in all likelihood, the liner system in the field should meet or exceed characteristics relative to those characteristics used in the design analysis. These characteristics will be verified by visual observations and quality control and quality assurance (QA/QC) procedures followed during construction.

The tension that will be generated in the proposed liner system components on slopes, after the protective cover material has been placed, may be approximated by the following equation (Reference 4):

$$\alpha = \frac{\gamma_c T_c^2}{\sin 2\beta} \left[\left(\frac{2H \cos \beta}{T_c} - 1 \right) \frac{\sin(\beta - \phi_{im})}{\cos \phi_{im}} - \frac{\sin \phi_{cm}}{\cos(\beta + \phi_{cm})} \right]$$

Where:

- α = Tension introduced into liner system (ppf);
- γ_c = Unit weight of protective cover soil (pcf);
- T_c = Thickness of protective cover soil (ft);
- β = Slope angle (degrees) = 18.4 degrees (3H:1V);
- H = Maximum height of the slope (ft);
- ϕ_{im} = Critical mobilized interface friction angle of cover system (degrees); and
- ϕ_{cm} = Mobilized friction angle of final cover soil (degrees).



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions C&D Landfill Phase 1

PROJECT NO. 0104048 SHEET 5 OF 8

DESCRIPTION Liner System Stability

Where:

$$\tan\phi_{im} = (\tan\phi_i)/FS$$

$$\tan\phi_{cm} = (\tan\phi_c)/FS$$

FS = Partial Factor of Safety (Ranges from 1.0 to 1.3, Reference 4)

The following "most critical" slope geometry exists and will be analyzed:

Proposed Liner System Interface Friction Values, (ϕ_i) for Side Slopes

Friction Angle Between Nonwoven
Geotextile and Protective Cover Material = 26 degrees

Friction Angle Between Nonwoven Geotextile
and Textured HDPE geomembrane = 24 degrees

Friction Angle Between Textured HDPE
Geomembrane and GCL = 18 degrees (assumed conservative)

Internal Friction Angle of Hydrated GCL
= 18 degrees (assumed conservative)

Friction Angle Between GCL
and Subgrade Soils = 31 degrees

The friction angle for the protective cover soil (ϕ_c) is 32 degrees

Discussion of Interface Friction Angles:

Nonwoven Geotextile/Protective Cover

The interface friction angle between nonwoven geotextiles and coarse grained soil (primarily sand), as reported in a number of studies, has been shown to range from about 25 to 44 degrees and average approximately 33 degrees, depending on the type of geotextile and the soil it is in contact with. Generally, the interface friction angle between these two components increases with increasing particle size and angularity. Perhaps, more important than the interface friction angle, these studies have also shown that the efficiency of transfer, which is the ratio of the interface friction angle to the internal friction angle of the soil, ranges from about 0.75 to 1.00 and averages about 0.93. These results indicate



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions C&D Landfill Phase 1

PROJECT NO. 0104048 SHEET 6 OF 8

DESCRIPTION Liner System Stability

that for most interfaces between nonwoven geotextile and coarse grained soil, the interface friction angle will be roughly 90 percent of the value of the internal friction angle of the coarse grained soil itself. For this analysis, it was assumed that the interface friction angle between the nonwoven geotextile and overlying protective cover material will be 26 degrees, which represents about 87 percent of the internal friction of 32 degrees (i.e., 81% efficiency) for the protective cover material.

Nonwoven Geotextile/Textured HDPE Geomembrane

Several investigators have conducted testing to evaluate the interface friction between textured HDPE geomembranes and nonwoven geotextiles. The results of these analyses show an interface friction angle ranging from 24 to 33 degrees, with apparent adhesion present in many of the test results. The test results that show interface friction angles of 24 degrees were obtained from tests performed explicitly for a major waste disposal and landfill development company. These tests consisted of various combinations of either GSE and NSC textured HDPE geomembranes adjacent to either Polyfelt or Trevira nonwoven geotextiles, which are some of the candidate manufacturers for textured HDPE geomembranes and nonwoven geotextiles to be used in the proposed landfill liner system. As such, an interface friction angle of 24 degrees was used to model this interface.

Textured HDPE Geomembrane/GCL (Option No. 2)

For this analysis, a relatively conservative interface friction angle of 18 degrees was used to model the interface between the textured HDPE geomembrane and GCL. The data for the interface between textured HDPE geomembranes and GCL's show interface friction angles ranging from 17 to 31 degrees. As such, the value of 18 degrees used in this analysis is highly conservative in terms of stability since it is unlikely that the actual field condition will reveal such a low value.

GCL/Subgrade Soil

For this analysis, an interface friction angle of 31 degrees was used to model the interface between the GCL and compacted clay liner soil. There is somewhat limited typical data for this interface. The interface friction angles between GCL and soils range from 17 to 41 degrees. As such, the value of 31 degrees used in this analysis is reasonable for this calculation.



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions C&D Landfill Phase 1

PROJECT NO. 0104048 SHEET 7 OF 8

DESCRIPTION Liner System Stability

The tension (stress) in the Proposed Liner System on slopes due to the placement of the protective cover material is as follows:

Mobilized Friction Angles:

The partial factor of safety (FS) applied to the various friction angles is 1.3, which is the highest partial factor of safety recommended by the Giroud and Beech.

The textured HDPE geomembrane/GCL interface is the critical interface. Thus, the mobilized friction angles are as follows:

Critical Interface: $\tan \phi_{im} = (\tan 18^\circ)/1.3$
 $\phi_{im} = \tan^{-1}((\tan 18^\circ)/1.3)$
 $= 14.0^\circ$

Protective Cover Soil: $\tan \phi_{cm} = (\tan 32^\circ)/1.3$
 $\phi_{cm} = \tan^{-1}((\tan 32^\circ)/1.3)$
 $= 25.7^\circ$

The cap tension is calculated using the following values:

$$\begin{aligned}\gamma_c &= 115 \text{ pcf} \\ T_c &= 2.0 \text{ ft} \\ \beta &= 18.4^\circ \\ H &= 8 \text{ ft} \\ \phi_{im} &= 14.0^\circ \\ \phi_{cm} &= 25.7^\circ\end{aligned}$$

The cap tension is calculated as follows:

$$\alpha = \frac{\gamma_c T_c^2}{\sin 2\beta} \left[\left(\frac{2H \cos \beta}{T_c} - 1 \right) \frac{\sin(\beta - \phi_{im})}{\cos \phi_{im}} - \frac{\sin \phi_{cm}}{\cos(\beta + \phi_{cm})} \right]$$



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions C&D Landfill Phase 1

PROJECT NO. 0104048 SHEET 8 OF 8

DESCRIPTION Liner System Stability

$$= \frac{115(2.0)^2}{\sin[2(18.4)]} \left[\left(\frac{2(8)\cos 18.4}{2.0} - 1 \right) \frac{\sin(18.4 - 14.0)}{\cos 14.0} - \frac{\sin 25.7}{\cos(18.4 + 25.7)} \right]$$
$$= -65.8 \text{ ppf}$$

CONCLUSIONS:

Results have shown a negative tensile force within the proposed liner system during protective cover placement in one construction period. The negative ("-") sign indicates that the internal frictional resistance of the proposed liner system, coupled with a buttressing effect (located at the toe of the slopes) provided by the protective cover soil is sufficient to prevent tensile stress from being generated within the liner system.

Thus, the protective cover soil may be placed on the slopes in one lift.

LINER SYSTEM ANCHOR TRENCH DESIGN

INTRODUCTION

As previously determined, tensile forces within the proposed liner system will be negative, meaning theoretically, the forces acting on the liner system can be handled by the internal friction and that there will be no tensile forces. The lack of tension means that there is no parameter with which to design the perimeter anchor trench. However, in reality, it is likely that some tensile stress will be developed in the liner system during installation and operation, therefore, an anchor trench is required. The magnitude of these tensile stress are essentially indeterminate.

The type and configuration of the anchor trench is similar to others now in use that exhibit more than adequate resistance. The anchor trench will be designed so that the maximum allowable tension force in the HDPE geomembrane is greater than the pullout resistance. This will allow the geosynthetics to pull out of the anchor trench before the geomembrane reaches its yield strength. The allowable tension force is based on the yield strength of the HDPE geomembrane and the pullout tension force is the sum of the frictional forces on the upper and lower faces of the HDPE geomembrane.

ANCHOR TRENCH DESIGN

The proposed anchor trench design is shown in the attached calculations. The anchor trench has the following minimum dimensions: Runout = 2 ft, Depth = 2 ft, Bottom Width = 2 ft, Material Runout in Anchor Trench = 1 ft.

Based on this geometry and the soil and geosynthetic properties presented in the calculations, the pullout resistance was calculated using the methodology presented in Koerner (1994). This design approach assumes that pullout is opposed by frictional resistance between the liner system components themselves and between the liner system components and the backfill soil used to construct the anchor trench. Calculation to analyze the proposed anchor trench design are provided at the end of this appendix. Referring to these calculations, it is seen that the short-term pullout resistance provided by the anchor trench is approximately 722 pounds per foot. This is an acceptable resistance value since it is less than the maximum allowable geomembrane tension of 1,008 pounds per foot. Therefore, pullout will occur before the liner material fails. This is the preferable failure, from the standpoint of maintaining the hydraulic integrity of the liner system.

CONCLUSION

The anchor trench that is to be located on the perimeter berm will provide sufficient short and long term resistance during liner installation and protective cover placement. If a tensile force is introduced into the liner system with a large enough magnitude to affect it, the material would pull out of the anchor trench before reaching its yield strength, which

is the preferable failure mode. It is concluded that the proposed liner system will be stable during all stages of the landfill development.

REFERENCE:

1. “2004 Specifier’s Guide, Geotechnical Fabrics Report”, Industrial Fabrics Association International (IFAI), Roseville, MN, December 2003.



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions LLC, C&D Landfill Phase 1

PROJECT NO. 0140408 SHEET 1 OF 4

DESCRIPTION Anchor Trench Design

OBJECTIVE:

To determine that the anchor trench provides proper pullout resistance.

METHODOLOGY:

The liner system consists of the following components (from top to bottom):

- 24 inches Protective Cover;
- Geotextile-Geonet-Geotextile Drainage Composite;
- 60-mil Textured HDPE Geomembrane;
- Compacted Soil Liner

The anchor trench will be designed so that the maximum allowable tension force in the HDPE geomembrane, T_{allow} , is greater than the pullout resistance, $T_{pullout}$. This will allow the geosynthetics to pull out of the anchor trench before the geomembrane reaches its yield strength. T_{allow} is based on the yield strength of the HDPE geomembrane and $T_{pullout}$ is the sum of the frictional forces on the upper and lower faces of the HDPE geomembrane.

REFERENCE:

1. "2004 Specifier's Guide, Geotechnical Fabrics Report", Industrial Fabrics Association International (IFAI), Roseville, MN, December 2003.
- 2.

CALCULATION:

The liner system design calls for the use of a 60-mil textured HDPE geomembrane liner. Assuming that potential suppliers of this material will be GSE Lining Technology, Inc. (GSE), National Seal Company (NSC), Serrot Corporation (Serrot), and Poly-Flex, Inc. (Poly-Flex), the following yield strengths for 60-mil textured HDPE geomembranes were taken from the 2003 Specifier's Guide (Reference 1):



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions LLC, C&D Landfill Phase 1

PROJECT NO. 0140408 SHEET 2 OF 4

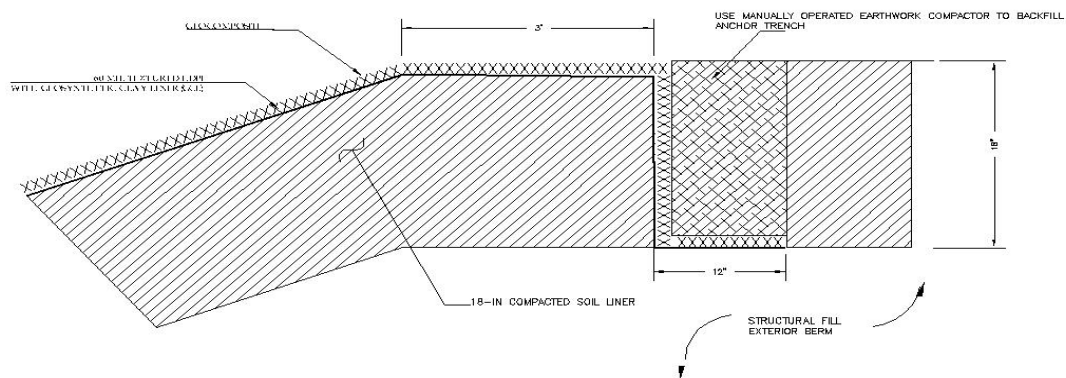
DESCRIPTION Anchor Trench Design

- GSE HD 60-mil: Yield Strength = 130 lbs/in
- Agru America 60-mil Yield Strength = 135 lbs/in
- Huikwang HD 150 60-mil Yield Strength = 126 lbs/in

The minimum reported yield strength of 126 lbs/in was used in this calculation. The maximum allowable tension force in the HDPE geomembrane, T_{allow} is found by applying a Factor of Safety Against Yield (FS_{yield}) of 1.5 to this yield strength. T_{allow} is calculated as follows:

$$\begin{aligned}
 T_{allow} &= \frac{\text{Yield Strength}}{FS_{yield}} \\
 &= \frac{126 \text{ ppi}}{1.5} * 12 \text{ in/ft} \\
 &= 1,008 \text{ lbs/ft}
 \end{aligned}$$

The proposed anchor trench designs are as follows:





BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions LLC, C&D Landfill Phase 1

PROJECT NO. 0140408 SHEET 3 OF 4

DESCRIPTION Anchor Trench Design

The frictional resistance mobilized by the anchor trench geometry to resist pullout is resolved as follows:

Where:

- $T_{pullout}$ = friction resistance against pullout (lbs/ft)
- F_{U1} = friction force above geomembrane (assumed negligible since cover soil probably moves along with liner as it deforms)
- F_{L1} = friction force below geomembrane (lbs/ft)
- $= q_1 * \tan(\delta_{gs}) * L_{RO}$
- q_1 = surcharge pressure (lbs/ft²)
- $= d_{cs} * \gamma_{cs}$
- d_{cs} = depth of cover soil (ft) = 2 ft
- γ_{cs} = unit weight of cover soil (lbs/ft³) = 120 lbs/ft³
- δ_{cs} = interface friction angle between geomembrane and compacted soil (degrees) = 18°
- L_{RO} = Length of runout (ft) = 2 ft
- F_{AT1} = $(\sigma_h)_{ave} * \tan(\delta_{gs}) * d_{AT}$
- $(\sigma_h)_{ave}$ = average horizontal stress in anchor trench (lb/ft²)
- $= K_o * \sigma_v$
- K_o = $1 - \sin(\phi)$
- ϕ = backfill soil angle of shear resistance (degrees) = 28°
- σ_v = $\gamma_{cs} * H_{ave}$ (lb/ft²)
- H_{ave} = average depth of anchor trench = 2 ft
- F_{AT2} = $(\sigma_h)_{ave} * \tan(\delta_{gc}) * d_{AT}$
- δ_{gc} = interface friction angle between geomembrane and drainage composite (degrees) = 24°
- d_{AT} = depth of anchor trench (ft) = 2 ft
- F_{U2} = $q_2 * \tan(\delta_{gc}) * L_{RO2}$
- q_2 = $d_{AT2} * \gamma_{cs}$
- d_{AT2} = depth of cover soil and backfill (ft) = 4 ft
- L_{RO2} = Length of runout in anchor trench (ft) = 1 ft
- F_{L2} = $q_2 * \tan(\delta_{gs}) * L_{RO2}$

The friction resistance to pullout $T_{pullout}$ is calculated as follows:

$$\begin{aligned}
 T_{pullout} &= F_{L1} + F_{AT1} + F_{AT2} + F_{U2} + F_{L2} \\
 &= [q_1 * \tan(\delta_{cs}) * L_{RO}] + [(\sigma_h)_{ave} * \tan(\delta_{cs}) * d_{AT}] + [(\sigma_h)_{ave} * \tan(\delta_{gc}) * d_{AT}] + [q_2 * \tan(\delta_{gc}) * L_{RO2}] \\
 &= [(2 \text{ ft} * 120 \text{ lbs/ft}^3) * \tan(18^\circ) * 2 \text{ ft}] + \{[1 - \sin(28^\circ)] * 120 \text{ lbs/ft}^3 * 2 \text{ ft} * \tan(18^\circ) * 2 \text{ ft}\} \\
 &\quad + \{[1 - \sin(28^\circ)] * 120 \text{ lbs/ft}^3 * 2 \text{ ft} * \tan(24^\circ) * 2 \text{ ft}\} + [(4 \text{ ft} * 120 \text{ lbs/ft}^3) * \tan(24^\circ) * 1 \text{ ft}] \\
 &\quad + [(4 \text{ ft} * 120 \text{ lbs/ft}^3) * \tan(18^\circ) * 1 \text{ ft}] \\
 &= 722 \text{ lbs/ft}
 \end{aligned}$$



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions LLC, C&D Landfill Phase 1

PROJECT NO. 0140408 SHEET 4 OF 4

DESCRIPTION Anchor Trench Design

CONCLUSION:

The maximum allowable tension force in the HDPE geomembrane, T_{allow} , is 1008 lbs/ft. The friction resistance to pullout $T_{pullout}$, is 722 lbs/ft. From Reference 1, the geomembrane will not normally experience any tensile forces. However, if a tensile force were somehow introduced into the liner system, the material would pull out of the anchor trench before reaching its yield strength.

MAXIMUM HEAD CALCULATIONS

This attachment refers to Section to Section .1624(b) of the North Carolina DENR Regulations, and specifically provides appropriate data and calculations to show that [from .1624(b)(2)] **"the Leachate Collection System (LCS) be hydraulically designed to remove leachate from the landfill and ensure that the leachate head on the composite liner does not exceed one foot."**

The leachate head directly above the primary HDPE geomembrane is required to be less than 1-foot to minimize the volume of leakage through the primary HDPE geomembrane.

Determination of the maximum head under worst case conditions was estimated using two methods. These two methods serve to "bracket" the potential leachate heads that could be developed on the proposed liner system. Each method was calculated based on the protective cover layer materials (Refer to Appendix B.1 for layer information).

METHOD 1

The first method utilized results from the Hydrologic Evaluation of Landfill Performance (HELP) computer model Version 3.07 (Schroeder et al). A detailed HELP model analysis of leachate generation is contained in this document. Under initial waste disposal conditions (2 feet of waste with no intermediate cover), the maximum leachate head was determined to be approximately 2 inches, which demonstrates that the double-sided geocomposite is adequately conveying the design leachate impingement rate.

METHOD 2

The second method of estimating the maximum hydraulic head on the proposed liner system is the methodology commonly referred to as the "Giroud" equation provided by Giroud et al., 1992. For a given liner slope, protective cover (drainage layer) permeability percolation rate, and spacing of lateral collection pipes, the location in the landfill experiencing the greatest hydraulic head will be at the lowest point along the longest flow path. Leachate heads on the primary HDPE geomembrane liner can be calculated using the following equation:

$$t_{\max} = j \frac{\sqrt{\tan^2 \beta + 4q_h} - \tan \beta}{2 \cos \beta} L$$

[Equation 1]

Where: t_{\max} = maximum head on liner (ft)
 q_h = leachate impingement rate (cm/sec)
 k = hydraulic conductivity of protective cover (cm/sec)
 L = length of longest flow path (ft)
 β = slope (degrees)

A hydraulic conductivity of the leachate collection zone was assumed to be equal to 1.0×10^{-3} cm/s. The length of the longest flow path on the base slopes is approximately 200 feet and the slope angle is approximately 2 percent (1.14 degrees). Using Equation 1 and a design leachate impingement rate of 1.55×10^{-5} cm/s, the maximum hydraulic head estimated by the Giroud equation is about 1 inch.

CONCLUSIONS

In summary, the two methods presented here indicate that the maximum anticipated hydraulic head on the proposed liner system should range between 2 inches (for 2 feet of waste overlying liner - from HELP model results) to 1 inch (as shown in the Giroud equation). As such, it is concluded that the proposed leachate collection system shall maintain the hydraulic head below 1-foot within the proposed landfill lateral expansion area. It should be noted that the leachate collection pump will not activate until the transducer indicates 8-inches of leachate is above the liner.



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions LLC – Maysvill C&D Landfill

PROJECT NO. 0140408 SHEET 1 OF 2

DESCRIPTION Geotextile Filter Retention

1. Obtain Apparent Opening Size (AOS) for Geotextile

Use 6 oz/sy nonwoven geotextile in which:

AOS = O_{95} = 0.212 mm (Synthetic Industries, Inc. 651 nonwoven geotextile)

2. Evaluate Geotextile Filter Criteria

The sandy soils in the protective soil layer overlying the nonwoven geotextile portion of the leachate collection system must meet the following gradation criteria in order for the geotextile to filter the soil material without clogging.

According to Carroll (1983), for nonwoven and woven geotextiles
(Table 2.3 from Koerner (1994), p. 101)

$$\frac{O_{95} \text{ Geotextile}}{d_{85} \text{ Of the Soil}} < 2 - 3$$

where:

d_{85} = Soil particle size for which 85% of the total soil is finer (mm)

O_{95} = 95% opening size of the geotextile

$$\therefore d_{85} > 0.106\text{mm} - 0.07\text{mm}$$



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions LLC C&D Landfill Phase 1

PROJECT NO. 0140408 SHEET 1 OF 4

DESCRIPTION Bearing Capacity Analysis

OBJECTIVE:

Estimate the bearing capacity of the subgrade soils for the proposed liner system. Near liner subgrade soils will consist of sandy materials compacted to a minimum of 95% maximum dry density.

METHODOLOGY:

Estimate bearing capacity using Terzaghi's ultimate bearing capacity equation.

REFERENCES:

1. Principles of Foundation Engineering, Second Edition, Das, Braja M., PWS Publishing Company, 1990.
2. "Construction Quality Assurance-Cell 2E, Phase I Construction, Charlotte Motor Speedway Landfill V, Appendix B.1," prepared by Almes & Assoc. Inc., August 2000.

CALCULATION:

The subgrade soils should possess the following minimum bearing capacity (q_{min}):

$$\begin{aligned} q_{min} &= 2.25 \text{ tsf} + \text{Total Applied Load psf} \\ &= (2.25 \text{ ton/ft}^2) \times (2000 \text{ lb./ton}) + \text{Total Applied Load psf} \\ &= 4,500 \text{ psf} + \text{Total Applied Load psf} \end{aligned}$$

Where:

$$\begin{aligned} \text{Total Applied Load} &= \text{Max Height of Waste} \times \text{Waste Density} \\ &= 42 \text{ ft} \times 65 \text{ pcf} \\ &= 2,730 \text{ psf} \end{aligned}$$



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions LLC C&D Landfill Phase 1

PROJECT NO. 0140408 SHEET 2 OF 4

DESCRIPTION Bearing Capacity Analysis

Therefore:

$$q_{\min} = 4,500 \text{ psf} + 2,730 \text{ psf} = 7,230 \text{ psf}$$

The ultimate bearing capacity, q_{ult} , of the subgrade soils will be calculated using Terzaghi's ultimate bearing capacity equation (Reference 1). Then, q_{ult} will be compared to the minimum required bearing capacity (maximum applied load), q_{\min} .

Assumptions:

- Subgrade (To Competent Rock)

$$\begin{aligned}\gamma_{d(\max)} &= 93.0 \text{ pcf} \quad (\text{Reference 2}) \\ \gamma_{\text{total}} &= 116.7 \text{ pcf} \quad (\text{Total unit weight at optimum moisture} = 25.5 \%) \\ \gamma_{\text{sat}} &= 123.1 \text{ pcf} \quad (\text{Saturated unit weight - assumed from total unit wt.}) \\ c &= 0 \text{ psf} \quad (\text{Assumed to be conservative}) \\ \phi &= 25^\circ \quad (\text{See Appendix E.2}) \\ N_\gamma &= 10 \quad (\text{Reference 1, p. 473})\end{aligned}$$

- Waste

$$\begin{aligned}\gamma_{\text{sat}} &= 65 \text{ pcf} \quad (\text{Saturated unit weight - assumed conservative}) \\ c &= 0 \text{ psf} \\ \phi &= 30^\circ \\ N_q &= 23 \quad (\text{Reference 1, p. 473})\end{aligned}$$

Theory:

The ultimate bearing capacity of soil for a strip footing may be given by:

$$q_{\text{ult}} = cN_c + qN_q + \frac{1}{2}\gamma_sBN_\gamma \quad (\text{General Shear Failure Equation})$$



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions LLC C&D Landfill Phase 1

PROJECT NO. 0140408 SHEET 3 OF 4

DESCRIPTION Bearing Capacity Analysis

For $c = 0$ psf

$$q_{ult} = 0 + qN_q + \frac{1}{2}\gamma_s B N_\gamma$$

$$q_{ult} = qN_q + \frac{1}{2}\gamma_s B N_\gamma$$

Where:

$$\begin{aligned} q &= \gamma_{\text{waste}} \times H_{\text{waste}} = \gamma_w \times H_w \\ N_q, N_\gamma &= \text{Modified Bearing Capacity Factors} \\ \gamma_s &= \text{Density of Subgrade} \\ B &= \text{Unit Width of Strip Footing} \end{aligned}$$

$$\begin{aligned} q_{ult} &= qN_q + \frac{1}{2}\gamma_s B N_\gamma \\ &= (\gamma_w \times H_w)N_q + \frac{1}{2}\gamma_s B N_\gamma \end{aligned}$$

For This Case:

$$\begin{aligned} \gamma_w &= 65 \text{ pcf} \\ H_w &= 46 \text{ ft. (Max. Waste Thickness)} \\ N_q &= 23 \\ \gamma_s &= 123.1 \text{ pcf} - 62.4 \text{ pcf} - (\text{Assume Subgrade to be Saturated}) \\ B &= 1 \text{ foot (Unit Width of Footing)} \\ N_\gamma &= 10 \end{aligned}$$

$$\begin{aligned} q_{ult} &= (65 \text{ pcf})(46.0 \text{ ft.})(23) + \frac{1}{2}(123.1 \text{ pcf} - 62.4 \text{ pcf})(1.0 \text{ ft.})(10) \\ &= 68,770 \text{ psf} + 303.5 \text{ psf} \\ &= 69,073.5 \text{ psf} \end{aligned}$$

$$q_{\text{allow}} = q_{ult}/FS$$

For $FS = 3.0$;



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions LLC C&D Landfill Phase 1

PROJECT NO. 0140408 SHEET 4 OF 4

DESCRIPTION Bearing Capacity Analysis

$$\begin{aligned} q_{\text{allow}} &= 69,073.5 \text{ psf}/3.0 \\ &= 23,024.5 \text{ psf} \end{aligned}$$

$$q_{\text{allow}} = \underline{\underline{23,024.5 \text{ psf}}}$$

As previously calculated:

$$\text{Min. B.C.} = q_{\text{min.}} = 7,230 \text{ psf}$$

Therefore;

$$q_{\text{min.}} = 7,230 \text{ psf} \ll 23,024.5 \text{ psf} = q_{\text{allow}}$$

Conclusion:

Based on the ultimate bearing capacity method, the subgrade soils possess more than adequate bearing capacity.

SUBGRADE SETTLEMENT AND STRAIN ANALYSIS

INTRODUCTION

This section addresses the settlement of the structural fill subgrade and the resulting strain in the geomembrane at the Green Recycling Solutions LLC C&D Landfill subsequent to waste placement.

To develop the grades required by the design, it will be necessary to place structural fill beneath portions of the landfill footprint. As waste is placed in the landfill above the structural fill, settlement of these soil components will occur. This settlement could result in a failure of the leachate collection system by creating low, undrainable areas in the landfill interior. Additionally, if the differential settlement of the soils is significant, the resulting strains could detrimentally effect the liner system.

SETTLEMENT ANALYSIS

Settlement of the structural fill can be estimated using the following equation:

$$\Delta H = \frac{C_c H}{1 + e_o} \log \frac{p_o + \Delta p}{p_o}$$

Where:

- ΔH = Settlement (ft);
- C_c = Coefficient of primary consolidation (dimensionless);
- H = Combined thickness of structural fill and compacted soil liner (ft);
- e_o = Initial void ratio of structural fill and compacted soil (dimensionless);
- p_o = Initial effective vertical stress in structural fill and compacted soil liner (psf); and
- Δp = Change in vertical effective stress produced by surcharge load from overlying municipal waste (psf).

Using the above equation, the above equation, the settlement was calculated for the interior toe of slope and at elevations 42, 44 and 46 base grades. The largest settlement of the structural fill was calculated to be 0.42 feet. The calculation of the settlement can be found in the calculation brief attached to this narrative.

After reviewing the attached calculations, it was concluded that the integrity of the leachate collection system would not be compromised. It was also concluded that, even though a settlement of 0.42 feet is anticipated, the resulting differential settlements are relative small and should not adversely effect the liner system.

STRAIN ANALYSIS

A large differential settlement of the structural fill could result in excessive resultant strains in the overlying geomembrane. The area containing the largest differential settlement was used to calculate the maximum resultant strain in the geomembrane. The maximum resultant strain was calculated as follows:

$$\text{Max. Resultant Strain} = \left(\frac{(\text{Settled Liner Length (ft)} - \text{Initial Liner Length (ft)})}{\text{Initial Liner Length (ft)}} \right) \times 100 \%$$

The maximum resultant strain for geomembrane was calculated to be 0.00002 percent. The calculation of the strain can be found in the calculation brief attached to this narrative.

CONCLUSION

The settlement of the structural fill has been evaluated in this analysis. Results show that settlement of these components resulting from the weight of the overlying waste will range from 0.11 feet near the perimeter to a maximum of about 0.42 feet near the center of the landfill. The maximum strain from differential settlement was estimated to be about 0.00002 percent, which is well below the allowable yield strain of 6 to 7 percent (ultimate yield strain with a factor of safety of 2) for HDPE geomembrane. Thus the resulting strain is small due to the small differential settlement within any particular area of the liner system.

Settlement of the structural fill will be relatively uniform over the entire landfill, and as such, the resulting settled base grade will still allow leachate to drain to the perimeter, and the leachate collection system will continue to function properly.

It is concluded that settlement of the structural fill and compacted soil liner will have minimal detrimental effect on the proper functioning of the liner and leachate collection systems. Additionally, the landfill grades have been designed to allow for a 5-foot vertical separation between HDPE liner and seasonal high water table to account for the predicted settlement.

REFERENCES:

1. Principles of Geotechnical Engineering, Das, Braja M., PWS Publishing Company, 1985.



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions C&D Landfill Phase 1

PROJECT NO. 0140408 SHEET 1 OF 5

DESCRIPTION Subgrade Settlement & Strain Analysis

OBJECTIVE:

To estimate the settlement that may occur in the structural fill beneath the landfill liner system and to determine the effect of this settlement with respect to maintaining proper flow conditions and minimizing liner system stress/strain. This settlement will occur as a consequence of placing C&D solid waste above the liner system.

METHODOLOGY:

Estimate settlement using one-dimensional consolidation theory.

REFERENCES:

1. Principles of Geotechnical Engineering, Das, Braja M., PWS Publishing Company, 1985.
2. Autodesk Land Desktop, 2004.
3. Topographic mapping prepared by Parker & Associates
4. "Site Hydrogeologic Study", Green Recycling Solutions LLC Maysville C&D Landfill, prepared by ERM NC Inc., December 2011.

CALCLATION:

Structural fill will be needed in all areas to develop the grades required by the design. Settlement of the structural fill will occur as waste is placed in the landfill, above these soil components.

Settlement of these components could result in "short-circuiting" the leachate collection system by creating low, undrainable areas in the landfill interior. Additionally, if differential settlement is significant, the resulting strains could detrimentally affect the liner system.



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions C&D Landfill Phase 1

PROJECT NO. 0140408 SHEET 2 OF 5

DESCRIPTION Subgrade Settlement & Strain Analysis

To evaluate the potential effect of settlement of the structural fill on the proper functioning of the liner system, an analysis is provided to estimate the settlement that may occur as follows.

Settlement

Settlement of the structural fill can be estimated using the following equation (Reference 1):

$$\Delta H = \frac{C_c H}{1 + e_o} \log \frac{p_o + \Delta p}{p_o}$$

Where:

- ΔH = Settlement (ft);
- C_c = Coefficient of primary consolidation (dimensionless);
- H = Combined thickness of structural fill and compacted soil liner (ft);
- e_o = Initial void ratio of structural fill and compacted soil (dimensionless);
- p_o = Initial effective vertical stress in structural fill and compacted soil liner (psf); and
- Δp = Change in vertical effective stress produced by surcharge load from overlying municipal waste (psf).

The coefficient of primary consolidation, C_c for remolded sandy and clayey silt soils was estimated using the following equation (Terzaghi and Peck, 1967, Reference 1):

$$C_c = 0.009(LL - 10)$$

Where:

- LL = Liquid limit (dimensionless).

The liquid limit, LL for material shown on the test boring logs were predominantly ML within the footprint of the proposed landfill is 25 (Conservative - assumed). Therefore, C_c equals 0.14.

The thickness of structural fill, H , was found using Land Desktop 2007 software, Proposed Grading Plan Drawing, and topographic mapping (Reference 3).

The initial void ratio, e_o , for the placed structural fill was estimated using the following equation (Reference 1):



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME **Green Recycling Solutions C&D Landfill Phase 1**

PROJECT NO. **0140408** SHEET **3** OF **5**

DESCRIPTION **Subgrade Settlement & Strain Analysis**

$$e_o = \frac{G_s \gamma_w}{\gamma_{d,a}} - 1$$

Where:

G_s = Specific Gravity = 2.70 (assumed);

γ_w = Density of water (pcf) = 62.4 pcf; and

$\gamma_{d,a}$ = Average dry density of in-situ soils and compacted soil liner (pcf).

The average initial void ratio based on the average dry density of in-situ soils and structural fill placed at the site (Reference 4) is 0.71.

The initial effective vertical stress in the structural fill, p_o is calculated using the following equation:

$$p_o = (H/2) * \gamma_d$$

Where:

γ_d = Dry density of structural fill (pcf).

The change in vertical effective stress in the structural fill, Δp , is calculated using the following equation:

$$\Delta p = H_t * \gamma_t$$

Where:

H_t = Maximum height of C&D waste; and

γ_t = Density of waste (pcf) = 65.0 pcf.

The maximum height of waste was found using Proposed Grading Plan and Facility Plan Drawings.



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions C&D Landfill Phase 1

PROJECT NO. 0140408 SHEET 4 OF 5

DESCRIPTION Subgrade Settlement & Strain Analysis

Settlement Analysis and Spreadsheet

Project Name: Green Recycling Solutions C&D Landfill Phase 1							
Project No.: 0140408							
Subject: Subgrade Settlement and Strain Analysis							
	Initial Void Ratio, $e_o = 0.71$			Maximum Settlement (ft) = 0.42		Maximum Waste Stress (psf) = 1,890.0	
Coefficient of Primary Consolidation, $C_c = 0.14$				Average Settlement (ft) = 0.26		Average Waste Stress (psf) = 1,012.5	
Unit Weight of Waste, γ_t (pcf) = 45				Minimum Settlement (ft) = 0.11		Minimum Waste Stress (psf) = 270.0	
Unit Weight of Soil, γ_d (pcf) = 120							
Number of Settlement Points = 4				<div>$\Delta H = \frac{C_c H}{1 + e_o} \log \frac{p_o + \Delta p}{p_o}$</div>			
Grid Node/ Point No.	Base Grade Elevation (MSL)	Subsurface and Clay Thickness, H (ft)	Municipal Waste Thickness, H_t (ft)	Initial Pressure at Midpoint of Str. Fill/ Clay, p_o (psf)	Added Pressure from Municipal Waste, Δp (psf)	Estimated Settlement of Str. Fill/Clay, ΔH (ft)	Resulting Settled Base Grade Elevation (MSL)
toe	40.0	5.0	6.0	300	270	0.11	39.9
42.0	42.0	5.0	16.0	300	720	0.22	41.8
44.0	44.0	5.0	26.0	300	1,170	0.28	43.7
46.0	46.0	7.0	42.0	420	1,890	0.42	45.6

In order to estimate the settlement that will occur within the landfill, settlement was evaluated at the interior toe of slope, at base elevations 40, 42, 44 and 46. Settlement was calculated using the equation provided above at these locations.

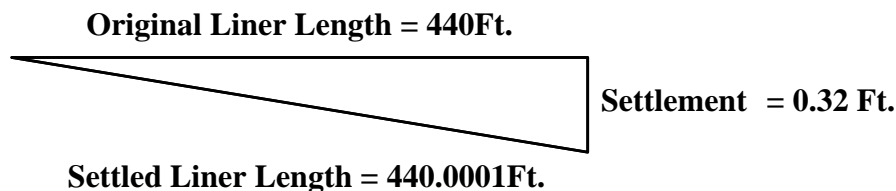
RESULTS:

Settlement

Results from the settlement evaluation (see above) show settlement of the structural fill ranged from 0.11 to 0.42 feet, and averaged about 0.28 feet.

Vertical Settlement Plan and Resulting Strain

Referring to the proposed grading plans, settlement base contours may have a maximum differential settlement of 0.32 ft over a distance of 440 feet (From toe to center of landfill). Differential settlement of this magnitude over this length would result in the following liner system strain being developed:





BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions C&D Landfill Phase 1

PROJECT NO. 0140408 SHEET 5 OF 5

DESCRIPTION Subgrade Settlement & Strain Analysis

$$\text{Maximum Resultant Strain} = [(.0001 \text{ ft}) \div 440 \text{ ft}] \times 100 = 0.000002\%$$

CONCLUSION:

The settlement of the structural fill has been evaluated in this analysis. Results show that settlement of these components resulting from the weight of the overlying municipal solid waste will range from 0.14 feet near the perimeter to a maximum of about 0.46 feet near the center of the landfill. The maximum strain from differential settlement was estimated to be about 0.000002 percent, which is well below the allowable yield strain of 6 to 7 percent (ultimate yield strain with a factor of safety of 2) for HDPE geomembrane. Thus, the resulting strain is small due to the small differential settlement within any particular area of the liner system.

Settlement of the natural soils and structural fill will be relatively uniform over the entire landfill, and as such, the resulting settled base grade will still allow leachate to drain to the perimeter, and the leachate detection system will continue to function properly.

It is concluded that settlement of the naturally occurring soils, structural fill and compacted soil liner will have minimal detrimental effect on the proper functioning of the liner and leachate collection systems.



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions LLC – Maysvill C&D Landfill

PROJECT NO. 0140408 SHEET 1 OF 4

DESCRIPTION Leachate Collection Pipe Loading conditions

OBJECTIVE:

Determine the Maximum Anticipated Load applied to the proposed leachate collection system and evaluate the structural integrity of the HDPE piping.

ASSUMPTIONS:

- Maximum Waste Thickness – 42 feet;
- Average Unit Weight of Waste - 60 pound per cubic foot (pcf);
- Modulus of Elasticity (E') of bedding material ~ 6,900 psi (Reference 2);
- Driscopipe 1000 Series (or approved equal) shall be used in all leachate collection applications;
- Live loads at the top of the maximum waste depth will be dissipated throughout the material such that they will not be considered significant to this calculation, and;
- Temperature in the landfill shall be assumed to be approximately 120° F.

METHODOLOGY:

- I. Establish the maximum design load by analyzing the load created by 42 feet of waste, which is the approximate maximum thickness of waste overlying the proposed liner system.
- II. Analyze the internal 6-inch diameter leachate collection piping system at the maximum design load for crushing, buckling and deflection in accordance with Driscopipe recommended design/analysis procedures.

I. Maximum Design Load Determination

The maximum design load is assumed to be generated by the maximum thickness of the future waste. Data regarding the applied loads are as follows:

- Maximum Waste Thickness = 42 feet (H_{waste})
- Average Unit Weight of Waste = 65 pcf (γ_{waste})

Therefore;

$$\Delta\sigma_{\text{max}} = \gamma_{\text{waste}} \times H_{\text{waste}}$$



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions LLC – Maysvill C&D Landfill

PROJECT NO. 0140408 SHEET 2 OF 4

DESCRIPTION Leachate Collection Pipe Loading conditions

Where:

γ_{waste} = Average Unit Weight of Waste

H_{waste} = Maximum Waste Thickness

$$\Delta\sigma_{\text{max}} = 65 \text{ pcf} \times 42 \text{ feet}$$

$$\Delta\sigma_{\text{max}} = 2,730 \text{ psf}$$

- Assuming that the stress contributed by the 24" thick bedding stone layer is its unit weight multiplied by its thickness [145 pcf * 24" = 290 psf], Determine The Total Applied Stress, (σ_{Total}):

Thus;

$$\sigma_{\text{Total}} = \Delta\sigma_{\text{max}} + \sigma_{\text{VOI}} \text{ (existing overburden stress created by protective cover)}$$

$$\sigma_{\text{Total}} = 2,730 \text{ psf} + 290 \text{ psf}$$

$$= \underline{\underline{3,020 \text{ psf}}} \text{ (Total Applied Stress or Max. Design Load)}$$

II. Pipe Design Analysis

A. 6-inch diameter HDPE SDR 17 leachate collection pipe Wall Crushing Factor of Safety:

$$S_a = \frac{(SDR - 1) * P_t}{2}$$

Where:

SDR – Pipe SDR (17 for this calculation)

P_t – Total Applied Stress/Maximum Design Load (in psi)

S_a – Stress affecting pipe wall crushing

$$S_a = \frac{(17 - 1) * 3,020 \text{ psf}}{2} * \frac{1 \text{ ft}^2}{144 \text{ in}^2}$$

$$S_a = 167.8 \text{ psi}$$



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions LLC – Maysvill C&D Landfill

PROJECT NO. 0140408 SHEET 3 OF 4

DESCRIPTION Leachate Collection Pipe Loading conditions

The Factor of Safety against crushing for Driscopipe is calculated as follows:

$$F.S. = \frac{1300 \text{ psi}}{S_a}$$

$$F.S. = \frac{1300 \text{ psi}}{167.8 \text{ psi}} = 7.7$$

The Factor of Safety against wall crushing for the leachate collection piping at the Green Recycling C&D Landfill is 7.7, and is therefore considered acceptable, with respect to wall crushing.

B. 6-inch diameter HDPE SDR 17 leachate collection pipe Wall Buckling Factor of Safety:

$$P_c = \frac{2.32(E)}{(SDR)^3} \quad P_{cb} = 0.8\sqrt{E' \times P_c}$$

Where:

P_c - Hydrostatic, critical-collapse differential pressure (psi)
 E - Stress and time dependent tensile modulus of elasticity of the pipe (psi)
 $E = 17,500 \text{ psi @ } 73.4^\circ\text{F} = 17,500 \text{ psi} \times 0.65 \text{ @ } 120^\circ\text{F} = 11,375 \text{ psi}$
 SDR - Pipe SDR (17 in this application)
 P_{cb} - Critical buckling soil pressure at the top of the pipe, (psi) =
 E' - Soil modulus = $1,000,000 \text{ psf} \div 144 = 6,944 \text{ psi} \approx 6,900 \text{ psi}$

$$P_c = \frac{2.32(11,375 \text{ psi})}{(17)^3} = 5.4 \text{ psi}$$

$$P_{cb} = 0.8\sqrt{6,900 \text{ psi} \times 5.4 \text{ psi}} = 154.4 \text{ psi}$$

$$F.S. = \frac{P_{cb}}{P_t}$$

$$F.S. = \frac{154.4 \text{ psi}}{20.9 \text{ psi}} = 7.4$$

The Factor of Safety against wall buckling for the leachate collection piping at the Green Recycling C&D landfill is 7.4, and is therefore considered acceptable with respect to wall buckling.



BY: _____ DATE: _____ CHKD BY: _____ DATE: _____

PROJECT NAME Green Recycling Solutions LLC – Maysvill C&D Landfill

PROJECT NO. 0140408 SHEET 4 OF 4

DESCRIPTION Leachate Collection Pipe Loading conditions

C. 6-inch diameter HDPE SDR 17 leachate collection pipe Ring Deflection Calculation:

The ring deflection of the collection piping is directly correlated to the strain created in the surrounding soil. Therefore, the strain in the soil will be calculated and the resultant percentage will be compared to allowable ring deflection percentages for Driscopipe 1000 series, for determination of acceptability.

$$\varepsilon_s = \frac{P_t \times D}{E'} \times 100\%$$

Where: ε_s – Pipe deflection/soil strain (%)
D – Deflection Lag Factor
E' – Soil Modulus (psi)
P_t – Total applied stress/Maximum design load (psi)

$$\varepsilon_s = \frac{20.9 \text{ psi} \times 1.5}{6,900 \text{ psi}} \times 100\% = 0.45\%$$

The allowable ring deflection for 6-inch HDPE SDR 17 Driscopipe 1000 series pipe is 2.7% (Reference 1). The calculated ring deflection of 0.45% is then considered acceptable.

REFERENCES

- 1.) Driscopipe® System Design Manual, pp. 33-47 .
- 2.) Bowles, Joseph E. (1981), Foundation Analysis and Design, Fourth Edition, p. 99.
- 3.) Das, B.M. (1990). Principles of Geotechnical Engineering, Second Edition, p. 199.
- 4.) Plexco/Spirolite Engineering Manual, System Design, pp. 24-64.

CHARACTERIZATION OF DESIGN SEISMIC EVENT

Per EPA Regulation 40 CFR Section 258.14 and North Carolina DENR Solid Waste Landfill Regulations Section NCAC .1622, (5), All containment structures, liners, geomembranes, leachate collection systems and surface water control systems in a seismic impact zone must be designed to resist the maximum horizontal acceleration in lithified earth material for the site.

A seismic impact zone is defined as an area with a 10% or greater chance that the maximum horizontal acceleration in lithified earth material will exceed .10g in 250 years.

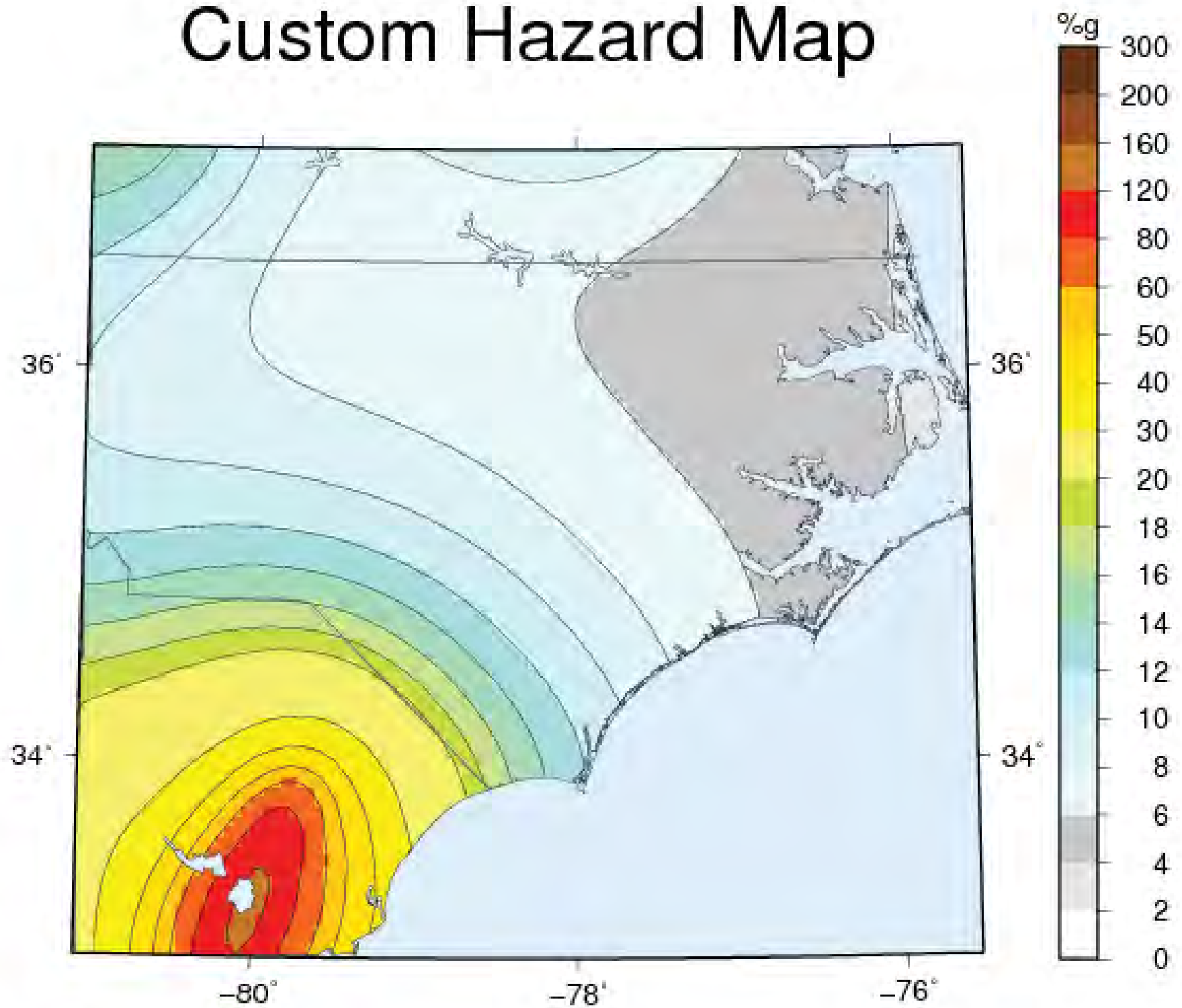
The degree of risk for a landfill corresponds to the maximum acceleration of a seismic event in which there is 90% or greater chance that this acceleration will not be exceeded in 250 years. Using the ground motion maps presented by Algermissen et al. (Ref 1) and the USGS web based custom seismic hazard mapping site, the effective peak acceleration for the Green Recycling C&D Landfill is between .06g and .08g.

The Green Recycling Solutions LLC proposed C&D Landfill is not in a seismic impact zone.

References

- 1) Algermissen, S.T. et al (1990) Probabilistic Earthquake Acceleration and Velocity Maps for the United States and Puerto Rico, US Geological Survey, Miscellaneous Field Studies Map. MF-2120.

Custom Hazard Map



Peak Ground Acceleration

Engineering Plan

Leachate Generation and Modeling

LEACHATE GENERATION SUMMARY

GREEN RECYCLING SOLUTIONS LLC MAYSVILLE C&D LANDFILL PHASE 1

Leachate generation rates for the Maysville C&D Landfill development, operations and closure were generated using: **THE HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE (HELP) MODEL, VERSION 3**, Developed by:

Paul R. Schroeder, Tamsen S. Dozier, Paul A. Zappi,
Bruce M. McEnroe, John W. Sjostrom and R. Lee Peyton
Environmental Laboratory
U.S. Army Corps of Engineers
Waterways Experiment Station
Vicksburg, MS 39180-6199

A summary of leachate generation rates for each phase of operation throughout Phase 1 development is shown on the table below:

	Area (ac)	Annual Average Leachate (cf)	Peak Daily Leachate (cf)	Average Daily Leachate (cf)	Maximum Head on Liner (in.)
Phase 1, Cell 1, No waste	1.0	61,382	7,599	168	1.10
Phase 1, Cell 1, 10-ft of waste	1.0	46,677	1,643	128	0.05
Phase 1 Cell 1, 30-ft of waste	1.0	46,626	965	128	0.03
Phase 1, Cell 1, Final Closure	1.0	5.487	0.12	0.02	0.03
Phase 1, Cell 2, No waste	1.3	79,797	9,879	219	1.43
Phase 1, Cell 2, 10-ft of waste	1.3	60,680	2,136	166	0.07
Phase 1 Cell 2, 30-ft of waste	1.3	60,614	1,255	166	0.03
Phase 1, Cell 2, Final Closure	1.3	7	0.16	0.02	0.04
Phase 1, Cell 3, No waste	1.8	110,488	13,678	302.71	1.98
Phase 1, Cell 3, 10-ft of waste	1.8	84,019	2,957	230.19	0.09
Phase 1 Cell 3, 30-ft of waste	1.8	83,927	1,737	229.94	0.05
Phase 1, Cell 3, Final Closure	1.8	10	0	0.03	0.06

Each Cell (1, 2 and 3) is managed with an independent leachate pump and storage tank so each Cell should be evaluated independently. A copy of the HELP Model Output Files follows this sheet. The Model was simulated for Cell 1 (1 – acre) with results applied to the Cells 2 and 3 acreage.

GREEN RECYCLING SOLUTIONS LLC
MAYSVILLE C&D LANDFILL
PHASE 1

HELP Model Output Simulation
Phase 1, Cell 1, Newly Constructed, No Waste

MAYSP1C1. OUT

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**
**      HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
**      HELP MODEL VERSION 3.07 (1 NOVEMBER 1997)
**      DEVELOPED BY ENVIRONMENTAL LABORATORY
**      USAE WATERWAYS EXPERIMENT STATION
**      FOR USEPA RISK REDUCTION ENGINEERING LABORATORY
**
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PRECIPITATION DATA FILE:  C:\HELP3\DATA4M1.D4
TEMPERATURE DATA FILE:   C:\HELP3\DATA7M1.D7
SOLAR RADIATION DATA FILE: C:\HELP3\DATA13M1.D13
EVAPOTRANSPIRATION DATA:  C:\HELP3\DATA11M1.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\MAYS01IN.D10
OUTPUT DATA FILE:         C:\HELP3\OUTPUT\MAYSP1C1.OUT

```

TIME: 12:13 DATE: 5/ 6/2013

```

*****
TITLE:  MAYSVILLE, PHASE 1, CELL 1, NO WASTE
*****

```

NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1 -----

```

          TYPE 1 - VERTICAL PERCOLATION LAYER
          MATERIAL TEXTURE NUMBER 4
THICKNESS           = 24.00 INCHES
POROSITY             = 0.4370 VOL/VOL
FIELD CAPACITY       = 0.1050 VOL/VOL
WILTING POINT        = 0.0470 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.1868 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.170000002000E-02 CM/SEC

```

LAYER 2 -----

TYPE 2 - LATERAL DRAINAGE LAYER
Page 1

MAYSP1C1. OUT

	MATERIAL	TEXTURE	NUMBER	
			34	
THICKNESS	=	0.20		INCHES
POROSITY	=	0.8500		VOL/VOL
FIELD CAPACITY	=	0.0100		VOL/VOL
WILTING POINT	=	0.0050		VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0224		VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	33.0000000000		CM/SEC
SLOPE	=	2.25		PERCENT
DRAINAGE LENGTH	=	200.0		FEET

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER

	MATERIAL	TEXTURE	NUMBER	
			35	
THICKNESS	=	0.60		INCHES
POROSITY	=	0.0000		VOL/VOL
FIELD CAPACITY	=	0.0000		VOL/VOL
WILTING POINT	=	0.0000		VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000		VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12		CM/SEC
FML PINHOLE DENSITY	=	4.00		HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00		HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD		

LAYER 4

TYPE 3 - BARRIER SOIL LINER

	MATERIAL	TEXTURE	NUMBER	
			17	
THICKNESS	=	0.60		INCHES
POROSITY	=	0.7500		VOL/VOL
FIELD CAPACITY	=	0.7470		VOL/VOL
WILTING POINT	=	0.4000		VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500		VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08		CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER

	MATERIAL	TEXTURE	NUMBER	
			6	
THICKNESS	=	120.00		INCHES
POROSITY	=	0.4530		VOL/VOL
FIELD CAPACITY	=	0.1900		VOL/VOL
WILTING POINT	=	0.0850		VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1900		VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03		CM/SEC

MAYSP1C1. OUT

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	0.50	
FRACTION OF AREA ALLOWING RUNOFF	=	5.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	4.056	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	9.614	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.034	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	27.737	INCHES
TOTAL INITIAL WATER	=	27.737	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
RALEIGH NORTH CAROLINA

STATION LATITUDE	=	35.87	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	86	
END OF GROWING SEASON (JULIAN DATE)	=	310	
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.70	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	70.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	78.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	72.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.55	3.43	3.69	2.91	3.67	3.66
4.38	4.44	3.29	2.73	2.87	3.14

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
39.60	41.60	49.30	59.50	67.20	73.90
77.70	77.00	71.00	59.70	50.00	42.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING

MAYSP1C1. OUT
 COEFFICIENTS FOR RALEIGH NORTH CAROLINA
 AND STATION LATITUDE = 35.87 DEGREES

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.47 5.09	4.13 5.95	2.90 1.76	1.41 3.46	1.78 0.70	5.80 4.70
RUNOFF	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
EVAPOTRANSPIRATION	1.195 4.198	1.910 3.354	2.720 1.535	1.675 2.264	2.175 0.575	3.873 1.192
LATERAL DRAINAGE COLLECTED FROM LAYER 2	0.6097 1.2021	0.5569 1.9775	1.6516 1.0326	0.4339 1.9150	0.1876 0.2427	0.1443 2.5295
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 3	0.001 0.002	0.001 0.003	0.003 0.002	0.001 0.003	0.000 0.000	0.000 0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 3	0.001 0.003	0.002 0.003	0.003 0.001	0.000 0.004	0.000 0.000	0.000 0.004

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.15	142114.484	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	26.666	96798.414	68.11
DRAINAGE COLLECTED FROM LAYER 2	12.4834	45314.762	31.89

MAYSP1C1. OUT

PERC. /LEAKAGE THROUGH LAYER 4	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0016		
PERC. /LEAKAGE THROUGH LAYER 5	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	0.000	1.364	0.00
SOIL WATER AT START OF YEAR	27.737	100684.805	
SOIL WATER AT END OF YEAR	27.737	100686.164	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.059	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.46 3.88	2.15 1.35	4.79 0.90	3.25 8.01	8.08 1.39	7.14 1.50
RUNOFF	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
EVAPOTRANSPIRATION	1.518 2.926	1.652 1.848	2.816 0.465	3.027 2.758	4.611 1.534	3.475 1.212
LATERAL DRAINAGE COLLECTED FROM LAYER 2	1.6894 0.8509	0.4071 1.2468	1.1914 0.2931	0.4653 4.2208	4.0008 0.6256	2.6311 0.2844
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 3	0.003 0.001	0.001 0.002	0.002 0.000	0.001 0.006	0.006 0.001	0.004 0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 3	0.002 0.001	0.000 0.001	0.002 0.000	0.000 0.011	0.009 0.001	0.005 0.000

MAYSP1C1. OUT

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.90	162986.984	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	27.841	101061.805	62.01
DRAINAGE COLLECTED FROM LAYER 2	17.9067	65001.355	39.88
PERC. /LEAKAGE THROUGH LAYER 4	0.000003	0.010	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0023		
PERC. /LEAKAGE THROUGH LAYER 5	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-0.847	-3076.141	-1.89
SOIL WATER AT START OF YEAR	27.737	100686.164	
SOIL WATER AT END OF YEAR	26.890	97610.023	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.028	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	8.46 7.60	2.96 16.42	6.34 5.13	0.99 4.30	1.78 1.99	3.75 2.02
RUNOFF	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
EVAPOTRANSPIRATION	1.926 4.896	2.299 4.612	2.394 2.481	1.731 2.079	1.534 2.054	2.276 1.088
LATERAL DRAINAGE COLLECTED FROM LAYER 2	4.5125 3.1633	2.6177 10.7250	2.8583 4.2521	0.4823 0.8696	0.2273 1.2162	0.4509 0.8582

MAYSP1C1. OUT

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 3	0.007	0.004	0.004	0.001	0.000	0.001
	0.005	0.084	0.007	0.001	0.002	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 3	0.009	0.004	0.011	0.000	0.000	0.002
	0.008	0.282	0.015	0.003	0.001	0.001

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
	-----	-----	-----
PRECIPITATION	61.74	224116.172	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	29.370	106613.258	47.57
DRAINAGE COLLECTED FROM LAYER 2	32.2333	117006.930	52.21
PERC./LEAKAGE THROUGH LAYER 4	0.000003	0.012	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0098		
PERC./LEAKAGE THROUGH LAYER 5	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	0.137	496.061	0.22
SOIL WATER AT START OF YEAR	26.890	97610.023	
SOIL WATER AT END OF YEAR	27.026	98106.086	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.069	0.00

MAYSP1C1. OUT

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.52 5.00	3.18 3.17	4.19 3.87	1.86 0.95	3.54 3.95	2.98 3.65
RUNOFF	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
EVAPOTRANSPIRATION	1.706 2.822	2.239 2.888	1.976 2.978	2.393 1.069	3.512 1.988	2.593 1.350
LATERAL DRAINAGE COLLECTED FROM LAYER 2	0.3311 1.0993	1.2983 0.4528	1.0841 1.1927	0.8417 0.4334	0.3908 1.1328	0.2088 2.3811
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 3	0.001 0.002	0.002 0.001	0.002 0.002	0.001 0.001	0.001 0.002	0.000 0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 3	0.000 0.002	0.002 0.000	0.001 0.003	0.001 0.000	0.000 0.002	0.000 0.006

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.86	141061.766	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	27.516	99882.523	70.81
DRAINAGE COLLECTED FROM LAYER 2	10.8470	39374.687	27.91
PERC. /LEAKAGE THROUGH LAYER 4	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0014		
PERC. /LEAKAGE THROUGH LAYER 5	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	0.497	1804.594	1.28

	MAYSP1C1. OUT		
SOIL WATER AT START OF YEAR	27.026	98106.086	
SOIL WATER AT END OF YEAR	27.524	99910.680	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.042	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.39 1.28	1.68 4.39	3.64 2.40	5.64 2.15	2.49 4.56	7.41 2.64
RUNOFF	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
EVAPOTRANSPIRATION	1.371 1.400	1.719 2.076	1.913 2.722	4.087 1.447	2.593 2.300	4.678 1.516
LATERAL DRAINAGE COLLECTED FROM LAYER 2	0.5830 0.7630	0.1783 0.7121	0.9732 0.8427	1.4959 0.3650	0.8602 1.7426	1.9868 0.5751
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 3	0.001 0.001	0.000 0.001	0.001 0.001	0.002 0.001	0.001 0.003	0.003 0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 3	0.001 0.001	0.000 0.002	0.002 0.001	0.001 0.000	0.002 0.004	0.005 0.001

ANNUAL TOTALS FOR YEAR 5

	MAYSP1C1. OUT INCHES	CU. FEET	PERCENT
	-----	-----	-----
PRECIPITATION	39.67	144002.109	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	27.823	100995.727	70.13
DRAINAGE COLLECTED FROM LAYER 2	11.0780	40213.152	27.93
PERC. /LEAKAGE THROUGH LAYER 4	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0014		
PERC. /LEAKAGE THROUGH LAYER 5	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	0.769	2793.260	1.94
SOIL WATER AT START OF YEAR	27.524	99910.680	
SOIL WATER AT END OF YEAR	28.293	102703.937	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.028	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
	-----	-----	-----	-----	-----	-----
PRECIPITATION						
TOTALS	3.26 4.57	2.82 6.26	4.37 2.81	2.63 3.77	3.53 2.52	5.42 2.90
STD. DEVIATIONS	2.96 2.29	0.95 5.93	1.30 1.69	1.89 2.69	2.64 1.66	1.99 1.28
RUNOFF						
TOTALS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
STD. DEVIATIONS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
EVAPOTRANSPIRATION						
TOTALS	1.543 3.248	1.964 2.956	2.364 2.036	2.583 1.923	2.885 1.691	3.379 1.272

	MAYSP1C1. OUT					
STD. DEVIATIONS	0.285 1.353	0.295 1.108	0.414 1.034	1.006 0.670	1.203 0.682	0.971 0.166
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	1.5451 1.4157	1.0116 3.0229	1.5517 1.5226	0.7438 1.5608	1.1334 0.9920	1.0844 1.3257
STD. DEVIATIONS	1.7393 0.9931	0.9910 4.3449	0.7746 1.5631	0.4520 1.6109	1.6251 0.5765	1.1466 1.0523
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3						
AVERAGES	0.0024 0.0022	0.0017 0.0181	0.0024 0.0024	0.0012 0.0024	0.0017 0.0016	0.0017 0.0020
STD. DEVIATIONS	0.0027 0.0015	0.0017 0.0367	0.0012 0.0025	0.0007 0.0025	0.0025 0.0009	0.0018 0.0016

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 5

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.86	(9.753)	162856.3	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	27.843	(0.9778)	101070.34	62.061
LATERAL DRAINAGE COLLECTED FROM LAYER 2	16.90969	(9.03000)	61382.180	37.69101
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00000	(0.00000)	0.010	0.00001

AVERAGE HEAD ON TOP OF LAYER 3	MAYSP1C1. OUT 0.003 (0.004)		
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00000 (0.00000)	0.000	0.00000
CHANGE IN WATER STORAGE	0.111 (0.6153)	403.83	0.248

♀

PEAK DAILY VALUES FOR YEARS	1 THROUGH	5
	(INCHES)	(CU. FT.)
PRECIPITATION	5.22	18948.600
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 2	2.09345	7599.23242
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000000	0.00111
AVERAGE HEAD ON TOP OF LAYER 3	1.184	
MAXIMUM HEAD ON TOP OF LAYER 3	1.103	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	12.6 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000000	0.00000
SNOW WATER	1.67	6061.1182
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.3134
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.0958

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

♀

FINAL WATER STORAGE AT END OF YEAR	5
LAYER	(INCHES) (VOL/VOL)

	MAYSP1C1. OUT	
-----	-----	-----
1	5. 0349	0. 2098
2	0. 0090	0. 0448
3	0. 0000	0. 0000
4	0. 4500	0. 7500
5	22. 7992	0. 1900
SNOW WATER	0. 000	

GREEN RECYCLING SOLUTIONS LLC
MAYSVILLE C&D LANDFILL
PHASE 1

HELP Model Output Simulation
Phase 1, Cell 1, 10-ft of Waste, Above Perimeter Berm

MAYSC10P. OUT

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**
**      HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
**      HELP MODEL VERSION 3.07 (1 NOVEMBER 1997)
**      DEVELOPED BY ENVIRONMENTAL LABORATORY
**      USAE WATERWAYS EXPERIMENT STATION
**      FOR USEPA RISK REDUCTION ENGINEERING LABORATORY
**
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PRECIPITATION DATA FILE:  C:\HELP3\DATA4M1.D4
TEMPERATURE DATA FILE:   C:\HELP3\DATA7M1.D7
SOLAR RADIATION DATA FILE: C:\HELP3\DATA13M1.D13
EVAPOTRANSPIRATION DATA:  C:\HELP3\DATA11M1.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\MAYOP10.D10
OUTPUT DATA FILE:         C:\HELP3\OUTPUT\MAYSC10P.OUT

```

TIME: 6:48 DATE: 6/19/2013

TITLE: MAYSVILLE, PHASE 1, CELL 1, 10-FT WASTE

NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

```

          TYPE 1 - VERTICAL PERCOLATION LAYER
          MATERIAL TEXTURE NUMBER 2
THICKNESS           = 6.00 INCHES
POROSITY             = 0.4370 VOL/VOL
FIELD CAPACITY       = 0.0620 VOL/VOL
WILTING POINT       = 0.0240 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.1178 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.579999993000E-02 CM/SEC

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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER

Page 1

MAYSC10P. OUT

		MATERIAL TEXTURE NUMBER	18	
THICKNESS	=	120.00	INCHES	
POROSITY	=	0.6710	VOL/VOL	
FIELD CAPACITY	=	0.2920	VOL/VOL	
WILTING POINT	=	0.0770	VOL/VOL	
INITIAL SOIL WATER CONTENT	=	0.3060	VOL/VOL	
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC	

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER

		MATERIAL TEXTURE NUMBER	4	
THICKNESS	=	24.00	INCHES	
POROSITY	=	0.4370	VOL/VOL	
FIELD CAPACITY	=	0.1050	VOL/VOL	
WILTING POINT	=	0.0470	VOL/VOL	
INITIAL SOIL WATER CONTENT	=	0.1851	VOL/VOL	
EFFECTIVE SAT. HYD. COND.	=	0.170000002000E-02	CM/SEC	

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER

		MATERIAL TEXTURE NUMBER	34	
THICKNESS	=	0.20	INCHES	
POROSITY	=	0.8500	VOL/VOL	
FIELD CAPACITY	=	0.0100	VOL/VOL	
WILTING POINT	=	0.0050	VOL/VOL	
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL	
EFFECTIVE SAT. HYD. COND.	=	33.0000000000	CM/SEC	
SLOPE	=	2.25	PERCENT	
DRAINAGE LENGTH	=	200.0	FEET	

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER

		MATERIAL TEXTURE NUMBER	35	
THICKNESS	=	0.60	INCHES	
POROSITY	=	0.0000	VOL/VOL	
FIELD CAPACITY	=	0.0000	VOL/VOL	
WILTING POINT	=	0.0000	VOL/VOL	
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL	
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC	
FML PINHOLE DENSITY	=	4.00	HOLES/ACRE	
FML INSTALLATION DEFECTS	=	2.00	HOLES/ACRE	
FML PLACEMENT QUALITY	=	3 - GOOD		

LAYER 6

MAYSC10P. OUT

TYPE 3 - BARRIER SOIL LINER

MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.60	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 6

THICKNESS	=	120.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1900	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
SOIL DATA BASE USING SOIL TEXTURE # 2 WITH BARE
GROUND CONDITIONS, A SURFACE SLOPE OF 5. % AND
A SLOPE LENGTH OF 80. FEET.

SCS RUNOFF CURVE NUMBER	=	81.70	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	5.159	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	13.358	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.376	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	65.124	INCHES
TOTAL INITIAL WATER	=	65.124	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
RALEIGH NORTH CAROLINA

STATION LATITUDE	=	35.87	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	86	
END OF GROWING SEASON (JULIAN DATE)	=	310	
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES

MAYSC10P. OUT

AVERAGE ANNUAL WIND SPEED	=	7.70 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	70.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	78.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	72.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
-----	-----	-----	-----	-----	-----
3.55	3.43	3.69	2.91	3.67	3.66
4.38	4.44	3.29	2.73	2.87	3.14

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
-----	-----	-----	-----	-----	-----
39.60	41.60	49.30	59.50	67.20	73.90
77.70	77.00	71.00	59.70	50.00	42.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA
AND STATION LATITUDE = 35.87 DEGREES

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
	-----	-----	-----	-----	-----	-----
PRECIPITATION	1.47	4.13	2.90	1.41	1.78	5.80
	5.09	5.95	1.76	3.46	0.70	4.70
RUNOFF	0.000	0.001	0.000	0.000	0.000	0.001
	0.144	0.038	0.000	0.009	0.000	0.000
EVAPOTRANSPIRATION	1.624	2.163	3.319	1.643	2.346	4.600
	4.514	4.462	2.024	2.760	0.669	1.203
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1.9728	0.7038	0.5843	1.0290	0.3263	0.1594
	0.1481	0.0960	0.6663	0.4494	1.2359	0.2600
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MAYSC10P. OUT

PERCOLATION/LEAKAGE THROUGH LAYER 7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 5	0.003	0.001	0.001	0.002	0.001	0.000
	0.000	0.000	0.001	0.001	0.002	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 5	0.003	0.001	0.001	0.001	0.000	0.000
	0.000	0.000	0.001	0.000	0.002	0.000

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
	-----	-----	-----
PRECIPITATION	39.15	142114.484	100.00
RUNOFF	0.192	698.091	0.49
EVAPOTRANSPIRATION	31.328	113719.531	80.02
DRAINAGE COLLECTED FROM LAYER 4	7.6312	27701.225	19.49
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0010		
PERC./LEAKAGE THROUGH LAYER 7	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-0.001	-4.265	0.00
SOIL WATER AT START OF YEAR	65.124	236398.437	
SOIL WATER AT END OF YEAR	65.122	236394.172	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.101	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

MAYSC10P. OUT

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.46 3.88	2.15 1.35	4.79 0.90	3.25 8.01	8.08 1.39	7.14 1.50
RUNOFF	0.070 0.043	0.000 0.001	0.000 0.000	0.000 0.276	0.303 0.000	0.015 0.000
EVAPOTRANSPIRATION	1.536 3.431	1.985 2.397	3.160 0.418	3.663 2.456	5.372 2.014	3.611 1.238
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1.8773 2.3525	1.6372 0.9253	0.6453 0.4353	0.9325 0.2365	0.3430 3.3115	1.9964 1.3568
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 5	0.003 0.004	0.003 0.001	0.001 0.001	0.001 0.000	0.001 0.005	0.003 0.002
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 5	0.003 0.002	0.002 0.001	0.000 0.000	0.001 0.000	0.000 0.003	0.003 0.002

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.90	162986.984	100.00
RUNOFF	0.708	2571.796	1.58
EVAPOTRANSPIRATION	31.281	113548.562	69.67
DRAINAGE COLLECTED FROM LAYER 4	16.0496	58259.988	35.75
PERC. /LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0021		
PERC. /LEAKAGE THROUGH LAYER 7	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-3.139	-11393.296	-6.99
SOIL WATER AT START OF YEAR	65.122	236394.172	
SOIL WATER AT END OF YEAR	61.984	225000.875	

MAYSC10P. OUT

SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.059	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	8.46 7.60	2.96 16.42	6.34 5.13	0.99 4.30	1.78 1.99	3.75 2.02
RUNOFF	0.115 0.167	0.007 2.567	0.167 0.525	0.000 0.079	0.000 0.000	0.173 0.000
EVAPOTRANSPIRATION	1.923 5.878	2.295 4.962	2.786 3.006	2.036 2.073	1.724 2.166	2.332 1.218
LATERAL DRAINAGE COLLECTED FROM LAYER 4	0.3036 0.1879	2.3426 1.8253	3.9227 7.9746	2.4921 2.8782	0.5089 0.9226	0.2026 1.0066
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 5	0.000 0.000	0.004 0.003	0.006 0.013	0.004 0.004	0.001 0.001	0.000 0.002
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 5	0.000 0.000	0.004 0.002	0.003 0.006	0.002 0.002	0.000 0.002	0.000 0.001

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	61.74	224116.172	100.00

MAYSC10P. OUT

RUNOFF	3. 799	13790. 698	6. 15
EVAPOTRANSPIRATION	32. 400	117610. 703	52. 48
DRAINAGE COLLECTED FROM LAYER 4	24. 5676	89180. 211	39. 79
PERC. /LEAKAGE THROUGH LAYER 6	0. 000003	0. 009	0. 00
AVG. HEAD ON TOP OF LAYER 5	0. 0032		
PERC. /LEAKAGE THROUGH LAYER 7	0. 000000	0. 000	0. 00
CHANGE IN WATER STORAGE	0. 974	3534. 578	1. 58
SOIL WATER AT START OF YEAR	61. 984	225000. 875	
SOIL WATER AT END OF YEAR	62. 957	228535. 453	
SNOW WATER AT START OF YEAR	0. 000	0. 000	0. 00
SNOW WATER AT END OF YEAR	0. 000	0. 000	0. 00
ANNUAL WATER BUDGET BALANCE	0. 0000	-0. 010	0. 00

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2. 52 5. 00	3. 18 3. 17	4. 19 3. 87	1. 86 0. 95	3. 54 3. 95	2. 98 3. 65
RUNOFF	0. 000 0. 093	0. 035 0. 000	0. 030 0. 144	0. 000 0. 000	0. 000 0. 022	0. 002 0. 229
EVAPOTRANSPIRATION	1. 706 3. 227	2. 225 2. 873	2. 532 3. 692	3. 125 1. 157	3. 415 1. 995	3. 070 1. 348
LATERAL DRAINAGE COLLECTED FROM LAYER 4	0. 8845 0. 1860	0. 4421 0. 1396	1. 2160 0. 3010	0. 6271 0. 4993	0. 3945 0. 4677	0. 2344 1. 0016
PERCOLATION/LEAKAGE THROUGH LAYER 6	0. 0000 0. 0000	0. 0000 0. 0000	0. 0000 0. 0000	0. 0000 0. 0000	0. 0000 0. 0000	0. 0000 0. 0000
PERCOLATION/LEAKAGE THROUGH LAYER 7	0. 0000 0. 0000	0. 0000 0. 0000	0. 0000 0. 0000	0. 0000 0. 0000	0. 0000 0. 0000	0. 0000 0. 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

MAYSC10P. OUT

AVERAGE DAILY HEAD ON	0.001	0.001	0.002	0.001	0.001	0.000
TOP OF LAYER 5	0.000	0.000	0.000	0.001	0.001	0.002

STD. DEVIATION OF DAILY	0.001	0.000	0.001	0.001	0.000	0.000
HEAD ON TOP OF LAYER 5	0.000	0.000	0.000	0.001	0.000	0.001

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.86	141061.766	100.00
RUNOFF	0.556	2017.194	1.43
EVAPOTRANSPIRATION	30.365	110223.852	78.14
DRAINAGE COLLECTED FROM LAYER 4	6.3938	23209.607	16.45
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0008		
PERC./LEAKAGE THROUGH LAYER 7	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	1.546	5611.182	3.98
SOIL WATER AT START OF YEAR	62.957	228535.453	
SOIL WATER AT END OF YEAR	64.503	234146.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.078	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.39	1.68	3.64	5.64	2.49	7.41
	1.28	4.39	2.40	2.15	4.56	2.64
RUNOFF	0.000	0.000	0.051	0.016	0.000	0.112
	0.000	0.000	0.004	0.000	0.031	0.067

MAYSC10P. OUT

EVAPOTRANSPIRATION	1.683	1.816	1.999	4.165	3.003	5.066
	1.678	2.357	3.383	1.590	2.292	1.627
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1.6596	0.6346	0.2738	0.2159	1.3684	0.4099
	1.6716	0.6633	0.4743	0.5126	0.2508	1.5165
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

 MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 5	0.003	0.001	0.000	0.000	0.002	0.001
	0.003	0.001	0.001	0.001	0.000	0.002
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 5	0.002	0.000	0.000	0.000	0.001	0.000
	0.002	0.001	0.001	0.000	0.000	0.001

 ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
	-----	-----	-----
PRECIPITATION	39.67	144002.109	100.00
RUNOFF	0.281	1020.624	0.71
EVAPOTRANSPIRATION	30.658	111289.664	77.28
DRAINAGE COLLECTED FROM LAYER 4	9.6513	35034.367	24.33
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0012		
PERC./LEAKAGE THROUGH LAYER 7	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-0.921	-3342.515	-2.32
SOIL WATER AT START OF YEAR	64.503	234146.625	
SOIL WATER AT END OF YEAR	63.582	230804.109	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.033	0.00

MAYSC10P. OUT

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.26 4.57	2.82 6.26	4.37 2.81	2.63 3.77	3.53 2.52	5.42 2.90
STD. DEVIATIONS	2.96 2.29	0.95 5.93	1.30 1.69	1.89 2.69	2.64 1.66	1.99 1.28
RUNOFF						
TOTALS	0.037 0.090	0.008 0.521	0.050 0.135	0.003 0.073	0.061 0.011	0.061 0.059
STD. DEVIATIONS	0.053 0.069	0.015 1.144	0.069 0.227	0.007 0.118	0.135 0.015	0.078 0.099
EVAPOTRANSPIRATION						
TOTALS	1.695 3.746	2.097 3.410	2.759 2.504	2.926 2.007	3.172 1.827	3.736 1.327
STD. DEVIATIONS	0.144 1.564	0.194 1.219	0.525 1.325	1.067 0.646	1.388 0.658	1.112 0.177
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	1.3396 0.9092	1.1521 0.7299	1.3284 1.9703	1.0593 0.9152	0.5882 1.2377	0.6005 1.0283
STD. DEVIATIONS	0.7198 1.0353	0.8102 0.7058	1.4896 3.3591	0.8614 1.1029	0.4419 1.2214	0.7861 0.4842
PERCOLATION/LEAKAGE THROUGH LAYER 6						
TOTALS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 7						
TOTALS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

MAYSC10P. OUT

DAI LY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0021 0.0014	0.0020 0.0011	0.0020 0.0031	0.0017 0.0014	0.0009 0.0020	0.0010 0.0016
STD. DEVIATI ONS	0.0011 0.0016	0.0014 0.0011	0.0023 0.0053	0.0014 0.0017	0.0007 0.0019	0.0012 0.0007

AVERAGE ANNUAL TOTALS & (STD. DEVIATI ONS) FOR YEARS 1 THROUGH 5

	I NCHES		CU. FEET	PERCENT
PRECI PI TATI ON	44.86	(9.753)	162856.3	100.00
RUNOFF	1.107	(1.5189)	4019.68	2.468
EVAPOTRANSPI RATI ON	31.206	(0.7831)	113278.46	69.557
LATERAL DRAINAGE COLLECTED FROM LAYER 4	12.85870	(7.52807)	46677.082	28.66152
PERCOLATI ON/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.002	(0.001)		
PERCOLATI ON/LEAKAGE THROUGH LAYER 7	0.00000	(0.00000)	0.000	0.00000
CHANGE I N WATER STORAGE	-0.308	(1.8413)	-1118.86	-0.687

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PEAK DAI LY VALUES FOR YEARS 1 THROUGH 5

	(I NCHES)	(CU. FT.)
PRECI PI TATI ON	5.22	18948.600
RUNOFF	2.052	7447.0986
DRAINAGE COLLECTED FROM LAYER 4	0.45263	1643.04187
PERCOLATI ON/LEAKAGE THROUGH LAYER 6	0.000000	0.00005
AVERAGE HEAD ON TOP OF LAYER 5	0.022	
MAXI MUM HEAD ON TOP OF LAYER 5	0.043	

MAYSC10P. OUT

LOCATION OF MAXIMUM HEAD IN LAYER	4		
(DISTANCE FROM DRAIN)		2.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER	7	0.000000	0.00000
SNOW WATER		1.67	6061.1182
MAXIMUM VEG. SOIL WATER (VOL/VOL)			0.3816
MINIMUM VEG. SOIL WATER (VOL/VOL)			0.1532

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 5

LAYER	(INCHES)	(VOL/VOL)
1	0.8286	0.1381
2	35.1079	0.2926
3	4.3938	0.1831
4	0.0029	0.0145
5	0.0000	0.0000
6	0.4500	0.7500
7	22.7992	0.1900
SNOW WATER	0.000	

GREEN RECYCLING SOLUTIONS LLC
MAYSVILLE C&D LANDFILL
PHASE 1

HELP Model Output Simulation
Phase 1, Cell 1, 30-ft of Waste, Above Perimeter Berm

MAYC11 NT. OUT

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**
**      HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
**      HELP MODEL VERSION 3.07 (1 NOVEMBER 1997)
**      DEVELOPED BY ENVIRONMENTAL LABORATORY
**      USAE WATERWAYS EXPERIMENT STATION
**      FOR USEPA RISK REDUCTION ENGINEERING LABORATORY
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PRECIPITATION DATA FILE:  C:\HELP3\DATA4M1.D4
TEMPERATURE DATA FILE:   C:\HELP3\DATA7M1.D7
SOLAR RADIATION DATA FILE: C:\HELP3\DATA13M1.D13
EVAPOTRANSPIRATION DATA:  C:\HELP3\DATA11M1.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\MAY1 NT.D10
OUTPUT DATA FILE:         C:\HELP3\OUTPUT\MAYC11 NT.OUT

```

TIME: 7: 8 DATE: 6/19/2013

TITLE: MAYSVILLE, PHASE 1, CELL 1, 30-FT WASTE INTERMEDIATE CLOS

NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

```

          TYPE 1 - VERTICAL PERCOLATION LAYER
          MATERIAL TEXTURE NUMBER 2
THICKNESS      = 6.00 INCHES
POROSITY        = 0.4370 VOL/VOL
FIELD CAPACITY  = 0.0620 VOL/VOL
WILTING POINT   = 0.0240 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.1178 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.579999993000E-02 CM/SEC

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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER

Page 1

MAYC11 NT. OUT

		MATERIAL TEXTURE NUMBER	18
THICKNESS	=	264.00	INCHES
POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.2920	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2985	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER

		MATERIAL TEXTURE NUMBER	4
THICKNESS	=	24.00	INCHES
POROSITY	=	0.4370	VOL/VOL
FIELD CAPACITY	=	0.1050	VOL/VOL
WILTING POINT	=	0.0470	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1842	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.170000002000E-02	CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER

		MATERIAL TEXTURE NUMBER	34
THICKNESS	=	0.20	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	33.0000000000	CM/SEC
SLOPE	=	2.25	PERCENT
DRAINAGE LENGTH	=	200.0	FEET

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER

		MATERIAL TEXTURE NUMBER	35
THICKNESS	=	0.60	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	4.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 6

MAYC11 NT. OUT

TYPE 3 - BARRIER SOIL LINER

MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.60	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 6

THICKNESS	=	120.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1900	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
SOIL DATA BASE USING SOIL TEXTURE # 2 WITH BARE
GROUND CONDITIONS, A SURFACE SLOPE OF 5. % AND
A SLOPE LENGTH OF 80. FEET.

SCS RUNOFF CURVE NUMBER	=	81.70	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	5.159	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	13.358	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.376	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	107.189	INCHES
TOTAL INITIAL WATER	=	107.189	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
RALEIGH NORTH CAROLINA

STATION LATITUDE	=	35.87	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	86	
END OF GROWING SEASON (JULIAN DATE)	=	310	
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES

MAYC11 NT. OUT

AVERAGE ANNUAL WIND SPEED	=	7.70 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	70.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	78.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	72.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
-----	-----	-----	-----	-----	-----
3.55	3.43	3.69	2.91	3.67	3.66
4.38	4.44	3.29	2.73	2.87	3.14

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
-----	-----	-----	-----	-----	-----
39.60	41.60	49.30	59.50	67.20	73.90
77.70	77.00	71.00	59.70	50.00	42.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA
AND STATION LATITUDE = 35.87 DEGREES

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
	-----	-----	-----	-----	-----	-----
PRECIPITATION	1.47	4.13	2.90	1.41	1.78	5.80
	5.09	5.95	1.76	3.46	0.70	4.70
RUNOFF	0.000	0.001	0.000	0.000	0.000	0.001
	0.144	0.038	0.000	0.009	0.000	0.000
EVAPOTRANSPIRATION	1.624	2.163	3.319	1.643	2.346	4.600
	4.514	4.462	2.024	2.760	0.669	1.203
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1.4651	1.1696	0.3560	1.2924	0.3415	0.1632
	0.1501	0.1034	0.6509	0.4304	1.2387	0.2697
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MAYC11 INT. OUT

PERCOLATION/LEAKAGE THROUGH LAYER 7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 5	0.002	0.002	0.001	0.002	0.001	0.000
	0.000	0.000	0.001	0.001	0.002	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 5	0.002	0.002	0.000	0.002	0.000	0.000
	0.000	0.000	0.001	0.000	0.001	0.000

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
	-----	-----	-----
PRECIPITATION	39.15	142114.484	100.00
RUNOFF	0.192	698.091	0.49
EVAPOTRANSPIRATION	31.328	113719.531	80.02
DRAINAGE COLLECTED FROM LAYER 4	7.6311	27700.986	19.49
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0010		
PERC./LEAKAGE THROUGH LAYER 7	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-0.001	-3.988	0.00
SOIL WATER AT START OF YEAR	107.189	389095.344	
SOIL WATER AT END OF YEAR	107.188	389091.344	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.140	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

MAYC11 NT. OUT

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.46 3.88	2.15 1.35	4.79 0.90	3.25 8.01	8.08 1.39	7.14 1.50
RUNOFF	0.070 0.043	0.000 0.001	0.000 0.000	0.000 0.276	0.303 0.000	0.015 0.000
EVAPOTRANSPIRATION	1.536 3.431	1.985 2.397	3.160 0.418	3.663 2.456	5.372 2.014	3.611 1.238
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1.3317 2.0584	1.9871 1.8092	0.8512 0.4465	0.9345 0.2339	0.3414 1.7182	1.3984 2.6948
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 5	0.002 0.003	0.003 0.003	0.001 0.001	0.001 0.000	0.001 0.003	0.002 0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 5	0.002 0.002	0.002 0.002	0.001 0.000	0.001 0.000	0.000 0.003	0.002 0.002

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.90	162986.984	100.00
RUNOFF	0.708	2571.796	1.58
EVAPOTRANSPIRATION	31.281	113548.562	69.67
DRAINAGE COLLECTED FROM LAYER 4	15.8051	57372.645	35.20
PERC. /LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0021		
PERC. /LEAKAGE THROUGH LAYER 7	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-2.894	-10505.985	-6.45
SOIL WATER AT START OF YEAR	107.188	389091.344	
SOIL WATER AT END OF YEAR	104.293	378585.375	

MAYC11 NT. OUT

SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.025	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	8.46 7.60	2.96 16.42	6.34 5.13	0.99 4.30	1.78 1.99	3.75 2.02
RUNOFF	0.115 0.167	0.007 2.567	0.167 0.525	0.000 0.079	0.000 0.000	0.173 0.000
EVAPOTRANSPIRATION	1.923 5.878	2.295 4.962	2.786 3.006	2.036 2.073	1.724 2.166	2.332 1.218
LATERAL DRAINAGE COLLECTED FROM LAYER 4	0.5109 0.2546	0.3001 1.4263	3.6080 3.2987	3.1112 4.9133	2.0430 2.4126	0.3422 2.4162
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 5	0.001 0.000	0.001 0.002	0.006 0.005	0.005 0.008	0.003 0.004	0.001 0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 5	0.000 0.000	0.000 0.002	0.002 0.005	0.002 0.001	0.002 0.002	0.000 0.002

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	61.74	224116.172	100.00

MAYC11 NT. OUT

RUNOFF	3. 799	13790. 698	6. 15
EVAPOTRANSPIRATION	32. 400	117610. 703	52. 48
DRAINAGE COLLECTED FROM LAYER 4	24. 6370	89432. 344	39. 90
PERC. /LEAKAGE THROUGH LAYER 6	0. 000003	0. 010	0. 00
AVG. HEAD ON TOP OF LAYER 5	0. 0032		
PERC. /LEAKAGE THROUGH LAYER 7	0. 000000	0. 000	0. 00
CHANGE IN WATER STORAGE	0. 904	3282. 459	1. 46
SOIL WATER AT START OF YEAR	104. 293	378585. 375	
SOIL WATER AT END OF YEAR	105. 198	381867. 812	
SNOW WATER AT START OF YEAR	0. 000	0. 000	0. 00
SNOW WATER AT END OF YEAR	0. 000	0. 000	0. 00
ANNUAL WATER BUDGET BALANCE	0. 0000	-0. 024	0. 00

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2. 52 5. 00	3. 18 3. 17	4. 19 3. 87	1. 86 0. 95	3. 54 3. 95	2. 98 3. 65
RUNOFF	0. 000 0. 093	0. 035 0. 000	0. 030 0. 144	0. 000 0. 000	0. 000 0. 022	0. 002 0. 229
EVAPOTRANSPIRATION	1. 706 3. 227	2. 225 2. 873	2. 532 3. 692	3. 125 1. 157	3. 415 1. 995	3. 070 1. 348
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1. 0730 0. 1860	0. 4485 0. 1387	1. 2032 0. 3018	0. 6360 0. 4994	0. 3955 0. 4666	0. 2346 0. 9726
PERCOLATION/LEAKAGE THROUGH LAYER 6	0. 0000 0. 0000	0. 0000 0. 0000	0. 0000 0. 0000	0. 0000 0. 0000	0. 0000 0. 0000	0. 0000 0. 0000
PERCOLATION/LEAKAGE THROUGH LAYER 7	0. 0000 0. 0000	0. 0000 0. 0000	0. 0000 0. 0000	0. 0000 0. 0000	0. 0000 0. 0000	0. 0000 0. 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

MAYC11 NT. OUT

AVERAGE DAILY HEAD ON TOP OF LAYER 5	0.002 0.000	0.001 0.000	0.002 0.000	0.001 0.001	0.001 0.001	0.000 0.001
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STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 5	0.001 0.000	0.000 0.000	0.001 0.000	0.001 0.001	0.000 0.000	0.000 0.002
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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.86	141061.766	100.00
RUNOFF	0.556	2017.194	1.43
EVAPOTRANSPIRATION	30.365	110223.852	78.14
DRAINAGE COLLECTED FROM LAYER 4	6.5558	23797.457	16.87
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0008		
PERC./LEAKAGE THROUGH LAYER 7	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	1.384	5023.348	3.56
SOIL WATER AT START OF YEAR	105.198	381867.812	
SOIL WATER AT END OF YEAR	106.582	386891.156	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.094	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.39 1.28	1.68 4.39	3.64 2.40	5.64 2.15	2.49 4.56	7.41 2.64
RUNOFF	0.000 0.000	0.000 0.000	0.051 0.004	0.016 0.000	0.000 0.031	0.112 0.067

MAYC11 INT. OUT

EVAPOTRANSPIRATION	1.683	1.816	1.999	4.165	3.003	5.066
	1.678	2.357	3.383	1.590	2.292	1.627
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1.5229	0.7740	0.2898	0.2270	1.3413	0.4258
	1.4390	0.8660	0.5037	0.5228	0.2684	1.4145
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 5	0.002	0.001	0.000	0.000	0.002	0.001
	0.002	0.001	0.001	0.001	0.000	0.002
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 5	0.002	0.001	0.000	0.000	0.001	0.000
	0.002	0.001	0.001	0.000	0.000	0.002

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.67	144002.109	100.00
RUNOFF	0.281	1020.624	0.71
EVAPOTRANSPIRATION	30.658	111289.664	77.28
DRAINAGE COLLECTED FROM LAYER 4	9.5952	34830.410	24.19
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0012		
PERC./LEAKAGE THROUGH LAYER 7	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-0.865	-3138.613	-2.18
SOIL WATER AT START OF YEAR	106.582	386891.156	
SOIL WATER AT END OF YEAR	105.717	383752.562	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.022	0.00

MAYC11 INT. OUT

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.26 4.57	2.82 6.26	4.37 2.81	2.63 3.77	3.53 2.52	5.42 2.90
STD. DEVIATIONS	2.96 2.29	0.95 5.93	1.30 1.69	1.89 2.69	2.64 1.66	1.99 1.28
RUNOFF						
TOTALS	0.037 0.090	0.008 0.521	0.050 0.135	0.003 0.073	0.061 0.011	0.061 0.059
STD. DEVIATIONS	0.053 0.069	0.015 1.144	0.069 0.227	0.007 0.118	0.135 0.015	0.078 0.099
EVAPOTRANSPIRATION						
TOTALS	1.695 3.746	2.097 3.410	2.759 2.504	2.926 2.007	3.172 1.827	3.736 1.327
STD. DEVIATIONS	0.144 1.564	0.194 1.219	0.525 1.325	1.067 0.646	1.388 0.658	1.112 0.177
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	1.1807 0.8176	0.9359 0.8687	1.2617 1.0403	1.2402 1.3200	0.8926 1.2209	0.5128 1.5535
STD. DEVIATIONS	0.4126 0.8785	0.6759 0.7606	1.3640 1.2687	1.1168 2.0119	0.7713 0.8866	0.5051 1.0064
PERCOLATION/LEAKAGE THROUGH LAYER 6						
TOTALS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 7						
TOTALS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

MAYC11 INT. OUT

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0018 0.0013	0.0016 0.0013	0.0019 0.0016	0.0020 0.0020	0.0014 0.0019	0.0008 0.0024
STD. DEVIATIONS	0.0006 0.0013	0.0012 0.0012	0.0021 0.0020	0.0018 0.0031	0.0012 0.0014	0.0008 0.0015

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.86 (9.753)	162856.3	100.00
RUNOFF	1.107 (1.5189)	4019.68	2.468
EVAPOTRANSPIRATION	31.206 (0.7831)	113278.46	69.557
LATERAL DRAINAGE COLLECTED FROM LAYER 4	12.84484 (7.50190)	46626.766	28.63062
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.002 (0.001)		
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00000 (0.00000)	0.000	0.00000
CHANGE IN WATER STORAGE	-0.294 (1.6899)	-1068.56	-0.656

♀

PEAK DAILY VALUES FOR YEARS 1 THROUGH 5

	(INCHES)	(CU. FT.)
PRECIPITATION	5.22	18948.600
RUNOFF	2.052	7447.0986
DRAINAGE COLLECTED FROM LAYER 4	0.26598	965.52301
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 5	0.013	
MAXIMUM HEAD ON TOP OF LAYER 5	0.025	

MAYC11 NT. OUT

LOCATION OF MAXIMUM HEAD IN LAYER	4		
(DISTANCE FROM DRAIN)		0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER	7	0.000000	0.00000
SNOW WATER		1.67	6061.1182
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.3816	
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.1532	

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

♀

FINAL WATER STORAGE AT END OF YEAR 5

LAYER	(INCHES)	(VOL/VOL)
1	0.8286	0.1381
2	77.1559	0.2923
3	4.4801	0.1867
4	0.0032	0.0159
5	0.0000	0.0000
6	0.4500	0.7500
7	22.7992	0.1900
SNOW WATER	0.000	

GREEN RECYCLING SOLUTIONS LLC
MAYSVILLE C&D LANDFILL
PHASE 1

HELP Model Output Simulation
Phase 1, Cell 1, Final Closure

MAYSC1FN. OUT

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**
**      HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
**      HELP MODEL VERSION 3.07 (1 NOVEMBER 1997)
**      DEVELOPED BY ENVIRONMENTAL LABORATORY
**      USAE WATERWAYS EXPERIMENT STATION
**      FOR USEPA RISK REDUCTION ENGINEERING LABORATORY
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PRECIPITATION DATA FILE:  C:\HELP3\DATA4M1.D4
TEMPERATURE DATA FILE:   C:\HELP3\DATA7M1.D7
SOLAR RADIATION DATA FILE: C:\HELP3\DATA13M1.D13
EVAPOTRANSPIRATION DATA:  C:\HELP3\DATA11M1.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\MAYFIN.D10
OUTPUT DATA FILE:         C:\HELP3\OUTPUT\MAYSC1FN.OUT

```

TIME: 6:57 DATE: 6/19/2013

TITLE: MAYSVILLE, PHASE 1, CELL 1, CLOSURE

NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

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          TYPE 1 - VERTICAL PERCOLATION LAYER
          MATERIAL TEXTURE NUMBER 2
THICKNESS      = 24.00 INCHES
POROSITY        = 0.4370 VOL/VOL
FIELD CAPACITY  = 0.0620 VOL/VOL
WILTING POINT   = 0.0240 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0567 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.579999993000E-02 CM/SEC

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LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER

Page 1

MAYSC1FN. OUT

	MATERIAL	TEXTURE	NUMBER	
			34	
THICKNESS	=	0.20		INCHES
POROSITY	=	0.8500		VOL/VOL
FIELD CAPACITY	=	0.0100		VOL/VOL
WILTING POINT	=	0.0050		VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100		VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	33.0000000000		CM/SEC
SLOPE	=	5.00		PERCENT
DRAINAGE LENGTH	=	100.0		FEET

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER

	MATERIAL	TEXTURE	NUMBER	
			36	
THICKNESS	=	0.40		INCHES
POROSITY	=	0.0000		VOL/VOL
FIELD CAPACITY	=	0.0000		VOL/VOL
WILTING POINT	=	0.0000		VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000		VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12		CM/SEC
FML PINHOLE DENSITY	=	4.00		HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00		HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD		

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER

	MATERIAL	TEXTURE	NUMBER	
			18	
THICKNESS	=	360.00		INCHES
POROSITY	=	0.6710		VOL/VOL
FIELD CAPACITY	=	0.2920		VOL/VOL
WILTING POINT	=	0.0770		VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2920		VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02		CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER

	MATERIAL	TEXTURE	NUMBER	
			4	
THICKNESS	=	24.00		INCHES
POROSITY	=	0.4370		VOL/VOL
FIELD CAPACITY	=	0.1050		VOL/VOL
WILTING POINT	=	0.0470		VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1050		VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.170000002000E-02		CM/SEC

LAYER 6

MAYSC1FN. OUT

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 34

THICKNESS	=	0.20	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	33.0000000000	CM/SEC
SLOPE	=	2.25	PERCENT
DRAINAGE LENGTH	=	200.0	FEET

LAYER 7

TYPE 4 - FLEXIBLE MEMBRANE LINER

MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.60	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	4.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 8

TYPE 3 - BARRIER SOIL LINER

MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.60	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08	CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 6

THICKNESS	=	120.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1900	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

MAYSC1FN. OUT

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
SOIL DATA BASE USING SOIL TEXTURE # 2 WITH BARE
GROUND CONDITIONS, A SURFACE SLOPE OF 5. % AND
A SLOPE LENGTH OF 80. FEET.

SCS RUNOFF CURVE NUMBER	=	81.70	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.095	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	9.614	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.528	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	132.254	INCHES
TOTAL INITIAL WATER	=	132.254	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
RALEIGH NORTH CAROLINA

STATION LATITUDE	=	35.87	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	86	
END OF GROWING SEASON (JULIAN DATE)	=	310	
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.70	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	70.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	78.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	72.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.55	3.43	3.69	2.91	3.67	3.66
4.38	4.44	3.29	2.73	2.87	3.14

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
39.60	41.60	49.30	59.50	67.20	73.90

77.70 77.00 MAYSC1FN. OUT 59.70 50.00 42.00
71.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA
AND STATION LATITUDE = 35.87 DEGREES

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.47 5.09	4.13 5.95	2.90 1.76	1.41 3.46	1.78 0.70	5.80 4.70
RUNOFF	0.000 0.108	0.000 0.021	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
EVAPOTRANSPIRATION	0.216 1.022	0.259 0.652	0.399 0.280	0.252 0.346	0.288 0.038	1.352 0.300
LATERAL DRAINAGE COLLECTED FROM LAYER 2	1.3481 4.1570	3.4220 5.2271	2.9326 1.4912	0.9949 3.3794	1.7868 0.4685	4.0382 4.3695
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.0001 0.0002	0.0001 0.0002	0.0001 0.0001	0.0001 0.0001	0.0001 0.0000	0.0002 0.0002
LATERAL DRAINAGE COLLECTED FROM LAYER 6	0.0001 0.0002	0.0001 0.0002	0.0001 0.0001	0.0001 0.0001	0.0001 0.0000	0.0002 0.0002
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 3	0.000 0.001	0.001 0.002	0.001 0.001	0.000 0.001	0.001 0.000	0.001 0.002
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 3	0.001 0.001	0.002 0.002	0.001 0.001	0.000 0.002	0.001 0.001	0.002 0.002
AVERAGE DAILY HEAD ON TOP OF LAYER 7	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 7	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000

MAYSC1FN. OUT

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.15	142114.484	100.00
RUNOFF	0.128	465.878	0.33
EVAPOTRANSPIRATION	5.405	19620.377	13.81
DRAINAGE COLLECTED FROM LAYER 2	33.6154	122023.969	85.86
PERC./LEAKAGE THROUGH LAYER 3	0.001439	5.224	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0010		
DRAINAGE COLLECTED FROM LAYER 6	0.0014	5.222	0.00
PERC./LEAKAGE THROUGH LAYER 8	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 7	0.0000		
PERC./LEAKAGE THROUGH LAYER 9	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	0.000	-0.942	0.00
SOIL WATER AT START OF YEAR	135.758	492801.312	
SOIL WATER AT END OF YEAR	135.758	492800.375	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.023	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.46 3.88	2.15 1.35	4.79 0.90	3.25 8.01	8.08 1.39	7.14 1.50
RUNOFF	0.040 0.018	0.000 0.000	0.000 0.000	0.000 0.084	0.161 0.000	0.001 0.000

	MAYSC1FN. OUT					
EVAPOTRANSPIRATION	0.197	0.302	0.443	0.567	2.152	0.945
	0.673	0.205	0.124	0.534	0.160	0.337
LATERAL DRAINAGE COLLECTED FROM LAYER 2	2.4816	1.7580	4.1330	2.6674	5.6432	6.1997
	3.3375	1.4080	0.7466	7.3434	1.1649	1.2395
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.0001	0.0001	0.0002	0.0001	0.0002	0.0002
	0.0001	0.0001	0.0000	0.0002	0.0001	0.0001
LATERAL DRAINAGE COLLECTED FROM LAYER 6	0.0001	0.0001	0.0002	0.0001	0.0002	0.0002
	0.0001	0.0001	0.0000	0.0002	0.0001	0.0001
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 3	0.001	0.001	0.001	0.001	0.002	0.002
	0.001	0.000	0.000	0.003	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 3	0.002	0.001	0.001	0.001	0.002	0.003
	0.002	0.001	0.000	0.003	0.001	0.001
AVERAGE DAILY HEAD ON TOP OF LAYER 7	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 7	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
	-----	-----	-----
PRECIPITATION	44.90	162986.984	100.00
RUNOFF	0.304	1103.822	0.68
EVAPOTRANSPIRATION	6.639	24100.912	14.79
DRAINAGE COLLECTED FROM LAYER 2	38.1228	138385.672	84.91
PERC./LEAKAGE THROUGH LAYER 3	0.001537	5.578	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0011		
DRAINAGE COLLECTED FROM LAYER 6	0.0015	5.577	0.00
PERC./LEAKAGE THROUGH LAYER 8	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 7	0.0000		

MAYSC1FN. OUT

PERC. /LEAKAGE THROUGH LAYER 9	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-0.168	-609.006	-0.37
SOIL WATER AT START OF YEAR	135.758	492800.375	
SOIL WATER AT END OF YEAR	135.590	492191.344	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.010	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	8.46 7.60	2.96 16.42	6.34 5.13	0.99 4.30	1.78 1.99	3.75 2.02
RUNOFF	0.019 0.050	0.000 2.080	0.056 0.570	0.000 0.053	0.000 0.000	0.135 0.000
EVAPOTRANSPIRATION	0.401 1.209	0.306 3.571	1.644 2.531	0.139 1.267	0.354 1.054	0.595 0.146
LATERAL DRAINAGE COLLECTED FROM LAYER 2	7.8127 6.3883	2.8970 8.0412	4.2584 4.1355	1.1006 2.5462	1.4242 2.1592	3.0221 1.8357
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.0003 0.0002	0.0001 0.0003	0.0002 0.0002	0.0001 0.0001	0.0001 0.0001	0.0001 0.0001
LATERAL DRAINAGE COLLECTED FROM LAYER 6	0.0003 0.0002	0.0001 0.0003	0.0002 0.0002	0.0001 0.0001	0.0001 0.0001	0.0001 0.0001
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 3	0.003 0.002	0.001 0.003	0.001 0.001	0.000 0.001	0.000 0.001	0.001 0.001
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	MAYSC1FN. OUT					
STD. DEVIATION OF DAILY	0.003	0.002	0.002	0.001	0.001	0.003
HEAD ON TOP OF LAYER 3	0.003	0.002	0.003	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 7	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 7	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	61.74	224116.172	100.00
RUNOFF	2.962	10753.766	4.80
EVAPOTRANSPIRATION	13.217	47976.719	21.41
DRAINAGE COLLECTED FROM LAYER 2	45.6210	165604.156	73.89
PERC. /LEAKAGE THROUGH LAYER 3	0.001793	6.508	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0013		
DRAINAGE COLLECTED FROM LAYER 6	0.0018	6.507	0.00
PERC. /LEAKAGE THROUGH LAYER 8	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 7	0.0000		
PERC. /LEAKAGE THROUGH LAYER 9	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-0.062	-224.826	-0.10
SOIL WATER AT START OF YEAR	135.590	492191.344	
SOIL WATER AT END OF YEAR	135.528	491966.531	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.143	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	MAYSC1FN. OUT					
	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.52 5.00	3.18 3.17	4.19 3.87	1.86 0.95	3.54 3.95	2.98 3.65
RUNOFF	0.000 0.053	0.012 0.000	0.021 0.129	0.000 0.000	0.000 0.005	0.000 0.142
EVAPOTRANSPIRATION	0.426 0.680	0.355 0.567	0.271 0.344	0.336 0.069	0.737 0.278	0.555 0.242
LATERAL DRAINAGE COLLECTED FROM LAYER 2	1.7755 3.9842	3.0760 2.5972	3.6608 3.2659	1.7759 1.2744	2.7353 3.6024	2.5453 3.3169
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.0001 0.0002	0.0001 0.0001	0.0001 0.0001	0.0001 0.0001	0.0001 0.0001	0.0001 0.0001
LATERAL DRAINAGE COLLECTED FROM LAYER 6	0.0001 0.0002	0.0001 0.0001	0.0001 0.0001	0.0001 0.0001	0.0001 0.0001	0.0001 0.0001
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 3	0.001 0.001	0.001 0.001	0.001 0.001	0.001 0.000	0.001 0.001	0.001 0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 3	0.001 0.002	0.002 0.001	0.002 0.002	0.001 0.001	0.001 0.002	0.001 0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 7	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 7	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.86	141061.766	100.00
RUNOFF	0.363	1318.382	0.93
EVAPOTRANSPIRATION	4.860	17641.271	12.51
DRAINAGE COLLECTED FROM LAYER 2	33.6097	122003.289	86.49

	MAYSC1FN. OUT		
PERC. /LEAKAGE THROUGH LAYER 3	0.001434	5.206	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0010		
DRAINAGE COLLECTED FROM LAYER 6	0.0014	5.204	0.00
PERC. /LEAKAGE THROUGH LAYER 8	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 7	0.0000		
PERC. /LEAKAGE THROUGH LAYER 9	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	0.026	93.663	0.07
SOIL WATER AT START OF YEAR	135.528	491966.531	
SOIL WATER AT END OF YEAR	135.554	492060.187	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.051	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.39 1.28	1.68 4.39	3.64 2.40	5.64 2.15	2.49 4.56	7.41 2.64
RUNOFF	0.000 0.000	0.000 0.000	0.048 0.002	0.004 0.000	0.000 0.011	0.078 0.048
EVAPOTRANSPIRATION	0.282 0.348	0.395 0.599	0.906 0.475	1.347 0.197	0.407 0.283	2.594 0.119
LATERAL DRAINAGE COLLECTED FROM LAYER 2	0.9454 1.0520	1.4102 3.0834	2.2753 2.5796	4.5843 1.2940	1.9011 4.8012	5.0169 2.4639
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.0001 0.0001	0.0001 0.0001	0.0001 0.0001	0.0002 0.0001	0.0001 0.0002	0.0002 0.0001
LATERAL DRAINAGE COLLECTED FROM LAYER 6	0.0001 0.0001	0.0001 0.0001	0.0001 0.0001	0.0002 0.0001	0.0001 0.0002	0.0002 0.0001
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MAYSC1FN. OUT

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 3	0.000 0.000	0.001 0.001	0.001 0.001	0.002 0.000	0.001 0.002	0.002 0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 3	0.001 0.000	0.000 0.001	0.002 0.001	0.002 0.001	0.001 0.002	0.002 0.002
AVERAGE DAILY HEAD ON TOP OF LAYER 7	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 7	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.67	144002.109	100.00
RUNOFF	0.191	694.938	0.48
EVAPOTRANSPIRATION	7.951	28861.623	20.04
DRAINAGE COLLECTED FROM LAYER 2	31.4074	114008.695	79.17
PERC./LEAKAGE THROUGH LAYER 3	0.001357	4.927	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0009		
DRAINAGE COLLECTED FROM LAYER 6	0.0014	4.926	0.00
PERC./LEAKAGE THROUGH LAYER 8	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 7	0.0000		
PERC./LEAKAGE THROUGH LAYER 9	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	0.119	431.927	0.30
SOIL WATER AT START OF YEAR	135.554	492060.187	
SOIL WATER AT END OF YEAR	135.673	492492.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.003	0.00

MAYSC1FN. OUT

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
-----	-----	-----	-----	-----	-----	-----
PRECIPITATION						

TOTALS	3.26 4.57	2.82 6.26	4.37 2.81	2.63 3.77	3.53 2.52	5.42 2.90
STD. DEVIATIONS	2.96 2.29	0.95 5.93	1.30 1.69	1.89 2.69	2.64 1.66	1.99 1.28
RUNOFF						

TOTALS	0.012 0.046	0.002 0.420	0.025 0.140	0.001 0.027	0.032 0.003	0.043 0.038
STD. DEVIATIONS	0.018 0.041	0.006 0.928	0.026 0.247	0.002 0.039	0.072 0.005	0.061 0.062
EVAPOTRANSPIRATION						

TOTALS	0.304 0.786	0.323 1.119	0.732 0.751	0.528 0.483	0.788 0.363	1.208 0.229
STD. DEVIATIONS	0.105 0.336	0.052 1.382	0.563 1.003	0.484 0.472	0.782 0.399	0.839 0.095
LATERAL DRAINAGE COLLECTED FROM LAYER 2						

TOTALS	2.8727 3.7838	2.5126 4.0714	3.4520 2.4438	2.2246 3.1675	2.6981 2.4392	4.1644 2.6451
STD. DEVIATIONS	2.8195 1.9121	0.8771 2.6143	0.8384 1.3550	1.4783 2.4982	1.7149 1.7691	1.4842 1.2338
PERCOLATION/LEAKAGE THROUGH LAYER 3						

TOTALS	0.0001 0.0002	0.0001 0.0002	0.0001 0.0001	0.0001 0.0001	0.0001 0.0001	0.0002 0.0001
STD. DEVIATIONS	0.0001 0.0001	0.0000 0.0001	0.0000 0.0000	0.0001 0.0001	0.0001 0.0001	0.0000 0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 6						

TOTALS	0.0001 0.0002	0.0001 0.0002	0.0001 0.0001	0.0001 0.0001	0.0001 0.0001	0.0002 0.0001
STD. DEVIATIONS	0.0001 0.0001	0.0000 0.0001	0.0000 0.0000	0.0001 0.0001	0.0001 0.0001	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						

TOTALS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MAYSC1FN. OUT

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 9

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0010	0.0010	0.0012	0.0008	0.0009	0.0015
	0.0013	0.0014	0.0009	0.0011	0.0009	0.0009

STD. DEVIATIONS	0.0010	0.0003	0.0003	0.0005	0.0006	0.0005
	0.0007	0.0009	0.0005	0.0009	0.0006	0.0004

DAILY AVERAGE HEAD ON TOP OF LAYER 7

AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 5

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.86	(9.753)	162856.3	100.00
RUNOFF	0.790	(1.2180)	2867.36	1.761
EVAPOTRANSPIRATION	7.614	(3.3511)	27640.18	16.972
LATERAL DRAINAGE COLLECTED FROM LAYER 2	36.47525	(5.66642)	132405.141	81.30183
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.00151	(0.00017)	5.489	0.00337
AVERAGE HEAD ON TOP OF LAYER 3	0.001	(0.000)		
LATERAL DRAINAGE COLLECTED FROM LAYER 6	0.00151	(0.00017)	5.487	0.00337
PERCOLATION/LEAKAGE THROUGH	0.00000	(0.00000)	0.001	0.00000

MAYSC1FN. OUT

LAYER 8

AVERAGE HEAD ON TOP OF LAYER 7	0.000 (0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.00000 (0.00000)	0.000	0.00000
CHANGE IN WATER STORAGE	-0.017 (0.1065)	-61.84	-0.038

 $\frac{0}{1}$

PEAK DAILY VALUES FOR YEARS	1 THROUGH	5
	(INCHES)	(CU. FT.)
PRECIPITATION	5.22	18948.600
RUNOFF	1.683	6110.6011
DRAINAGE COLLECTED FROM LAYER 2	1.47030	5337.19385
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.000037	0.13351
AVERAGE HEAD ON TOP OF LAYER 3	0.016	
MAXIMUM HEAD ON TOP OF LAYER 3	0.032	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	0.0 FEET	
DRAINAGE COLLECTED FROM LAYER 6	0.00003	0.12160
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00001
AVERAGE HEAD ON TOP OF LAYER 7	0.000	
MAXIMUM HEAD ON TOP OF LAYER 7	0.001	
LOCATION OF MAXIMUM HEAD IN LAYER 6 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.000000	0.00000
SNOW WATER	1.67	6061.1182
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.2421
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.0362

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

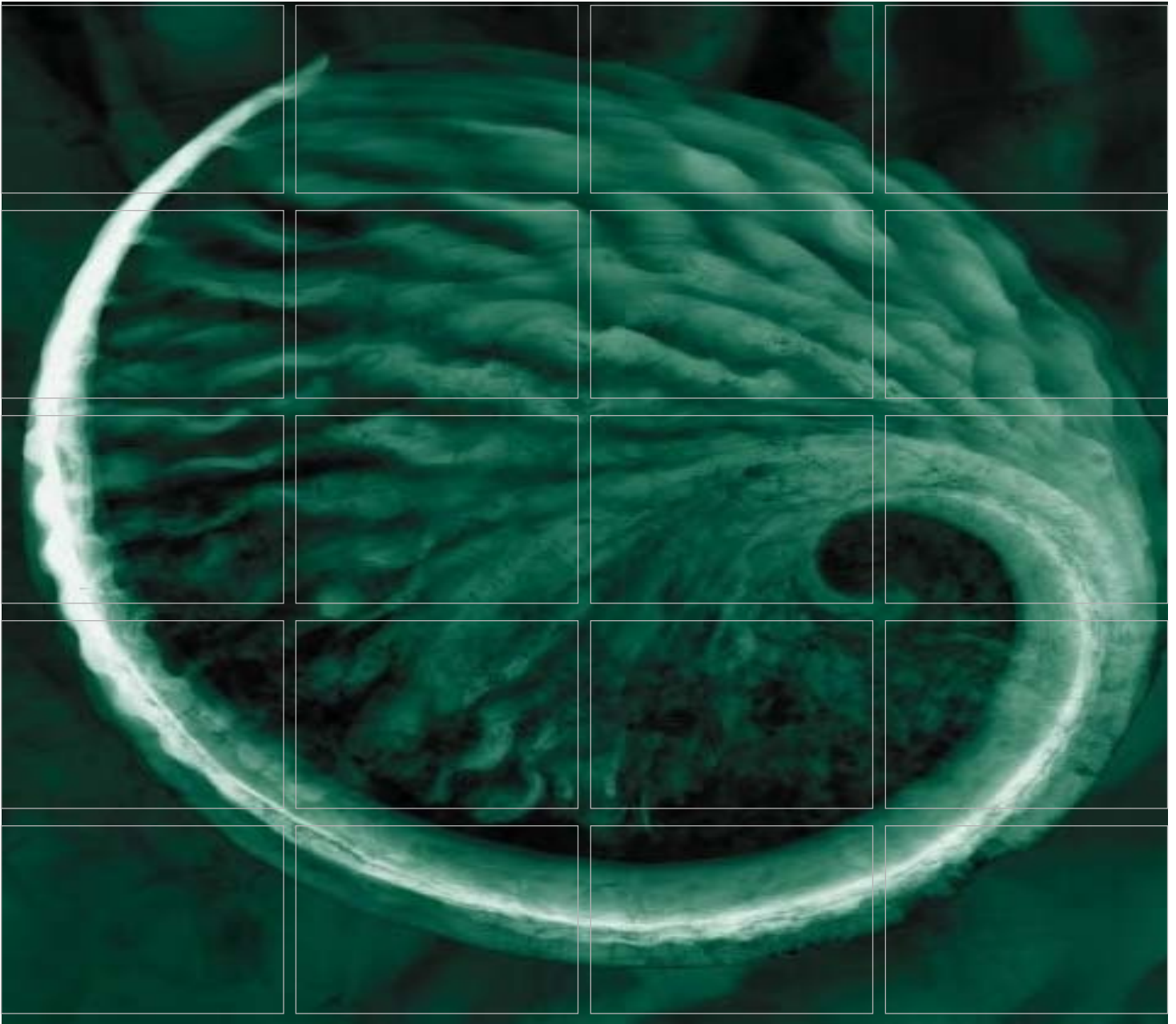
Page 15

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FINAL WATER STORAGE AT END OF YEAR 5

LAYER	(INCHES)	(VOL/VOL)
1	1. 2753	0. 0531
2	0. 0023	0. 0116
3	0. 0000	0. 0000
4	105. 1200	0. 2920
5	2. 5200	0. 1050
6	0. 0020	0. 0100
7	0. 0000	0. 0000
8	0. 4500	0. 7500
9	22. 7992	0. 1900
SNOW WATER	0. 000	



Green Recycling Solutions LLC

Technical Specifications

Maysville Construction & Demolition

Debris (C&D) Landfill

Maysville, North Carolina

June 2013

**TECHNICAL SPECIFICATIONS
GREEN RECYCLING SOLUTIONS C&D LANDFILL
MAYSVILLE, NORTH CAROLINA**

TABLE OF CONTENTS

DIVISION 0 - BIDDING AND CONTRACT DOCUMENTS

<u>SECTION</u>	<u>SUBJECT</u>
00001	Title Page
00003	Table of Contents

DIVISION 1 - GENERAL REQUIREMENTS

<u>SECTION</u>	<u>SUBJECT</u>
01010	Scope of Work
01051	Survey Requirements
01410	Testing Laboratory Services

DIVISION 2 - SITE WORK

<u>SECTION</u>	<u>SUBJECT</u>
02100	Site Preparation
02200	Excavation, Grading, Backfill, and Compaction
02272	Non-woven Geotextiles
02273	Geosynthetic Drainage Composite
02275	Compacted Soil Liner (<i>Alternate for future use</i>)
02276	Erosion and Sedimentation Control
02623	High Density Polyethylene (HDPE) Pipe
02700	Drainage/Protective Cover Material
02776	Textured Geomembrane Liner
02777	Geosynthetic Clay Liner
02985	Seeding and Mulching
11323	Leachate Pumps
15100	Valves & Appurtenances

DIVISION 3 – CONCRETE (Not Applicable)

DIVISION 4 - MASONRY (Not Applicable)

DIVISION 5 - METALS (Not Applicable)

DIVISION 6 - WOOD AND PLASTICS (Not Applicable)

DIVISION 7 - THERMAL AND MOISTURE PROTECTION (Not Applicable)

DIVISION 8 - DOORS AND WINDOWS (Not Applicable)

DIVISION 9 – FINISHES (Not Applicable)

DIVISION 10 – SPECIALTIES (Not Applicable)

DIVISION 11 – EQUIPMENT (Not Applicable)

DIVISION 12 - FURNISHINGS (Not Applicable)

DIVISION 13 - SPECIAL CONSTRUCTION (Not Applicable)

DIVISION 14 - CONVEYING SYSTEM (Not Applicable)

DIVISION 15 – MECHANICAL (Not Applicable)

DIVISION 16 – ELECTRICAL (Not Applicable)

SECTION 01010

SCOPE OF WORK

PART 1: GENERAL

1.01 DESCRIPTION OF WORK

- A. Work covered in these Technical Specifications encompasses the performance of earthwork and grading, installation of geosynthetics, placement of HDPE pipe, placement of premanufactured HDPE leachate riser vaults, installation of pumps and valves, along with general construction associated with the construction of the Green Recycling Solutions C&D Landfill located in Maysville, North Carolina.
- B. The major components constructed under this project include:
 - Site preparation and grading;
 - Develop on-site borrow areas as needed;
 - Construct an anchor trench and perimeter berm;
 - Construct liner system;
 - Construct leachate collection pipe;
 - Construct leachate transmission line;
 - Construct temporary intermediate berm;
 - Construct a temporary rainflap berm;
 - Construct HDPE leachate riser vaults.
- C. Provide all labor, materials, equipment, tools, services and incidentals necessary to complete all work required by the Contract to construct the facility as indicated on the Contract Drawings and specified herein.
- D. Complete the Work, in-place, tested, and ready for continuous service. Perform or provide repairs, replacements and restoration required as a result of damages resulting from construction operations.
- E. The Contractor is responsible for furnishing and installing all materials, equipment, and incidentals, which are reasonable and necessary for the proper completion of the Work.

1.02 DRAWINGS AND SPECIFICATIONS FURNISHED TO THE CONTRACTOR FOR CONSTRUCTION

- A. Five sets of Contract Drawings and five sets of Specifications shall be furnished to the Contractor for construction at no charge. Additional sets may be purchased at the cost of reproduction.

The Contract Drawings that accompany these Technical Specifications are part of the Contract Documents and shall consist of, but are not limited to, the following:

- Title Sheet
- Existing Conditions Plan
- Top of Clay Liner Plan
- Borrow Area Plan
- Liner System Details
- Leachate Collection System Details

1.03 ABBREVIATIONS AND REFERENCES

- A. Whenever reference is made to the furnishing of materials or testing thereof to conform to the standards of any technical society, organization or body, it shall be construed to mean the latest standard, code, specification or tentative specification adopted and published at the date of construction commencement, even if reference has been made to an earlier standard. Where standards, specifications or codes of the various technical societies, organizations or bodies have been referred to throughout the Specifications, the referenced standard, specification or code is hereby made a part of the Contract the same as if herein repeated in full. In the event of any conflict between any of these specifications, standards, codes or tentative specifications, and the specifications, the latter shall govern.
- B. Reference to a technical society, organization, or body may be made in the Specifications by abbreviations, in accordance with the following list:

AASHTO	-	The American Association of State Highway and Transportation Officials
ACI	-	American Concrete Institute
AISC	-	American Institute of Steel Construction
AGA	-	American Gas Association
ANSI	-	American National Standards Institute
ASCE	-	American Society of Civil Engineers
ASME	-	American Society at Mechanical Engineers
ASSE	-	American Society of Sanitation Engineers
ASTM	-	American Society of Testing Materials
AWPA	-	American Wood Preservers Association
AWS	-	American Welding Society
AWWA	-	American Water Works Association
CRSI	-	Concrete Reinforcing Steel Institute
DIPRA	-	Ductile Iron Pipe Research Association
EPA	-	Environmental Protection Agency

FED.SPEC.	-	Federal Specifications
IEEE	-	Institute of Electrical and Electronic Engineers
OSHA	-	Occupation Health and Safety Act
NCDOT	-	North Carolina Department of Transportation
NEMA	-	National Electrical Manufacturers Association

- C. When no reference is made to a code, standard, or specification, the standard specifications of the ASTM, the ANSI, the ASME, the IEEE, or the NEMA shall govern.

1.04 CODES AND STANDARDS

The publications listed below form a part of this specification to the extent referenced.

- A. American Society for Testing and materials (ASTM) Standards
1. ASTM C33 – Standard Specification for Concrete Aggregates.
 2. ASTM C443 – Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 3. ASTM C478 – Standard Specification for Precast Reinforced Concrete Manhole Sections.
 4. ASTM C924 – Standard Practice for Testing Concrete Pipe Sewer Lines By Low-pressure Air Test Method.
 5. ASTM D422 – Standard Test Method for Particle Size Analysis of Soils.
 6. ASTM D638 – Standard Test Method for Tensile Properties of Plastic.
 7. ASTM D746 – Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
 8. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft).
 9. ASTM D792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
 10. ASTM D882 – Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
 11. ASTM D1004 – Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
 12. ASTM D1056 – Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

13. ASTM D1204 – Standard Test Method for Linear Dimensional Changes of Non Rigid Thermoplastic Sheeting or Film at Elevated Temperature.
14. ASTM D1238(E) – Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
15. ASTM D1248 – Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
16. ASTM D1505 – Standard Test Method for Density of Plastics by the Density - Gradient Technique.
17. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
18. ASTM D1603 – Standard Test Method for Carbon Black in Olefin Plastics.
19. ASTM D1693 – Standard Test method for Environmental Stress – Cracking of Ethylene Plastics.
20. ASTM D1777 – Standard Test Method for Thickness of Textile Materials.
21. ASTM D2216 – Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
22. ASTM D2419 – Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
23. ASTM D2434 – Standard Test Method for Permeability of Granular Soils (Constant Head).
24. ASTM D2487 – Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
25. ASTM D2488 – Standard Practice for Description and Identification of Soils (Visual - Manual Procedure).
26. ASTM D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
27. ASTM D2850 – Standard Test Method for Unconsolidated, Undrained Triaxial Compressive Test on Cohesive Soils.
28. ASTM D2922 – Standard Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).
29. ASTM D2937 – Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.

30. ASTM D3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
31. ASTM D3042 – Standard Test Methods for Insoluble Residue in Carbonate Aggregates.
32. ASTM D3350 – Standard Specifications for Polyethylene Plastic Pipes and Fittings Materials.
33. ASTM D3776 – Standard Test Methods for Mass Per Unit Area (Weight) of Fabric.
34. ASTM D3895 – Standard Test Method for Oxidative Induction Time of Polyolefins by Differential Scanning Calorimetry.
35. ASTM D4101 – Standard Specification for Propylene Plastic Injection and Extrusion Materials.
36. ASTM D4218 – Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.
37. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
38. ASTM D4373 – Standard Test method for Calcium Carbonate Content of Soils.
39. ASTM D4429 – Standard Test Method for CBR (California Bearing Ratio) of Soils in Place.
40. ASTM D4437 – Standard Practice for Determining the Integrity of field seams used in joining Flexible Polymeric Sheet Geomembranes.
41. ASTM D4491 – Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
42. ASTM D4533 – Standard Test Method for Trapezoidal Tearing Strength of Geotextiles.
43. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
44. ASTM D4716 – Standard Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
45. ASTM D4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile.

46. ASTM D4833 – Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
47. ASTM D5035 – Standard Test Method for Breaking force and Elongation of Textile Fabrics (Strip Method).
48. ASTM D5084 – Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
49. ASTM D5199 – Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.
50. ASTM D5261 – Standard Test Method for Measuring Mass per unit area of Geotextiles.
51. ASTM D5321 – Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by Direct Shear Method.
52. ASTM D5397 – Standard Test Method for Evaluation of Stress crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.
53. ASTM D5596 – Standard Test Method for microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.
54. ASTM D5641 – Standard Practice for Geomembrane seam Evaluation by Vacuum Chamber.
55. ASTM D5820 – Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geosynthetics.
56. ASTM D5994 – Standard Test method for Measuring Core Thickness of Textured Geomembranes.
57. ASTM D5596 – Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.
58. ASTM D6392 – Standard Test Method for Determining the Integrity of Non-reinforced Geomembrane Seams Produced using Thermo-fusion Methods.
59. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.
60. ASTM F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

B. American National Standards Institute (ANSI) / American Water Works Association (AWWA)

1. ANSI/AWWA C104/A21.4 – Cement-Mortar Lining for Ductile-Iron and Fittings for Water.
2. ANSI/AWWA C105/A21.5 – Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. ANSI/AWWA C110/A21.10 – Ductile-Iron and Gray-Iron Fittings, 3 in Through 48 in (75 mm through 1200 mm), for Water and Other Liquids.
4. ANSI/AWWA C111/A21.11 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. ANSI/AWWA C150/A21.50 – Thickness Design of Ductile-Iron Pipe.
6. ANSI/AWWA C151/A21.51 – Ductile-Iron Pipe, Centrifugally Cast, for Water.
7. ANSI/AWWA C600 – Installation of Ductile-Iron Water Mains and Their Appurtenances.
8. ANSI/AWWA C605-94 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
9. ANSI/AWWA C900-97 – Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 inch through 12 inch (100 mm through 300 mm), for Water Distribution.
10. ANSI/AWWA C905-97 – Polyvinyl Chloride (PVC) Pressure pipe and Fabricated Fittings, 14 through 48 inch. (350 mm through 1,200 mm), for Water Transmission and Distribution.
11. ANSI/AWWA C907-91 – Polyvinyl Chloride (PVC) Pressure Fittings for Water – 4 inch through 8 inch (100 mm through 200 mm).
12. ANSI/AWWA C908-98 – PVC Self-Tapping Saddle Tees for use on PVC Pipe.
13. ANSI/AWWA C909-98 – Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 inch through 12 inch (100 mm through 300 mm), for Water Distribution.

C. Federal Test Method Standards (FTMS)

1. FTMS – 101/2065 – Punching Resistance and Elongation Test (1/8 inch Radius Probe Method).

D. Geosynthetic Research Institute (GRI)

- E. Occupational Safety and Health Administration (OSHA)
- F. Green Recycling Solutions C&D Landfill Permit Application - (Available for review at Facility office)

1.05 DEFINITIONS

Unless otherwise indicated in these Technical Specifications, the following definitions are applicable:

- Owner

Green Recycling Solutions LLC
Maysville C&D Recycling Center and C&D Landfill
Maysville, North Carolina

- Engineer

ERM NC, Inc
8000 Corporate Center Drive, Suite 200
Charlotte, North Carolina 28226

- Project Manager

The Project Manager is the official on-site representative and employee of the Owner and is responsible for coordinating meetings, schedules, and field activities.

- Contractor

The Contractor is the company responsible for performing all construction activities associated with the Work with the exception of geosynthetic liner materials installation.

- Geosynthetics Installer

The Geosynthetics Installer is the company responsible for performing all geosynthetics construction activities outlined on and in the Construction Drawings and Specifications.

- CQA Consultant

The Construction Quality Assurance (CQA) Consultant is the person or persons responsible for observing and documenting all construction activities described on and in the Contract Drawings and Specifications.

- Soils CQA Laboratory

The Soils CQA Laboratory is responsible for performing the laboratory testing required to determine specific characteristics of the soils and aggregates, required on and in the Contract Drawings and Technical Specifications.

- Geosynthetics CQA Laboratory

The Geosynthetic CQA Laboratory is responsible for performing the laboratory testing required to ensure that all geosynthetic materials meet the project specifications.

1.06 SCHEDULE

- A. All Work addressed in these Specifications must be completed as agreed to on the Project Schedule attached.

PART 2: PRODUCTS (NOT APPLICABLE)

PART 3: EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01051

SURVEY REQUIREMENTS

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. Provide certified survey work required in execution of the Project. The term "certified" as used throughout this Section shall mean work by a surveyor registered to practice in the state of North Carolina.
- B. Provide Record Drawings to be used for recovering quantities and documenting construction.
- C. The Contractor shall retain the services of a registered land surveyor licensed in the State of North Carolina to perform all certification surveying.

1.02 RELATED SECTIONS

- A. Section 01010: Scope of Work

1.03 SUBMITTALS

- A. Submit name and address of registered land surveyor and registered professional engineer (if utilized) to be used on this project to the Engineer.
- B. On request of the Engineer, submit documentation to verify accuracy of field engineering work.
- C. The Contractor is required to submit surveys prepared, signed and sealed by a registered land surveyor to the Engineer. These drawings shall constitute the project record documents. The Contractor shall submit the survey information in AutoCAD Release 14 or higher format to the Engineer. All elevation information in the AutoCAD file must be at appropriate 3-D elevation. All horizontal data in the AutoCAD file shall be at appropriate coordinates. All entities shall be placed on layer with names, which adequately describe the entity being mapped.
- D. The Contractor shall provide the survey work necessary to conduct all earthwork performed under this contract.
- E. The Surveyor is required to perform, and submit to the Engineer, the following surveys:
 - 1. Composite Liner System survey providing the limits of the landfill footprint, the elevations of the subgrade materials, finished grade of the compacted soil liner material, and finished grade of protective cover material. The spacing of the survey points shall be as follows:

- a. Surfaces with slopes less than 10 percent shall be surveyed on a square grid not larger than 100 linear feet.
- b. On slopes greater than 10 percent, a square grid not wider than 100 feet will be used and a line at the crest, midpoint, and toe of slope will also be taken.
- c. A line of survey points no farther than 100 feet apart will be taken along any slope break (this includes the inside edge and outside edge of any bench on a slope).
- d. Along liner features, such as leachate collection piping, survey sections or points should be at 50-foot intervals.

No compacted soil liner material shall be placed until a certified survey is submitted and approved by the Engineer that the subgrade elevations conform to the grades shown on the Contract Drawings. No synthetic liner shall be placed until a certified survey is submitted and approved by the Engineer demonstrating that the surface of soil liner conforms to the Contract Drawings and that the thickness of the soil liner is a minimum of 24 inches at all certification points. Any and all work conducted by the Contractor performed prior to receipt of the Engineer certification shall be done at the Contractor's own risk, at no additional cost to the Owner or Engineer for any remediation required on the construction work.

2. Certified survey of the surface and subsurface structures installed by the Contractor shall be provided after completion of the project and shall include the following:
 - a. Surface Facilities – composite liner system, limits of new road, channels, riprap aprons and outlets, and location of guardrail, concrete walkways, utility poles, control panels, segregation berms, cleanouts and access ramps.
 - b. Subsurface Facilities - leachate pipe, metal drainage pipes (including basin outlets), and spring drain indicating alignment and invert elevations, location of drop inlets (including grate elevation), manholes, riser vaults, buried valves, valve boxes, meter vault, and electrical conduit.
3. As required, provide a certified topographic map survey of the limits of rock excavation. The initial survey shall define the areal limits and rock surface elevations. The final survey shall define the limits and elevations of the completed rock excavation area.

1.04 SURVEYOR QUALIFICATIONS

- A. The surveying of all Work shall be performed under the direct supervision of a qualified, licensed Land Surveyor in the State of North Carolina or registered professional engineer. Surveying personnel shall be experienced in the provision of surveying services, which shall include detailed, accurate documentation.

1.05 SURVEY REFERENCE POINTS

- A. Existing basic horizontal and vertical control points for the Project shall be those designated on the Contract Drawings.
- B. Locate and protect control points prior to starting site work and preserve all permanent reference points during construction.
 - 1. The Contractor's shall establish the necessary working control points and as such shall move or relocate them as necessary.
 - 2. The Contractor surveyor shall not make changes or relocations to any permanent control point without prior written notice to the Engineer.
 - 3. The Contractor shall report to the Engineer when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
 - 4. The Contractor's surveyor shall be required to correctly replace project control points, which may be lost or destroyed.
 - a. Establish replacements based on original horizontal and vertical survey control.

1.06 PROJECT SURVEY REQUIREMENTS

- A. Establish a minimum of one (1) permanent benchmark for the site at the location(s) designated on the Contract Drawings. The vertical and horizontal controls for the benchmark(s) shall be established within normal land surveying standards. The benchmark(s) horizontal and vertical position(s) shall be tied to the North Carolina State Plane Coordinate System and the National Geodetic Vertical Datum of 1929.
 - 1. Record locations, with horizontal and vertical data, on Project Record Documents.
- B. The survey instruments used for this work shall be precise and accurate to meet the needs of the project. Survey instrumentation shall be capable of reading to a precision of 0.01 of a foot with a setting accuracy of 10 seconds. Calibration certificates for the survey instrumentation shall be submitted to the Engineer or CQA Consultant prior to initiation of surveying activities.

- C. The following surfaces shall be surveyed to determine the lines and grades achieved during construction.
 - 1. Surface excavation/structural fill (prior to compacted soil liner placement).
 - 2. Surface of the finished soil liner (including edges, bottom, and limits of pipe trenches and sump).
 - 3. Surface and limits of all geosynthetics.
 - 4. Anchor trench centerline before and after backfilling.
 - 5. Alignments and inverts of piping, tanks, manholes, and riser vaults, both inside and outside the landfill footprint area.
 - 6. Profiles, cross sections, and inverts for ditches, roads, and sedimentation basins.
- D. Establish all lines and grades prior to construction. Surveying of lines and grades shall be conducted on an ongoing basis during construction of the soil layers, geosynthetics placement, access road construction, erosion and sedimentation control construction, and building site subgrade preparation. Surveying shall be performed to provide documentation for record plans, verify quantities of soils, geosynthetics, and to comply with the required grades. Surveying conducted at the site shall be part of the construction quality assurance program.
- E. Acceptable tolerances on survey coordinates, within the landfill footprint area shall be 0 to – 0.2 feet on subgrade elevations, and 0 to + 0.2 feet on compacted soil liner materials and protective cover layers, provided that minimum permit conditions and state regulations are adhered to (e.g., thickness, grades, etc.). Surveying tolerances may need to be more stringent in the sump area to measure accurate construction of the leachate management system.

1.07 RECORDS

- A. All field survey notes shall be retained electronically or manually by the Senior Surveyor. The surveyor should produce record plans for the CQA Consultant as the job progresses. The results from the field surveys shall be documented in a set of Record Drawings. At a minimum, these plans shall show the final elevations of the surfaces at a scale of 1 inch equals 100 feet with contour intervals no greater than 2 feet.
- B. Update the Project Record Drawings on a regular basis based on the completed work.
- C. Maintain an accurate record of changes, revisions, and modifications.
- D. All survey results shall be certified by a registered Land Surveyor or registered professional engineer licensed by the state of North Carolina.

PART 2: PRODUCTS (NOT APPLICABLE)

PART 3: EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01410

TESTING LABORATORY SERVICES

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. The Owner shall retain the services of independent laboratories to perform testing specifically indicated in these Technical Specifications and on the Contract Drawings. The Owner or Engineer may, at any time, elect to have materials and equipment tested for conformity with the Contract Documents.
 - 1. The Contractor shall cooperate with the CQA Consultant and laboratory to facilitate the execution of their required services.
 - 2. The testing laboratories shall provide such Quality Control/Quality Assurance testing as specified in these Technical Specifications.
 - 3. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the Work of the Contract.

1.02 RELATED SECTIONS

- A. Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities shall be carried out in accordance with the appropriate governing bodies requirements.
- B. Laboratory testing is required for, but not limited to, the following Sections:
 - 1. Section 02200: Excavation, Grading, Backfill, and Compaction
 - 2. Section 02272: Non-woven Geotextiles
 - 3. Section 02273: Geosynthetic Drainage Composite
 - 4. Section 02275: Compacted Soil Liner
 - 5. Section 02276: Erosion and Sedimentation Controls
 - 6. Section 02700: Protective Cover Material
 - 7. Section 02776: Textured Geomembrane Liner

1.03 LIMITATION OF AUTHORITY OF THE TESTING LABORATORIES

- A. Laboratory is not authorized to:
 - 1. Release, revoke, alter or enlarge on requirements of Contract Documents.
 - 2. Approve or accept any portion of the Work.
 - 3. Perform any duties of the Contractor, Owner, or Engineer.

1.04 LABORATORY RESPONSIBILITIES

- A. The testing laboratories shall process and distribute required copies of test reports and related instructions to assure necessary retesting and replacement of materials with the least possible delay in progress of the work.
- B. Secure and deliver to the laboratory adequate quantities of representative samples, which require testing.

1.05 CONTRACTOR RESPONSIBILITIES

- A. Cooperate with the CQA Consultant and laboratory personnel and provide access to work area.
- B. Secure and deliver to the CQA Consultant adequate quantities of representative samples, which require testing for delivery to the testing laboratory.
- C. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. Standard specifications for quality and workmanship are indicated in these Technical Specifications and the Contract Drawings. The Engineer may require the Contractor to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in these Technical Specifications and Contract Drawings. Costs of the testing and providing statements and certificates shall be as stated in Section A of Part 2.

PART 2: PAYMENT

- A. All cost for Quality Control testing and providing statements and certificates for the geosynthetic materials shall be the responsibility of the Contractor.
- B. All cost for Quality Control/Quality Assurance testing for the soil and geosynthetic materials shall be the responsibility of the Owner.

END OF SECTION

SECTION 02100

SITE PREPARATION

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, and equipment required and perform all site preparation, complete as shown on the Contract Drawings and as specified herein.
- B. Obtain all permits required for site preparation work prior to proceeding with the work, including clearing and tree removal.

1.02 RELATED SECTIONS

- A. Section 02200: Excavation, Grading, Backfill, and Compaction
- B. Section 02276: Erosion and Sedimentation Control

1.03 SUBMITTALS

- A. Submit copies of all permits required prior to clearing work, specifically for open burning.
- B. Contractor shall supply actual limits of clearing and grubbing survey.

PART 2: PRODUCTS (NOT APPLICABLE)

PART 3: EXECUTION

3.01 SURVEY

- A. The Contractor shall stake out the limits of the clearing and grubbing as specified herein or denoted on the Contract Drawings

3.02 CLEARING & GRUBBING

- A. Clearing shall be conducted to fell and remove standing trees, brush, down timber, fences and debris from areas of proposed grading, excavation, trenching, filling, preloading, or dynamic deep compaction. Trees shall be cut three feet or less from existing grades. All other brush or other material shall be cut flush to ground level.
- B. The limits of grubbing shall coincide with the limits of clearing. Remove completely all stones or surface boulders; individual stumps and roots greater than 1-½ inches in diameter; and matted roots and brush.
- C. All grubbing holes and depressions excavated below the original ground surface shall be refilled with common fill and compacted to a density conforming to the surrounding ground surface.

3.03 STRIPPING

- A. Prior to the start of general excavation, grading, or filling, all surficial organic soils from proposed work areas shall be removed. Stripping shall extend to the surface of underlying inorganic soils.
- B. Stripped organic soils shall be stockpiled at locations as directed by the Owner. Stockpiles of materials, which are not expected to be reused within three months, shall be graded smooth and seeded. Silt barriers shall be installed encircling all stockpiles.

3.04 DISPOSAL

- A. The Contractor shall dispose of all material and debris from the clearing and grubbing operation by hauling such material and debris to an approved facility.
- B. All woody material from clearing and grubbing operations shall be chipped or cut into log lengths. Chipped materials shall be stockpiled or disposed of as directed by the Owner. Logs shall be removed from the site as directed by the Owner.
- C. On-site disposal of cleared and grubbed materials by open-air burning will be allowed provided the Contractor obtains the proper permits in advance.

3.05 PROTECTION

- A. Prior to commencement of work under this Section, protection for trees and shrubs, which are to remain after construction, shall be provided by the Contractor. Arrange an on site conference with the Owner to identify and mark trees and shrubs which are to remain. No clearing shall be performed without a clear understanding of existing conditions to be preserved. All trees to be saved at areas abutting limits of work shall be marked using colored plastic tape around the trunk.
- B. Protection shall be maintained until all work in the vicinity of the work being protected has been completed.
- C. Heavy equipment operation or stockpiling of materials shall not be permitted within the branch spread of existing trees.
- D. Any damage to existing tree crowns, trunks, or root systems shall be repaired immediately. Roots exposed and/or damaged during the work shall immediately be cut off cleanly inside the exposed or damaged area. Cut surfaces shall be treated with acceptable tree wound paint, and topsoil spread over the exposed root area.
- E. When work is completed, all dead and downed trees shall be removed. Live trees shall be trimmed of all dead and diseased limbs and branches. All cuts shall be cleanly made at their juncture with the trunk or preceding branch without injury to the trunk or remaining branches. Cuts over 1-in in diameter shall be treated with acceptable tree wound paint.
- F. Construction activities shall be restricted to those areas within the limits of construction designated on the Drawings, within public rights-of-way, and within easements provided by the Owner. Adjacent properties and improvements thereon, public or private, which become damaged by construction operations shall be promptly restored to their original condition, to the full satisfaction of the property owner.

END OF SECTION

SECTION 02200

EXCAVATION, GRADING, BACKFILL, AND COMPACTION

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment and incidentals necessary to perform all excavation, backfill, compaction and grading required to complete the work shown on the Contract Drawings and specified herein. The work shall include, but not necessarily be limited to excavation, backfilling, grading, compaction, disposal of waste and surplus materials, placing crushed stone, construction of berms, and all related work such as sheeting, bracing and dewatering.
- B. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA excavation safety standards 29 CFR Part 1926.650 Subpart P and State requirements. Where conflict between OSHA and State regulations exists, the more stringent requirements shall apply.
- C. Excavated topsoil and excess cut material will be stockpiled in locations illustrated on the Contract Drawings or as directed by the Owner.

1.02 RELATED SECTIONS

- A. Section 02276: Erosion and Sedimentation Control
- B. Section 02985: Seeding and Mulching

1.03 QUALITY ASSURANCE

- A. Testing and Inspection Service:
 - 1. The CQA Consultant shall perform soil testing and monitoring services for the quality assurance testing during earthwork operations. Refer to Section 01410, Testing Laboratory Services.

1.04 PROTECTION

- A. Sheeting and Bracing (if required)
 - 1. The Contractor shall furnish, put in place and maintain such sheeting and bracing as may be required by Federal, State and local safety requirements to support the sides of excavations; to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction; and to protect adjacent structures from undermining or other damage. If the Engineer is of the opinion that at any location sufficient or proper supports have not been provided, he/she may order additional supports put in, and compliance with such order shall not relieve or release the Earthwork Contractor from his/her responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill. All voids shall be filled to the satisfaction of the Engineer.

2. The Contractor shall construct the sheeting outside the neat lines of the foundation, unless indicated otherwise, to the extent deemed desirable for the method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressures to which the structure or trench will be subjected. Any movement or bulging, which may occur, shall be corrected to provide the necessary clearances and dimensions.
3. All sheeting and bracing 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 and be compacted, which must be approved by the Engineer, by ramming with tools especially adapted to that purpose, or otherwise as may be directed.
4. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating any obligation on his/her part to issue such orders and his/her failure to exercise his/her 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.
5. No sheeting is to be withdrawn if driven below mid-diameter of any pipe and under no circumstances shall any sheeting be cut off at a level lower than 1 ft above the top of any pipe.

B. Drainage and Dewatering

1. At all times during construction the Contractor shall provide and maintain proper equipment and facilities to remove all water entering excavations and 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 into the excavated areas.
2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.
3. The Contractor shall take all additional precautions to prevent uplift due to water pressure of any structure during construction.
4. Drainage shall be disposed of so that flow or seepage back into the excavated area will be prevented.
5. Flotation shall be prevented 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.
6. The Contractor shall remove the dewatering equipment after the system is no longer required.
7. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, etc in order to prevent adverse effects on groundwater or surface water quality.

1.05 SOIL TESTING

- A. Previous to the general placement of the soil materials and during such placement, the Engineer may select areas within the limits of the fill for testing. The Contractor shall cooperate fully in obtaining the information desired.
- B. Payment for testing will be made by the Owner. If test results are unsatisfactory, all costs involved in correcting deficiencies in compacted materials to the satisfaction of the Engineer, will be borne by the Contractor.

PART 2: PRODUCTS

2.01 MATERIALS

- A. Soil materials used in constructions shall be as described below. The Contractor shall notify the Engineer of the source of each material. The Contractor shall make every reasonable effort to utilize on-site sources and only use off-site sources once on-site sources have been exhausted. This includes stockpiled and rehandled soils, coarse sand, and topsoil. These operations are in no way considered out of scope for this work. All materials from off-site sources shall be approved by the Engineer prior to being delivered to the site.
- B. Common Fill shall be used in areas where other soil materials are not indicated or specified. They shall consist of material that has no stone greater than 2/3 of the required loose lift thickness and shall be free from organic materials, loam, wood, trash and other deleterious materials which will deteriorate in time or which cannot be properly compacted. Common fill shall not contain granite blocks, broken concrete, masonry rubble or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling. Snow, ice and frozen soil will not be permitted. Common Fill shall be compacted to 90 percent of the Standard Proctor (ASTM D698) maximum dry density with a moisture content no greater than 10 percent above optimum, or as otherwise shown in the Contract Drawings.
- C. Structural Fill shall be used for fill, backfill, and embankments below the base liner system, channels, and roadways where other materials are not indicated or specified. Structural Fill shall contain no stones larger than 2/3 of the required loose lift thickness for the compaction equipment being utilized but not greater than 6 inches in their largest dimension, a maximum of 50 percent passing the No. 200 Sieve and shall be free from organic materials, loam, wood, trash and other deleterious materials which will deteriorate in time or which cannot be properly compacted. Structural Fill shall be compacted as follows:
 - 1. Beneath the liner system of the landfill, in embankments, and in channels, the top 24 inches of structural fill shall be compacted to 95 percent of the Standard Proctor (ASTM D698) maximum dry density with a moisture content not to exceed + 5 percent of optimum. Refer to Table 3.2 in the CQA Plan for the specific test methods to be used, a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for the structural fill.
 - Refer to Table 3 in the CQA Plan for the specific test methods to be used, a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for structural fill.

2. In areas of fill, a 24-inch layer of structural fill shall be used directly below all roadways. The structural fill shall be compacted to 95 percent of the Standard Proctor (ASTM D698) maximum dry density with a moisture content not to exceed + 5 percent of optimum with the exception of the top 8 inches. The top 8 inches shall be compacted to 100 percent of the Standard Proctor (ASTM D698) maximum dry density with a moisture content of ± 3 percent of optimum.

PART 3: EXECUTION

3.01 GENERAL EXCAVATION

- A. Excavation shall be made to the grades shown on the Contract Drawings. The bottom of the excavations shall be rendered firm and dry and in all respects acceptable to the Engineer. The Engineer shall be notified of all unexpected subgrade conditions such as unstable subgrade or rock outcrops and shall be given the opportunity to observe the unexpected subgrade conditions prior to their removal or undercutting.
- B. Excavation and dewatering shall be accomplished by methods, which preserve the undisturbed state of subgrade soils. Soils which become soft, loose, "quick", or otherwise unsatisfactory for support of structures, earthen or man-made, as a result of inadequate excavation, dewatering, proofrolling, or other construction methods shall be removed and replaced as required by the Engineer at the Contractor's expense.
- C. Dewatering shall be such as to prevent "boiling" condition or detrimental underseepage at the base of the excavation as specified herein before.
- D. Excavation equipment shall be satisfactory for carrying out the work in accordance with the Technical Specifications.
- E. When excavation for bottom of soil liner, bottom of leachate detection system, or for subgrade for roads has reached prescribed depths, the Engineer shall be notified and will observe the subgrade conditions. If materials or conditions are not satisfactory to the Engineer, the Engineer will issue directions for replacing materials or correcting conditions at no additional expense to the Owner.
- F. In excavating to subgrade, the Contractor will use care to prevent disturbance and remolding of the subgrade. Material, which has become softened and mixed with water, shall be removed.
- G. Approval of subgrade or prepared grade prior to backfill shall be by the Engineer. The Engineer shall supervise the proofrolling operation and recommend undercut or other remedial steps as necessary to provide a firm, stable, and properly moistened subgrade.

3.02 TRENCH EXCAVATION

- A. Excavation for all trenches required for the installation of pipes shall be made to the depths indicated on the Contract Drawings and in such a manner and to such widths as will give suitable room for laying the pipe or installing the ducts within the trenches, for bracing and supporting the trench sides and for pumping and drainage facilities. Contractor shall render the bottom of the excavations firm and stable and in all respects acceptable to the Engineer.
- B. Excavated materials shall remain on the property of the Owner and shall be reused as backfill if suitable for such or stockpiled for other uses as directed.

- C. In the case unsuitable bearing soil, as determined by the Engineer, is encountered at the specified subgrade elevation, the Engineer may direct the removal of the unsuitable materials and backfill with appropriate materials.
- D. The Contractor shall provide adequate pumping and drainage of facilities to keep all excavations and work sufficiently dry from groundwater and/or surface runoff so as not to adversely affect construction product nor cause excessive disturbance of underlying ground. Water from trenches and excavations shall be disposed in such a manner as will not cause injury to public health, nor damage to public or private property, existing work or work in progress. The Contractor shall comply with all applicable environmental protection and/or sediment/erosion control regulations.
- E. Whenever practical, laying of pipe shall start at the lowest point in the drainage system of pipe run. Immediately before laying, the interior surfaces and ends of the sections of pipe shall be cleaned by wiping or other procedures, as necessary. Bell and Spigot pipe shall be laid with the bell end up grade. Joints shall be made up in accordance with the approved manufacturers procedures. Completed pipe lines shall be true to line and grade. Misaligned pipe, leaks, broken pipe or other defects shall be repaired or replaced by the Contractor as directed by the Engineer.
- F. Pipes and structures shall be backfilled with materials specified on the Contract Drawings. Fill shall be placed in lifts not exceeding 9 inches in thickness and each lift shall be compacted as stated above for the specified materials used.

3.03 ROCK AND BOULDER EXCAVATION

- A. The following material classifications, based on the type of excavation equipment required, shall be used to identify materials for payment:
 - 1. Soil or Partially Weathered Rock. Soil or partially weathered rock (PWR) shall be defined as any material that can be removed by a Caterpillar 235D/Caterpillar 350 excavator or equivalent.
 - 2. Rippable rock. Rippable rock shall be defined as any material that cannot be removed by a Caterpillar 235D/Caterpillar 350 excavator or equivalent but can be removed by a Caterpillar D9N or equivalent equipped with a single shank ripper.
 - 3. Rock. Rock shall be defined as any material that cannot be removed by a Caterpillar D9N or equivalent equipped with a single shank ripper. The methodology for excavating such material shall be approved by the Engineer.
- B. Boulder excavation shall refer to the removal of rocks exceeding 1 cubic yard in volume, which can be excavated by means other than blasting.
- C. Where rock is encountered, it shall not be excavated until measurements have been made in accordance with Section 01051, Survey Requirements. The means of excavation shall be subject to approval by the Owner via change order.
- D. Excavation below the liner system will be based on the grades shown on the Contract Drawings and the Engineer. The minimum depth to rock below the bottom of the soil liner shall be four feet.
- E. Excavation for pipe trenches outside the Limits of Waste will be based on the rectangular cross-sections as follows:

1. Width: 8 inches from the sides of the pipe.
2. Depth: 8 inches below the bottom of the pipe or deeper where directed by the Engineer.
3. Height: Based on the actual elevation of top of rock surface, as determined by the Engineer.
4. Boulders of more than 1 cubic yard in volume will be measured for payment as rock excavation.

3.04 GENERAL BACKFILL

- A. Materials placed in fill areas shall be deposited to the lines and grades shown on the Contract Drawings.
- B. Material conforming to the requirements of Common Fill shall be placed in layers having a maximum loose thickness of 12 inches and shall be compacted as specified above.
- C. Structural Fill shall be used where specified on the Contract Drawings. Structural Fill shall be placed in layers having a maximum thickness of 12 inches measured before compaction and shall be compacted as specified above.
- D. The surfaces of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the grading plan and no soft spots or uncompacted areas will be allowed in the work.
- E. No compacting shall be done when the material is covered with frost or frozen or is too wet either from rain or from excess application of water. At such times, work shall be suspended until the previously placed and new materials have thawed and/or dried sufficiently to permit proper compaction.

3.05 ROAD SUBGRADE PREPARATION

- A. The road subgrade for crushed stone pavement areas in fill sections shall consist of, at a minimum, 24 inches of structural fill. The structural fill shall be placed and compacted as specified above with the exception of the final 8 inches. The top 8 inches of subgrade shall be compacted to 100 percent standard proctor (ASTM D698) with a moisture content ± 3 .
- B. The road subgrade for crushed stone pavement areas in cut sections shall consist of firm hard natural soils.
- C. Road subgrades shall be proofrolled as described in Section 02200, 3.01 G.
- D. Grading shall be performed to the elevations shown on the Contract Drawings and otherwise as directed by the Engineer and shall be performed in such a manner that the requirements for formation of all grade lines can be followed. A tolerance of plus or minus 0.1 feet from the established grade shall be permitted after the subgrade has been graded to a uniform surface. The maximum differential between the established grade and graded subgrade within any 100-foot section shall be 0.1 feet. During the process of grading, the subgrade shall be maintained in such condition that it will be well drained at all times. When required, temporary drains and drainage ditches shall be installed to intercept or divert surface water, which may affect the performance or condition of the work.

- E. If at the time of grading it is not possible to place material in its final location, it shall be stockpiled in approved areas. Stockpiled material shall be placed, compacted and smooth rolled at the end of each day to deter water infiltration. No extra payment will be made for the stockpiling or rehandling of excavated material.
- F. Engineer or owner reserves the right to make minor adjustments in lines or grades if deemed necessary as the work progresses, in order to obtain satisfactory construction.
- G. Stones or rock fragments larger than 6 inches in their greatest dimensions will not be permitted in the top 6 inches of the finished subgrade of all fills or embankments.
- H. In cuts, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to finished grade of slope. All cut and fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Contract Drawings or as directed by the Engineer.
- I. In cuts where highly micaceous, elastic silts or cohesionless silts or other unacceptable materials are encountered at subgrade, the material shall be undercut to a depth of at least 18 inches below the subgrade and replaced with Structural Fill as directed by the Engineer. This work shall be performed upon approval by the Owner via change order.

3.06 HANDLING OF SURPLUS MATERIALS

- A. Excavated materials shall not be removed from the site except as specified by the Owner. Materials shall be neatly stockpiled on-site at locations specified on the Contract Drawings.
- B. Surplus fill shall become the property of the Owner and be stockpiled at locations directed by the Owner.

3.07 DISPOSAL AND REPLACING OF ROCK

- A. The Contractor shall remove and dispose of all pieces of ledge and boulders, which are not suitable for use in other parts of the work. Rock disposed by hauling away to spoil areas is to be replaced by approved surplus soil excavation obtained elsewhere on the work, insofar as it is available. Any deficiency in the backfill material shall be made up with acceptable material approved by the Engineer.
- B. Rock or cobbles larger than 12 inches in diameter may not be used in the upper 2 feet of Common Fill.

END OF SECTION

SECTION 02272

NON-WOVEN GEOTEXTILES

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment and incidentals required to install filter fabric complete as shown on the Drawings and as specified herein.

1.02 RELATED SECTIONS

- A. Section 02200: Excavation, Grading, Backfill, and Compaction.
- B. Section 02273: Geosynthetic Drainage Composite
- C. Section 02276: Erosion and Sedimentation Control

1.03 SUBMITTALS

The following information shall be submitted to the Engineer by the Contractor prior to installation of the materials:

1. A list of guaranteed "minimum average role value" (MARV) properties for the type of geotextile to be supplied.
2. Written certification signed by the manufacturer that the geotextiles properties meet or exceed the guaranteed MARV.
3. Manufacturer's quality control certificates illustrating that minimum required material properties have been obtained.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 1. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 2. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 3. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
 4. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile.

5. ASTM D4759 - Standard Practice for Determining the Specification Conformance of Geosynthetics.
 6. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
 7. ASTM D5261 - Standard Test Methods for Mass Per Unit Area (Weight) of Fabric.
- B. Where reference is made to one of the above standards, the revision in effect at the time of the work shall apply.

1.05 FABRIC APPLICATIONS

- A. The non-woven geotextile is to be used for: placement beneath riprap in channels and sediment traps, stone construction entrance, and beneath the access road stone base course. The unit weights of the filter fabric for each application shall be as specified on the Contract Drawings.

1.06 DELIVERY, STORAGE AND HANDLING

- A. The non-woven geotextile shall be shipped, stored and handled in accordance with manufacturer's recommendations and as specified herein.
- B. The non-woven geotextile shall be stored in an area protected from ultraviolet light, precipitation, snow or other inundation, mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions.
- C. Non-woven geotextile shall not be exposed to precipitation prior to installation. During cold weather events, the non-woven geotextile shall be protected from freezing.
- D. The CQA Consultant shall observe rolls upon delivery and prior to installation. Any deviations from the storage requirements shall be reported to the Engineer and Owner.

1.07 REQUIREMENTS PRIOR TO INSTALLATION

- A. Prior to installation, the subgrade shall be inspected and approved by the CQA consultant. The subgrade shall be smooth, uniform and compacted for the installation of the non-woven geotextile.

1.08 SAMPLE COLLECTION

- A. Samples of non-woven geotextile materials shall be taken by the CQA Consultant at a frequency of one (1) sample per every 100,000 square feet of material delivered. Samples shall be taken along the entire width of the roll and shall be no less than 3 feet long.

1.09 MATERIAL WARRANTY

- A. The manufacturer shall warrant the material against manufacturing defects and material degradation for a period of twenty (20) years from the date of installation. The manufacturer shall replace any material, which fails within the warranty period. The manufacturer shall furnish a written warranty covering the requirements of this Paragraph.

PART 2: PRODUCTS

2.01 GENERAL

- A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration. Any manufacturer's materials shall be allowed, provided they meet the minimum average roll value requirements.

2.02 MATERIALS

- A. All non-woven geotextile shall be a non-woven needle punched polypropylene fabric consisting of filaments formed into a stable network, such as Nicolon Mirafi or approved equal.
- B. The unit weight of the non-woven geotextile shall be as specified on the Contract Drawings.
- C. The non-woven geotextile shall be nonbiodegradable, nonreactive within a pH range of 3 to 11, resistant to ultraviolet light exposure, and resistant to insects and rodents. Test results from any sampled roll in the lot, when tested in accordance with ASTM D4759, shall meet or exceed the values listed in Table 1.

TABLE 1

**MINIMUM AVERAGE ROLL VALUES
GEOTEXTILE FABRICS**

PROPERTIES	TEST METHOD	MINIMUM AVERAGE ROLL VALUES	
		UNIT	6 oz./ sy
Mass Per Unit Area	ASTM D5261	oz/yd ²	6
Grab Tensile Strength	ASTM D4632	lbs	150
Grab Elongation	ASTM D4632	%	50
Puncture Resistance	ASTM D4833	lbs	90
Trapezoidal Tear Strength	ASTM D4533	lbs	70
Apparent Opening Size	ASTM D4751	sieve size	70-100
Permittivity	ASTM D4491	sec ⁻¹	1.3

2.03 QUALITY CONTROL DOCUMENTATION

A. Prior to installation, the Contractor or Owner shall provide the following information certified by the manufacturer for the delivered fabric to the CQA Consultant.

1. Each roll delivered to the Project site shall have the following identification information:

- a. Manufacturer's name
- b. Product identification
- c. Lot Number
- d. Thickness
- e. Mass per unit area
- f. Roll number
- g. Roll weight
- h. Roll dimensions

2. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling procedures, frequency and test results. At a minimum, the geotextile test results shall be provided every 100,000 square feet of manufactured fabric in accordance with test requirements specified in Table 1.

2.04 CONFORMANCE TESTING

A. Conformance testing shall be performed by an independent laboratory approved by the Owner. The CQA Consultant shall obtain samples from the delivered material, mark the machine direction and identification number. Sampling of the non-woven geotextile material shall be performed as specified in section 1.08.A of these Technical Specifications.

1. Mass Per Unit Area (ASTM D5261)
2. Grab Tensile Strength (ASTM D4632)
3. Puncture Resistance (ASTM D4833)
4. Trapezoidal Tear Strength (ASTM D4533)

B. These conformance tests shall be performed in accordance with the reference standards, by the testing laboratory.

C. All conformance test results shall be reviewed by the Engineer and accepted, prior to the deployment of the fabric. All test results shall meet, or exceed, the property values listed in Table 1.

D. If a roll fails, the manufacturer may obtain samples from rolls manufactured immediately before and after the failing roll and request testing by the laboratory at the manufacturer's expense. If these rolls pass, then only the failing roll will be rejected. If they fail, one or both of those rolls will be rejected and the CQA consultant and project manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

- E. The cost of conformance testing shall be borne by the Owner and shall be performed by an independent laboratory selected by the Owner.

PART 3: EXECUTION

3.01 INSTALLATION

- A. Fabric Placement
 - 1. The subgrade shall be maintained in a smooth, uniform and compacted condition during installation of the non-woven geotextile. Overlap between adjacent panels of non-woven geotextile shall be a minimum of 12 inches, or shall be heat bended or leistered over a minimum width of 2 inches.
 - 2. Non-woven geotextile for roadways shall be anchored with 1/16" diameter pins, at least 18 inches long, pointed at one end and have a head that will retain a steel washer having an outside diameter of no less than 1.5 inches, unless otherwise approved by the Engineer.

3.02 FIELD QUALITY CONTROL

- A. The non-woven geotextile installation and related work shall be inspected by the CQA Consultant. All work in the system therein being inspected shall be complete, clean and ready for use.
- B. Discrepancies shall be noted by the CQA Consultant and repaired by the Contractor at no additional expense to the owner. Final acceptance of the system shall be contingent upon the approval of the Engineer.

END OF SECTION

SECTION 02273

GEOSYNTHETIC DRAINAGE COMPOSITE

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. The Liner Contractor shall furnish all labor, materials, equipment and incidentals required to install geosynthetic drainage composite as shown on the Contract Drawings and as specified herein.

1.02 RELATED SECTIONS

- A. Section 02200: Excavation, Grading, Backfill and Compaction.
- B. Section 02276: Erosion and Sedimentation Control
- C. Section 02272: Non-woven Geotextiles

1.03 SUBMITTALS

- A. The following information shall be submitted to the CQA Consultant prior to deployment of the material:
 - 1. Manufacturer's background information.
 - 2. List of material properties and samples with attached certified test results.
 - 3. Manufacturer's quality control program and manual including description of laboratory facilities.
 - 4. Shop Drawing, including details of overlap, seaming, anchoring, connections and other construction details.
 - 5. Installation schedule.
 - 6. A manual that specifically defines the quality control and quality assurance program during installation including manufacturer's installation instructions.
 - 7. Copy of quality control certificates in conformance with Paragraph 2.02.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM D1238(E) – Standard Test method for melt Flow Rates of Thermoplastics by Extrusion Plastometer.
2. ASTM D1505 – Standard Test method for Density of Plastics by the Density – Gradient Technique.
3. ASTM D1603 – Structural Test Method for Carbon Black in Olefin Plastics.
4. ASTM D1777 – Standard Test Method for Measuring Thickness of Textile Materials.
5. ASTM D3776 – Standard Test Method for Mass Per Unit Area (weight) of Fabric.
6. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
7. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
8. ASTM D4632 - Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method).
9. ASTM D4716 - Standard Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products.
10. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile.
11. ASTM D4759 - Standard Practice for Determining the Specification Conformance of Geosynthetics.
12. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products.
13. ASTM D5035 – Standard Test Method for Breaking Force and Elongation of textile Fabrics (Strip Method).
14. ASTM D5199 – Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.

- B. Where reference is made to one of the above standards, the revision in effect at the time of construction shall apply.

1.05 APPLICATION

- A. The geosynthetic drainage composite shall consist of a geosynthetic drainage netting employed in combination with geotextile filter fabric to provide a three dimensional structure to provide planar water flow.
- B. The geosynthetic drainage composite shall consist of geosynthetic drainage netting with geotextile filter fabric to both sides of the drainage netting.
- C. The geosynthetic drainage composite shall, when tested according to ASTM D 4716, in the proposed configurations and under an applied normal compressive force of 10,000 pounds per square foot, provide a minimum transmissivity of 5×10^{-4} meters squared per second under a hydraulic gradient of 0.25. The geosynthetic drainage composite shall be tested after a minimum 24-hour seating time.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. The geosynthetic drainage composite shall be shipped, stored and handled in accordance with manufacturer's recommendations and as specified herein.
- B. The material shall be stored with a cover so that it is protected from exposure to sunlight, precipitation, mud, dirt, dust or other damaging conditions, and shall be elevated from the ground (a minimum of 3 inches) to protect the fabric from stones and other sharp objects. During cold weather, geotextiles must be protected from freezing.

1.07 REQUIREMENTS PRIOR TO INSTALLATION

- A. Prior to installation of the geosynthetic drainage composite, the material shall be inspected by the CQA Consultant and tested in accordance with the CQA Plan.

1.08 MATERIAL WARRANTY

- A. The manufacturer shall warrant the material against manufacturing defects and material degradation for a period of 20 years from the date of installation. The manufacturer shall replace any material, which fails within the warranty period. The manufacturer shall furnish a written warranty covering the requirements of this Paragraph.

1.09 GUARANTEE

- A. The Geosynthetics Installer shall guarantee the material against defects in installation and workmanship for the period of 2 years commencing with the date of Final Acceptance. The guarantee shall include the services of qualified service technicians and all materials required for the repairs at no expense to the Owner.

PART 2: PRODUCTS

2.01 GENERAL

- A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration.

2.02 MATERIALS

- A. The non-woven geotextile component of the geosynthetic drainage composite shall satisfy the requirements of Section 02272 of these Specifications for 6 ounce per square yard (oz/sy) nominal weight fabric. The 6 oz/sy geotextile will be used for the base liner drainage system, enhanced liner system, and alternate cap drainage layer.
- B. The bonding of the geotextile filter fabric to the drainage net shall be by heat bonding unless another method is approved by the Engineer. The bonding process shall not introduce adhesives or other foreign matter. The strength of the bond between the drainage net and the geotextile filter fabric shall be greater than the friction developed between the geotextile fabric and the overlying granular free-draining soil.
- C. The geosynthetic drainage netting component of the geosynthetic drainage composite shall be constructed of diagonally overlapping and bonded high density polyethylene strands unless other configurations are approved by the Engineer. The geosynthetic drainage netting shall satisfy the following criteria:

<u>Property</u>	<u>Test Method</u>	<u>Requirement</u>
Density (g/cc)	ASTM D 1505	0.940 min.
Thickness of Netting (inches)	ASTM D 5199	0.250 min.
Mass Per Unit Area (lbs/ft ²)	ASTM D 3776	0.16 min.
Carbon Black Content (percent)	ASTM D 1603	2-3
Tensile Strength @ Break (lbs/in)	ASTM D 5035	55 min.

D. The geosynthetic drainage composite shall meet the following criteria:

<u>Property</u>	<u>Test Method</u>	<u>Requirement</u>
Transmissivity @ $\sigma = 10,000 \text{ lb/ft}^2$, $i = 0.25$ Minimum 24-hour seating time.	ASTM D4716	$\geq 5 \times 10^{-4} \text{ m}^2/\text{sec}$
Ply-Adhesion (g/in)	ASTM F904	≥ 150

The geocomposite drainage net shall be supplied in a roll width of 6.5 feet or greater.

2.03 QUALITY CONTROL DOCUMENTATION

A. Prior to installation, the Geosynthetics Installer shall provide to the CQA Consultant the following information certified by the manufacturer for the delivered material.

1. Each roll delivered to the Project site shall have the following identification information:
 - Manufacturer's name
 - Product identification
 - Lot Number
 - Roll number
 - Roll dimensions
2. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling procedures, frequency, and test results. The geotextile shall meet the test requirements of Section 02273 at the specified frequencies. At a minimum, the geonet test results shall be provided every 100,000 square feet of manufactured material in accordance with test requirements specified in Paragraph 2.02.C. The geosynthetic drainage composite test results, at a minimum, shall be provided every 200,000 square feet of manufactured material in accordance with test requirements specified in Paragraph 2.02.D.

2.04 CONFORMANCE TESTING

- A. Conformance testing shall be performed by the Geosynthetics CQA Laboratory. The CQA Consultant shall obtain samples from the delivered material and mark the identification number. One sample shall be taken per 250,000 square feet, or one sample per lot, whichever results in the greater number of conformance tests. This sampling frequency may be increased as deemed necessary by the Engineer. The samples shall be 3 feet wide taken across the entire roll width and shall not include the first 3 feet.

- B. These conformance tests shall be performed in accordance with test requirements Paragraph 2.02.D.
- C. The results of the conformance testing shall be evaluated in accordance with the following procedure:
 - 1. If the average test values for the sample meet all of the values given in the design specifications and the Manufacturer's guaranteed minimum values, the samples pass.
 - 2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures shall be implemented by the CQA Consultant. Additional tests required for further evaluation shall be done at no expense to the Owner.
 - 3. For the failing parameter(s), one additional test shall be performed on the sample. This test may be performed by another CQA Geosynthetics laboratory at the discretion of the CQA Consultant and the Project Manager.
 - 4. If the test values for the additional test meet the required values, the roll and adjacent rolls pass and are acceptable.
 - 5. If the test value does not meet requirements, reject the roll, collect samples from the closest numerical roll on both sides of the failed roll, and test for the failed parameter(s). If one or both of these tests do not meet the requirements, those roll(s) shall be rejected and the CQA Consultant and Project Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.
- D. The cost of first-run conformance testing shall be borne by the Owner and shall be performed by an independent Quality Assurance Laboratory selected by the Owner. If the fabric fails the first-run unit conformance tests, the Liner Contractor shall pay for the cost of subsequent conformance testing until all conformance tests are passed and the fabric is accepted by the Engineer.

PART 3: EXECUTION

3.01 INSTALLATION

- A. Geosynthetic Drainage Composite Placement
 - 1. On slopes, the material shall be secured in the anchor trench and then rolled down the slope in such a manner as to continually keep the material in tension. If necessary, the material shall be positioned by hand after being unrolled to minimize wrinkles. The material can be placed in the horizontal direction (i.e. across the slope) in the locations approved by the Engineer.
 - 2. In the presence of wind, the material shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and remain until replaced with overlying material.
 - 3. Sandbags shall be filled with a fine-grained sand material and must be handled with care to prevent rupture.

4. Unless otherwise specified, the geosynthetic drainage composite shall not be welded to the geomembrane.
5. The Geosynthetics Installer shall take the necessary precautions to prevent damage to the underlying layers during placement of the material. Care should be taken not to leave tools on the material.
6. During placement of the material, care shall be taken not to entrap dirt or excessive dust that could cause clogging of the drainage system, and/or stones that could damage the adjacent geomembrane. If any dirt, excessive dust, and/or any stones are entrapped in or below the material, the material and the underlying liner material shall be washed or swept prior to placement of the material.
7. Adjacent rolls shall be overlapped by at least 4 inches.
8. The geonet component shall be secured with ties made of plastic or polymer braid, which are white or yellow in color. Metallic devices shall not be allowed.
9. Ties shall be placed every 5 feet down the slope, every 2 feet across the slope, every 6 inches in the anchor trench, and every 6 feet on horizontal surfaces.
10. No base T-Seams shall be closer than 5 feet from the toe of a slope of 10 percent or greater.
11. Sewing of the overlying geotextile shall be accomplished consistent with the manufacturer's recommendations for sewn seams and shall employ threads of polyester, polyethylene, or polypropylene or other chemically resistant material as approved by the Engineer. Sewn seams shall be capable of developing the full tensile strength of the geotextile material.

B. Repairs

1. Any holes or tears shall be repaired by placing a patch extending 2 feet beyond the edges of the hole or tear the patch shall be secured to the original net component by tying every 6 inches. The overlying geotextile material shall be sewn.
2. If the hole or tear width across the roll is more than on-half the width of the roll, the damaged area shall be cut out and the two portions of the material shall be joined as indicated above.

3.03 FIELD QUALITY CONTROL

- A. The CQA Consultant shall observe the material installation and related work. All work in the system therein being inspected shall be complete, clean and ready for use. All work shall meet the requirements of cleanliness and workmanship, as determined by the CQA Consultant.
- B. Discrepancies shall be noted and repaired at no additional expense to the Owner. Final acceptance of the system shall be contingent upon the approval of the CQA Consultant.

END OF SECTION

SECTION 02275

COMPACTED SOIL LINER (Alternate for future use)

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment and incidentals required to install the compacted soil liner material as shown on the Contract Drawings and as specified herein. Associated work includes quality control testing, borrow source excavation, hauling, constructing a test pad, placement, moisturizing, harrowing, compaction, and grading for base liner construction within the landfill footprint.

1.02 RELATED SECTIONS

- A. Section 02200: Excavation, Grading, Backfill, and Compaction
- B. Section 02776: Textured Geomembrane Liner
- C. Section 01051: Survey Requirements

1.03 SUBMITTALS

- 1. Contractor shall submit a subgrade elevation survey certified by a Land Surveyor professionally registered in the state of North Carolina.
- 2. Contractor shall submit a soil liner elevation survey certified by a Land Surveyor professionally registered in the state of North Carolina.
- 3. Contractor shall submit a list of surveyed coordinates of locations where undisturbed Shelby tube samples are obtained.

1.04 REFERENCE STANDARDS

- A. American Society for Testing Materials (ASTM)
 - 1. ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils.
 - 2. ASTM D698 - Standard Test Method for Moisture-Density Relations of Soil and Soil Aggregate Mixtures Using 5.5-lb (2.49 kg) Hammer and 12-in (305 mm) Drop.
 - 3. ASTM D854 - Standard Test Method for Specific Gravity of Soils.
 - 4. ASTM D1140 - Standard Test Method for Amount of Material in Soils Finer Than the Number 200 (75 micrometer) Sieve.

5. ASTM D1556 - Standard Test Methods for Density and Unit Weight of Soil In Place by Sand-Cone Method.
 6. ASTM D1557 - Standard Test Methods for Moisture-Density Relations of Soils Aggregate Mixtures Using 10-lb (4.54 kg) Hammer and 18-in (457 mm) Drop.
 7. ASTM D2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.
 8. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes.
 9. ASTM D2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedures).
 10. ASTM D2922 - Density of Soil in Place by Nuclear Methods (Shallow Depth).
 11. ASTM D2937 - Standard Test Method for Density of Soils in Place by the Drive-Cylinder Method.
 12. ASTM D3017 - Standard Test Method for Water Content of Soil in Place by Nuclear Methods (Shallow Depth).
 13. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 14. ASTM 4767 - Test method for Consolidated - Undrained Triaxial Compression Test on Cohesive Soils.
 15. ASTM D5084 - Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
 16. ASTM D5321 - Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic Friction by the Direct Shear Method.
- B. Where reference is made to one of the above standards, the revision in effect at the time of construction shall apply.

1.05 QUALITY CONTROL AND QUALITY ASSURANCE

- A. The CQA Consultant shall provide direction and testing as necessary to control the quality of the borrow material and moisture control for the test pad and the installed liner.
- B. A test pad shall be constructed on site using the same equipment and installation procedures that will be used during full-scale liner construction. The purpose of the test pad is to assure that the construction procedures followed during liner installation will produce an acceptable liner. Construction requirements and testing procedures for the test pad are specified in Paragraph 3.01.

- C. Material to be used for compacted soil liner construction shall be free of roots, stumps, other organic materials, rocks, and other deleterious debris.

1.06 QUALIFICATIONS

Construction of the compacted soil liner shall be performed by personnel that have experience in the installation of compacted soil liner.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. It is assumed that compacted soil liner material will be obtained from on-site borrow areas. However, if soil liner material is required to be obtained from off-site sources, the material shall be delivered and stockpiled onsite in designated areas approved by the Engineer. Removal and placement of material shall be done in a manner to minimize mixing with soils adjacent to and beneath the stockpile.
- B. The stockpiled soil shall be compacted and/or sealed at the end of each day and during rain events.
- C. The storage sites should be cleared and level.
- D. The Contractor shall protect the compacted soil liner material delivered to the site from inclement weather conditions and any traffic that may occur near the stockpile.

PART 2: PRODUCT

2.01 MATERIALS

- A. The soil liner material shall consist of relatively homogenous silty and clayey soils which are substantially free of debris, plant materials, roots, frozen materials, organics and rocks over 3 inches in diameter. Soil liner material is intended to be obtained from on-site borrow areas as designated by the Owner. The compacted soil liner material shall provide a compacted permeability of $k \leq 1.0 \times 10^{-7}$ centimeters per second (cm/s) with a minimum layer thickness of 24 inches or a compacted permeability of $k \leq 1.0 \times 10^{-5}$ cm/s with a minimum thickness of 18 inches; based on alternative shown on contract drawings.

2.02 CONFORMANCE TESTING

- A. Initial conformance testing shall be performed by the CQA Consultant on samples from the soil source to assure compliance with the specifications. The samples will be obtained from multiple test pits to be dug by the Engineer. The following tests shall be performed on the samples.
 - 1. Soil Classification (ASTM D2487) (As specified by CQA Consultant)
 - 2. Sieve Analysis (ASTM D422) (including hydrometer analysis) (1 per 5,000 cy)
 - 3. Atterberg Limits (ASTM 4318) (1 per 5,000 cy)

4. Standard Proctor (ASTM D698) (As specified by CQA Consultant)
 5. Drive Tube (ASTM D2937) or Sand Cone (ASTM D1556) (1 per each day that a Nuclear Density gauge is used)
 6. Laboratory Hydraulic conductivity (ASTM D5084 except as modified in Paragraph 3.01-G) (1 per acre per lift)
 7. Moisture Content (ASTM D2216) (1 per day)
 8. Nuclear Densometer (ASTM D2922 and D3017) (1 per 100 ft grid per lift)
- B. Based on the laboratory test results, a tentative moisture-density criteria shall be developed by the Engineer for the compaction of the low permeability soil material to achieve the required compacted permeability of $k \leq 1.0 \times 10^{-7}$ cm/s or $k \leq 1.0 \times 10^{-5}$ cm/s. These criteria shall be tested utilizing a test pad as described in paragraph 3.01. Test result of in place material from the test pad shall be used to confirm or modify the tentative moisture density criteria.

PART 3: EXECUTION

3.01 TEST PAD

- A. A test pad of a dimension of no less than 40-ft by 60-ft and the minimum required thickness shall be constructed onsite using the same equipment, processing and installation procedures that will be used during full-scale liner construction. The soil liner material to be used for the test pad shall be the same material that the Contractor proposes to use for construction of the actual base liner. If approved by the Engineer, the test pad may be installed within the liner limits and incorporated in the work, provided the pad passes all testing requirements.
- B. The subgrade beneath the test pad shall be proof rolled prior to test pad construction to ensure a hard surface.
- C. The construction of the test pad shall be directed by the CQA Consultant. The CQA Consultant shall use the tentative moisture-density criteria established by the Engineer to set moisture contents and percent compaction. The CQA Consultant may perform tests as needed to assist in the construction of the test pad. However, only the final results of the CQA Consultant's tests will be recognized for determining the performance of the pad.
- D. For each lift, the CQA Consultant shall test the moisture content and density at a minimum of six locations per lift. Two 6-inch Shelby Tube Samples shall be obtained per 6-inch lift by the CQA Consultant. One tube shall be used to perform a permeability test and one tube will be kept as a backup in case of damage to the first sample or dispute of test results. Grain sizes, Atterberg limits, remolded permeability and standard proctor will be performed at a frequency of 1 per lift.
- E. If the initial test pad does not provide the specified results, adjustments in the tentative moisture-density criteria will be performed by the Engineer based on the laboratory results

and test data of this test pad. The material for this test pad shall be removed fully from the landfill foot print area and replaced in the low permeability soil material stockpile.

- F. Additional test pads shall be constructed by the Contractor, at no additional cost to the owner, until an acceptable method for obtaining the specified liner requirements has been achieved.
- G. One Triaxial type hydraulic conductivity test (ASTM D5084) will be performed on the undisturbed Shelby Tube samples obtained from the test pad. These tests will be performed on 3-inch diameter (O.D.) undisturbed samples obtained from the Shelby Tubes (ASTM D1587), trimmed if needed, encapsulated within a flexible latex membrane, and mounted in tri-axial type permeameters. The test specimen shall be consolidated under an effective stress of 10 to 12 pounds per square inch and permeated under a backpressure as recommended in paragraph 8.3 of ASTM D5084 to achieve saturation. The hydraulic gradient used for hydraulic conductivity measurements shall be established in the laboratory, which will provide for accelerated testing and final results within seven days. The hydraulic conductivity shall be performed at the maximum hydraulic gradient (20) according to paragraph 8.5.1 of ASTM D5084 or as specified by Engineer. The hydraulic gradient shall be increased slowly in increments with careful observations of the test sample for consolidation, piping, etc. The inflow and outflow from the sample shall then be monitored and the hydraulic conductivity calculated for each recorded flow increment. The tests will continue until steady state flow is achieved as specified in paragraph 8.5 of ASTM D5084.
- H. The soil liner thickness shall be determined by construction survey to the tolerance specified in Section 01051 of these Technical Specifications.

3.02 SUBGRADE PREPARATION

- A. The subgrade shall be graded in accordance with the Contract Drawings. Any fill required to achieve preparation grades shall be placed and compacted in accordance with the requirements of Section 02200.
- B. The soil liner subgrade shall be proofrolled by the Contractor and examined by the Engineer to detect unstable or loose soils. Proofrolling shall be accomplished with six (6) passes (minimum) of a self-propelled drum or tamping foot roller with a static weight of the drum of at least 15,000 pounds unless otherwise specified by the Engineer.
- C. The Engineer shall be notified if bedrock or other unpredicted subsurface conditions are encountered during excavation.
- D. The subgrade surface shall not be smooth rolled. The subgrade surface shall be left in a roughened condition to allow good adherence between the subgrade and the initial lift of the soil liner.
- E. The Engineer shall observe and approve the subgrade and the survey plan of subgrade elevation submitted by the Contractor before installation of the soil liner can proceed. It shall be the Contractor's responsibility to properly prepare and maintain the subgrade in a uniform and compacted condition during installation of the soil liner.

- F. If the subgrade is damaged during liner installation, the Contractor shall restore and recompact the area. All costs related to the retest and restoration of the subgrade shall be paid for by the Contractor.

3.03 Compacted Soil Liner Material Placement

- A. The CQA Consultant shall supervise the liner installation. Work shall not be performed by the Contractor without the CQA Consultant onsite. The CQA Consultant shall perform field tests as required to ensure proper installation. The CQA Consultant shall perform tests as described in section 3.04 to determine acceptance of the liner.
- B. Soil liner material shall be spread and compacted in lifts not exceeding 6 inches (compacted thickness) to produce a total compacted thickness of not less than 24 inches or 18 inches based on thickness shown on contract drawings. Grade stakes or laser survey equipment shall be used to control thickness of each lift. Remove stakes and backfill stake holes with bentonite or as approved by NC DENR after the completion of each lift.
- C. The surface of each preceding lift shall be scarified prior to placement of overlying lifts.
- D. Water For Compaction
 - 1. The Contractor shall provide water as required to achieve and maintain the required moisture content and guarantee constructability and proper condition of the in-place and stockpiled material.
 - 2. Prior to installing the liner, the Contractor shall inspect the subgrade to ensure that it has been sufficiently wetted to prevent excessive absorption of moisture from the installed material.
 - 3. Should the material be stockpiled for any length of time, the Contractor shall slope and compact the stockpile to prevent erosion and oversaturation.
 - 4. Should the material become oversaturated, the Contractor shall spread and dry the material as needed to adjust the moisture to the proper level.
- E. The materials shall be uniformly compacted to no less than the minimum dry density of the acceptable zone that corresponds to the placement moisture content. The acceptable zone shall be as specified by the Engineer in accordance with the procedures outlined in 2.02 B. Density shall be uniformly obtained throughout the entire thickness of the liner.
- F. To achieve the specified compaction the Contractor shall use a self-propelled compactor such as the Caterpillar 815, or an equivalent, which provides steel kneading feet capable of fully penetrating the loose lift and into the previously compacted lift, in spreading and kneading the materials. A smooth wheel compactor such as a Caterpillar CS553 or equivalent shall be used with sufficient number of passes to smooth the upper surface of the compacted soil liner. All detectable rocks 1 inch or larger shall be removed. This type of compactor shall be used only for final smoothing of the surface. It shall not be used for achieving the specified compaction.

- G. Liner material shall be disked, harrowed, and kneaded as necessary to break down all clods and produce a uniform material that is free of clods. A clod is defined for the purposes of construction as any subrounded ball of soil material exceeding 1-½ inches in diameter, typically with the core containing less than the specified moisture. If the Engineer observes that all clods have not been broken down, the Contractor shall rework the material to the satisfaction of the Engineer.
- H. Liner material that has been contaminated with clusters of rock or gravel, sand lenses, organic debris or other deleterious material shall be removed and replaced with appropriate materials.
- I. No liner material shall be placed, spread, or compacted while the ground or the liner material is frozen/thawing, saturated, desiccated, during unfavorable weather conditions or periods of precipitation. The liner surface must be made smooth and free from ruts or indentations at the end of any working day when significant precipitation is forecast and/or at the completion of the compaction operations in that area in order to prevent saturation of the liner material. Any regrading due to the above conditions or final preparation should be retested at those locations for liner thickness prior to placement of the next lift or synthetic liner placement. Areas previously meeting the conformance test requirements that are reworked in excess of the top 3 inches per lift shall be retested. Retesting will be at the cost of the Contractor.
- J. Work shall be limited to an area where a lift can be completed in one working day. Completion of an area shall be defined as the construction of a liner of a minimum 24 inches or 18 inches that is homogeneously installed at a moisture content and density within the acceptable zone, free of organic materials and rocks larger than 1 inch diameter, and possessing a smooth rolled surface matching design grades. Work on the slopes shall be undertaken prior to work on the bottom grades to permit drainage in the event of rainfall. In bottom grades, compacted soil liner construction will progress from downhill to uphill.
- K. If a lift of soil liner is not to receive a subsequent lift within 16 hours of its completion, the lift shall be sealed with a smooth wheel compactor, such as the caterpillar CS553 or equivalent, at the end of each day's work to protect the liner from desiccation. Should desiccation cracks develop, the liner shall be scarified, disked, rewetted and recompactd in accordance with the Technical Specifications to the depth of any such cracks or as instructed by the Engineer. If desiccation extends below 1/2 the lift thickness, the lift shall be removed and replaced.
- L. During construction, the Contractor shall make all necessary provisions to deal with inclement weather conditions. The Contractor shall be fully responsible for control of stormwater during installation of the liner system and for moisture control and protection of the soil liner.
- M. After finish grading and smooth rolling is completed, the compacted soil liner shall not be less than 24 inches or 18 inches in any location. Liner thickness will be tested by the CQA Consultant on a per lift basis at a frequency specified in the CQA Plan. Each test shall penetrate all underlying lifts to the subgrade elevation. The thickness shall be measured from top of subgrade to top of soil liner. Areas not meeting the thickness requirements shall be augmented with additional soil liner material at the expense of the Contractor. Any additional testing or CQA services associated with corrective action for achieving the required liner thickness will be at the cost of the Contractor. The added material shall be worked into the in-place liner to ensure homogeneity and proper bonding. This shall be done

by scarification of the surface prior to addition of the new material. As a minimum, the top 3 inches of the soil liner shall be wetted, kneaded, compacted and reworked with the additional material to obtain the required thickness.

3.04 Quality Assurance

- A. The Soil CQA Laboratory shall conduct the tests specified in paragraph 2.02 during installation of the compacted soil liner at the specified minimum frequencies.
- B. The Engineer shall have the authority to request additional tests in areas that, in the Engineer's judgement, may be suspect or deficient. Hydraulic conductivity tests shall be conducted in accordance with ASTM D5084 except as modified in Paragraph 3.01.G. For each sample tested, one back-up sample will be extracted in the proximity of the sample location. This sample will be held in a controlled environment at the QAL as a precautionary measure. If adequate demonstration is presented that a sample was not representative of the soil liner or that an error in testing occurred, the backup sample will be tested and the original test will be disregarded.
- C. Any sample or area tested shall be rejected, removed and replaced if it does not meet the requirements of these Specifications. Reconstructed areas shall have feathered, overlapping edges that tie into adjacent liner areas.

3.05 CORRECTIVE ACTION

- A. If soil has been desiccated to a depth less than or equal to the thickness of a single lift, the desiccated lift shall be disked, moistened, and recompact. However, disking may produce large, hard clods of clay that will require pulverization. Also, it should be recognized that if the soil is wetted, time must be allowed for water to be absorbed into the clods of clay and hydration to take place uniformly. For this reason it will be necessary to remove the desiccated soil from the construction area, to process the lift in a separate processing area, and to replace the soil accordingly.

END OF SECTION

SECTION 02276

EROSION AND SEDIMENTATION CONTROL

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. The work specified in this Section consists of constructing, maintaining and removing erosion and sedimentation controls as necessary during construction.
- B. Temporary erosion controls may include, but are not limited to, surface stabilization, which shall be accomplished with vegetation and mulch, erosion matting, temporary earthen diversion berms and ditches; and minimization of disturbed acreage. Contractor is responsible for preventing excessive on-site erosion during construction. The performance of Contractor's erosion controls is subject to approval by Owner and NC DENR Division of Land Quality.
- C. Stockpiles shall be protected from transfer of material due to erosion by providing sedimentation controls along the toe of the slopes, seeding the side slopes, and by maintaining appropriate grades on slopes to facilitate stability.
- D. Contractor shall be responsible for maintaining all temporary and permanent erosion control structures on the landfill property throughout the construction process. Maintenance shall include but not be limited to making all repairs necessary to maintain the structures as well as remove all accumulated sediment as necessary to keep the structures in proper working condition. The frequency of sediment removal from all on-site erosion control structures shall be bi-monthly at a minimum. Contractor shall be responsible for constructing whatever diversion structures are necessary to insure that all disturbed on-site drainage/run-off on the property (within the limits described above) is routed through one of the existing on-site rock check dams, sediment traps, or sediment basins. Silt fence shall be installed as needed to insure against off-site runoff until all diversion structures are constructed and operational.

1.02 RELATED SECTIONS

- A. Section 01410: Testing Laboratory Services
- B. Section 02100: Site Preparation
- C. Section 02200: Excavation, Grading, Backfill, and Compaction

1.03 REFERENCE DOCUMENTS

- A. Standard Building Code
- B. North Carolina Sediment and Erosion Control Manual
- C. State Approved Erosion and Sedimentation Control Plan

PART 2: PRODUCTS

2.01 CONTROL STRUCTURES

- A. Provide erosion and sedimentation controls as specified by NC DENR Division of Land Quality and as specified in the Approved Erosion and Sedimentation Control Plan. Controls shall include, but are not limited to: loaming and seeding, mulch netting, erosion matting, riprap, erosion control stone, filter fabric, silt fence, earthen diversion berms, ditches, and other similar controls.

PART 3: EXECUTION

3.01 EROSION CONTROL

- A. Grassing shall be performed in accordance with Section 02985.
- B. Riprap channel and spillway lining material shall be sound durable rock or crushed concrete fragments, which are angular in shape. The riprap shall be sized as indicated on the Contract Drawings. The riprap shall be graded such that a compact mass without excessive voids is created.

3.02 STORM WATER DITCH CONSTRUCTION

- A. Clear, grub, and strip all organic materials as specified in Section 02200.
- B. Excavate as required to achieve the grades indicated on the Contract Drawings.
- C. Install outlet structures, dewatering structures, etc. in accordance with the Approved Erosion and Sedimentation Control Plan, and these Specifications to the elevations and grades indicated on the Contract Drawings.
- D. Place topsoil and seed slopes as required.

3.03 CONTROL STRUCTURES

- A. Catch basins, manholes, endwalls and other drainage structures shall be built to the lines, grades, dimensions and design shown on the Contract Drawings with the necessary appurtenances as shown on the Contract Drawings or specified herein.

3.04 PERFORMANCE

- A. Should any of the temporary erosion and sediment control measures employed by the Contractor fail to produce results which comply with the requirements of the State of North Carolina, Contractor shall immediately take whatever steps are necessary to correct the deficiency at his own expense.

END OF SECTION

SECTION 02623

HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment and incidentals required and install high density polyethylene (HDPE) leachate collection and conveyance piping, fittings and appurtenances as shown on the Contract Drawings and as specified herein.

1.02 RELATED SECTIONS

- A. Section 02200: Excavation, Grading, Backfill, and Compaction

1.03 SUBMITTALS

- A. The Contractor shall submit the following information to the Engineer:
 - 1. List of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site.
 - 2. The origin of the resin to be used in the manufacturing of the pipe including the suppliers name and production plant, as well as brand name and number.
 - 3. Documentation from the resin's manufacturer showing results of the following tests for resin identification:
 - a. Melt Flow Index ASTM D1238
 - b. Density ASTM D1505
 - 4. Manufacturer quality control manual describing implementation of quality control procedures during pipe manufacturing process.
 - 5. Pipe manufacturer's certification of compliance with these Specifications.
 - 6. Complete, detailed shop drawings of all polyethylene pipe, including the location of all fittings, joints and connections to structures.
 - 7. Manufacturer's recommendations for handling, storing and installing pipe and fittings.
 - 8. For each shipment of pipe a manufacturer's certification that the pipe was manufactured from the same resin identified in Paragraph 1.03A.1.
 - 9. Certification demonstrating that the joining technician was trained by the pipe manufacturer and is qualified to perform heat fusion welding.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
1. ASTM D1055 - Standard Specifications for Flexible Cellular materials – Latex Foam.
 2. ASTM D1238 - Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
 3. ASTM D1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
 4. ASTM D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique.
 5. ASTM D2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
 6. ASTM D2657 - Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
 7. ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
 8. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fitting Materials.
 9. ASTM F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
 10. ASTM F1055 – Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
- B. Where reference is made to one of the above standards, the revision in effect at the time of construction shall apply.

1.05 QUALITY ASSURANCE

- A. Resin Evaluation
1. All incoming resin shall be sampled for conformance testing against test results supplied by the resin manufacturer. Samples shall be taken from the top and bottom of each compartment from every hopper car received. The following conformance tests shall be performed on the samples:
 - a. Melt Flow Index ASTM D1238
 - b. Density ASTM D1505
 - c. The results of these tests shall become part of the manufacturer's permanent quality control records.

B. Finished Product Evaluation

1. Each length of pipe produced shall be checked by production staff for the items listed below. The results of all measurements shall be recorded on production sheets, which become part of the manufacturer's permanent records.
 - a. Pipe in process shall be checked visually, inside and out for cosmetic defects (grooves, pits, hollows, etc).
 - b. Pipe outside diameter shall be measured using a suitable periphery tape to ensure conformance with ASTM F714.
 - c. Pipe wall thickness shall be measured at 12 equally spaced locations around the circumference at both ends of the pipe to ensure conformance with ASTM F714.
 - d. Pipe length shall be measured.
 - e. Pipe marking shall be examined and checked for accuracy.
 - f. Pipe ends shall be checked to ensure they are cut square and clean.
 - g. Subject inside surface to a "reverse bend test" to ensure the pipe is free of oxidation (brittleness).

C. Stress Regression Testing

1. The polyethylene pipe manufacturer shall provide certification that stress regression testing has been performed on the specific polyethylene resin being utilized in the manufacture of this product. This stress regression testing shall have been done in accordance with ASTM D2837 and the manufacturer shall provide a product supplying a minimum Hydrostatic Design Basis (HDB) of 1,600 psi as determined in accordance with ASTM D2837.

1.06 WARRANTY

- A. The pipe material manufacturer shall provide an unconditional extended warranty for the pipe covering the cost of materials for repair or replacement plus installation manpower should the pipe fail within the warranty period. The manufacturer's extended warranty shall be for ten years after the final acceptance of the project by the Owner. The manufacturer shall guarantee that the pipe furnished is suitable for the purpose intended and free from defects of material and workmanship for the duration of the extended warranty. In the event the pipe fails to perform as specified, the pipe manufacturer shall promptly replace defective pipe without any cost to the Owner.

PART 2: PRODUCT

2.01 HDPE LEACHATE COLLECTION AND CONVEYANCE PIPING

- A. HDPE Pipe resins shall be high molecular weight, high density polyethylene constructed of compounds qualified as Type III or Type IV, Category 5, Class C, Grade P34 per ASTM Standard D1248 or meeting the requirements of cell classification PE 335434C, PE 345434C, or PE 345534C for polyethylene 3408 material per ASTM D 3350-84. The raw materials shall contain 2 to 3 percent carbon black (well dispersed). The pipe shall not contain recycled compound except that generated in the manufacturers own plant from resin of the same specification from the same raw material supplier.

- B. HDPE pipe shall meet Standard Dimension Ratio (SDR) specified on the Contract Drawings.
- C. Polyethylene pipe manufactured to ASTM D2513 and otherwise satisfying the requirements indicated above may be substituted for pipe manufactured to ASTM F714.
- D. The pipe shall be joined by butt fusion. All joints shall be made in strict compliance with the manufacturer's recommendations by personnel certified to perform HDPE pipe welding. Where butt fusion of pipes is not possible, electrofusion of the pipes shall be allowed upon approval from the Engineer.
- E. Pipe shall be furnished in standard laying lengths not exceeding 50 feet.
- F. All HDPE fittings shall meet the same requirements as the pipe and shall satisfy the requirements of ASTM F1055 as required.
- G. All valve connections to the HDPE piping shall be flanged. Other methods of connection may be allowed upon review by the Engineer.

2.02 PIPE IDENTIFICATION

- A. The following shall be continuously printed on the pipe or spaced at intervals not exceeding 5 feet:
 - 1. Name and/or trademark of the pipe manufacturer.
 - 2. Nominal pipe size.
 - 3. Dimension ratio.
 - 4. The letters PE followed by the polyethylene grade in accordance with ASTM D1248, followed by the hydrostatic design basis in 100's of psi, e.g., PE 3408.
 - 5. Manufacturing standard reference, e.g., ASTM F714.
 - 6. A production code from which the date and place of manufacture can be determined.

2.03 PERFORATIONS

- A. The leachate collection pipes inside the lined landfill shall be perforated as designated on the Contract Drawings. The perforations shall be drilled into the pipe after manufacture in the locations illustrated in the Contract Drawings.
- B. The perforations shall be covered with tape compatible to the pipe material upon delivery to prevent soil material from entering the pipe prior to installation. The tape shall be removed at installation.

PART 3: EXECUTION

3.01 INSTALLATION

- A. HDPE Pipe shall be installed in accordance with the instruction of the manufacturer, as shown on the Contract Drawings and as specified herein. All butt fusion joints shall be done by a factory qualified joining technician as designated by the pipe manufacturer.
- B. Pipe shall be laid to lines and grades with bedding and backfill as illustrated in the Contract Drawings. The tape covering the perforations shall be removed during installation.
- C. When pipe laying is not in progress, including lunchtime, the open ends of the pipe shall be closed by fabricated plugs, or by other approved means. All plugs shall be OD fitting type plugs. No plugs will be allowed that require insertion of the plug into pipe.
- D. Pipe shall be stored on clean level ground to prevent undue scratching or gouging. The handling of the pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. The maximum allowable depth of cuts, scratches or gouges on the exterior of the pipe is 10 percent of wall thickness. The interior pipe surface shall be free of cuts, gouges or scratches.
- E. Sections of pipe with cuts, scratches or gouges deeper than allowed shall be removed completely and the ends of the pipeline rejoined.
- F. The pipe shall be joined by the method of thermal butt fusion, as outlined in ASTM D2657. All joints shall be made in strict compliance with the manufacturer's recommendations. In locations where butt fusion equipment cannot be used, a thermal coupling such as Central Electrofusion Systems or equal shall be used when approved by the Engineer.
- G. Mechanical connections of the polyethylene pipe to auxiliary equipment such as valves, pumps and tanks shall be through flanged connections, which shall consist of the following:
 - 1. A stainless steel back-up polyethylene flange shall be thermally butt-fused to the stub end of the pipe.
 - 2. A 316 stainless steel back up ring on both sides of the connection shall be used as approved by the Engineer.
- H. Flange connections shall be provided with a full-face neoprene gasket.
- I. All HDPE pipe must be at the temperature of the surrounding soil at the time of backfilling and compaction.

- J. Installation of pipe shall be observed and accepted by the Engineer or CQA Consultant prior to backfilling.

3.02 FUSION PROCESS FOR JOINTS

- A. Delivered pipes shall be examined by the Contractor and the CQA Consultant or Engineer. The Engineer or CQA Consultant shall verify that pipes are not broken, cracked, or contain otherwise damaged or unsatisfactory material.
- B. Prior to fusing, the Contractor shall verify that the fusion surface area is clean and free of moisture, dust, dirt, debris of any kind, and foreign material. The CQA Consultant shall notify the project manager of any deviation.
- C. Weather Conditions for Butt-Fusion:
- Butt-fusion of PE pipe joints is normally done in uncontrolled atmospheres. Fusion of the PE joints shall be performed at temperatures above 32°F, unless otherwise authorized in writing by the Owner or Engineer.
- D. General Butt-Fusion procedure:
- Be sure that surfaces of the fusion tools, pipe and fittings are free of moisture and debris.
 - Heat the surfaces to be joined – both the pipe and fittings – simultaneously at the prescribed temperatures for a specific time.
 - Remove the heater – bring melted surfaces together and hold until solidified.
- E. The CQA Consultant shall verify that the general butt-fusion procedure has been followed by the pipe installer. If a different joining method is proposed, it shall be approved in advance by the Owner or Engineer and the CQA Consultant.

3.03 TESTING

- A. All non-perforated pipe shall be field tested (with the exception of non-perforated cleanouts) using the pressure test procedures given in ASTM C924. The Contractor shall supply all labor, equipment, material, gauges, pumps, meters and incidentals required for testing.
- B. All non-perforated leachate conveyance pipe shall undergo pressure testing. The test pressure shall be a minimum of 10 psi. Contractor shall submit verification and results. All testing shall be conducted in the presence of the Engineer or the CQA Consultant.
- C. Steps should be taken to stabilize the temperature of the piping material. On hot, sunny days where the magnitude of pipe expansion is known to be significant, the piping may require common fill material to be placed over it in order to stabilize the temperature of the pipe material.

- D. Testing procedure shall be as follows:
1. Fill line with compressed air.
 2. Apply initial test pressure and allow to stand without makeup pressure for three hours, to allow for diametric expansion or pipe stretching to stabilize.
 3. After this equilibrium period, apply the specified test pressure and turn the pump off. The final test pressure shall be held for three hours.
 4. Upon completion of the test, the air pressure shall be bled off from a location other than the point where the pressure is monitored. The pressure drop shall be witnessed by the resident project representative at the point where the pressure is being monitored and shall be noted on the recorded pressure read-out submitted to the Engineer.
 5. All vacuum and air release valves shall be isolated from the test sections to avoid damage or failure of these devices.
- E. Allowable amount of pressure loss for expansion during the pressure test shall not exceed one percent of the test gauge pressure. If there are no visual leaks or significant pressure drops during the final test period, the installed pipe passes the test.
- F. If any test of pipe laid disclosed leakage or significant pressure drop greater than that allowed, the Contractor shall, at his/her own expense, locate and repair the cause of leakage and retest the line.
- G. All visible leaks are to be repaired regardless of the amount of leakage.
- H. The following steps shall be performed when a pipe segment fails the air test:
- The pipe and all fusions shall be inspected for cracks, pinholes or perforations.
 - All blocked risers and capped ends shall be inspected for leaks.
 - Leaks shall be verified by applying a soapy water solution and observing soap bubble formation
 - All pipe and fused joint leaks shall be repaired by cutting out the leaking area and refusing the pipe.

3.04 CLEANING

- A. At the conclusion of the work, thoroughly clean all of the new pipelines to remove all dirt, stones, pieces of wood, or other material which may have entered during the construction period. Debris cleaned from the lines shall be removed from the job site. If, after this cleaning, any obstructions remain, they shall be removed at the Contractors expense.

END OF SECTION

SECTION 02700

DRAINAGE / PROTECTIVE COVER MATERIAL

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment and incidentals required and install protective cover, coarse aggregates, and drainage sand materials as shown on the Contract Drawings and as specified herein. Associated work includes testing, sample collection, excavation, loading, shipping, delivering, stockpiling, and installation of granular fill and protective cover materials.

1.02 RELATED SECTIONS

- A. Section 01051: Survey Requirements
- B. Section 02200: Excavation, Grading, Backfill, and Compaction
- C. Section 02272: Non-woven Geotextiles
- D. Section 02273: Geosynthetic Drainage Composite
- E. Section 02776: Textured Geomembrane Liner

1.03 SUBMITTALS

- A. The Contractor shall submit the following to the CQA Consultant:
 - 1. A top of liner survey certified by a land surveyor professionally registered in the state of North Carolina.
 - 2. A top of protective cover certified by a land surveyor professionally registered in the state of North Carolina.
 - 3. A top of granular drainage layer survey certified by a land surveyor professionally registered in the state of North Carolina.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM).
 - 1. ASTM C33 - Standard for Fine Concrete Aggregate.
 - 2. ASTM C40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

3. ASTM C136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 4. ASTM D75 - Standard Practice for Sampling Aggregates.
 5. ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils.
 6. ASTM D854 - Standard Test Method for Specific Gravity of Soils.
 7. ASTM D2434 - Permeability of granular soils by constant head tests.
 8. ASTM D3042 - Standard Test Method for Insoluble Residue in Carbonate Aggregate.
 9. ASTM D4373 - Standard Test Method for Calcium Carbonate Content of Soils.
- B. The American Association of State Highway and Transportation Officials (AASHTO)
1. AASHTO M43 – Standard Specification for sizes of aggregates for road and bridge construction.
- C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. The Quality Control and Quality Assurance consists of laboratory conformance testing of samples supplied from each granular fill source and quality control during installation.
- B. Conformance testing requirements are specified in Paragraph 2.02. The purpose of conformance testing is to assure that the supplied samples from each source conform to the Specifications and specified hydraulic conductivity.
- C. Field quality assurance requirements are specified in Paragraph 3.02. The purpose of field quality assurance procedures is to assure that the granular drainage layer and protective cover have been installed in accordance with these Technical Specifications and meet the specified hydraulic conductivity.

1.06 QUALIFICATIONS

- A. The work shall be performed by a Contractor that has experience in installation of Granular Drainage Material and protective cover over synthetic liners.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be stockpiled on site in areas as directed by the Owner or Engineer. Provisions shall be implemented to minimize surface water impact on the stockpile. Removal and placement of granular fill material shall be done in a manner to minimize intrusion of soils adjacent to and beneath the stockpile.

PART 2: PRODUCT

2.01 MATERIAL

- A. Protective Cover material to be used as part of the leachate collection system shall consist of inorganic sandy soils free from ice, snow, roots, sod, rubbish, debris, clay, or other deleterious material. Protective Cover shall contain no sharp angular stone or other material potentially injurious to the geomembrane liner. Protective Cover shall have a maximum particle size of 6-inches and a minimum of 30 percent passing the No. 4 sieve.
- B. Coarse Aggregate Material to be used as part of the leachate collection system shall consist of inorganic crushed stone free from ice, snow, roots, sod, rubbish, debris, clay, or other deleterious material. Coarse Aggregate Material shall contain no sharp angular stone or other material potentially injurious to the geomembrane liner. Coarse Aggregate Material shall meet the gradation requirements of AASHTO M43, for No. 57 or No. 67 stone materials, as determined by ASTM D422. Coarse Aggregate Material shall also have a permeability of 1.0×10^{-2} cm/sec or greater.

2.02 CONFORMANCE TESTING

- A. The CQA Consultant shall submit samples of materials from Borrow sources for testing by the Soils CQA Laboratory. If samples do not meet the specified criteria the CQA Consultant may submit additional samples from sources approved by the Engineer for conformance testing.
- B. Testing shall be performed on samples from each Borrow source to assure compliance with these Technical Specifications. The following tests shall be performed on the Drainage Sand and Coarse Aggregate Material samples.
 - 1. Sieve Analysis (ASTM D422)
 - 2. Carbonate Content (ASTM D3042 or D4373)
 - 3. Permeability (ASTM D2434)
- C. Sieve Analysis (ASTM D422) shall be performed on the Protective Cover samples from each borrow source.

PART 3: EXECUTION

3.01 PROTECTIVE COVER PLACEMENT

- A. After installation completion and acceptance of the composite liner system, geocomposite drainage layer and related work activities, place the material to the thickness and extents as shown on the Contract Drawings.
- B. During the placement of the protective cover, no construction equipment shall be allowed directly on the liner or drainage geocomposite. A 3-foot thick traffic surface consisting of granular drainage material shall be constructed to support haul trucks traveling over the liner.
- C. Only low ground pressure dozers shall be used for spreading and grading of the protective cover materials. Equipment used for placement of the protective cover shall be subject to the CQA Consultant's approval.
- D. The protective cover materials shall be placed on slopes starting at the toe of the slope and spreading toward the top of the slope.
- E. Protective Cover material shall only be spread when the liner is lying evenly over the base of the landfill. Material shall not be spread over wrinkles in the liner that form during periods of high temperature and direct sunlight. A wrinkle is defined as a ripple in the liner in which its height (as measured from the clay surface) exceeds its width.
- F. No material shall be placed or spread while the ground or material is frozen or thawing or during unfavorable weather conditions.

3.02 COARSE AGGREGATE MATERIAL PLACEMENT

- A. After installation completion and acceptance of the composite liner system, geocomposite drainage layer and related work activities, place the material to the thickness and extents as shown on the Contract Drawings.
- B. During placement of the coarse aggregate material, no construction equipment shall be allowed directly on the liner or drainage geocomposite. A 3-foot thick traffic surface consisting of protective cover or drainage sand material shall be constructed to support trucks traveling over the liner.
- C. Material shall be deposited in the disposal unit without vehicles traveling on the geocomposite. Material shall be installed in a trench or mounded to the dimensions shown on the Contract Drawings.
- D. Only low ground pressure equipment shall be used for placement of coarse aggregate materials. Equipment used for placement of the coarse aggregate material shall be subject to the CQA Consultant's approval.
- E. Coarse aggregate material shall only be spread when the liner is lying evenly over the base of the landfill. Material shall not be spread over wrinkles in the liner that form during

periods of high temperature and direct sunlight. A wrinkle is defined as a ripple in the liner in which its height (as measured from the clay surface) exceeds its width.

- F. No material shall be placed or spread while the ground or material is frozen or thawing or during unfavorable weather conditions.

3.04 TESTING FREQUENCY AND MATERIAL REQUIREMENTS

- A. The protective cover thickness shall be confirmed by a topographic survey performed at locations specified on the Construction Drawings to the tolerances specified in Section 01051 of these Technical Specifications.
- B. Sieve Analysis, and Carbonate content testing of drainage sand and coarse aggregate material shall be performed using the test methods and frequencies specified in Table 3.2-2.
- C. Sieve analysis of the protective cover material shall be performed using the test methods and frequencies specified in Table 3.2-2.

END OF SECTION

SECTION 02776

TEXTURED GEOMEMBRANE LINER

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. The Geosynthetics Installer shall furnish all labor, materials, equipment and incidentals required and install Textured Geomembrane Liner [High Density Polyethylene (HDPE) liner and Linear Low Density Polyethylene (LLDPE)] as shown on the Contract Drawings and as specified herein.

1.02 RELATED SECTIONS

- A. Section 02200: Excavation, Backfill and Compaction.
- B. Section 02273: Geosynthetic Drainage Composite
- C. Section 02777: Geosynthetic Clay Liner

1.03 SUBMITTALS

- A. Within 15 calendar days following the Effective Date of the Agreement, submit the following information:
 - 1. Submittals relating to liner manufacturer and liner
 - a. Corporate Background
 - b. Manufacturing capabilities:
 - (1) Information on factory size, equipment, personnel, number of shifts per day and production capacity per shift.
 - (2) List of material properties and samples of liner with attached certified test results.
 - (3) Manufacturer's quality control program and manual including description of laboratory facilities.
 - (4) A list of ten completed facilities totaling a minimum of three million square feet, for which the manufacturer has manufactured a textured geomembrane liner. The following information shall be provided for each facility.
 - Name and purpose of facility, its location and date of installation.

- Name of Owner, project manager, design engineer and installer.
 - Liner thickness, liner material and surface area.
 - Information on performance of the facility.
- c. The origin of the resin to be used in the manufacturing of liner including the supplier's name and production plant, as well as brand name and number.
- d. Copy of quality control certificates in conformance with Paragraphs 2.01 and 2.02.
- e. Certification that the textured geomembrane liner and extrudate produced for this project have the same properties.
2. Submittals relating to Geosynthetics Installer
- a. Background Information
- b. Installation capabilities:
- (1) Information on equipment (including tensiometer) and personnel.
 - (2) Anticipated average daily production (Complete including QC measures).
- c. A list of five completed facilities totaling two million square feet for which the installer has installed textured geomembrane liner. The following information shall be provided for each facility:
- (1) Name and purpose of facility, its location and date of installation.
 - (2) Name of Owner, design engineer, manufacturer and name and telephone number of contact at the facility who can discuss the project.
 - (3) Thickness of liner and surface area of the installed liner.
 - (4) Type of seaming, patching and tacking equipment.
 - (5) A copy of the manufacturer's certification or approval letter.
 - (6) Resume of the qualifications of the Installation Supervisor and Master Seamer, and Quality Control personnel to be assigned to this project.
- d. Shop drawings, including:

- (1) Proposed panel layout showing the installation layout identifying field seams as well as any variance or additional details, which deviate from the Drawings.
 - (2) Details of seaming the liner, anchoring, connections, penetrations and other construction details.
- e. Installation schedule.
- f. A quality control manual that specifically defines the quality assurance program during installation. The manual shall include daily procedures, welding techniques, field testing procedures, lab testing procedures, specific steps that are to be taken in the event of a failure or defect, personnel requirements, levels of authority and all other information necessary to ensure a high quality liner installation.
- g. A list of personnel performing field seaming operations along with pertinent experience information.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
 - 2. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
 - 3. ASTM D751 - Standard Test Methods for Testing Coated Fabrics.
 - 4. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
 - 5. ASTM D1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
 - 6. ASTM D1204 - Standard Test Method for Linear Dimensional Changes of Non-rigid Thermoplastic Sheeting or Film at Elevated Temperature.
 - 7. ASTM D1238 - Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
 - 8. ASTM D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique.

9. ASTM D1603 - Standard Test Method for Carbon Black in Olefin Plastics.
 10. ASTM D3895 - Standard Test Method for Copper-Induced Oxidative Induction Time of Polyolefins Differential Scanning Calorimetry.
 11. ASTM D4218 - Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle Furnace Technique.
 12. ASTM D4437 - Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes.
 13. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
 14. ASTM D5397 - Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.
 15. ASTM D5596- Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.
 16. ASTM D5641 - Standard Practice for Geomembrane seam Evaluation by Vacuum Chamber.
 17. ASTM D5820 – Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geosynthetics.
 18. ASTM D5994 - Standard Test method for Measuring Core Thickness of Textured Geomembranes.
 19. ASTM D6392 - Standard Test Method for Determining the Integrity of Non-reinforced Geomembrane Seams Produced using Thermo-fusion Methods.
- B. Federal Test Method Standards (FTMS)
1. FTMS 101/2065 - Test Method For Puncture Resistance for Plastics.
- D. Geosynthetic Research Institute (GRI)
1. GRI Test Method GM13 - Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes.
- D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. In addition to manufacturer and installer requirements for qualifications and certification specified in Paragraph 1.03 the Quality Assurance consists of conformance testing of the material delivered to the site and field quality control during installation.
- B. Conformance testing requirements are specified in Paragraph 2.03. The purpose of conformance testing is to assure that the supplied material conforms to the specifications and to the manufacturer's quality control certificates.
- C. Field quality control requirements are specified in Paragraph 3.06. The purpose of field quality control procedures is to assure that the liner has been installed in accordance with the specifications and manufacturer's recommendations.
- D. Quality Control Plan
 - 1. Sample forms for liner quality control documentation located in Appendix 3B of the CQA Plan shall be used for field installation documentation. Alternative forms, which provide the same level of detail, may be used for documentation as approved by the Engineer.
- E. Geomembrane Quality Control Documentation
 - 1. Pre-installation Conference
 - a. Prior to commencing work, a pre-installation conference shall be held and the following project personnel shall be identified by name and recorded in the project files:
 - Contractor
 - Contractor's Representative
 - Engineer's Field Representative
 - Geosynthetics Installation Supervisor (Quality Control Personnel)
 - Geosynthetics Installer
 - Quality Assurance Laboratory
 - b. Two duplicate project files shall be maintained. One shall be maintained by the Engineer Field Representative and the other shall be maintained by the Installation Supervisor. At the end of each work week the files shall be updated and checked to assure that copies of all pertinent project information are included in each file.
- F. Record Drawings
 - 1. The Geosynthetics Installer shall furnish record drawings showing changes, if any, from the approved installation drawings which are to include all destructive sample locations, any patches used to repair liner defects, and all panel and patch identifications assigned in the field; and a copy of complete documentation for final installation of the liner.

1.06 QUALIFICATIONS

A. Manufacturer

1. The Manufacturer of the lining material described below shall have previously demonstrated the ability to produce this liner by having at least five years continuous experience in the manufacture of textured geomembrane liner and successfully manufactured a minimum of 50 million square feet of similar liner material for hydraulic lining installations.

B. Geosynthetics Installer

1. The Geosynthetics Installer shall be the manufacturer or an approved installer trained and certified to install the manufacturer's liner. Installation shall be performed under the constant direction of a single Installation Supervisor who shall remain on site and be in charge throughout the liner installation, for liner layout, seaming, patching, testing, repairs and all other activities required by the installer. The Installation Supervisor shall have installed or supervised the installation and seaming of a minimum of two million square feet of textured geomembrane liner. In addition, the Geosynthetics Installer shall designate a Master Seamer, who shall not be the Installation Supervisor. The Master Seamer shall be present during all seaming operations and shall have a minimum five million square feet of seaming experience, and shall be thoroughly experienced with extrusion welding, fusion welding, and welding in both hot and cold weather.

1.07 DELIVERY, STORAGE AND HANDLING

- A. The geomembrane liner shall be packaged and shipped by appropriate means to prevent damage of the liner rolls. Unloading and storage of the liner is the responsibility of the Geosynthetics Installer. The geomembrane liner shall be unloaded in the presence of the Engineer or his representative. The Geosynthetics Installer shall be responsible for replacing any damaged or unacceptable material at no cost to the Owner.
- B. Damage during unloading shall be documented by the Engineer or his representative. All damaged rolls must be separated from the undamaged rolls until the proper disposition of that material has been determined by the Engineer.
- C. The geomembrane liner rolls shall be stored so as to be protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions and excessive heat that may damage the liner material. The rolls shall be stored on a prepared surface (not wooden pallets) and shall not be stacked more than two rolls high.

1.08 MATERIAL WARRANTY

- A. The textured geomembrane liner manufacturer shall warrant the liner, on a prorated basis, against manufacturing defects and material degradation under outdoor exposure for a period of 20 years from the date of installation. The manufacturer shall replace any material, which fails from the above causes within the warranty period at no

expense to the Owner. The manufacturer shall furnish a written warranty covering the requirements of this Paragraph.

1.09 GUARANTEE

- A. The Geosynthetics Installer shall guarantee the textured geomembrane liner against defects in installation and workmanship for the period of two years commencing with the date of final acceptance. The guarantee shall include the services of qualified service technicians and all materials required for the repairs at no expense to the Owner.

1.10 DEFINITIONS AND RESPONSIBILITIES

A. Geosynthetics Installer

- 1. The Geosynthetics Installer is the firm or corporation with whom the Owner has entered into agreement to construct the project. The Geosynthetics Installer shall be the Manufacturer or approved installer trained and certified to install the Manufacturer's geomembrane. The Geosynthetics Installer is responsible for all submittals by the Manufacturer as required by the Specifications. The Geosynthetics Installer is responsible for scheduling and coordination of the required work with the Manufacturer to complete the project. The Geosynthetics Installer shall be responsible for field handling, storing, placing, seaming, field testing and all other aspects of the liner installation. The Geosynthetics Installer is responsible for furnishing record drawings and a copy of the complete documentation of the liner system. The Geosynthetics Installer is also responsible for daily updating of the design drawings onsite and for any and all deviations from these drawings. All deviations must be initialed and approved by the Engineer's Field Representative onsite.

B. Manufacturer

- 1. The Manufacturer is the firm or corporation responsible for production of the liner material to be used in the project. The Manufacturer shall produce a consistent product meeting the project specifications, and shall provide quality control documentation for the product specified herein. The Manufacturer is responsible for the condition of the geosynthetic until the material is accepted by the Engineer's Field Representative upon delivery and installation. The Manufacturer shall produce a consistent product meeting the project specifications.

PART 2: PRODUCTS

2.01 MATERIALS

A. General

1. The liner shall be manufactured of new, prime first-quality products designed and manufactured specifically for the purpose of liquid containment in hydraulic structures and must be chemically resistant to leachate.
2. The liner material shall be so produced as to be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter.
3. The sheets shall be manufactured in a minimum 15-ft seamless width. Labels on the roll shall identify the thickness, length, width, roll number and manufacturer's lot number.
4. The textured liner must not delaminate during tensile testing (i.e., textured layers and "particles" of texture must not separate).

B. Properties

1. The liner rolls shall meet the minimum properties listed in, Table 1 for HDPE liner and Table 3 for LLDPE liner.

C. Other Materials

1. Extrudate welding rods shall be manufactured from the same resin as the liner and supplied by the manufacturer and shall be delivered in the original sealed containers. Each container shall have a label bearing the brand name, Manufacturer's lot number and complete directions as to proper storage.

2.02 QUALITY CONTROL DOCUMENTATION

- A.** Prior to installation of any liner material, the Geosynthetics Installer shall provide the following information certified by the Manufacturer for the delivered liner.
1. Origin, identification and production of the resin (supplier's name, brand name and production plant).
 2. Copies of quality control certificates issued by the resin supplier.
 3. Manufacturer's certification verifying that the quality of the resin used to manufacture the liner meets the properties shown in, Table 1 for HDPE liner and Table 3 for LLDPE liner.
 4. Each roll delivered to the project site shall have the following identification information:
 - Manufacturer's name
 - Product identification
 - Thickness
 - Roll number
 - Length and width (or width and area)
 5. Quality control certificates, signed by the Manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling

procedures, frequency, and test results. At a minimum, the following test results shall be provided in accordance with test requirements specified in Table 1 for HDPE liner and Table 3 for LLDPE liner:

- Thickness
- Density
- Tensile properties
- Tear resistance
- Puncture resistance
- Carbon black content
- Carbon black dispersion

Refer to Table 3.4 of the CQA Plan for required testing frequencies.

2.03 CONFORMANCE TESTING

- A. Conformance testing shall be performed by an independent Quality Assurance Laboratory approved by the Owner. One sample shall be taken per 100,000 square feet, or one sample per lot, whichever results in the greater number of conformance tests. Samples will be taken across the entire width of the roll and will not include the first three linear feet. Unless otherwise specified, samples will be three feet long and the width of the roll. The CQA Consultant shall obtain the samples from the roll, and mark the machine direction and identification number. The following conformance tests shall be conducted at the laboratory:
 - Thickness
 - Density
 - Tensile properties
 - Tear resistance
 - Puncture resistance
 - Carbon black content
 - Carbon black dispersion
- B. These conformance tests shall be performed in accordance with Table 1 for HDPE liner and Table 3 for LLDPE liner. All costs for the initial conformance testing will be paid by the Owner.
- C. All conformance test results shall be reviewed by Engineer and accepted or rejected, prior to the placement of the liner. All test results shall meet, or exceed, the property values listed in Table 1 for HDPE liner and Table 3 for LLDPE liner. In the case of failing test results, the Manufacturer may request that another sample be retested by an independent laboratory with the Manufacturer's technical representative present during the testing procedures. The Manufacturer shall pay for this retesting. The Manufacturer may also have the sample retested at two different laboratories approved by the Owner. If both laboratories report passing results, the material shall be accepted. If both laboratories do not report passing results, all liner material from the lot representing the failing sample will be considered out of specification and rejected.

PART 3: EXECUTION

3.01 COMPACTED SOIL LINER PREPARATION (ALTERNATE FUTURE USE)

- A. Preparation of the compacted soil liner surface shall be as specified in Section 02275.
- B. The surface of the compacted soil liner shall be smooth, uniform, and free from sudden changes in grade (such as vehicular ruts), rocks, stones, debris and deleterious materials. The moisture content of the compacted soil liner must be maintained within the project specifications until the synthetic liner has been installed. If excessive drying occurs, the contractor shall rehydrate and compact the affected area to the Engineer's satisfaction. During actual placing and seaming of the geomembrane liner, the compacted soil liner surface shall be kept free of all standing water. If the compacted soil liner surface below the liner becomes wet and unstable, it shall be dried and recompacted to the Engineer's satisfaction. If drying and recompacting the material is insufficient, the unstable material must be removed and replaced with approved material.
- C. Before the liner installation begins, the Contractor and Geosynthetics Installer shall verify in writing and submit to the Engineer:
 - 1. Lines and grades are in relative conformance with the Drawings and Specifications.
 - 2. The surface area to be lined has been rolled and compacted, free of irregularities and abrupt changes in grade.
- D. The Contractor shall not proceed with geomembrane liner installation until a complete report on the compacted soil liner thickness and hydraulic conductivity tests has been submitted and approved by the CQA Consultant. If the Contractor proceeds with synthetic liner installation and associated layers (drainage net, geotextile and sand) prior to completion of the report, the Contractor will do so at his/her own risk. If any compacted soil liner tests fail, the Contractor will be required to remove overlying synthetic liner system layers, repair deficient compacted soil liner area(s) and reinstall the liner system in accordance with project specification requirements. Any synthetic liner system materials damaged during the repair work shall be replaced with new material. All costs associated with such actions will be paid for entirely by the Contractor including, but not limited to, labor, additional liner system material, testing, labor and material costs incurred by the Engineer to perform additional inspection services.

3.02 ANCHOR TRENCH

- A. The anchor trench shall be constructed as shown on the Contract Drawings and as specified herein.
- B. Slightly rounded corners shall be provided in the trench to avoid sharp bends in the liner.
- C. The anchor trench shall be adequately drained to prevent water ponding and softening of adjacent soils. The anchor trench shall be backfilled with local fill material and

compacted to 95 percent standard proctor density, ASTM D698 as specified in Section 02200.

- D. If the anchor trench is located in a clay susceptible to desiccation, the amount of trench open at any time shall be limited to one day of liner installation capacity.

3.03 GEOMEMBRANE LINER PLACEMENT

A. Weather Conditions

- 1. Geomembrane liner placement shall not proceed at an ambient temperature below 40 degrees Fahrenheit (F) or above 140 degrees F unless otherwise authorized, in writing, by the Engineer or his/her field representative. Geomembrane liner placement shall not be performed during precipitation, excessive moisture, in an area of ponded water, or excessive winds.

B. Method of Placement

- 1. Each liner panel shall be laid out in accordance with the approved shop drawings prepared by the Manufacturer. The layout shall be designed to keep field joining of the textured geomembrane liner to a minimum and consistent with proper methods of textured geomembrane liner installation.
- 2. Each liner panel shall be identified by panel number, roll number and date of deployment. The liner panel number shall be placed on the ends of each panel and in the middle.
- 3. For liner placed on 4 to 1 or steeper slopes, the seams shall be oriented in the direction of the slope. Horizontal seams on 4 to 1 slopes or steeper shall not be allowed except for cases in which it is unavoidable. In these instances, a cap strip shall be placed over the seam.
- 4. The equipment used to deploy the liner shall not cause rutting of the compacted soil liner surface. If rutting occurs, the Geosynthetics Installer shall suspend all liner placement activities and repair the ruts and immediately employ an alternative method for liner deployment. Liner rolls shall be placed using spreader and rolling bars with cloth slings. If a sheet must be relocated a distance greater than its width, a slip-sheet shall be used.
- 5. The CQA Consultant shall inspect each panel, after placement and prior to seaming, for damage and/or defects. Defective or damaged panels shall be replaced or repaired, as approved by the Engineer.
- 6. The Installer shall not drag the liner panels over the compacted soil liner.
- 7. All liner shall be anchored as shown on the Contract Drawings and consistent with Manufacturer's recommendations. Sufficient liner shall be installed within the anchor trench to ensure proper installation prior to backfilling the trench.
- 8. Personnel working on the liner shall not smoke, wear damaging shoes or involve themselves in any activity that may damage the liner.

9. The liner shall be properly weighted with sand bags to avoid uplift due to wind.
10. Vehicular traffic across the liner shall not be allowed.
11. All damage shall be recorded and located on the record drawings.
12. When tying into existing liner, all excavation of previously installed liner shall be performed by hand to prevent damage.
13. The liner shall be kept free of debris, unnecessary tools and materials. In general, the liner area shall remain uncluttered in appearance. Any generators in use while on the liner shall have "drop" sheets placed underneath.
14. Fuel shall not be stored on the liner, and the refueling of generators shall not be performed on the liner.
15. To prevent a "trampoline effect" from forming, the Geosynthetics Installer shall place sufficient sand bags on the liner along the toe of slopes to ensure full contact of the geomembrane liner with the compacted soil liner surface. In addition, the horizontal seams nearest the toe of slope shall remain unwelded until all other seams in the area are completed. The final seam shall be welded when the liner is cool and fully contracted. Care shall be taken to ensure that the liner contacts the subgrade in all locations before completing the seam.

3.04 FIELD SEAMS

- A. Individual panels of liner shall be laid out and overlapped by a minimum of 6 inches prior to fusion seaming and 3 inches for extrusion welding. The area to be welded shall be cleaned and prepared in accordance with the Installer's quality control welding procedures.
- B. Double track hot wedge fusion welder shall be used for straight welds.
- C. Extrusion welder shall be used for cross seam tees, patches, tie-in seams, repairs, penetration boots and detailed work.
- D. The welding equipment used shall be capable of continuously monitoring and controlling the temperature, speed, and pressure in the zone of contact where the machine is actually fusing the liner material so as to ensure that changes in environmental conditions will not affect the integrity of the weld.
- E. No "fish mouths" will be allowed within the seam area. Where "fish mouths" occur, the material shall be cut, overlapped and a patch fusion weld shall be applied. All welds upon completion of the work shall be tightly bonded. Any liner area showing injury due to excessive scuffing, puncture, or distress from any cause shall be replaced or repaired with an additional piece of liner. The number of patches per 100-foot length shall not exceed five. If more than 5 patches per 100-foot length are necessary, then the entire 100-foot length of seam shall be capped. Further welding will cease at this time and the Engineer shall be notified.

- F. All seams shall have a seam number that corresponds with the panel layout numbers. The numbering system shall be used in the development of the record drawings. Seam numbers shall be derived from the combination of the 2 panel numbers that are to be welded together.
- G. All fusion welded "T" seams (i.e., the result of the liner panels placed perpendicular to each other) shall be double welded where possible. The extrusion process shall be used for the second weld.
- H. All extrudate shall be free of dirt, dry and protected from damage.
- I. If an extrusion welder is stopped for longer than one minute, it shall be purged to remove heat-degraded extrudate. All purged extrudate shall be placed on a sacrificial sheet and disposed of.
- J. All seams constructed on sloped surfaces shall be vertical seams. Where horizontal seams can't be avoided (due to compounded slopes) on sideslope surfaces, an 18 inches wide cap strip of the same synthetic material shall be placed on top of the horizontal seam and welded to the adjacent panels to provide additional structural integrity. All cap strip seams shall be non-destructively tested.
- K. All vertical panels placed on sloped surfaces shall extend a minimum of 5 feet inward from the toe of slope or edge of trench.
- L. All end seams shall be staggered a minimum of 5 feet in length between contiguous panels.
- M. To prevent moisture buildup during fusion welding, it may be necessary to place a movable protective layer of plastic directly below each overlap of liner that is to be seamed.
- N. If required, a firm substrate shall be provided by using a flat board or similar hard surface directly under the seam overlap to achieve proper support.
- O. All seams shall extend to the full extent into the anchor trench.
- P. If seam overlap grinding is required, the process must be completed according to the Manufacturer's instructions within 1 hour of the seaming operation, and in a way that does not damage the geomembrane.
- Q. All factory seams, field seams and repair welds shall meet seam strength requirements specified in Table 2 for HDPE liner and Table 4 for LLDPE liner.

3.05 SEAMING WEATHER CONDITIONS

- A. Normal Weather Conditions
 - 1. The normal required weather conditions for seaming are:
 - a. Ambient temperature higher than 40 degrees and lower than 140 degrees F.

- b. No precipitation or other excessive moisture, such as fog or dew.
- c. No excessive winds.

B. Cold Weather Conditions

1. If the ambient temperature is below 40 degrees F, the following conditions shall be met to ensure quality seaming process:
 - a. Preheating the surface of the liner to achieve normal temperature range.
 - b. Preheating may be waived by the Engineer if the installer demonstrates that satisfactory welds of equivalent quality may be obtained without preheating at the expected temperature of installation.
 - c. Preheating devices shall be approved by the manufacturer.
 - d. Care shall be taken to assure that surface temperatures are not lowered below the minimum required surface temperature for welding due to winds.
 - e. Additional destructive tests samples shall be taken at the discretion of the Engineer.
 - f. Pre-weld test seams, as described in Paragraph 3.06.A, shall be performed under the same weather conditions that will be encountered during production seaming.

C. Warm Weather Conditions

1. If the sheet temperature is above 140 degrees F, no seaming of liner shall be permitted unless the installer can demonstrate, to the satisfaction of the Engineer that liner seam quality is not adversely impacted.
2. Pre-weld test seams, as described in Paragraph 3.06.A, shall be performed under the same weather conditions that will be encountered during production seaming.
3. Additional destructive tests shall be taken at the discretion of the Engineer.

3.06 FIELD QUALITY CONTROL

A. Pre-Weld Testing

1. A test weld from each seaming crew shall be run at the beginning of each day, every four (4) hours of continuous seaming, every time seaming equipment is

changed, if significant changes in geomembrane temperature and weather conditions are observed, and at the CQA Consultants discretion for each seaming apparatus and technician used that day. The test weld shall be made under the same conditions that exist for production seaming. Each test weld shall be 3 feet long. The test weld shall be marked with date, ambient temperature and welder's name, temperature and speed of the welding equipment used, and the welding machine number. The Geosynthetics Installer must have a tensiometer on-site before and during liner installation for the purpose of testing samples. Six specimens of welds 1 inch wide shall be cut from the test weld and tested on site with the presence of the CQA Consultant for shear and peel strength (3 each). Each sample must meet the requirements presented in Table 2 for HDPE liner and Table 4 for LLDPE liner. No welder may start work until the welder's test weld has been approved by the CQA Consultant.

2. Test welds shall be made on fragment pieces of geomembrane liner to verify that seaming conditions are adequate. A passing test weld shall be made for each seaming device and technician. A change in technician or welding equipment warrants the welding of a new passing test weld. If the seaming apparatus is turned off for any reason, a new passing test weld must be completed for that specific seaming apparatus.

B. Non-destructive Seam Testing

1. The Geosynthetics Installer shall non-destructively test production seams over their full length using a vacuum test unit (for extrusion seams only), air pressure test, or other approved method. The testing shall be carried out to the accepted standards of the industry. The purpose of non-destructive tests is to check the continuity of seams. It does not provide any information on seams strength. Continuity testing shall be carried out as the seaming work progresses (maximum of 3,000 linear feet), not at the completion of all field seaming, unless otherwise approved by the Engineer. The Geosynthetics Installer shall complete any required repairs in accordance with technical specifications and the CQA Plan. Non-destructive testing shall not be permitted before sunrise or after sunset unless the installer demonstrates capabilities to do so.
2. Vacuum Testing
 - a. Equipment for testing single wedge fusion seams and extrusion seams shall be comprised of the following:
 - (1) A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft rubber gasket attached to the bottom, port hole or valve assembly and a vacuum gauge.
 - (2) A vacuum tank and pump assembly equipped with a pressure controller and pipe connections.
 - (3) A rubber pressure/vacuum hose with fittings and connections.
 - (4) A plastic bucket and wide paint brush.

- (5) A soapy solution.
 - b. The following procedures shall be followed by the Geosynthetics Installer:
 - (1) Excess sheet overlap shall be trimmed away prior to vacuum testing.
 - (2) Clean the window and gasket surfaces, and check for leaks in the vacuum testing equipment.
 - (3) Energize the vacuum pump and reduce the tank pressure to approximately 5 psi.
 - (4) Wet the area to be tested with the soapy solution.
 - (5) Place the vacuum box over the wetted area and apply downward pressure on the vacuum box to ensure a tight seal between the liner and the vacuum box.
 - (6) Close the bleed valve and open the vacuum valve.
 - (7) Ensure that a leak-tight seal is created.
 - (8) For a minimum period of 10 seconds, examine the liner through the viewing window for the presence of soap bubbles.
 - (9) If no bubbles appear after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum of 3-inch overlap and repeat the process.
 - (10) All areas where soap bubbles appear shall be marked and repaired in accordance with Paragraph 3.07G and then retested.
 - (11) All test locations, which have passed vacuum testing, shall be marked with the test date and the name of the individual performing the test.
 - c. If the seam cannot be tested prior to final installation, the seaming operations shall be observed by the Engineer's Field Representative for uniformity and completeness.
3. Air Pressure Testing.
- a. The following procedures are applicable to those processes, which produce a double seam with an enclosed space.
 - b. Equipment for testing double fusion seams shall be comprised of the following:

- (1) An air pump equipped with pressure gauge capable of generating and sustaining a minimum pressure of 30 psi (30 to 35 psi) and mounted on a cushion to protect the liner.
 - (2) A manometer equipped with a sharp hollow needle, or other approved pressure feed device.
- c. The following procedures shall be followed by the Geosynthetics Installer.
- (1) Seal both ends of the seam to be tested.
 - (2) Insert needle or other approved pressure feed device into the tunnel created by the double wedge fusion weld.
 - (3) Energize the air pump to a minimum pressure of 30 to 35 psi, close valve and sustain pressure for at least five minutes.
 - (4) If loss of pressure exceeds 10 percent, or pressure does not stabilize, the faulty area located and repaired in accordance with Paragraph 3.07.G. Following repair, the seam must be retested.
 - (5) If the faulty area cannot be isolated and repaired, the length of seam, which cannot be tested, shall be capped with liner strip, extrusion welded and vacuum tested. The seam shall be documented as a failed seam indicating the corrective measure.
 - (6) If loss of pressure is 10 percent or less, release air pressure at the opposite end of where the pressure is applied to verify that the full seam was pressurized and that there was no blockage in the air channel.
 - (7) Remove needle or other approved pressure feed device and seal.
 - (8) All test locations which have passed air pressure testing shall be marked with the test date and the name of the individual performing the test, as well as the beginning time and pressure, and the ending time and pressure.
- d. Destructive seam testing shall be performed in accordance with Paragraph 3.07.

In the event of non-compliance air pressure test, the following procedure shall be followed:

- Check the seam and seals and retest the seam.
- If deviation with specified maximum pressure differential reoccurs, cut 1-inch samples from each end suspect area.
- Perform destructive peel tests on the sample using the field tensiometer.
- If all areas pass destructive testing, the installer may:
 1. Cap-strip the suspect area.

2. Further isolate the air pressure failure as agreed upon by the CQA Consultant and Project Manager.
3. If one or more samples fail the peel tests, additional samples will be taken. When two failing samples are located, the suspect areas will be considered non-complying. In this section the seam shall be cap-stripped. Test the entire length of the seam by vacuum testing.
4. If the seam is in non-compliance due to air channel blockage, the blockage shall be isolated, as agreed upon by the CQA Consultant.
5. All sections shall be retested and repaired in accordance with this section.

3.07 DESTRUCTIVE SEAM TESTING

- A. The purpose of the destructive testing is to evaluate seam strength properties. A minimum of one test sample shall be obtained per 500 feet of production seam length per welder or one sample per welder per day, whichever yields the largest number of samples. The CQA Consultant shall determine the location of samples. Selection of such locations may be prompted by suspicion of overheating, contamination, or other potential cause that may adversely impact the welds. The Installer shall perform the sampling. The CQA Consultant shall forward the samples to the Quality Assurance Laboratory for testing.
- B. Sampling Procedures
 1. Samples shall be cut by the Installer at locations chosen by the CQA Consultant as the seaming progresses.
 2. The seams shall not be covered by another material before the test samples have been tested by the Quality Assurance Laboratory and accepted by CQA Consultant.
 3. Upon obtaining each sample, assign a number to the sample and mark it accordingly.
 4. Record sample location on layout drawing.
 5. Holes in the liner resulting from destructive seam testing shall be immediately repaired in accordance with Paragraph 3.07G.
- C. Size and Disposition of Samples

1. The sample for laboratory testing shall be 12 inches wide by 36 inches long with the seam centered lengthwise. The sample shall be cut into three parts and distributed as follows:
 - a. One portion to the Installer for field testing, 12 inches by 12 inches.
 - b. One portion for Quality Assurance Laboratory testing, 12 inches by 12 inches.
 - c. One portion to the Owner for on-site archive storage, 12 inches by 12 inches.

D. Quality Assurance Laboratory Test

1. The CQA Consultant shall package and ship destructive test samples to the independent Quality Assurance Laboratory approved by the Owner.
2. Laboratory tests shall include shear and peel strength tests. The minimum acceptable values obtained in these tests shall be in accordance with Table 2 for HDPE liner and Table 4 for LLDPE liner.
3. The laboratory shall cut the sample to 1-inch wide coupons using die cast or other means. At least 10 coupons shall be cut for peel and shear test.
4. Five coupons shall be tested for shear and the other 5 shall be tested for peel strength. A passing test shall meet the minimum required values, presented in Table 2 for HDPE liner and Table 4 for LLDPE liner, for the 5 coupons tested for each method.
5. The Quality Assurance Laboratory shall provide verbal test results to the Engineer no more than 24 hours after they receive the samples. The Engineer shall review the laboratory results as soon as they become available.

E. Procedures for Destructive Test Failure

1. The following procedures shall apply whenever a sample fails a destructive test. The installer has two options.
 - a. The installer can repair the seam between any two passing test locations.
 - b. Two new samples shall be taken at a minimum of 10 feet on each side of the original failed sample. These samples shall be sent to the Quality Assurance Laboratory for testing. Subsequent failure of test samples shall cause the testing to move further down the seam until the extent of the faulty seam has been determined.
 - c. In the event the whole seam is determined to be faulty. The Engineer may request samples to be taken from the previous seam welded by the same machine and welder, until two passing tests are obtained.
2. All acceptable repaired seams shall be bound by two passing destructive test locations. In cases where repaired seam exceeds 150 feet, a sample taken from

the zone in which the seam has been repaired must pass destructive testing. Repairs shall be made in accordance with Paragraph 3.07.G.

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

F. Repair Procedures

1. Any portion of the liner exhibiting signs of defect, failing a destructive or a nondestructive test, shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be made by the Engineer.
2. The repair procedures available include:
 - a. Patching, used to repair large holes, tears, undispersed raw materials and contamination by foreign matter. Apply a new piece of geomembrane sheet over, and at least 6 inches beyond the limits of a defect. The patch shall be extrusion seamed to the underlying geomembrane, and must pass non-destructive testing.
 - b. Spot welding or seaming, used to repair small tears, pinholes, or other minor, localized defects. Apply a "bead" of extrudate, maximum length of 6 inches, over a defect.
 - c. Capping, used to repair large lengths of failed seams. Apply a new strip of geomembrane along the length of a faulty seam. The cap strip shall extend at least 6 inches beyond the limit of the seam and the edges will be extrusion seamed to the underlying geomembrane.
 - d. Flap-welding can be used where an adequate flap exists (1 1/2 inches minimum), extrusion weld the flap of a fusion seam. At the ends of this repair, the flap shall be cut to allow the extrusion weld to enclose the failed area.
 - e. For small lengths of failed seam (less than 3 feet), extrusion welding can be used to repair provided there is sufficient overlap between the two liner panels.
3. For any repair method, the following provisions shall be satisfied:
 - a. Surfaces of the liner, which are to be repaired using extrusion methods, shall be abraded no more than one hour prior to the repair.
 - b. All surfaces shall be clean and dry at the time of the repair.
 - c. All seaming equipment used in repairing procedures must be approved.
 - d. The repair procedures, materials, and techniques will be approved in advance of the specific repair by the CQA Consultant and Geosynthetics Installer.

- e. Patches or caps will extend at least 6 inches beyond the edge of the defect, and all corners of patches will be rounded.
- f. Seam repairs over 150 feet long will require a destructive test to be taken from the repair.

G. Repair Verification

- 1. Each repair shall be numbered and logged by the Installer. Each repair shall be non-destructively tested using the methods described in Paragraph 3.06 as appropriate. Repairs, which pass the nondestructive test, shall be taken as an indication of an adequate repair. Repairs more than 150 feet long may be of sufficient length to require destructive test sampling, at the discretion of the Engineer. Failed tests indicate that the repair is unacceptable, and shall be redone and retested until passing test results are achieved. The Engineer shall observe all non-destructive testing of repairs. The Geosynthetics Installer shall record the number of each repair, date and test outcome.

H. Large Wrinkles

- 1. When seaming of the geomembrane is completed (or when seaming of a large area of the geomembrane is completed) and prior to placing overlying materials, the CQA Consultant shall observe the geomembrane wrinkles. The CQA Consultant will indicate to the Project Manager which wrinkle should be cut and resealed by the Installer. The seams produced as a result of repairing wrinkles will be tested like any other repair.

3.08 DISPOSAL OF WASTE MATERIAL

- A. Upon completion of installation, the Liner Contractor shall dispose of all trash, waste material and equipment used in connection with the performed work and shall leave the premises in a neat and acceptable condition.

TABLES

TABLE 1
MATERIAL PROPERTIES
TEXTURED HIGH DENSITY POLYETHYLENE (HDPE) LINER

PROPERTY	TEST METHOD	UNIT	LIMIT	VALUE
Thickness	ASTM D5994	mils	average/min.	60 / 54 ⁽¹⁾
Asperity Height ⁽²⁾	GM 12	mils	min	10
Density	ASTM D1505/D792	g/cc	min.	0.940
Tensile Properties ⁽³⁾ (Each Direction)	ASTM D638; Type IV			
1. Yield Strength		lb/in	min.	126
2. Break Strength		lb/in	min.	90
3. Elongation at Yield		%	min.	12
4. Elongation at Break		%	min.	100
Tear Resistance	ASTM D1004	lb	min.	42
Puncture Resistance	ASTM D4833	lb	min.	90
Stress Crack Resistance ⁽⁴⁾	ASTM D5397	hr	min.	200
Carbon Black Content	ASTM D1603	%	range	2.0 to 3.0
Carbon Black Dispersion	ASTM D5596	N/A	Rating	9 of 10 Category 1 or 2 1 of 10 Category 3
Oxidative Induction Time (OIT)/ High pressure OIT	ASTM D5885	min.	min.	400
Oven Aging at 85° C/ High Pressure OIT - % retained after 90 days	ASTM D5721/ ASTM D5885	%	min.	80
UV Resistance/ High Pressure OIT - % retained after 1600 hrs ⁽⁵⁾⁽⁶⁾	GM 11/ ASTM D5885	%	min.	50

TABLE 1 (continued)

Notes:

- (1) The first value represents the minimum average thickness measurements of 10 measurements the second value represents the lowest allowable individual thickness measurement.
- (2) Of 10 readings; 8 out of 10 must be ≥ 7 mils, and lowest individual reading must be ≥ 5 mils.
- (3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
 - Yield elongation is calculated using a gage length of 1.3 inches.
 - Break elongation is calculated using a gage length of 2.0 inches.
- (4) The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials. The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
- (5) The condition of the test should be 20 hr. UV cycles at 75° C followed by 4 hr. condensation at 60° C.
- (6) UV resistance is based on percent retained value regardless of the original HP-OIT value.

TABLE 2

FACTORY AND FIELD SEAM PROPERTIES
TEXTURED HIGH DENSITY POLYETHYLENE (HDPE) LINER

PROPERTY	UNIT	TEST METHOD	REQUIRED VALUE
Bonded Shear Strength	lb/in	ASTM D6392/D4437	FTB and 100 % of Yield Strength of Parent Material
Seam Peel Adhesion	lb/in	ASTM D6392/D4437	FTB and 65% of Yield Strength of Parent Material

Notes:

1. For laboratory testing only, a maximum of 1 non-FTB (Film Tear Bond) per 5 specimens is acceptable provided that strength requirements are met on that sample.
2. For double-wedge fusion welded seams, both tracks shall be tested to meet compliance with the minimum seam values specified.
3. Strain Rate: 2 in/min. and 1 inch wide strips.
4. Test welds shall be made upon start of work for each seamer, every four (4) hours of continuous seaming, every time seaming equipment is changed, if significant changes in geomembrane temperature and weather conditions are observed, and at the discretion of the CQA Consultant.

TABLE 3
MATERIAL PROPERTIES
TEXTURED LINEAR LOW DENSITY POLYETHYLENE (LLDPE) LINER

PROPERTY	TEST METHOD	UNIT	LIMIT	VALUE
Thickness	ASM D5994	mils	average/ min.	40 / 36 ⁽¹⁾
Asperity Height ⁽²⁾	GM 12	mils	in.	10
Density	ASTM D1505/D792	g/cc	min.	0.920
Tensile Properties ⁽³⁾ (Each Direction)	ASTM D638; Type IV			
1. Yield Strength		lb/in	min.	150
2. Break Strength		lb/in	min.	500
Tear Resistance	ASTM D1004	lb	min.	25
Puncture Resistance	ASTM D4833	lb	min.	55
Stress Crack Resistance ⁽⁴⁾	ASTM D5397	hr	min.	200
Carbon Black Content	ASTM D1603	%	Range	2.0 to 3.0
Carbon Black Dispersion	ASTM D 5596	n/a	Rating	9 of 10 Category 1 or 2 1 of 10 Category 3
Oxidative Induction Time (OIT)/ High Pressure OIT	ASTM D5885	min	min.	400
Oven Aging at 85°C/ High Pressure OIT - % retained after 90 days	ASTM D 5721/ ASTM D5885	%	min.	80
UV Resistance/ High Pressure OIT - % retained after 1600 hrs ⁽⁵⁾⁽⁶⁾	GM11/ ASTM D5885	%	min.	50

TABLE 3 (continued)

Notes:

- (1) The first value represents the minimum average thickness measurements of 10 measurements the second value represents the lowest allowable individual thickness measurement.
- (2) Of 10 readings; 8 out of 10 must be ≥ 7 mils, and lowest individual reading must be ≥ 5 mils.
- (3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
 - Yield elongation is calculated using a gage length of 1.3 inches.
 - Break elongation is calculated using a gage length of 2.0 inches.
- (4) The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials. The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
- (5) The condition of the test should be 20 hr. UV cycles at 75° C followed by 4 hr. condensation at 60° C.
- (6) UV resistance is based on percent retained value regardless of the original HP-OIT value.

TABLE 4
FACTORY AND FIELD SEAMS PROPERTIES
TEXTURED LINEAR LOW DENSITY POLYETHYLENE (LLDPE) LINER

PROPERTY	UNIT	TEST METHOD	REQUIRED VALUE
Bonded Shear Strength	lb/in	ASTM D6392/D4437	FTB and 100 % of Yield Strength of Parent Material
Seam Peel Adhesion	lb/in	ASTM D6392/D4437	FTB and 65% of Yield Strength of Parent Material

Notes:

1. For laboratory testing only, a maximum of 1 non-FTB (Film Tear Bond) per 5 specimens is acceptable provided that strength requirements are met on that sample.
2. For double-wedge fusion welded seams, both tracks shall be tested to meet compliance with the minimum seam values specified.
3. Strain Rate: 20 in/min. and 1 inch wide strips.
4. Test welds shall be made upon start of work for each seamer, every four (4) hours of continuous seaming, every time seaming equipment is changed, if significant changes in geomembrane temperature and weather conditions are observed, and at the discretion of the CQA Consultant.

END OF SECTION

SECTION 02777

GEOSYNTHETIC CLAY LINER

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. Work covered in this section shall consist of the manufacture, fabrication (if needed), supply, and installation of geosynthetic clay liner (GCL). The Geosynthetics Installer shall provide all labor, materials, transportation, supervision, tools, equipment, and services necessary to complete and test the GCL installation as described in and on the Technical Specifications and Construction Drawings.
- B. All procedures, operations, and testing methods shall be in strict accordance with these Technical Specifications and the CQA Plan. The installed system shall conform exactly to the Technical Specifications and Contract Drawings except where otherwise authorized in writing by the Engineer or Owner.

1.02 RELATED SECTIONS

- A. Section 02200: Excavation, Backfill and Compaction.
- B. Section 02273: Geosynthetic Drainage Composite
- C. Section 02776: Textured Geomembrane Liner

1.03 SUBMITTALS

- A. The Geosynthetics Installer shall, prior to delivery of materials, submit to the Owner and CQA Consultant certification from the GCL manufacturer that the delivered GCL will meet the minimum specifications listed in this Technical Specification and the CQA Plan. Within 15 calendar days following the Effective Date of the Agreement, submit the following information:
 - 1. Submittals relating to Manufacturer and GCL liner
 - a. Corporate Background
 - b. Manufacturing capabilities:
 - (1) Information on factory size, equipment, personnel, number of shifts per day and production capacity per shift.
 - (2) List of material properties and samples of liner with attached certified test results.

- (3) Manufacturer's quality control program and manual including description of laboratory facilities.
- (4) A list of ten completed facilities totaling a minimum of 2,000,000 square feet, for which the manufacturer has manufactured a GCL liner. The following information shall be provided for each facility.
 - Name and purpose of facility, its location and date of installation.
 - Name of Owner, project manager, design engineer and installer.
 - GCL Liner thickness and surface area.
 - Information on performance of the facility.
- c. Copy of quality control certificates in conformance with Paragraphs 2.01 and 2.02.

2. Submittals relating to Geosynthetics Installer

- a. Background Information
- b. Installation capabilities:
 - (1) Information on equipment (including Granular Bentonite spreader) and personnel.
 - (2) Anticipated average daily production (complete including QC measures).
- c. A list of five completed facilities totaling 2,000,000 square feet for which the installer has installed GCL. The following information shall be provided for each facility:
 - (1) Name and purpose of facility, its location and date of installation.
 - (2) Name of Owner, design engineer, manufacturer and name and telephone number of contact at the facility who can discuss the project.
 - (3) Thickness of GCL liner and surface area of the installed liner.
 - (4) A copy of the manufacturer's certification or approval letter.
 - (5) Resume of the qualifications of the Installation Supervisor and Quality Control personnel to be assigned to this project.
- d. Installation schedule.

- e. A quality control manual that specifically defines the quality assurance program during installation. The manual shall include daily procedures, field testing procedures, lab testing procedures, specific steps that are to be taken in the event of a failure or defect, personnel requirements, levels of authority and all other information necessary to ensure a high quality liner installation.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM D2216 – Standard Test Method for Laboratory Determination of Water (moisture) Content of Soil, Rock and Soil-Aggregate Mixtures.
 - 2. ASTM D4354 – Standard Practice for Sampling of Geosynthetics for Testing.
 - 3. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
 - 4. ASTM D4833 – Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products.
 - 5. ASTM D5084 – Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
 - 6. ASTM D5261 – Standard Test Method for Measuring Mass Per Unit Area of Geotextiles.
 - 7. ASTM D5887 - Standard Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter.
 - 8. ASTM D5888 - Standard Guide for Storage and Handling of Geosynthetic Clay Liners.
 - 9. ASTM D5889 - Standard Practice for Quality Control of Geosynthetic Clay Liners.
 - 10. ASTM D5890 - Standard Test Method for Swell Index of Clay Mineral Components of Geosynthetic Clay Liners.
 - 11. ASTM D5891 - Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners.

12. ASTM D5993 - Standard Test Method for Measuring Mass Per Unit of Geosynthetic Clay Liners.
 13. ASTM D6072 - Standard Guide for Obtaining Samples of Geosynthetic Clay Liners.
 14. ASTM D6102 - Standard Guide for Installation of Geosynthetic Clay Liners.
 15. ASTM D6141 - Standard Guide for Screening the Clay Portion of a Geosynthetic Clay Liner (GCL) for Chemical Compatibility to Liquids.
 16. ASTM D6243 - Standard Test Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method.
 17. ASTM D6495 - Standard Guide for Acceptance Testing Requirements for Geosynthetic Clay Liners.
 18. ASTM D6496 - Standard Test Method for Determining Average Bonding Peel Strength Between the Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners.
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. In addition to manufacturer and installer requirements for qualifications and certification specified in Paragraph 1.03 the Quality Assurance consists of conformance testing of the material delivered to the site and field quality control during installation.
- B. Conformance testing requirements are specified in Paragraph 2.03. The purpose of conformance testing is to assure that the supplied material conforms to the specifications and to the manufacturer's quality control certificates.
- C. Field quality control requirements are specified in Paragraph 3.03. The purpose of field quality control procedures is to assure that the liner has been installed in accordance with the specifications and manufacturer's recommendations.
- D. Geomembrane Quality Control Documentation
1. Pre-installation Conference
 - a. Prior to commencing work, a pre-installation conference shall be held and the following project personnel shall be identified by name and recorded in the project files:

- Contractor
 - Contractor's Representative
 - Engineer's Field Representative
 - Geosynthetics Installer
 - Installation Supervisor: Quality Control Personnel
 - Quality Assurance Laboratory
- b. Two duplicate project files shall be maintained. One shall be maintained by the Engineer Field Representative and the other shall be maintained by the Installation Supervisor. At the end of each work week the files shall be updated and checked to assure that copies of all pertinent project information are included in each file.

1.06 QUALIFICATIONS

A. Manufacturer

1. The Manufacturer of the lining material described below shall have previously demonstrated the ability to produce this liner by having at least five years continuous experience in the manufacture of GCL liner and successfully manufactured a minimum of 10,000,000 square feet of similar liner material for hydraulic lining installations.

B. Geosynthetics Installer

1. The Geosynthetics Installer shall be the manufacturer or an approved installer trained and certified to install the manufacturer's liner. Installation shall be performed under the constant direction of a single installation supervisor who shall remain on site and be in charge throughout the liner installation, for liner layout, seaming, patching, repairs and all other activities required by the installer. The Installation Supervisor shall have installed or supervised the installation of a minimum of 2,000,000 square feet of GCL liner.

1.07 DELIVERY, STORAGE AND HANDLING

- A. The GCL liner shall be packaged and shipped by appropriate means to prevent damage of the liner rolls. Unloading and storage of the liner is the responsibility of the Geosynthetics Installer. The GCL liner shall be unloaded in the presence of the CQA Consultant or his representative. The Geosynthetics Installer shall be responsible for replacing any damaged or unacceptable material at no cost to the Owner.
- B. Damage during unloading shall be documented by the CQA Consultant or his representative. All damaged rolls must be separated from the undamaged rolls until the proper disposition of that material has been determined by the Engineer.
- C. The GCL liner rolls shall be stored so as to be protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions and excessive heat that may damage the liner material. The rolls shall be stored on a prepared surface (not wooden pallets) and shall not be stacked more than **two rolls** high. All rolls shall be covered by additional plastic tarps.

1.08 DEFINITIONS AND RESPONSIBILITIES

A. Geosynthetics Installer

1. The Geosynthetics Installer is the firm or corporation with whom the Owner has entered into agreement to construct the project. The Geosynthetics Installer shall be the Manufacturer or approved installer trained and certified to install the manufacturer's geomembrane. The Geosynthetics Installer is responsible for all submittals by the Manufacturer as required by the Specifications. The Geosynthetics Installer is responsible for scheduling and coordination of the required work with the Manufacturer. The Geosynthetics Installer shall be responsible for field handling, storing, placing, sewing, and all other aspects of installation. The Geosynthetics Installer is responsible for furnishing record drawings and a copy of the complete documentation of the liner system. The Geosynthetics Installer is also responsible for daily updating of the design drawings onsite and for any and all deviations from these drawings. All deviations must be initialed and approved by the Engineer's Field Representative onsite.

B. Manufacturer

1. The Manufacturer is the firm or corporation responsible for production of the GCL liner material to be used in the project. The Manufacturer shall produce a consistent product meeting the project specifications, and shall provide quality control documentation for the product specified herein. The Manufacturer is responsible for the condition of the GCL liner until the material is accepted by the Engineer's Field Representative upon delivery and installation. The Manufacturer shall produce a consistent product meeting the project specifications.

PART 2: PRODUCTS

2.01 MATERIALS

- A. GCL materials shall be stored, handled, and installed in strict accordance with the manufacturer's recommendation. At a minimum, the Owner shall provide a dry storage area on firm level ground. All rolls shall be packaged in moisture resistant plastic sleeves with cardboard cores sufficiently strong to resist collapse during transit and handling. All rolls shall be covered by additional plastic tarps.
- B. The GCL shall be a reinforced GCL with a sodium bentonite layer encapsulated between woven and non-woven geotextiles as manufactured by Colloid Environmental Technologies Company (Bentomat ST) or Engineer approved alternate, and shall meet the minimum average roll value conformance testing specifications presented in Table 1. The non-woven geotextile side of the GCL shall be installed against the textured HDPE liner.

TABLE 1

CONFORMANCE TESTING SPECIFICATIONS FOR GCL			
PROPERTY	TEST METHOD	MINIMUM AVERAGE	
		ROLL VALUE	UNIT
Swell Index	ASTM D5890	24	ml
Fluid Loss	ASTM D5891	18	ml
Bentonite Content ⁽¹⁾	ASTM D5993	0.75	lbs/ft ²
GCL Peel Strength	ASTM D6496	2.5	lb/in
Permeability ⁽²⁾	ASTM D5084	5.0 x 10 ⁻⁹	cm/sec

⁽¹⁾At 0 percent moisture content or oven dried condition.

⁽²⁾Permeability test pressures and gradients shall be determined by the Engineer.

- C. Any accessory bentonite used for sealing seams, penetrations, or repairs, shall be the same granular bentonite as used in the production of the GCL itself.
- D. The minimum acceptable dimensions for the GCL panels shall be 15 feet wide and 125 feet long. Short rolls (rolls less than 125 feet long) may be supplied, but at a rate not to exceed 5 percent of the total square footage produced for this project.
- E. A minimum overlap guideline and a construction match-line delineating the overlap zone shall be imprinted with non-toxic ink on both edges of the GCL panel to ensure the accuracy of the seam. These lines shall be used during CQA to ensure the minimum overlap is achieved. The minimum overlap guideline shall indicate where the edge of the panel must be placed in order to achieve a full 6 inches of bentonite overlap for each panel.

2.02 QUALITY CONTROL DOCUMENTATION

- A. Prior to installation of any liner material, the Geosynthetics Installer shall provide the following information certified by the Manufacturer for the delivered liner.
 - 1. Origin, identification and production of the GCL liner (supplier's name, brand name and production plant).
 - 2. Bentonite Manufacturer Certification – Bentonite Manufacturer quality control documentation for the particular lot of clay used in the production of rolls delivered.
 - 3. Geotextile Manufacturer Certification – Geotextile Manufacturer quality control documentation for the particular lots of geotextiles used in the production of the rolls delivered.
 - 4. Each roll delivered to the project site shall have the following identification information:

- Manufacturer's name
 - Product identification
 - Thickness or total roll weight
 - Lot or Batch Number
 - Roll number
 - Length and width (or width and area)
 - Geotextile Type and Roll numbers (upper & lower)
5. Quality control certificates, signed by the Manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling procedures, frequency and test results. At a minimum the following test results shall be in accordance with test requirements specified in Table 1:
- Bentonite Content
 - GCL Peel Strength
 - Swell Index
 - Fluid Loss
 - Permeability

Refer to Table 3.3 of the CQA Plan for the required testing frequencies.

2.03 CONFORMANCE TESTING

- A. Conformance testing shall be performed by an independent Quality Assurance Laboratory approved by the Owner at the frequencies specified in Table 3.3 of the CQA Plan.. Samples will be taken across the entire width of the roll and will not include the first 3 linear feet. Unless otherwise specified, samples will be 3 feet long and the width of the roll. The CQA Consultant shall obtain the samples from the roll, and mark the machine direction and identification number.
- B. The following conformance tests shall be performed in accordance with Table 1:
- GCL Peel Strength
 - Permeability
- If all the test values for a sample meet all of the values given in the above conformance testing specifications, and also the Manufacturer's guaranteed minimum values, the sample passes.
 - If any of the test values for the sample do not meet one or more of the required conformance testing values, additional evaluation procedures will be implemented by the CQA Consultant:
 - For the failing test parameter(s), the CQA Geosynthetic Laboratory shall perform two additional tests on the sample. The tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Owner;
 - If all of the test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.

- If one or more of the additional test values do not meet requirements, the CQA Consultant shall reject the roll and collect samples from the closest numerical roll on both sides of the failed roll and test for the failed parameter(s). If one or both of these tests do not meet requirements, those roll(s) will be rejected and the CQA Consultant and Owner shall determine further testing protocol and criteria for identifying the limits of rejected rolls.
- C. The CQA Consultant will ensure that conformance samples are removed at the specified frequency and forwarded to the CQA Consultant's Laboratory. The CQA Consultant will review laboratory test results as soon as they become available, and make appropriate recommendations to the Owner. All conformance test results shall be reviewed by Engineer and accepted or rejected, prior to the placement of the GCL liner. All test results shall meet, or exceed, the property values listed in Table 1. In the case of failing test results, the Manufacturer may request that another sample be retested by an independent laboratory with the Manufacturer's technical representative present during the testing procedures. The Manufacturer shall pay for this retesting. The Manufacturer may also have the sample retested at two different laboratories approved by the Owner. If both laboratories report passing results, the material shall be accepted. If both laboratories do not report passing results, all liner material from the lot representing the failing sample will be considered out of specification and rejected.

PART 3: EXECUTION

3.01 SURFACE PREPARATION

- A. Preparation of the soil surface be as specified in Section 02275.
- B. The soil surface shall be smooth, uniform, free from sudden changes in grade (such as vehicular ruts), rocks, stones, debris and deleterious materials. The moisture content of the compacted soil liner must be maintained within the project specifications until the synthetic liner has been installed.

During actual placing of the GCL liner, the soil surface shall be kept free of all standing water. If the soil surface below the GCL liner becomes wet and unstable, it shall be dried and recompacted to the CQA Consultant's satisfaction. If drying and recompacting the material is insufficient, the unstable material must be removed and replace with approved material.

- C. Before the liner installation begins, the Contractor and installer shall verify in writing and submit to the CQA Consultant:
1. Lines and grades are in relative conformance with the Drawings and Specifications.
 2. The surface area to be lined has been rolled and compacted, free of irregularities and abrupt changes in grade.
- D. The Contractor shall not proceed with GCL liner installation until a complete report on the grading and structural fill placement has been submitted and approved by the

Engineer. If the Contractor proceeds with synthetic liner installation and associated layers (drainage net, geotextile and sand) prior to completion of the report, the Contractor will do so at his/her own risk. If any compacted soil liner tests fail, the Contractor will be required to remove overlying synthetic liner system layers, repair deficient compacted soil liner area(s) and reinstall the liner system in accordance with project specification requirements. Any synthetic liner system materials damaged during the repair work shall be replaced with new material. All costs associated with such actions will be paid for entirely by the Contractor including, but not limited to, labor, additional liner system material, testing, labor and material costs incurred by the Engineer to perform additional inspection services.

3.02 ANCHOR TRENCH

- A. The anchor trench shall be constructed as shown on the Contract Drawings and as specified herein.
- B. Slightly rounded corners shall be provided in the trench to avoid sharp bends in the liner.
- C. The anchor trench shall be adequately drained to prevent water ponding and softening of adjacent soils. The anchor trench shall be backfilled with local fill material and compacted to 95 percent standard proctor density, ASTM D698 as specified in Section 02200.
- D. If the anchor trench is located in a clay susceptible to desiccation, the amount of trench open at any time shall be limited to one day of liner installation capacity.

3.03 GCL LINER PLACEMENT

- A. Weather Conditions
 - 1. GCL liner placement shall not proceed at an ambient temperature below 40 degrees Fahrenheit (F) or above 100 degrees F unless otherwise authorized, in writing, by the Engineer or his/her field representative. GCL liner placement shall not be performed during precipitation, excessive moisture, in an area of ponded water, or excessive winds. The Geosynthetics Installer shall limit the deployment of GCL to areas that may subsequently be covered by the primary HDPE geomembrane, including seaming of all HDPE panels during the same day.
- B. Handling and Storage
 - 1. The party responsible for unloading the GCL shall contact the manufacturer prior to shipment to determine the correct unloading methods and equipment if different from the pre-approved and specified methods.
 - 2. The GCL roll must be supported during handling to ensure worker safety and prevent damage to the liner. Under approved circumstances only, shall the rolls be dragged, lifted from one end, lifted with only the forks of a lift truck or pushed to the ground from the delivery vehicle.

3. The CQA inspector shall verify that proper handling equipment exists which does not pose any danger to installation personnel or risk of damage or deformation to the liner material itself. Suitable handling equipment is described below.
 - a. Spreader Bar Assembly – A spreader bar assembly shall include both a core pipe or bar and a spreader bar beam. The core pipe shall be used to uniformly support the roll when inserted through the GCL core while the spreader bar beam will prevent chains or straps from chafing the roll edges.
 - b. Stinger – A stinger is a rigid pipe or rod with one end directly connected to a forklift or other handling equipment. If a stinger is used, it should be fully inserted to its full length into the roll to prevent excessive bending of the roll when lifted.
 - c. Roller Cradles – Roller cradles consist of two large diameter rollers spaced approximately 3 inches apart, which both support the GCL roll and allow it to freely unroll. The use of roller cradles shall be permitted if the rollers support the entire width of the GCL roll.
 - d. Straps – Straps may be used to support the ends of spreader bars but are not recommended as the primary support mechanism. As straps may damage the GCL where wrapped around the roll and generally do not provide sufficient uniform support to prevent roll bending or deformation, great care must be exercised when this option is used.
4. Each roll shall be visually inspected when unloaded to determine if any packaging or material has been damaged during transit. Repairs to damaged GCL shall be performed in accordance with Section 3.05 of this specification.
 - a. Rolls exhibiting damage shall be marked and set aside for closer examination during deployment.
 - b. Minor rips or tears in the plastic packaging shall be repaired with moisture resistant tape prior to being placed in storage to prevent moisture damage.
 - c. GCL rolls delivered to the project site shall be only those indicated on GCL manufacturing quality control certificates.
5. Storage of the GCL rolls shall be the responsibility of the Geosynthetics Installer or other designated party. All GCL rolls shall be stockpiled and maintained dry in a flat location area away from high-traffic areas sufficiently close to the active work area to minimize handling.
6. The presence of free-flowing water within the packaging shall require that roll to be set aside for further examination to ascertain the extent of damage, if any. Free-flowing water within the packaging of unreinforced GCLs shall be cause for rejection of that roll.
 - a. GCL should be stored no higher than three to four rolls high or limited to the height at which the handling apparatus may be safely handled by installation

personnel. Stacks or tiers of rolls should be situated in a manner that prevents sliding or rolling by “choking” the bottom layer of rolls.

- b. Rolls shall not be stacked on uneven or discontinuous surfaces in order to prevent bending, deformation, and damage to the GCL or cause difficulty inserting the core pipe.
- c. An additional tarpaulin or plastic sheet shall be used over the stacked rolls to provide extra protection for GCL material stored outdoors.
- d. Bagged bentonite material shall be stored and tarped next to GCL rolls unless other more protective measures are available. Bags shall be stored on pallets or other suitably dry surface, which will prevent undue prehydration.

C. Method of Placement

- 1. GCL shall be installed such that all seams of the material are laid perpendicular to contours of constant elevation. Exceptions to this can be approved by the Owner or CQA Consultant only. The layout shall be designed to keep field overlapping of the GCL liner to a minimum and consistent with proper methods of GCL liner installation. The non-woven side of the GCL shall be placed against the soil liner.
- 2. For GCL liner placed on 4 to 1 or steeper slopes, the overlap seams shall be oriented in the direction of the slope. Horizontal seams on 4 to 1 slopes or steeper shall not be allowed except for cases in which it is unavoidable. Horizontal overlapping seaming methods on 4 to 1 slopes or steeper shall be approved by the Engineer prior to or during the Geosynthetics pre-construction meeting.
- 3. The equipment used to deploy the liner shall not cause rutting of the low permeability soil liner surface. If rutting occurs, the Geosynthetics Installer shall suspend all liner placement activities and repair the ruts and immediately employ an alternative method for liner deployment. GCL liner rolls shall be placed using spreader and rolling bars with cloth slings. If a sheet must be relocated a distance greater than its width, a slip-sheet shall be used.
- 4. The CQA Consultant shall inspect each panel, after placement and for damage and/or defects. Defective or damaged panels shall be replaced or repaired, as approved by the CQA Consultant.
- 5. The GCL shall not be permitted to become hydrated (wet) at any time before, during or after its installation, prior to placement of the primary geomembrane (including seaming of geomembrane). The Geosynthetics Installer shall limit deployment of GCL to areas that may subsequently be covered by the primary geomembrane including seaming of all panels during the same day. Any GCL that is damaged due to rain or any other conditions shall be removed and replaced by the Geosynthetics Installer at no additional cost to the Owner provided the damage was the direct fault of the Geosynthetics Installer. The Owner or CQA Consultant will make determination of the need for removal and replacement.

6. The GCL shall be oriented per the manufacturer's directions. The CQA Consultant shall verify that every GCL panel is installed with this orientation.
7. GCL shall be adjusted to smooth out creases or irregularities, but shall not be pulled enough to induce tension or stress.
8. The Geosynthetics Installer shall not drag the GCL liner panels over the compacted soil liner.
9. All GCL liner shall be anchored as shown on the Contract Drawings and consistent with Manufacturer's recommendations. Sufficient liner shall be installed within the anchor trench to ensure proper installation prior to backfilling the trench.
10. Personnel working on the GCL liner shall not smoke, wear damaging shoes or involve themselves in any activity that may damage the liner.
11. The GCL liner shall be properly weighted with sand bags to avoid uplift due to wind.
12. Vehicular traffic across the GCL liner shall not be allowed.
13. When tying into existing liner, all excavation of previously installed liner shall be performed by hand to prevent damage.

3.04 OVERLAPPED FIELD SEAMS

- A. Individual panels of liner shall be laid out and overlapped by a minimum of 12-inches along longitudinal seams and 12 inches minimum on the panel end seams. GCL shall be adjusted to smooth out creases or irregularities, but shall not be pulled enough to induce tension or stress.
- B. GCL seams shall consist of a simple overlap and shall not be permitted to be "stapled" or "pinned". All dirt, soil and debris shall be removed from the overlap. Panels shall be shingled in a down gradient direction. A loose layer of sodium Bentonite shall be spread along each overlap at a rate consistent with manufacturers recommendation.

3.05 REPAIRS

- A. Prior to cover material placement, damage to the GCL shall be identified and repaired by the installer. Damage is defined as any rips or tears in the geotextiles, delamination of geotextiles or a displaced panel.
 1. Rip and Tear Repair (Flat Surfaces) – Rips or tears may be repaired by completely exposing the affected area, removing all foreign objects or soil, and by then placing a patch cut from unused GCL over the damage (damaged material may be left in place), with a minimum overlap of 12 inches on all edges. Accessory bentonite should be placed between the patch edges and the repaired material at a rate of a quarter pound per lineal foot of edge spread in a continuous six-inch fillet.

2. Rip and Tear Repair (Slopes) – Damaged GCL material on slopes shall be repaired by the same procedures above, however, the edges of the patch should also be adhered to the repaired liner with an adhesive to keep the patch in position during backfill or cover operations.
 3. Displaced Panels – Displaced panels shall be adjusted to the correct position and orientation. The adjusted panel shall then be inspected for any geotextile damage or bentonite loss. Damage shall be repaired by the above procedure.
 4. Premature Hydration – If the GCL is prematurely hydrated, installer shall notify the QA/QC technician and Project Engineer for a site-specific determination as to whether the material is acceptable or if alternative measures must be taken to ensure the quality of the design – dependent upon the degree of damage.
- B. Care shall be taken to minimize the loss of bentonite into underlying liner materials. Loose bentonite that is present on underlying materials shall be either swept or vacuumed off of the underlying material.

3.06 OVERLYING GEOSYNTHETICS

- A. Precautions shall be taken to prevent damage to the GCL by restricting the use of heavy equipment over the liner system.
- B. Installation of the overlying geosynthetic component can be accomplished through the use of lightweight, rubber-tired equipment such as a 4-wheel all-terrain vehicle (ATV). This vehicle can be driven directly on the GCL, provided the ATV makes no sudden stops, starts, or turns.
- C. A slip-sheet (such as 20-mil smooth HDPE) may be used to facilitate placement of the textured geomembrane. The slip-sheet shall first be placed over the GCL in order to allow the geomembrane to slide into its proper position. Once the overlying geomembrane is properly positioned, the slip-sheet shall be carefully removed paying close attention to avoiding any movement to the geomembrane.

END OF SECTION

SECTION 02985

SEEDING AND MULCHING

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals necessary and finish grade, seed, and maintain all seeded areas as specified herein including all areas disturbed by the Contractor's operations.

1.02 RELATED SECTIONS

- A. Section 02276: Erosion and Sedimentation Control

1.03 SUBMITTALS

- A. Submit to the Engineer for review all materials and equipment furnished under this Section, including seed mixtures and product label information.
- B. Samples of all materials shall be submitted for inspection and acceptance upon Engineer's request.
- C. The Contractor shall submit a survey of the limits of seeding and mulching.

1.04 REFERENCE ITEM

- A. Current Erosion and Sedimentation Control Plan Reports prepared for the Green Recycling Solutions LLC Maysville C&D Recycling Center and C&D Landfill.

PART 2: PRODUCTS

2.01 MATERIALS

- A. Fertilizer shall be complete commercial fertilizer, 10-10-10 grade. It shall be delivered to the site in the original unopened containers each showing the manufacturer's guaranteed analysis. Store fertilizer so that when used it shall be dry and free flowing.
- B. Lime shall be ground limestone containing not less than 85 percent calcium and magnesium carbonates.
- C. Seed shall be from the same or previous year's crop; each variety of seed shall have a percentage of germination not less than 90 percent, a percentage of purity not less than 85 percent, and shall have not more than one percent weed content.

- D. The seed shall be furnished and delivered premixed in the proportions specified in Paragraph 3.01. A manufacturer's certificate of compliance to the specified mixes shall be submitted by the manufacturer for each seed type. These certificates shall include the guaranteed percentages of purity, weed content and germination of the seed, and also the net weight and date of shipment. No seed may be sown until the Contractor has submitted the certificates.
- E. Seed shall be delivered in sealed containers bearing the dealer's guaranteed analysis.
- F. Mulch shall be clean small-grain straw.
- G. Mulch for use in hydroseeding applications shall be a special processed cellulose fiber containing no growth or germination inhibiting factors. It shall be manufactured such that after addition and agitation in slurry tanks with water, the fibers become uniformly suspended to form a homogenous slurry. When sprayed on the ground, the materials shall allow absorption and percolation of moisture.

PART 3: EXECUTION

3.01 APPLICATION

- A. Temporary Seeding – areas left disturbed for longer that 30 days but less than one (1) year.

TIME PERIOD	ITEM	RATE OF APPLICATION (lb./acre)
January 1 to May 1	Rye (Grain)	120
	Annual Lespedeza (Kobe)	50
	Limestone	2,000
	10-10-10 Fertilizer	750
	Nitrogen (March only)	50
	Mulch	4,000
May 1 to August 15	German Millet	40
	Limestone	2,000
	10-10-10 Fertilizer	750
	Mulch	4,000
August 15 to December 30	Rye (Grain)	120
	Limestone	2,000
	10-10-10 Fertilizer	1,000
	Mulch	4,000

If it is necessary to extend temporary cover beyond June 15, the area should be overseeded with 50 lb./acre of Kobe lespedeza in latter February or early March.

B. Permanent Seeding

TIME PERIOD	ITEM	RATE OF APPLICATION (lb./acre)
August 20 to October 25	Tall Fescue	100
	Sericea Lespedeza	30
	Kobe Lespedeza	10
	Common Bermuda or Pensacola Bahia	10/25
	Limestone	4,000
	10-10-10 Fertilizer	1,000
	Mulch	4,000 to 5,000
February 1 to April 15	Tall Fescue	100
	Sericea Lespedeza	30
	Kobe Lespedeza	10
	Limestone	4,000
	10-10-10 Fertilizer	1,000
	Mulch	4,000 to 5,000

If seed mixture is being applied after August 20, Unscarified Sericea seed should be used. To extend spring seeding dates into June, add 15 lb./acre hulled Bermudagrass.

3.02 INSTALLATION

- C. Seed all disturbed areas of construction, excluding areas to be paved for roads, building footprints, and riprap lined ditches unless the areas meet the following conditions:
1. Graded surfaces on which further construction will not be proceeding within 30 days shall be covered with at least 3 inches of vegetative support material and shall be seeded.
 2. Surfaces, which are at final grade or on which further construction shall not be proceeding within one (1) year, shall be covered with at least five inches of vegetative support material and shall be seeded.
- D. The vegetative support material cover shall be graded smooth and tracked with a light bulldozer. All brush, roots, stumps, litter, large rocks, debris or other foreign matter shall be removed from the tracked surface. The surface of the vegetative support material shall be scarified by raking unless the surface remains loose and friable from grading and tracking.
- E. Seeding, mulching, and conditioning shall normally be performed during those periods and within the seasons which are normal for such work as determined by the prevailing weather and locally accepted practice, as approved by the Engineer.
- F. No seeding should be undertaken in windy or unfavorable weather, when the ground is too wet to rake easily, when it is in a frozen condition, or too dry.

- G. The subgrade of all areas to be seeded shall be raked and all rubbish, sticks, roots, and stones larger than 2 inches shall be removed.
- H. Fertilizing, liming, seeding, and mulching shall normally be accomplished in one operation by hydraulic application (hydroseeding). Separate hand or mechanical application of fertilizer, lime, seed, and mulch shall be employed only for small areas and repair.
- I. Seeding shall be done within five days following surface preparation. The hydroseeding equipment shall be so designed that when the mixture is sprayed over an area the required application rates are uniformly achieved.
- J. Immediately following this preparation, seed shall be applied, depending on the period of year, at the rates specified in Section 3.01.
- K. All seeded areas shall be mulched with clean small-grain straw at a specified in Section 3.01. Asphalt emulsion shall be applied uniformly at a rate of 0.1 gallons per square yard to tack the mulch, unless otherwise shown on the plans. Mechanical tacking will be considered on a case-by-case basis as approved by the Engineer.
- L. The Contractor shall keep all seeded areas watered and in good condition. Reseeding shall be done if and when necessary until a good, healthy, uniform growth is established over the entire area seeded.
- M. On slopes, the Contractor shall provide against washouts by an approved method. Any washout, which occurs, shall be regraded and reseeded at the Contractor's expense until good sod is established.

3.03 MAINTENANCE

- A. The Contractor shall maintain all seeded areas in a condition approved by the Engineer until final acceptance of the Contract. Maintenance shall include, but not be limited to, mowing, raking clippings and leaves, repair of seeded areas, irrigation, and weed control. Protection shall be provided for all seeded areas against trespassing and damage. Slopes shall be protected from damage due to erosion, settlement, and other causes and shall be repaired promptly.
- B. When protection of newly completed areas is necessary at a time, which is outside of the normal seeding season, the surfaces shall be protected by application of hay, straw, or woodchip mulch. On slopes steeper than 3 feet horizontal to 1 foot vertical, the hay or straw shall be held in place by tar tack or covered with staked erosion nets of jute, burlap, etc.
- C. All seeded areas shall be inspected on a regular basis and any necessary repairs or reseedings shall be made within the planting season, if possible.

END OF SECTION

SECTION 11323

LEACHATE PUMPS

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals to submersible leachate pumps as specified herein. Pumps shall be submersible pumps designed for sewage and wastewater applications. Each pump shall be furnished ready to insert in the 18 inch conduit with rollers attached to permit easy movement into the leachate sump. The pumps shall be as follows (or Engineer approved alternate) as indicated in the Construction Drawings:

EPG SurePump, patented, stainless steel Wheeled Sump Drainer, size 4, with 1/2 HP, 460 V, 3Ø motor, 40' of jacketed 14-4 CP motor lead, 0-11' level sensor with built-in lightning arrestor and 40' Hytrel lead, and 30' of 1/8" stainless steel suspension cable and clamps.

- B. Pumps shall be furnished complete with all necessary accessories and controls including, but not limited to, control panel(s), liquid level sensors, junction boxes and wiring, check valves, flexible disconnect system hoses, pull cables and mounting hardware. All such accessories shall be supplied by the manufacturer of the pumps or otherwise approved by the manufacturer for use with the pumps. All disconnect systems, hardware, junction boxes, wiring and other accessories to be installed in the sumps or risers shall be waterproof, non-sparking, explosion proof and otherwise designed for hazardous atmospheres, submersion, or wet locations as appropriate.

1.02 SUBMITTALS

- A. The following shall be submitted to the Engineer prior to pump placement:
1. Shop and Erection Drawings showing all important details and dimensions.
 2. Descriptive literature bulletins and/or catalogs of the equipment.
 3. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves which show that they meet the specified requirement for total head, capacity, efficiency, NPSHR, submergence and horsepower. Curves shall be submitted on 8-½ inch x 11-inch sheets, at an adequate scale. Curves shall be plotted from zero flow at shut off head to pump capacity at minimum specified total head.
 4. Approximate total weight of the equipment including the weight of the single largest item.

5. Drawings showing the layout of the control panel. The layout shall show front and side elevations and shall indicate every device mounted on the inner door and subpanel with complete identification.
 6. Complete wiring diagrams and schematics of all power and control systems showing wiring requirements between all system components, motors, sensors, control panels and related systems.
 7. A complete list of the equipment ordered.
 8. Manufacturer/supplier warranty.
- B. In the event that it is impossible to conform to certain details of the Specifications due to different manufacturing techniques, the submittal shall describe completely all nonconforming aspects.
- C. Operating and Maintenance Data.
1. Operating and Maintenance Manuals shall be furnished. The manuals shall be prepared specifically for equipment furnished and installed and shall include all required cross sections, drawings, equipment lists, description, etc., that are required to instruct operating and maintenance personnel unfamiliar with such equipment.
 2. A factory representative, who has complete knowledge of proper operation and maintenance, shall be provided for one day to instruct representatives of the Owner on proper operation and maintenance.

1.03 QUALITY ASSURANCE

- A. To assure unity of responsibility, the pump, control panel and other auxiliary equipment and materials specified in this Section shall be furnished and coordinated by the pump manufacturer. The Contractor and manufacturer shall assume responsibility for the satisfactory installation and operation of the entire pumping system including pumps and control as specified.
- B. The submersible pump and other equipment covered by these Specifications are intended to be standard design and proven ability. The pump shall be designed for sewage removal. The pump shall be equipped with level sensing system and rollers for ease of installation. The pump shall be of the sealed submersible type as manufactured by EPG Companies, Inc. of Maple Grove, MN or Engineer approved alternate. The furnished pump shall be designed, constructed and installed in accordance with the Hydraulic Institute Standards and shall operate satisfactorily when installed.
- C. The control system shall have an established record of successful performance for similar service.
- D. All equipment, including the pump, furnished under this Specification shall be new and unused, shall be the standard product of manufacturer having a successful record of

manufacturing and serving the equipment and systems specified herein for a minimum of three years (five years for the pump).

1.04 DELIVERY, STORAGE, AND HANDLING

- A. All equipment and parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is complete and the units and equipment are ready for operation.
- B. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.
- C. Finished surfaces of all exposed pump openings shall be protected by wooden blanks strongly built and securely bolted thereto.
- D. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment and proper care shall be taken to protect parts from the entrance of water during shipment, storage and handling.
- E. Each box or package shall be properly marked to show its net weight in addition to its contents.

1.05 WARRANTY REQUIREMENTS

- A. All equipment supplied under this section shall be warranted for a period of one year by the Contractor and the equipment manufacturers. Warranty period shall commence on the date of final acceptance.
- B. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail due to manufacturing defects during the warranty period, it shall be replaced and the unit(s) shall be restored to service at no additional cost to the Owner.
- C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed.

1.06 ADDITIONAL WARRANTY REQUIREMENTS

- A. Pumps
 - 1. The warranty shall cover defects in workmanship and materials and cover all costs for both labor and parts required to inspect and repair pumping equipment delivered to the pump manufacturer's authorized repair and maintenance service center. During the one-year warranty period, the Contractor shall be responsible for removing and reinstalling the pumping equipment. The Contractor shall be responsible for all transportation and shipping costs for delivery of the pumping equipment to the service center and return to the site.

B. Control Panels

1. Control panel shall be provided with a warranty covering 100 percent of the cost for repair or replacement of defective equipment concurrent with warranty period for Pump, to include all equipment associated with pumps, level transmitters, and/or flow meters.
2. Warranty service to inspect defects in the control panel shall be performed at the pump station site by the Contractor and/or the pump manufacturer/supplier. Repair and/or replacement of defective components to the greatest extent possible shall be performed at the project site; however, no major component, whose removal will render the equipment or pump station inoperable, shall be removed without providing a spare or "loaner" replacement component for use and operation of the pump station while the original component is being repaired.

C. Agreement to Warranty Conditions

1. The pump manufacturer/supplier shall, as a part of the required Shop Drawing and product submittal data, deliver a certified statement of agreement and materials to be supplied and installed under this Section.
2. Operating and Maintenance Data, a typewritten or printed copy of the product warranties, including the above provisions and applicable dates of commencement and expiration of each warranty period, shall be supplied with other required product data.

1.07 PATENTS AND LICENSES

- A. The pumping equipment manufacturer shall be responsible for all patents or licenses that exist for the equipment provided.
- B. The manufacturer shall assume all costs of patent fees or licenses for the equipment or process and shall safe-guard and save harmless the Owner from all damages, judgements, claims and expenses arising from licenses fees, or claimed infringement of any letters, patent or patent rights, or fees for the use of any equipment of process, structural feature or arrangement of any of the component parts of the installation and the price bid shall be deemed to include payment of all such patent fees, licenses or other costs pertaining thereto.

PART 2: PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. The manufacturer shall submit a data sheet specific to each pump supplied, the data sheet shall have the name of the manufacturer, the rated capacity, total head, speed and all other pertinent data.

2.02 PUMPING SYSTEM – GENERAL

- A. The pump shall be a totally submersible centrifugal pump capable of pumping domestic and commercial raw sewage.
- B. The pump shall produce, at a minimum, a flow rate of 10 gallons per minute against a 15-foot total head. The pump curve shall satisfy the following:

The pump control shall be set as follows:

Inches above Centerlines of Pump

- | | |
|--------------------|----|
| ▪ High Level Alarm | 30 |
| ▪ Pump On | 18 |
| ▪ Pump Off | 8 |

- C. Provide and fully test two (2) pumps, with one to be stored as backup following Final Acceptance Tests specified in paragraph 3.02.

2.03 PUMP CONSTRUCTION

- A. The motor housing and volute case shall be of stainless steel construction. All fasteners are to be 302 stainless steel. The impeller shall be of 304 stainless steel construction. The impeller shall be dynamically balanced by grinding on back shroud.
- B. The pump shaft shall be 304 stainless steel. The rotor shaft shall be supported by, radial sleeve bearings, and kingsbury type thrust bearings.
- C. A Viton, carbon and ceramic face seal shall be provided. A seal chamber shall separate the seals. The seal chamber shall be oil filled to lubricate the seal face and to transmit heat from shaft to outer shell. A seal leak probe shall be provided on each pump.

2.04 SUBMERSIBLE MOTORS

- A. The motor shall be ½ HP, 240-Volt, 60-Hz, 3 Phase-phase unit (as specified in Construction Drawings). The motor shall be non-overloading for the entire pump operating curve. Motors shall be 4-inch, high thrust, corrosion-resistant motors as manufactured by Franklin Electric or Engineer approved alternate having the following characteristics:
 - Enclosure: Hermetically sealed windings, corrosion-resistant materials. Filtered check

- valve plugged to prevent interchange with pumped fluids. Stainless steel, splined shaft.
 - Bearings: Radial sleeve bearings, kingsbury type thrust bearings.
 - Lubrication: Water based.
 - Overload Protection: Standard single-phase magnetic starter with special ambient compensated quick trip overload relays in all three legs required for positive motor protection.
 - Motors shall be designed for operation in severe environments.
 - Motors shall be constructed of 304 stainless steel.
- B. The motor shall have an overload element embedded in the winding to protect the motor against over-current and overheating conditions. The overload element shall automatically reset when the motor cools. The complete motor and pump impeller shall be removable as a unit from the volute casing.
- C. The motor power cable shall be potted into a steel connector with polyurethane resin for a leak-proof seal. A cord nut and rubber grommet shall clamp the cord into the bushing. Power cords shall withstand a pull of 100 pounds. No splices in the power cord will be acceptable between the pump and the control panel. Pump electrical cables of sufficient length shall be provided so that the cables will be continuous between the pump and the control panel with no splices being allowed. The motor cable shall be of the MSHA type insulated cable with a double jacketed protection system, neoprene outside, synthetic rubber inside, exceeding industry standards for oil, gas, and sewage resistance.
- D. The pump shall be supplied with a 1/8-inch diameter stainless steel lifting cable, all hardware to attach the cable to the pump shall be stainless steel. The Flexible transmission hose shall be 2 inch diameter hose Super-Vac Industrial Hose by Gates Rubber Company of Denver, CO or Engineer approved alternate. The lifting cable shall be attached to the flexible transmission hose with nylon ties every 5 feet.
- E. The pumps shall be supplied with power and sensor conductors encapsulated in a single cable. Pump motor cables shall be sized to meet applicable NEC requirements. The cable entry system shall be field serviceable. Any cable entry system requiring epoxy silicones or other secondary sealing systems shall not be acceptable.

2.05 PUMP CONTROL SYSTEM

- A. Control equipment shall be mounted within a NEMA 4 type enclosure. The control panel shall be mounted adjacent to the location of the leachate pre-treatment controls. The control panel shall be located at a convenient height to be accessible by a person in a standing position. The panel and appurtenance shall be sheltered from direct vertical rainfall by a pitched roof providing a 6-inch minimum overhang all around. A ground fault protected, duplex 120 volt, weatherproof electrical receptacle shall be provided. All electrical materials and equipment shall conform to NEMA and NEC standards. All wiring shall be in rigid conduit. All switches shall be labeled.
1. Circuit breakers shall be thermal-magnetic with dead fronts to be used both as disconnect switches and overcurrent protection due to short circuits in the motor branch

circuit conductors, control equipment, and motors. Thermal-magnetic circuit breakers shall be provided for the motor-pilot circuits and each auxiliary circuit.

2. Magnetic across-the-line starters with under-voltage release shall be provided for the pump. The starter shall have thermal overload heater coils in each phase to prevent single phasing.
3. An EPG pump control panel model L925 (or Engineer approved equal) in a NEMA 4 enclosure shall be mounted on the backboard. It shall have a breaker, magnetic starter, hand-on-off selector switch, and running light for the pump. The control panel shall also be fitted with a remote tank full sensor.
4. Pump and level control cables shall pass into the control panel in sealed cable grips.
5. The level control shall be by a pressure transducer EPG LevelMaster Submersible Level Sensor System or engineered equivalent. The pressure transducer shall be attached to the pump casing. The pump controls shall be set at the proper elevations to control starting the pump; one will be the high water alarm and one will be off for the pump. The pressure transducer shall be listed by Underwriters' Laboratories (U.L.) and bear the U.L. label. A remote full tank sensor shall be incorporated to shut the pump off if the level in the leachate tank reaches the maximum safe level. High water conditions at the sump shall energize a 60-watt red light to be located at the top of the control panel support and shall also sound a buzzer. The decibel level of the buzzer shall be adjustable.
6. The Contractor shall provide all wiring and labor necessary to connect the station to commercial 230-volt and/or 120-volt, 3-phase, 60-Hz, power source and pay the cost of electrical service to the site.

2.06 SHOP PAINTING

- A. Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry and free from all mill-scale, rust, grease, dirt and other foreign matter.
- B. Gears, bearing surfaces and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to the Engineer up to the time of the final acceptance test.

2.07 DISCHARGE PIPING AND APPURTENANCES

- A. The pump discharge piping shall be flexible hose chemically compatible with domestic and commercial sewage. The pump and transmission piping will be located inside the leachate sump piping. The pipe diameter shall be as specified on the Construction Drawings.

- B. The discharge piping shall be connected to the riser vault piping via EPG-N Series Quick Disconnect fittings. Disconnect fitting shall be attached to flexible hose piping via threaded stainless steel pipe with a barbed hose connection end.

PART 3: EXECUTION

3.01 INSTALLATION

- A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Construction Drawings. Installation shall include furnishing oil and grease for initial operation, if required, in accordance with the manufacturer's recommendations.
- A. The Contractor shall submit a certificate from the equipment manufacturer stating that the equipment is ready for operation and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

3.02 INSPECTION AND TESTING

- A. General
 - 1. The Engineer shall have the right to inspect, test or witness tests of all materials or equipment to be furnished under these Specifications, prior to their shipment from the point of assembly.
 - 2. The Engineer shall be notified in writing prior to the initial shipment or testing, in ample time so that arrangements can be made for inspection by the Engineer.
 - 3. The pump manufacturer shall perform the following test on each pump prior to shipment from the factory.
 - a. Megger motor and pump for insulation breaks or moisture.
 - b. Prior to submergence, the pump shall be run and checked for correct rotation.
 - c. Pump shall be run for a minimum of thirty minutes in a submerged condition.
 - d. The pump shall be removed from test location, meggered immediately for moisture, and upper and lower seal unit shall be checked for water intrusion.
 - e. A written certification test report regarding the above test shall be supplied with each pump at the time of shipment.
 - 4. The services of a factory representative shall be furnished for a minimum of one-half day per pumping station and shall have complete knowledge of proper operation and maintenance to inspect the final installation and supervise the test run of equipment.

5. Field tests shall not be conducted until such time that the entire installation is complete and ready for testing.
6. In the event that the equipment does not meet the Final Acceptance Test, the Contractor shall, at his own expense, make such changes and adjustments in the equipment, which he deems necessary and shall conduct further tests until full satisfaction is indicated by the Engineer and written certification is received thereof.
7. The Contractor shall supply an adequate volume of water to each sump location to meet the requirements of this section.
8. All pumps supplied shall be installed and tested, including the backup pumps. One pump shall remain operational after the Final Acceptance Tests.

B. Pump

1. After each pump has been completely installed and working under the direction of the manufacturer, conduct such tests as are necessary to indicate that the pump conforms to the Specifications in the presence of the Engineer. Supply all electrical power, water, labor, equipment and incidentals required to complete the field tests.
2. The Final Acceptance Test shall demonstrate that all items of these Specifications have been met by the equipment as installed and shall include, but not be limited to, the following tests:
 - a. That all units have been properly installed and are in correct alignment.
 - b. That the units operate without overheating or overloading any parts without objectionable vibration.
 - c. That there are no mechanical defects in any of the parts.
 - d. That the pumps can deliver the specified pressure and quantity of liquid.
 - e. That the level sensor and pump control system operates as specified.
 - f. That the flow meter sensor and transmitter system operates and records as specified.
3. If the pump performance does not meet the Specifications, corrective measures shall be taken or the pump shall be removed and replaced with a pump, which satisfies the conditions, specified. A 24-hour operating period of the pump will be required before acceptance.

- C.** The Contractor shall check all motors for correct clearance and alignment in accordance with manufacturer's instructions. The Contractor shall check direction of rotation of all motors and reverse connections if necessary.

END OF SECTION

SECTION 15100

VALVES AND APPURTENANCES

I. PART 1: GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required, and install complete and ready for operation, all valves and appurtenances as shown on the Contract Drawings and as specified herein.
- B. The equipment shall include, but not be limited to, the following:
 - 1. Gate valves
 - 2. Check valves
 - 3. Butterfly valves
 - 4. Air and Vacuum Release Valves
 - 5. Flowmeters
 - 6. Double Check Valve Assemblies
- C. All piping, fittings and valves within the leachate riser vaults shall be HDPE or schedule 80 Polyvinyl Chloride (PVC) that meet all applicable AWWA pipe standards. Connections between HDPE and PVC piping shall be made with flanged mechanical fittings.

1.02 RELATED SECTIONS

- A. Section 02200: Excavation, Grading, Backfill, and Compaction
- B. Section 02623: High Density Polyethylene (HDPE) Pipe

1.03 DESCRIPTION OF SYSTEMS

- A. All of the equipment and materials specified herein is intended to be standard for use in controlling and monitoring the flow of wastewater, sludges, water, air or chemicals, depending upon the applications.

1.04 QUALIFICATIONS

- A. All valves, meters, and appurtenances shall be products of well established firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.
 - 1. Drawings showing all important details of construction and dimensions.
 - 2. Descriptive literature, bulletins, and/or catalogs pertaining to the specific equipment.
 - 3. The total weight of each item.
 - 4. A complete total bill of materials.
 - 5. A list of the manufacturer's recommended spare parts.

1.05 OPERATING INSTRUCTIONS

- A. Operating and maintenance instructions for all valves, meters and appurtenances shall be furnished to the Owner by the Contractor. The instructions shall include all required cuts, drawings, equipment lists, descriptions, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

1.06 TOOLS

- A. Special tools, if required for normal operation and maintenance, shall be supplied with the equipment.

II. PART 2: PRODUCTS

2.01 VALVES AND FLOWMETERS

- A. The Contractor shall furnish and install appropriately sized gate valves as shown on Contract Drawings.
 - 1. Gate valves associated with the sanitary sewer force main shall be ASAHI/America or Engineer approved equal with an operational pressure rating of no less than 150 psi.
 - 2. Gate valves associated with the facility water lines shall be approved by the National Sanitary Foundation (NSF) or the American Society of Sanitation Engineers (ASSE) for use in potable water distribution systems. Gate valves shall have an operational pressure rating of no less than 200 psi. All gate valves associated with the facility water line shall be approved by the Engineer prior to installation.
- B. The Contractor shall furnish and install check valves as shown on the Construction

Drawings.

1. Ball check valves associated with the sanitary sewer forces main shall be ASAHI/America true union or Engineer approved alternate, with an operating pressure of no less than 150 psi.
 2. Ball check valves associated with the facility water line shall be approved by the NSF of ASSE for use in a potable water distribution system. Ball check valves shall have an operational pressure rating of not less than 200 psi. Ball check valves associated with the facility water line shall be approved by the Engineer prior to installation.
 3. Swing check valves may be used in the construction of the sanitary sewer force main and in the facility water line. All swing check valves shall have an operational pressure rating of not less than 150 psi (sanitary force main) or 200 psi (facility water line). All swing check valves used in the facility water line shall be approved by the NSF or ASSE for use in potable water distribution systems. All swing check valves shall be approved by the Engineer prior to installation.
- C. Butterfly valves shall be ASAHI/America or Engineer approved alternate with a one or two part stem and housing stem extension where applicable. Butterfly valves shall have an operating pressure of not less than 100 psi. No butterfly valves shall be used in the facility water line construction.
- D. The Contractor shall furnish and install air and air/vacuum release valves as shown on the drawings. Valves shall be by Crispin Universal® or approved equal. Valves shall be of non-sputtering type. All valves, associated with the water distribution system, shall be NSF or ASSE approved for use in a potable water distribution system. All valves to be used in the facility water line construction shall be approved by the Engineer prior to installation.
- E. Flowmeters shall be EPG Companies model 52 EP200, 2 inch paddlewheel-type or Engineer approved alternate, metering systems shall be used to register product flow and record totalized flow rate for sanitary sewer force main. The metering system shall operate from a 115 volt, 60 Hertz, or 240 volt, 50 Hertz single phase power supply. The nominal diameter of the flow tube shall be 4 inches.
1. The flow tube shall be made of PVC and shall have 15D#ASA Flanges , and shall include Type 316 stainless steel bolts. O-ring seals shall be made of Viton, and gaskets shall be made of nitrile rubber.
 2. The metering sensor shall utilize a dual magnet drum design. The sensor shall be installed in such a way as to maximize accuracy with a linear repeatability factor of ± 0.5 percent. The mean velocity measurement range shall be 0 to 50 feet per second (0 to 15 meters per second). The minimum detectable mean velocity shall be 0.02 feet

per second (0.006 meters per second). A mean velocity of 0.1 foot per second (0.03 meters per second) shall be measured with a maximum error of +/-5 percent of flow rate. Accuracy shall be traceable to the US National Institute of Standards and Technology (NIST), and shall be guaranteed on-site for applications such as drinking water, raw sewage, and similar media, even with a permanent coating of raw sewage or similar on the electrodes, provided that specification parameters and installation recommendations are met. A NIST traceable calibration certificate shall be provided with each flow meter.

3. The meter shall include a uni-directional, ten-digit flow rate and recording totalizer. The meter shall be front panel programmable for ease of calibration to line size and change in units. The meter shall include a non-volatile memory to retain programmed settings and totalized flow when power is disconnected. The meter shall display flow and totalized rates using a ten digit ¾-inch high (nominal) display.
 4. The flowmeter shall maintain full function in temperatures between 0 °F and 125 °F. A heater may be utilized in order to meet the operational temperatures. The meter shall have an operating pressure capability of no less than 150 psi.
 5. The meter shall be constructed of materials capable of withstanding a volatile environment and corrosive liquid. The flow transmitter shall be housed in a rugged, lockable, watertight, dust-tight, corrosion resistant NEMA 4 cast aluminum, fusion bonded epoxy enamel painted enclosure suitable for conduit connections. Meter specifications shall be submitted to the Engineer for approval prior to purchase.
- F. All meters associated with the facility water line or sewer lines shall be approved by the Local Public Utility Department prior to purchase. The Engineer and Contractor shall work in tandem to gain approval for all meters not purchased from the Local Public Utility Department.
- G. The Contractor shall furnish and install appropriately sized double check valve assembly approved by the ASSE for use in a portable water distribution system in the locations specified on the Contract Drawings. (If there is a discrepancy in the valves location between the Contract Drawings and the support Building Drawings, the Support Building Drawings will supercede the Contract Drawings. Valves shall be of bronze body type, have two independently operated spring-loaded “Y” type center guided with an operating pressure of 190 psi.

III.PART 3: EXECUTION

3.01 INSTALLATION

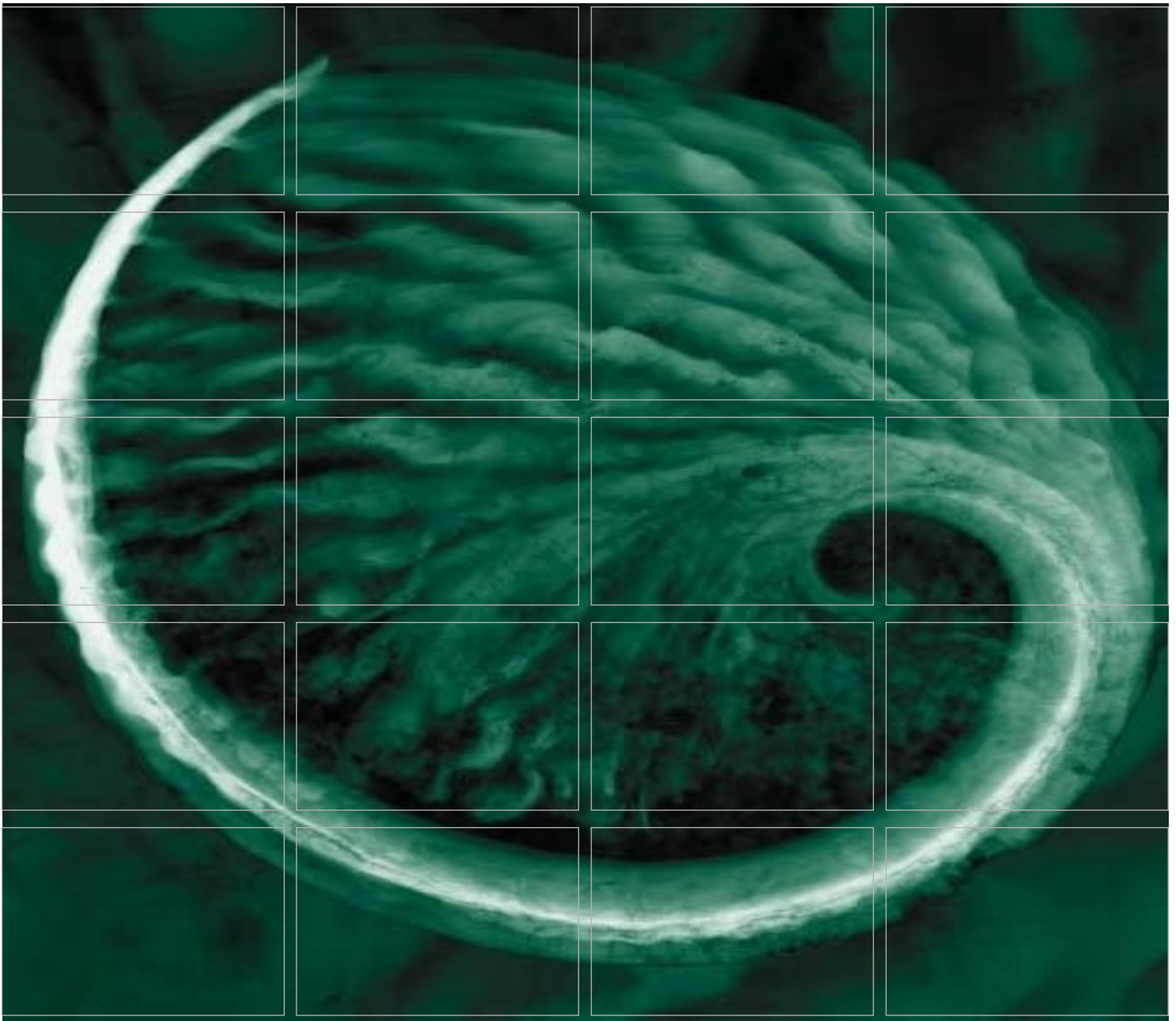
- A. All valves and appurtenances shall be installed in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.

- B. After installation, all valves and appurtenances shall be tested at least 1 hour at the working pressure corresponding to the class of pipe, unless a different test pressure is specified by the Engineer. If any joint proves to be defective, it shall be repaired to the satisfaction of the Engineer.
- C. All materials shall be carefully inspected for defects in workmanship and materials; all debris and foreign material cleaned out of valve openings, etc.; all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves and other equipment, which do not operate easily, or are otherwise defective, shall be repaired or replaced at no additional cost to the Owner.
- D. Valves shall be set on a firm foundation and supported by tamping selected material under the sides of the valve. The valve box shall be supported during backfilling and maintained in vertical alignment with the top flush with finish grade.

3.02 INSPECTION AND TESTING

- A. The various pipe lines in which the valves and appurtenances are to be installed are specified to be field tested. During these tests any defective valve or appurtenance shall be adjusted, removed and replaced, or otherwise made acceptable to the Engineer.
- B. Various regulating valves or other appurtenances shall be tested to demonstrate their conformance with the specified operational capabilities and any deficiencies shall be corrected or the device replaced or otherwise made acceptable to the Engineer.

END OF SECTION



Green Recycling Solutions LLC

Construciton Quality Assurance (CQA) For
Construction of Maysville Construction &
Demolition Debris Landfill
Maysville, North Carolina

June 2013

3.0 CONSTRUCTION QUALITY ASSURANCE PLAN

TABLE OF CONTENTS

3.1 GENERAL

3.1.1 Introduction

3.1.2 Scope of the CQA Plan

3.1.3 Definitions and Use of Terms

3.1.3.1 Definitions Relating To CQA

3.1.3.2 References To Standard

3.1.3.3 Units

3.1.4 Responsibility and Authority

3.1.4.1 Permitting Agency

3.1.4.2 Owner

3.1.4.2.1 Regional Engineer

3.1.4.2.2 Project Manager

3.1.4.3 Permit Engineer

3.1.4.4 Design Engineer

3.1.4.5 CQA Consultant

3.1.4.6 Soils CQA Laboratory

3.1.4.7 Geosynthetics CQA Laboratory

3.1.4.8 Earthwork Contractor

3.1.4.9 Geosynthetics Manufacturer

3.1.4.10 Geosynthetics Installer

3.1.5 Project Meetings

3.1.5.1 Pre-Construction

3.1.5.2 Weekly Progress Meetings

3.1.5.3 Problem or Work Deficiency Meetings

TABLE OF CONTENTS (cont'd)

- 3.1.6 Qualifications of Key Personnel and Organizations
 - 3.1.6.1 CQA Consultant
 - 3.1.6.2 Soils And Geosynthetics CQA Laboratories
 - 3.1.6.3 Earthwork Contractor
 - 3.1.6.4 Geosynthetics Manufacturer
 - 3.1.6.5 Geosynthetics Installer
- 3.2 STRUCTURAL FILL, COMPACTED SOIL LINER, AND DRAINAGE MATERIALS
 - 3.2.1 Introduction
 - 3.2.2 Test Methods and Sampling Requirements
 - 3.2.3 Subgrade
 - 3.2.4 Structural Fill
 - 3.2.5 Compacted Soil Liner (Alternate to Geosynthetic Clay Liner)
 - 3.2.6 Protective Cover
 - 3.2.7 Drainage Sand (Not Used Intentionally)
 - 3.2.8 Coarse Aggregate
 - 3.2.9 Potential Problems and Deficiencies
 - 3.2.9.1 Notification
 - 3.2.9.2 Repairs and Testing
- 3.3 GEOSYNTHETIC CLAY LINER
 - 3.3.1 General
 - 3.3.2 Materials
 - 3.3.2.1 Storage and Handling
 - 3.3.2.2 Quality Control Testing
 - 3.3.2.3 Conformance Testing
 - 3.3.3 Installation Methods
 - 3.3.3.1 Storage and Handling
 - 3.3.3.2 Compacted Soil Liner Preparation
 - 3.3.3.3 Anchor Trench
 - 3.3.3.4 Placement of GCL Liner
 - 3.3.3.5 GCL Seaming Requirements
 - 3.3.3.6 Repairs
 - 3.3.3.7 Overlying Geosynthetics

TABLE OF CONTENTS (cont'd)

3.4 GEOMEMBRANE

3.4.1 Manufacture, Shipment and Storage

3.4.1.1 Manufacture Of Polyethylene Geomembrane

- 3.4.1.1.1 Resin Quality
- 3.4.1.1.2 Certification of Property Values
- 3.4.1.1.3 Quality Control Certificates

3.4.1.2 Shipment And Handling

3.4.1.3 Conformance Testing Of Geomembrane

- 3.4.1.3.1 Sample Collection
- 3.4.1.3.2 Test Results

3.4.1.4 Storage

3.4.2 Geomembrane Installation

3.4.2.1 Earthwork

3.4.2.2 Geomembrane Placement

- 3.4.2.2.1 Panel Layout
- 3.4.2.2.2 Field Panel Identification
- 3.4.2.2.3 Installation Schedule
- 3.4.2.2.4 Weather Conditions
- 3.4.2.2.5 Anchorage System
- 3.4.2.2.6 Method of Placement
- 3.4.2.2.7 Damage

3.4.2.3 Field Seaming

- 3.4.2.3.1 Extrusion Seaming
- 3.4.2.3.2 Fusion Seaming
- 3.4.2.3.3 Seam Preparation
- 3.4.2.3.4 Weather Conditions for Seaming
- 3.4.2.3.5 Trial Seams
- 3.4.2.3.6 General Seaming Procedure
- 3.4.2.3.7 Non-Destructive Seam Continuity Testing

TABLE OF CONTENTS (cont'd)

3.4.2.4 Defects And Repairs

- 3.4.2.4.1 Repair Procedures
- 3.4.2.4.2 Verification of Repairs
- 3.4.2.4.3 Large Wrinkles

3.4.2.5 Backfilling Of Anchor Trench

3.4.2.6 Liner System Certification/Acceptance

3.4.2.7 Materials In Contact With The Geomembranes

- 3.4.2.7.1 Geonet
- 3.4.2.7.2 Appurtenances

3.5 GEOCOMPOSITE

3.5.1 Manufacturer's Documentation

- 3.5.1.1 Certification Of Property Values
- 3.5.1.2 Labeling

3.5.2 Shipment and Storage

3.5.3 Conformance Testing of Geocomposite

- 3.5.3.1 Sample Collection
- 3.5.3.2 Test Results

3.5.4 Handling and Placement

3.5.5 Stacking and Joining

3.5.6 Repair

3.5.7 Placement of Materials on Geocomposite

3.6 GEOTEXTILE

3.6.1 Manufacturer's Documentation

- 3.6.1.1 Certification Of Property Values
- 3.6.1.2 Labeling

3.6.2 Shipment and Storage

3.6.3 Conformance Testing of Geotextile

- 3.6.3.1 Sample Collection
- 3.6.3.2 Test Results

TABLE OF CONTENTS (cont'd)

- 3.6.4 Handling And Placement
- 3.6.5 Seams and Overlaps
- 3.6.6 Repairs
- 3.6.7 Placement of Materials on Geotextiles
- 3.7 POLYETHYLENE PIPE AND FITTINGS
 - 3.7.1 Material Requirements
 - 3.7.1.1 Pipe
 - 3.7.1.2 Fittings
 - 3.7.1.3 Joints
 - 3.7.2 Manufacturer's Documentation
 - 3.7.2.1 Certification Of Property Values
 - 3.7.2.2 Quality Control Certificates
 - 3.7.3 Fusion Process for Joints
 - 3.7.3.1 Preparation
 - 3.7.3.2 Weather Conditions For Butt-Fusion
 - 3.7.3.3 General Butt-Fusion Procedure
 - 3.7.4 Pressure Testing of Joints
 - 3.7.4.1 Segment Testing: Pre-Installation
 - 3.7.4.2 Test Failure
 - 3.7.4.3 Final Test
 - 3.7.4.4 Test Reporting
- 3.8 SURVEYING
 - 3.8.1 Introduction
 - 3.8.2 Survey Control
 - 3.8.3 Surveying Personnel
 - 3.8.4 Precision and Accuracy
 - 3.8.5 Lines and Grades
 - 3.8.6 Frequency and Spacing
 - 3.8.7 Tolerances
 - 3.8.8 Documentation

TABLE OF CONTENTS (cont'd)

3.9 DOCUMENTATION

3.9.1 Introduction

3.9.2 Daily Recordkeeping

3.9.2.1 Daily Summary Report

3.9.2.2 Construction Problem and Solution Report

3.9.2.3 Photographic Reporting Data Sheets

3.9.2.4 Design and/or Specification Changes and Clarifications

3.9.3 Reports

3.9.3.1 Final Record Documentation

TABLES

SAMPLE DOCUMENTATION FORMS

3.0 CONSTRUCTION QUALITY ASSURANCE PLAN

3.1 GENERAL

3.1.1 Introduction

The Construction Quality Assurance Manual for Solid Waste Containment Systems (CQA Manual) has been prepared for the Maysville C&D Landfill owned and operated by Green Recycling Solutions LLC in response to the requirements of the solid waste regulations and with reference to the following guidelines:

- USEPA Technical Guidance Document (TGD): Quality Assurance and Quality Control for Waste Containment Facilities (EPA/400-R-93/182, September 1993);
- USEPA Technical Guidance Document (TGD); Inspection Techniques for the Fabrication of Geomembrane Field Seams (EPA/530-SW-91-051, May 1991); and
- ASTM Standards and Other Specifications and Test Methods on the Quality Assurance of Landfill Liner Systems.

The CQA Manual also incorporates elements of the CQA manuals of the manufacturers and installers of containment system components as appropriate.

The purpose of the CQA Manual is to present the principles and practices of construction quality assurance required by NCDENR - Division of Waste Management, to be implemented during the construction of its waste disposal, surface impoundment, and other waste containment facilities. Quality management involves both quality assurance and quality control activities performed to verify that construction activities meet the permitted design plans and specifications.

For the purposes of the permit application, the CQA Manual is written in general terminology (i.e., using "Permitting Agency," "Owner," or "CQA Consultant" versus actual names of entities). During the construction process, the specific parties involved will review this CQA Manual and modify it as necessary for site-specific conditions. The modifications will be amended to this CQA Manual and will become the site-specific CQA Plan (Appendix 3A), referred to as "CQA Plan" throughout this CQA Manual.

3.1.2 Scope of the CQA Plan

The CQA Plan includes five primary elements:

- Responsibility and Authority;
- CQA Personnel Qualifications;
- Monitoring Activities;
- Sampling & Testing Strategies; and
- Documentation.

Activities and sampling strategies are presented for the individual component of the solid waste containment system as follows:

- Structural Fill, Compacted Soil Liner, and Drainage Materials;
- Geosynthetic Clay Liner;
- Geomembrane;
- Geocomposite;
- Geotextile
- Polyethylene Pipe and Fittings;
- Surveying; and
- Documentation.

This CQA Plan has been developed to work in conjunction with design/construction plans and specifications for the facility. In the case of conflict between this CQA Plan and standards set by the design/construction plans, and specifications, the design/construction plans shall take precedence over both specifications and the CQA Plan, and specifications shall take precedence over the CQA Plan.

3.1.3 Definitions and Use of Terms

The following provides general information regarding specific terms, references, and units as used in the CQA Manual.

3.1.3.1 Definitions Relating To CQA

In the context of this CQA Manual, Construction Quality Assurance and Construction Quality Control are defined as follows:

- Construction Quality Assurance (CQA)
CQA refers to measures taken by the Owner to determine if the Contractors are in compliance with the design plans, and specifications.
- Construction Quality Control (CQC)
CQC refers to measure taken by the contractor to determine compliance with the requirements for material and workmanship as stated the contract drawings and specifications.

3.1.3.2 References To Standard

The CQA Manual includes references to test procedures of the American Society for Testing and Materials (ASTM), the Federal Test Method Standards (FTMS), and the Geosynthetics Research Institute (GRI).

3.1.3.3 Units

Properties and dimensions given in the CQA Manual are expressed in U.S. units and may be followed by approximate equivalent values in SI units in parentheses. The values given in SI units are typically accurate within ten percent. In cases of conflict, the U.S. units shall govern.

3.1.4 Responsibility and Authority (15A NCAC 13B.0541(b)(1))

The principal parties involved in the CQA of the solid waste containment system include the Permitting Agency, the Owner, the Project Manager, the Regional Engineer, the Design Engineer, the CQA Consultant, the Soils CQA Laboratory, the Geosynthetics CQA Laboratory, the Earthwork Contractor, the Geosynthetics Manufacturer, and the Geosynthetics Installer. The general responsibilities and authorities of each of these parties is authority of a given party may be modified or expanded as dictated by specific project needs during Pre-Construction Meetings.

3.1.4.1 Permitting Agency

The Permitting Agency is authorized to issue the permit for construction of the waste containment facility based on review and acceptance of the permit application.

3.1.4.2 Owner

The Owner is responsible for coordinating the design and construction of the landfill containment system. The Regional Engineer and Project Manager are two representatives of the Owner responsible for coordinating the design and construction of the landfill facility.

3.1.4.2.1 Regional Engineer

The Regional Engineer is responsible for all correspondence with the Permitting Agency and manages the Design Engineer and the CQA Consultant. This responsibility includes compliance with the permit and the submission of CQA documentation demonstrating that the facility was constructed in accordance with the design specifications.

The Regional Engineer has the authority to select and dismiss parties charged with design and CQA. The Regional Engineer also has the authority to accept or reject design plans and specifications, CQA plans, and CQA reports.

3.1.4.2.2 Project Manager

The Project Manager is the official on-site representative of the Owner and is responsible for coordinating schedules, meetings, and field activities. This responsibility includes communications to the Owner, CQA Consultant, Surveyor, Contractors, Manufacturer, and other involved parties.

The Project Manager has the authority to select and dismiss parties charged with construction activities. The Project Manager also has the authority to direct contractors hired by the Owner and to accept or reject their material and workmanship.

3.1.4.3 Permit Engineer(s)

The Permit Engineer(s) is a firm or person, retained by the Owner, to prepare permit documents for acceptance by the Permitting Agency. The permit documents include forms, narratives, CQA Plan, design plans, and specifications, which support the siting and design of the landfill. The permit documents establish the limits, type, and details of the liner system and leachate management system and all other components of the site. The permit documents provide minimum specifications and are the governing document when a specification contradiction arises.

During construction, the Permit Engineer(s), the site's Project Manager, and The Regional Engineer must approve substantive changes to the design plans or specifications of the facility. Substantive changes include any changes, which modify or impact the technical basis for any engineered component of the facility design.

3.1.4.4 Design Engineer

The Design Engineer is a firm or person, retained by the Owner, to prepare permit and/or construction documents for acceptance by the Permitting Agency and necessary to construct the facility. The permit documents include forms, narratives, CQA Plan, design of the landfill. The permit documents establish the limits, type, and details for liner system and leachate management system and all other components for the site. The permit documents provide minimum specifications and are the governing document when a specification contradiction arises.

During construction, the Design Engineer may be requested to clarify discrepancies in the construction documents or CQA Plan if necessary, the Design Engineer may also approve substantive changes to the design plans or specifications for the facility. Substantive changes include any changes, which modify or impact the technical basis for any engineered component of the facility design.

3.1.4.5 CQA Consultant

The CQA Consultant is responsible for observing and documenting activities related to the permit documents and the CQA Plan. The CQA Consultant is represented by the

CQA Consultant's Engineer of Record and supporting on-site CQA monitoring personnel as appropriate.

In general, the responsibilities and authorities of the CQA Consultant include:

- A working understanding of the permit documents, design plans, and specifications in relation to all aspects for the CQA Plan;
- Scheduling, coordinating, and performing CQA activities;
- Performing independent on-site observation of the work in progress to assess compliance with the CQA Plan, permit documents, design plans, and technical specifications;
- Recognizing and reporting deviations from the CQA Plan, permit document, design plans, and/or specifications to the Regional Engineer and Project Manager;
- Secure documents which approve changes to the CQA Plan, permit documents, design plans, and/or specifications;
- Verifying that the CQA Consultant's test equipment meets testing and calibration requirements, and that tests are conducted according to standardized procedures defined in the CQA Plan;
- Recording and maintaining test data accurately;
- Identifying CQA tested work that should be accepted, rejected, or further evaluated;
- Verifying that corrective measures are implemented;
- Documenting and reporting CQA activities;
- Collecting data needed for record documentation as defined in Section 3.9; and
- Maintaining open lines of communications with other parties involved in the construction.

The CQA Consultant is also responsible for insuring documentation for major construction activities. Construction activities include the following:

- Subbase;
- Base liner System;
- Leachate Collection system;
- Final Cover System, and
- Erosion and sedimentation control structures.

Documentation shall bear the seal of a Professional Engineer registered in the state of North Carolina.

3.1.4.6 Soils CQA Laboratory

The Soils CQA laboratory is responsible for performing the laboratory testing required by the CQA Plan to determine specific characteristics of the soils and aggregates. The Soils CQA Laboratory is also responsible for providing adequate documentation of analytical

results, test methods followed, and testing equipment used. Work of the Soils CQA Laboratory will be administered by, and reported to, the CQA Consultant.

3.1.4.7 Geosynthetics CQA Laboratory

The Geosynthetics CQA Laboratory is responsible for performing the laboratory testing required by the CQA Plan to determine specific characteristics of the geosynthetics. The Geosynthetics CQA Laboratory is also responsible for providing adequate documentation of analytical results, test methods followed, and testing equipment used. Work of the Geosynthetics CQA Laboratory may be administered by the CQA Consultant. All results shall be reported to the CQA Consultant.

3.1.4.8 Earthwork Contractor

The Earthwork Contractor is responsible for moving earth to establish the liner grades, the preparation of the compacted soil liner, and granular drainage materials composing the soils components of the containment system. The Earthwork Contractor may also be responsible for construction of sedimentation and erosion control facilities, anchor trenches for liner installation, and other support activities outside the containment system site.

It is the responsibility of the Earthwork Contractor that the construction be performed using the procedures and equipment necessary to produce results in conformance with contract documents.

The Earthwork Contractor may also be responsible for the placement of Geotextile, Geosynthetic reinforcement, piping and electrical systems. In this capacity, the Earthwork Contractor is responsible for the quality of the materials and installation of the materials in conformance with the contract documents.

3.1.4.9 Geosynthetics Manufacturer

The Geosynthetics Manufacturer(s) is responsible for the production of geosynthetics, which meet the requirements of the contract documents. The Geosynthetics Manufacturer is also responsible for providing adequate documentation regarding the characteristics of the rein, the characteristics of the finished product, the testing performed to determine the characteristics, and the quality control measures taken during manufacturing.

The Geosynthetics Manufacturer(s) may be responsible for the safe transportation of the geosynthetics between the manufacturing plant and the site. The Geosynthetics Manufacturer is responsible for carefully loading and transporting geosynthetics and accepts full responsibility for damage to the geosynthetics, which may occur during these operations.

3.1.4.10 Geosynthetics Installer

The Geosynthetics Installer(s) is responsible for unloading, field handling, storing, placing, seaming, temporarily anchoring against wind, and other aspects of geosynthetics installation in accordance with the contract documents. The Geosynthetics Installer may also be responsible for the preparation and completion of anchor trenches.

Prior to installation, the Geosynthetics Installer is responsible for the preparation of the panel layout drawing identifying fabricated and field seams including dimensions and details. Prior to mobilization, the Geosynthetics Installer is responsible for providing the installation schedule and a list of proposed field personnel and their qualifications. The Geomembrane Installer is responsible for providing quality control documentation and subgrade acceptance certificates. Upon completion of the installation, the Geosynthetics Installer shall provide the geomembrane installation certification, the Manufacturer's warranty and the installation warranty.

3.1.5 Project Meetings (15A NCAC 13B .0541 (b)(5))

To achieve a high degree of quality during installation, clear, open channels of communication are essential. The following meeting should be held when appropriate.

3.1.5.1 Pre-Construction

Following the completion of the contract documents and selection of a CQA Consultant for the project, a Pre-Construction Meeting may be held. At a minimum, the meetings shall be attended by the Regional Engineer, the Project Manager, the CQA Consultant's Engineer of Record, the CQA Consultant's monitoring personnel, the Earthwork Contractor, the Geosynthetics Installer, the Design Engineer, and other involved parties.

The purpose for this meeting is to begin planning for coordination of tasks, anticipate problems which might cause difficulties and delays in construction, and, above all, present the CQA Plan to the parties involved. It is very important that the rules regarding testing, repair, etc., be known and accepted.

The meeting shall include the following activities:

- Distribute relevant documents;
- Discuss Construction Scheduling;
- Review critical design details of the project;
- Review the CQA Manual;
- Make appropriate modifications to the CQA Manual to include CQA activities that are necessary;
- Reach a consensus on the site-specific CQA Plan and quality control procedures, especially on methods for determining acceptability of the soils and geosynthetics comprising the containment system and/or final cover system;

- Select testing equipment and review protocols for testing and placement of soil materials;
- Confirm the methods for documenting and reporting, and for distributing documents and reports; and
- Confirm the lines of authority and communication.

Two Pre-Construction Meetings may be held, one prior to earthwork construction, and one prior to geosynthetic placement. Regardless, all meetings must be documented by the CQA Consultant, and minutes will be transmitted within one (1) week to all parties involved.

3.1.5.2 Weekly Progress Meetings

A weekly progress meeting shall be held between the CQA Consultant, the Geosynthetic Installer, the Earthwork Contractor, the Project Manager, and other involved parties. Those attending will discuss, plan, coordinate the work, and CQA activities to be completed that week. More frequent meetings may be held if necessary to address construction issues. The meeting will be documented by the CQA Consultant and minutes will be transmitted to all involved parties within one (1) week.

3.1.5.3 Problem Or Work Deficiency Meetings

A special meeting shall be held when and if a problem or deficiency, which would impact the construction schedule, is present or likely to occur and cannot wait to be addressed during regular weekly meetings. At a minimum, the meeting shall be attended by the affected Contractor, the Project Manager, and the CQA Consultant. The purpose of the meeting is to define and resolve the problem or work deficiency as follows:

- Define and discuss the problem or deficiency;
- Review alternative solutions; and
- Implement an action plan to resolve the problem or deficiency.

The meeting shall be documented by the CQA Consultant and minutes shall be transmitted within one (1) week to all involved parties.

3.1.6 Qualifications of Key Personnel and Organizations

The following Qualifications shall be required of the key personnel and organizations involved in the construction of Solid Waste Containment Systems:

3.1.6.1 CQA Consultant

The CQA Consultant shall be pre-qualified and approved by the Owner. The CQA Consultant shall be a qualified engineering firm with experience in construction quality assurance and quality control, particularly on projects involving similar containment systems. The CQA Consultant shall designate an Engineer of Record who is a Professional Engineer registered in the state of North Carolina. The Engineer of Record shall be solely responsible for the CQA personnel and their activities, as well as the preparation of a documentation report to document the project has been constructed in general accordance with the CQA Plan, permit documents, permit, design plans, and specifications. The CQA Consultant shall be capable of assigning technically qualified personnel to the project, including on-site CQA Monitors, as needed. The person designated as the Engineer of Record shall possess a thorough knowledge of all aspects of earthwork and geosynthetic construction.

CQA Monitors shall be specifically trained in quality assurance of geosynthetics, and earthwork. At a minimum, one CQA monitor shall be on-site having a minimum of two years experience and have worked on at least four projects of five acres or greater.

3.1.6.2 Soils And Geosynthetics CQA Laboratories

The Soils CQA laboratory shall be pre-qualified by the Owner. The Soils and Geosynthetics CQA Laboratories shall be experienced in performing laboratory tests to determine characteristics as required by this CQA Plan. The Soils and Geosynthetics Laboratories shall demonstrate that it follows the standard test methods listed in the CQA Plan and maintains the appropriately calibrated equipment to perform the tests. The Soils and Geosynthetics Laboratories shall also demonstrate to the CQA Consultant and Regional Engineer that it adheres to a formal in house quality control program and can provide the required analytical documentation and reports.

3.1.6.3 Earthwork Contractor

The Earthwork Contractor shall be pre-qualified and approved by the Owner. The Earthwork Contractor shall be capable of assigning the personnel and equipment required to perform the work within the schedule.

3.1.6.4 Geosynthetics Manufacturer

The Geosynthetics Manufacturer(s) shall be able to provide sufficient production capacity and experience to meet the demands of the project. In particular, the Geosynthetics Manufacturer shall be pre-qualified and approved by the Owner. The Manufacturers of geosynthetics shall provide, upon request of owner, sufficient documentation of production capacity and experience to the satisfaction of the Owner.

3.1.6.5 Geosynthetics Installer

The Geosynthetic Installer(s) shall be trained and qualified to install geosynthetics. Prior to confirmation of contractual agreements, the Geomembrane Installer shall provide the Project Manager with a list of proposed seaming personnel and their professional records. This certificate shall be reviewed by the Project Manager and the CQA Consultant. Proposed seaming personnel deemed insufficiently experienced shall not be accepted by the Project Manager or shall be required to pass a seaming test.

The Geosynthetic Installer shall designate one representative as the Installation Supervisor, who will represent the Installer on-site and at site meetings. The Installation Supervisor shall be qualified by experience. The Installation Supervisor must have supervised the installation of a minimum of 2 million square feet of geomembrane. The Installation Supervisor shall be approved by the Project Manager.

In addition, the Geosynthetic Installer shall designate a Master Seamer, who shall not be the Installation Supervisor. The Master Seamer shall be present during all seaming operations and shall have a minimum of 5 million square feet of field seaming experience, and shall be thoroughly experienced with extrusion welding, fusion welding, and welding in both hot and cold weather.

3.2 STRUCTURAL FILL, COMPACTED SOIL LINER, AND DRAINAGE MATERIALS

3.2.1 Introduction

Section II of the CQA Manual addresses the CQA activities associated with components of the solid waste containment system, which is to be constructed of soil or aggregate. These components may include:

- Subgrade
- Structural Fill
- Compacted Soil Liner
- Soil layers
 - Protective Cover
 - Drainage Sand
- Coarse Aggregates

The soil and aggregate components of the containment system shall meet requirements related to material characteristics and construction quality. Both field and laboratory tests shall be performed prior to construction to evaluate if the characteristics of soil and aggregate from proposed sources meet the material acceptance requirements of the permit and design specifications. Throughout construction, additional field and laboratory testing shall be performed to evaluate if the placed material meets the requirements of the permit and construction documents with regard to material acceptance and construction quality.

3.2.2 Test Methods and Sampling Requirements (15A NCAC 13B .0541 (b)(3))

Tables 3.2-1A and 3.2-1B (Tables) present the laboratory and field test methods, which shall be used to determine material characteristics and evaluate construction quality for the soil and aggregate components of the containment system. The tests shall be conducted in accordance with the current versions of the corresponding standard methods given.

Table 3.2-2 (Tables) provides information regarding the minimum test frequencies. The table also includes the locations at which samples shall be collected, the sample size, and the acceptance criteria.

Four types of sampling location strategies shall be used for the various soil and aggregate components:

- As required by the CQA Consultant to evaluate material characteristics prior to the use of the material in construction. These samples may come from the source of a material such as a production plant or from a test pit in natural material.
- For specific bulk volumes of material in stockpiles (e.g., 1 sample per 5,000 cy). These samples are usually taken on material, which has been processed or segregated for a particular purpose.
- For materials placed over long linear extent (such as roads and embankments), use stationing, offsets, and approximate elevation. Stationing should be designated as 1+00, 2+00, etc. and offsets should be designated as left or right of the stationing line based on view toward increased stations.
- Once per 10,000 square feet means that the project area will be split into 10,000 square foot sections with one sample being taken from an appropriate point within the section, selected by the CQA Consultant.

3.2.3 Subgrade

Subgrade refers to a surface, which is exposed after stripping topsoil or excavating to establish liner or filling to structural fill grades. Generally, Compacted Soil Liner is placed on Subgrade.

The prepared subgrade should conform to the contours shown on the grading plan, as verified by the Surveyor. Vegetation shall be stripped in accordance with the design specifications and the surface proofrolled. Potentially deleterious materials such as organics or soft materials shall be removed and the resulting voids filled with acceptable material, appropriately compacted.

Refer to Table 3.2-2 for the specific test methods to be used, a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for the structural fill. After proofrolling and/or other suitable techniques, visual examination of the subgrade preparation by the CQA Consultant should be sufficient to

evaluate its suitability as a foundation for the compacted low permeability soil. If necessary, structural fill will be used to establish subgrade elevations for the containment system and berms. Use of structural fill will require the following field-testing to be performed:

- Determination of moisture/density relationship for the subgrade and/or fill material through laboratory testing; and
- Evaluation of compaction of prepared subgrade and/or fill through field density testing.

The subgrade should be accepted by the CQA Consultant if it does not pump or rut excessively. If excessive pumping or rutting occurs, the area should be reworked or removed by undercutting to more suitable material.

The surface of the finished subgrade will be surveyed in accordance with Section 3.7 for record documentation prior to placement of the compacted soil liner.

3.2.4 Structural Fill

Structural fill will be used in several locations to establish design elevations for the containment system, construct berms, roads, sedimentation basins, and fill pads for structures, etc. Structural fill shall meet the requirements presented in Table 3.2-2.

Structural fill will be placed in 8-inch to 12-inch loose horizontal lifts unless otherwise approved by Design Engineer.

Refer to Table 3.2-2 for the specific test methods to be used, a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for the structural fill.

The completed surface shall be smooth, firm, and free of loose debris. Any damaged areas of the compacted fill shall be excavated and repaired at no additional cost to the owner. Areas where pumping or rutting occurs shall be reworked or removed by undercutting to obtain a more suitable material.

The soil liner subgrade shall be proofrolled by the Contractor and examined by the CQA Consultant to detect unstable or loose soils. Proofrolling shall be accomplished with six (6) passes (minimum) of a self-propelled drum or tamping foot roller with a static weight of the drum of at least 15,000 pounds unless otherwise approved by the CQA Consultant.

Upon completion of the design grades, the Earthwork Contractor shall survey the surface to verify that the layer has been constructed to the design lines, grades, and thickness indicated on the Contract Drawings. Survey Tolerances can be found in Section 3.8 of the CQA Plan.

Where appropriate, the CQA Consultant shall prepare a documentation report for the prepared structural fill based on a review of the CQC information and CQA monitoring

performed during installation of the structural fill.

3.2.5 Compacted Soil Liner

Compacted Soil Liner refers to the soil material placed directly beneath the geosynthetic liner system. Compacted Soil Liner is placed on proof-rolled subgrade or compacted structural fill. Compacted soil material shall consist of relatively homogenous, clayey, and silty soils, which are substantially free of debris, rock, plant materials, frozen materials, foreign objects, and organics. If an approved borrow source is not identified in the permit or permit application, the Earthwork Contractor shall identify a borrow area (preferably on-site) for the compacted low permeability soil. The CQA Consultant shall obtain samples from within the identified borrow area and subject the soils to the testing indicated in Table 3.2-2.

Based on the results of these laboratory tests, material, which meets the requirements of compacted low permeability soil liner, shall be identified. As listed in Table 3.2-2, permeability testing is required. The soil shall be subjected to laboratory permeability tests on samples compacted in the laboratory to a variety of moisture/density values. A band of moisture/density values, which results in the required permeability, should be delineated based on the laboratory testing data. This band will then be used as the acceptable range of moisture/density values for field compaction control.

A test pad shall be constructed prior to beginning installation of the compacted soil liner and wherever there is a significant change in soil material properties. The area, thickness, slope and equipment used for the test pad should be representative of full-scale construction. For each lift, a minimum of 3 test locations shall be established for testing moisture content and density. One composite sample shall be collected per lift for lab testing as indicated in Table 3.2-2, which includes recompacted lab permeability testing. One undisturbed sample shall be taken from each lift for lab permeability testing. The undisturbed samples should, to the extent practical, represent the “acceptable” range of moisture contents and densities predicted by pre-construction laboratory data.

The data from the test pad shall be used to verify and modify the allowable range of moisture/density values for construction.

Compacted soil liner material shall spread and compacted in lifts not exceeding 6 inches (compacted thickness). The lift depth shall be verified by a manual method. Soil clods shall be broken down, and moisture conditioning shall be conducted to preserve the homogeneity of the soil and to obtain a relatively uniform moisture content through the soil mass. The moisture content of the compacted soil liner shall be field tested during processing, placement, and compaction. The action of heavy equipment on the compacted soil liner shall be observed for penetration, pumping, and cracking. The number of passes used to compact each lift shall be observed and documented. The surface of each preceding lift shall be scarified prior to placement of overlying lifts.

Compaction of lifts shall be performed with an appropriately heavy, properly ballasted, vibratory compactor subject to approval from the Owner and/or CQA Consultant. A minimum of 6 passes will be required on each area of each lift to remold the soil liner regardless of whether the lift meets compaction specifications.

If desiccation and crusting of the lift surface occurs before placement of the next lift, this area will be sprinkled with water and then scarified and tested for water content to ensure uniform moisture before placement of a subsequent lift.

Equipment or truck traffic shall not be permitted on the surface during the period between scarifying and placement of the following lift.

At the beginning of each days work, the previously placed compacted soil liner shall be observed by the CQA Consultant and the Earthwork Contractor. The Owner, Engineer, and/or CQA Consultant may specify recompaction of the top surface of soil as necessary in the judgment of the CQA Consultant, to obtain the compaction criteria and provide a suitable surface for the next lift. This work will be performed at no additional cost to the Owner.

No compacted soil liner shall be placed over a lift, which has not been tested and approved by the CQA Consultant. Should the field tests indicate that the density of any layer of compacted soil liner, or portion thereof, is below the required density, the particular layer, or portion thereof, shall be reworked at no additional cost to the Owner.

No compacted soil liner material shall be placed, spread, or compacted during unfavorable weather conditions or during periods of heavy precipitation.

Any penetrations made in the compacted soil liner shall be backfilled with bentonite or as approved by NC DENR.

The compacted soil liner surface shall be made smooth and free from ruts or indentations at the end of every working day when precipitation is forecast and/or at the completion of the compaction operations in that area.

The finished surface of the compacted soil liner shall be firm, uniform, and smooth. Upon completion of the design grades, the Earthwork Contractor shall survey the surface to verify that the layer has been constructed to the design lines, grades, and thickness indicated on the Contract Drawings. Survey Tolerances can be found in Section 3.7 of the CQA Plan. Surveying shall be performed to verify that the finished compacted soil liner dimensions are as specified in the design and to prepare as-built documentation.

Refer to Table 3.2-2 for the specific test methods to be used, a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for the compacted soil liner. Perforations in the compacted soil liner created by nuclear density probes, stakes, or any other methods shall be filled with bentonite or as approved by NC DENR.

The CQA Consultant shall prepare a Documentation Report for the constructed Compacted Soil Liner based on a review of CQC information and CQA monitoring performed during installation of the Compacted Soil Liner.

3.2.6 Protective Cover

The protective cover layer shall be a 24-inch layer composed of soil/aggregate meeting the gradation and permeability for this material as required in Table 3.2-2. The soil shall be substantially free of organics, frozen material, foreign objects, or other deleterious materials.

Refer to Table 3.2-2 for the specific test methods to be used, a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for the protective cover.

Protective cover shall be placed in one 24-inch lift and in such a manner so as not to damage the underlying geosynthetic liner materials. Low ground-pressure equipment shall be used to place the material. The equipment shall be operated on a minimum lift thickness of 24 inches.

A ramp will be constructed on the liner in advance of any non-low ground pressure equipment, which will be utilized to haul or place protective cover. This ramp will be no less than 36 inches in height and will also be constructed of protective cover.

Surveying shall be performed to verify that finished protective cover dimensions/thicknesses are as specified in the design. Upon completion of the design grades, the Earthwork Contractor shall survey the surface to verify that the layer has been constructed to the design lines, grades, and thickness indicated on the Contract Drawings. Survey Tolerances can be found in Section 3.8 of the CQA Plan.

The CQA Consultant shall prepare a Documentation Report for the Protective Cover layer based on a review of the CQC information and CQA monitoring performed during installation of the material.

The finished surface of the protective cover layer will be surveyed in accordance with Section 3.9 for record documentation.

3.2.7 Drainage Sand – not used intentionally

3.2.8 Coarse Aggregate

Coarse aggregate shall be placed around pipes, and in the leachate collection sump.

The coarse aggregate to be placed around pipes shall be composed of aggregate meeting the gradation and general requirements for material as presented in Table 3.2-2. The aggregate shall be substantially free of organics, frozen material, foreign objects, or other

deleterious materials.

Refer to Table 3.2-2 for the specific test methods to be used, a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for the drainage material.

3.2.9 Potential Problems and Deficiencies

During construction, the frequency of testing may be increased at the discretion of CQA Consultant or the Owner when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when:

- The roller slips during compaction operations;
- Dirt-clogged rollers are used to compact the material;
- The roller may not have used optimum ballast;
- Equipment break downs during placement;
- Excessive pumping or cracking of material occurs;
- Adverse weather conditions;
- Work conducted in difficult areas; or
- High frequency of failing tests.

If a defect is discovered in the earthwork product, the CQA Consultant shall immediately determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Consultant shall determine the extent of the deficient area by additional tests, observations, a review of records, or other appropriate means. All deficiencies shall be corrected by the Earthwork Contractor to the satisfaction of the CQA Consultant and the Owner.

3.2.9.1 Notification

The CQA Consultant shall notify the Earthwork Contractor immediately upon discovering the defect. After determining the extent and nature of the defect, the CQA Consultant shall notify the Project Manager as necessary.

3.2.9.2 Repairs and Retesting

The Earthwork Contractor shall correct the deficiency to the satisfaction of the CQA Consultant and Owner. If a design specification criterion cannot be met, or unusual weather conditions hinder work, then the CQA Consultant shall develop and present to the Owner suggested solutions for approval.

The CQA Consultant shall schedule appropriate retests after the work deficiency has been corrected. Retests recommended by the CQA Consultant must verify that the defect has been corrected before any additional work is performed by the Earthwork Contractor in the area of the deficiency.

3.3 GEOSYNTHETIC CLAY LINER (Not Used)

3.3.1 General

Geosynthetic clay liner (GCL) shall meet material acceptance and construction quality requirements as stated in this Section of the CQA Plan and in the design specifications.

3.3.2 Materials

3.3.2.1 Storage and Handling

GCL materials shall be stored, handled, and installed in strict accordance with the manufacturer's recommendation. At a minimum, the Owner shall provide a dry storage area on firm level ground. The Geosynthetics Installer shall cover all rolls with additional plastic tarps.

3.3.2.2 Quality Control Testing

Quality control testing shall be conducted by the manufacturer and the results submitted to the CQA Consultant to demonstrate that the GCL meets the certification requirements as contained in the CQA Plan. The Manufacturer's quality control manager shall sign quality control certificates. Each certificate shall have Manufacturer's name, product identification, lot number, length, width roll identification number, sampling procedures, frequency and test results. At a minimum the following test results shall be provided in accordance with test requirements specified in Table 3.3-1.

- Bentonite Content
- GCL Peel Strength
- Swell Index
- Fluid Loss
- Permeability

3.3.2.3 Conformance Testing

The GCL shall be manufactured by Colloid Environmental Technologies Company (Bentomat ST) or Engineer approved equal, and shall meet the minimum average roll value conformance testing specifications contained in Table 3.3-2.

If a conformance test is found to be failing the following procedures shall be used to determine the acceptance of the material:

- If all the test values for a sample meet all of the values given in the conformance testing requirements in Table 3.3-2, and also the Manufacturer's guaranteed minimum values, the sample passes.
- If any of the test values for the sample do not meet one or more of the required conformance testing values, additional evaluation procedures will be implemented by the CQA Consultant:
 - For the failing test parameter(s), the CQA Geosynthetic Laboratory shall perform two additional tests on the sample. The tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Owner.
 - If all of the test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
 - If one or more of the additional test values do not meet requirements, the CQA Consultant shall reject the roll and collect samples from the closest numerical roll on both sides of the failed roll and test for the failed parameter(s). If one or both of these tests do not meet requirements, those roll(s) will be rejected and the CQA Consultant and Owner shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

The CQA Consultant will ensure that conformance samples are removed at the specified frequency and forwarded to the CQA Consultant's Laboratory. The CQA Consultant will review laboratory test results as soon as they become available, and make appropriate recommendations to the Owner. All conformance test results shall meet, or exceed, the property values listed in Table 3.3-2. In the case of failing test results, the Manufacturer may request that an independent laboratory retest another sample with the Manufacturer's technical representative present during testing procedures. The Manufacturer shall pay for this retesting. The Manufacturer may also have the sample retested at two different laboratories approved by the Owner. If both laboratories report passing results, the material shall be accepted. If both laboratories do not report passing results, all liner material from the lot representing the failing sample will be considered out of specification and rejected.

The Geosynthetics Installer shall, prior to delivery of materials, submit to the Owner and CQA Consultant certifications from the GCL manufacturer that the delivered GCL will meet the minimum specifications listed in this Technical Specification and the CQA Plan.

3.3.3 Installation Methods

3.3.3.1 Storage and Handling

Materials shall be transported, stored, and handled so as to prevent damage of the liner rolls. The GCL materials shall be stored so as to be protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, and excessive heat. GCL Liner rolls shall not be moved from this structure until the day they are to be installed.

Storage of GCL in the open environment shall be avoided. The storage of GCL Liner shall be sufficiently close to the work area to minimize handling. Spreader bars, stingers, roller cradles, or straps shall be used to handle and place the GCL Liner.

Protective plastic wrapping shall not be removed until just prior to deployment.

The GCL shall not be permitted to become hydrated (wet) at any time before, during or after its installation, prior to placement of the primary geomembrane (including seaming of geomembrane). Geosynthetics Installer shall limit deployment of GCL to areas that may subsequently be covered by the primary geomembrane including seaming of all panels during the same day. Any GCL that is damaged due to rain or any other conditions shall be removed and replaced by the Geosynthetics Installer at no additional cost to the Owner provided the damage was the direct fault of the Geosynthetics Installer. The Owner or CQA Consultant will make determination of the need for removal and replacement.

3.3.3.2 Prepared Subbase Preparation

Preparation of the prepared subbase surface shall be as specified in Section 3.2.4, of the CQA manual.

The surface of the prepared subbase shall be smooth, uniform, and free from sudden changes in grade (such as vehicular ruts), rocks, stones, debris, ice, standing water, and deleterious materials. The moisture content of the prepared subbase must be maintained within the project specifications until the synthetic liner has been installed. If excessive drying occurs, the contractor shall rehydrate and compact the affected area to the Engineer's satisfaction.

During actual placing of the GCL, the prepared subbase surface shall be kept free of all standing water. If the prepared subbase surface below the GCL liner becomes wet and unstable, it shall be dried and recompact to the Engineer's satisfaction. If drying and

recompacting the material is insufficient, the unstable material must be removed and replaced with approved material.

Before the liner installation begins, the Contractor and installer shall verify in writing and submit to the CQA Consultant that the lines and grades are in relative conformance with the Contract Drawings and Specifications and that the surface area to be lined has been rolled and compacted, free of irregularities, abrupt changes in grade and meets the requirements of Section 3.7 of the CQA manual.

Any synthetic liner system materials damaged during the repair work shall be replaced with new material. All costs associated with such actions will be paid for entirely by the Contractor including, but not limited to, labor, additional liner system material, testing, labor and material costs incurred by the Engineer to perform additional inspection services.

3.3.3.3 Anchor Trench

The anchor trench shall be constructed as shown on the Contract Drawings and as specified herein. Slightly rounded corners shall be provided in the trench to avoid sharp bends in the liner.

The anchor trench shall be adequately drained to prevent water ponding and softening of adjacent soils. Backfilling of anchor trenches shall be performed in accordance with the Technical Specifications and Section 3.4.2.5 of the CQA Manual.

If the anchor trench is located in clay susceptible to desiccation, the amount of trench open at any time shall be limited to one day of liner installation capacity.

3.3.3.4 Placement of GCL Liner

GCL shall not be installed when working conditions exceed temperatures of 104° Fahrenheit (F) or are less than 40°F. GCL liner placement shall not be performed during precipitation, excessive moisture, in an area of ponded water, or excessive winds. The Geosynthetics Installer shall limit the deployment of GCL to areas that may subsequently be covered by the primary HDPE geomembrane, including seaming of all HDPE panels during the same day.

GCL shall be installed such that all seams of the material are laid perpendicular to contours of constant elevation. Exceptions to this can be approved by the Owner or CQA Consultant only.

The GCL shall be oriented per the manufacturer's directions. The CQA Consultant shall verify that every GCL panel is installed with this orientation.

For GCL liner placed on 4 to 1 or steeper slopes, the overlap seams shall be oriented in the direction of the slope. Horizontal seams on 4 to 1 slopes or steeper shall not be allowed except for cases in which it is unavoidable. The Engineer prior to or during the Geosynthetics pre-construction meeting shall approve horizontal overlapping seaming methods on 4 to 1 slopes or steeper.

The equipment used to deploy the liner shall not cause rutting of the prepared subbase surface. If rutting occurs, the Liner Contractor shall suspend all liner placement activities and repair the ruts and immediately employ an alternative method for liner deployment. GCL liner rolls shall be placed using spreader and rolling bars with cloth slings. If a sheet must be relocated a distance greater than its width, a slip-sheet shall be used.

The CQA Consultant shall inspect each panel after placement for damage and/or defects. Defective or damaged panels shall be replaced or repaired, as approved by the CQA Consultant.

GCL shall be adjusted to smooth out creases or irregularities, but shall not be pulled enough to induce tension or stress.

The Geosynthetics Installer shall not drag the GCL liner panels over the compacted soil liner.

All GCL seams shall have an overlap of 6 inches minimum along longitudinal seams and 24 inches minimum on the panel end seams.

Care shall be taken to minimize the loss of bentonite into underlying liner materials. Loose bentonite that is present on underlying materials shall be either swept or vacuumed off of the underlying material.

Vehicular traffic across the GCL liner shall not be allowed. When tying into existing liner, all excavation of previously installed liner shall be performed by hand to prevent damage.

3.3.3.5 GCL Seaming Requirements

Individual panels of liner shall be laid out and overlapped by a minimum of 12-inches along longitudinal seams and 12 inches minimum on the panel end seams. GCL shall be adjusted to smooth out creases or irregularities, but shall not be pulled enough to induce tension or stress.

GCL seams shall consist of a simple overlap and shall not be permitted to be "stapled or pinned." All dirt, soil, and other debris shall be removed from the overlap. Panels should be shingled in a down gradient direction. A loose layer of sodium bentonite shall be spread along each overlap at a rate consistent with manufacturer's recommendations.

Damaged areas shall be repaired by removing the damaged area and placing a new piece of GCL underneath the damaged area. This new piece shall extend a minimum of 12 inches beyond the damaged area in all dimensions.

3.3.3.6 Repairs

Prior to cover material placement, damage to the GCL shall be identified and repaired by the installer. Damage is defined as any rips or tears in the geotextiles, delamination of geotextiles or a displaced panel.

- Rip and Tear Repair (Flat Surfaces) – Rips or tears may be repaired by completely exposing the affected area, removing all foreign objects or soil, and by then placing a patch cut from unused GCL over the damage (damaged material may be left in place), with a minimum overlap of 12 inches on all edges. Accessory bentonite should be placed between the patch edges and the repaired material at a rate of a quarter pound per lineal foot of edge spread in a continuous six-inch fillet.
- Rip and Tear Repair (Slopes) – Damaged GCL material on slopes shall be repaired by the same procedures above, however, the edges of the patch should also be adhered to the repaired liner with an adhesive to keep the patch in position during backfill or cover operations.
- Displaced Panels – Displaced panels shall be adjusted to the correct position and orientation. The adjusted panel shall then be inspected for any geotextile damage or bentonite loss. Damage shall be repaired by the above procedure.
- Premature Hydration – If the GCL is prematurely hydrated, the Geosynthetics Installer shall notify the QA/QC technician and Project Engineer for a site-specific determination as to whether the material is acceptable or if alternative measures must be taken to ensure the quality of the design – dependent upon the degree of damage.

Care shall be taken to minimize the loss of bentonite into underlying liner materials. Loose bentonite that is present on underlying materials shall be either swept or vacuumed off of the underlying material.

3.3.3.7 Overlying Geosynthetics

Precautions shall be taken to prevent damage to the GCL by restricting the use of heavy equipment over the liner system.

Installation of the overlying geosynthetic component can be accomplished through the use of lightweight, rubber-tired equipment such as a 4-wheel all-terrain vehicle

(ATV). This vehicle can be driven directly on the GCL, provided the ATV makes no sudden stops, starts, or turns.

A slip-sheet (such as 20-mil smooth HDPE) may be used to facilitate placement of the textured geomembrane. The slip-sheet shall first be placed over the GCL in order to allow the geomembrane to slide into its proper position. Once the overlying geomembrane is properly positioned, the slip-sheet shall be carefully removed paying close attention to avoiding any movement to the geomembrane.

3.4 GEOMEMBRANE

3.4.1 Manufacture, Shipment and Storage

The following addresses the activities associated with the manufacture of the geomembrane; the shipment, handling, and delivery of geomembrane to the site; conformance testing of delivered geomembrane; and the storage of the geomembrane prior to installation.

3.4.1.1 Manufacture Of Polyethylene Geomembrane

The Geosynthetics Manufacturer shall provide documentation that the material meets the requirements of the design specifications, as listed in Table 3.4-1 [High Density Polyethylene (HDPE)] and Table 3.4-4 [Liner Low Density Polyethylene (LLDPE)] (Tables), and that adequate quality control measures have been implemented during the manufacturing process.

3.4.1.1.1 Resin Quality

The raw material shall be first quality polyethylene resin contain no more than 2 percent clean “reground”, “reworked”, or “trim” material by weight, and meeting the specification, outlined in Table 3.4-1 (HDPE) and Table 3.4-4 (LLDPE).

Prior to the shipment of polyethylene geomembrane material, the Geosynthetics Manufacturer shall provide the Project Manager and the CQA Consultant with the following information:

- The origin (Resin Supplier's name and resin production plant), identification (brand name number), and production date of the resin;
- A copy of the quality control certificates issued by the Resin Supplier;
- Reports on the tests conducted by the Manufacturer to verify the quality of the resin used to manufacture the geomembrane rolls and extrudate rods meet the requirements indicated above; and
- A statement that no reclaimed polymer is added to the resin (however, the use of polymer recycled during the manufacturing

process may be permitted if done with appropriate cleanliness and if recycled polymer does not exceed 2 percent by weight).

At the Owner's discretion and cost, testing may be carried out on the resin by the Geosynthetics CQA Laboratory for purposes of verifying conformance. If the results of the manufacturer and the Geosynthetics CQA Laboratory testing differs, the testing will be repeated by the Geosynthetics CQA Laboratory, and the Geosynthetics Manufacturer will be permitted to monitor this testing. The results of this letter series of tests will prevail, provided that the applicable test methods have been followed.

3.4.1.1.2 Certification of Property Values

In addition to information regarding the raw material, the Geosynthetics Manufacturer shall provide the Project Manager and the CQA Consultant with the following prior to shipment of the geomembrane:

- A properties sheet certification including, at a minimum, guaranteed values for all specified properties presented in Table 3.4-1 (HDPE) and Table 3.4-4 (LLDPE).
- A list of quantities and descriptions for materials other than the base polymer, which comprise the geomembrane.

The CQA Consultant shall verify that the property values certified by the Geosynthetics Manufacturer meet the test methods and values shown on Table 3.4-1 (HDPE) and Table 3.4-4 (LLDPE).

3.4.1.1.3 Quality Control Certificates

Prior to shipment, the Geosynthetics Manufacturer shall provide the Project Manager and the CQA Consultant with quality control certificates for the geomembrane to be shipped to the site. The quality control certificate will be signed by a responsible party employed by the Geosynthetics Manufacturer. The quality control certificate will include:

- Roll numbers and identification; and
- Sampling procedures and results of quality control tests.

The Geosynthetics Manufacturer shall be required to perform, at a minimum, the tests at the minimum frequencies presented in Table 3.4-1 (HDPE) and Table 3.4-4 (LLDPE).

The CQA Consultant shall:

- Verify that the quality control certificates have been provided at the frequency specified in Table 3.4-1 (HDPE) and Table 3.4-4 (LLDPE) for all rolls; and
- Review the quality control certificates and verify that the test methods and values meet the requirements presented in Table 3.4-1 (HDPE) and Table 3.4-4 (LLDPE)

3.4.1.2 Shipment And Handling

Shipment of the geomembrane to the site is the responsibility of the Owner, Geosynthetics Manufacturer, or Geosynthetics Installer depending on the contract documents. Handling of geomembrane on-site is the responsibility of the Geosynthetics Installer.

The CQA Consultant shall confirm that:

- Handling equipment used on-site poses minimal risk of damage to the geomembrane; and
- The personnel handle the geomembranes with care.

Upon delivery at the site, the Geosynthetics Installer and the CQA Consultant shall confirm that roll identification corresponds to quality control certificates, and shall conduct a visual examination of the exposed outer surface of each roll for defects, damage, and labeling. This examination shall be conducted without unrolling rolls unless defects or damages are found or suspected. All roll identifying labels shall be weatherproof. The CQA Consultant will indicate to the Project Manager:

- Rolls, or portions thereof, that should be rejected and removed from the site because they have severe flaws;
- Rolls that have minor repairable flaws; and
- Rolls without proper identification.

The Project Manager shall reject rolls without proper identification.

3.4.1.3 Conformance Testing Of Geomembrane

Upon, or prior to, delivery of the rolls of geomembrane, the CQA Consultant shall verify that samples are removed and forwarded to the Geosynthetics CQA Laboratory for

testing to verify conformance with the test methods, values, and frequencies presented in Table 3.4-2 (HDPE) and Table 3.4-5 (LLDPE).

3.4.1.3.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at a minimum frequency as specified in Table 3.4-2 (HDPE) and Table 3.4-5 (LLDPE). If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted to assure that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample.

Samples will be taken across the entire width of the roll and will not include the first 3 lineal feet. Unless otherwise specified, samples will be 3 feet long by the roll width. The CQA Consultant will mark the machine direction on the samples with an arrow. Conformance testing shall be conducted in accordance with Table 3.4-2 (HDPE) and Table 3.4-5 (LLDPE).

3.4.1.3.2 Test Results

The results of the conformance testing shall be evaluated in accordance to the following procedure:

- If the average test values for the sample meet the requirement presented in Table 3.4-2 (HDPE) and Table 3.4-5 (LLDPE), and the Manufacturer's guaranteed minimum values, the sample passes.
- If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Additional tests required for further evaluation shall be at no expense to the Owner.
- For the failing parameter(s), perform one additional test on the sample. This test may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Project Manager.
- If the test values for the additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
- If the test value does not meet requirements, reject the roll, collect samples from the closest numerical roll on both sides of the failed roll and test for the failed parameter(s). If one or both of these tests do not meet requirements, those roll(s) will be

rejected and the CQA Consultant and Project Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

3.4.1.4 Storage

The Geosynthetics Installer shall be responsible for the storage of the geomembrane on site unless otherwise specified. Storage space should protect the geomembrane from theft, vandalism, passage of vehicles, damage from the supporting subgrade, water, and weather. The geomembrane shall be stored on sandy subgrade free of rocks and sharp objects. The maximum stacking height for rolls shall be four rolls high.

The CQA Consultant shall observe that storage of the geomembrane provides adequate protection against dirt, shock, and other sources of damage.

3.4.2 Geomembrane Installation

3.4.2.1.1 Earthwork

Installation of Geomembrane involves three primary tasks; earthwork, placement of geomembrane panels, and seaming the field panels. The installation of the geomembrane and anchoring it in place is crucial to the performance of the geomembrane. The CQA Consultant shall monitor Geomembrane Installation activities.

The CQA Consultant shall document that:

- A qualified Land Surveyor has verified lines and grades; and
- The requirements of Section 3.2 of the CQA Plan are satisfied.
- The compacted soil liner on which the overlying geosynthetic liner system is to be placed shall have been compacted and graded smooth in accordance with the CQA Plan. The surface shall be free of sharp or pointed stones, which would tend to puncture the overlying geomembrane. In addition, all stones within the top lift of compacted soil liner shall be smaller than ¾-inch diameter.
- If necessary, base and sideslope surfaces shall be rolled with a smooth drum roller to smooth out rough or badly gouged compacted soil liner. Sharp-pointed fragments of stone, dried soil clods or other deleterious materials shall be removed. This work will be performed by the Earthwork Contractor.
- The underlying soil liner provides a firm, smooth, unyielding foundation for the overlying geosynthetic liner system with no sudden, sharp or abrupt changes or break in grade. No standing water or excessive moisture shall be allowed. Areas that are soft, wet, or otherwise unsuitable for liner installation

shall be excavated and replaced with suitable material by the Earthwork Contractor. Immediately prior to installation of the first component of the geosynthetic liner system, the Geosynthetics Installer and on-site Project Manager shall walk the entire surface of the soil liner, to ensure that it is acceptable.

The Geosynthetics Installer shall certify in writing that the surface on which the geomembrane will be installed is acceptable. This subgrade acceptance certificates shall be given by the Geosynthetics Installer to the CQA Consultant prior to commencement of geomembrane installation in the area under consideration. The CQA Consultant will document the acceptance certification for the CQA Final Report.

It is the Geosynthetics Installer's responsibility to protect the compacted soil liner after it has been accepted. After the supporting soil has been accepted by the Geosynthetics Installer, it shall be the responsibility of the Geosynthetics Installer and the CQA Consultant to indicate to the Project Manager any change in the compacted soil liner condition that may require repair work.

3.4.2.2 Geomembrane Placement

The placement of field panels of geomembrane is the responsibility of the Geosynthetics Installer and shall be performed in accordance with the approved panel layout and the following.

3.4.2.2.1 Panel Layout

At the Pre-Construction Meeting, the Geosynthetics Installer shall provide the Project Manager and the CQA Consultant with a drawing of the facility to be lined showing expected panel layout. The CQA Consultant shall review the panel layout drawing and verify it is consistent with the acceptance state of practice and the CQA Plan. The Panel Layout Drawing shall be approved by the CQA Consultant's Engineer of Record.

Seams should be oriented parallel to the line of maximum slope, i.e., oriented along, not across the slope, unless approved by the engineer. In corners and odd-shaped geometric locations, the number of seams should be minimized. Horizontal seams should not be closer than 5 feet from the toe of slopes, or areas of potential stress concentration, unless otherwise authorized.

3.4.2.2.2 Field Panel Identification

The CQA Consultant shall document that the Geosynthetics Installer labels each field panel with an "identification code" (number and/or letter) consistent with the layout plan. This identification code shall be agreed upon by the Project Manager, Geosynthetics Installer, and CQA Consultant. It is the responsibility of the Geosynthetics Installer and the CQA Consultant to verify that each field panel placed can be tracked to the original roll number. The identification code will be marked at a location agreed upon by the

Project Manager, Geosynthetics Installer, and the CQA Consultant at the Pre-Construction meeting.

The CQA Consultant shall establish a table or chart showing correspondence between roll numbers and field panel identification codes. The field panel identification code will be used for all quality assurance records.

3.4.2.2.3 Installation Schedule

Field panels shall be placed one at a time unless otherwise approved by the CQA Consultant and the Project Manager. Each field panel shall be seamed after its placement in order to minimize the number of unsealed field panels exposed to weather.

It is usually beneficial to "shingle" overlaps in the downward direction to facilitate drainage in the event of precipitation. It is also beneficial to proceed in the direction of prevailing winds. Scheduling decisions must be made during installation, in accordance with varying conditions. In any event, the Geosynthetics Installer shall be fully responsible for the decision made regarding placement procedures.

The CQA Consultant shall record the identification code, location, date of installation, time of installation, weather conditions and ambient temperature. The CQA Consultant shall evaluate field changes by the Geosynthetics Installer, which may have affected the original schedule proposed by the Geosynthetics Installer, and advise the Project manager on the acceptability of that change.

3.4.2.2.4 Weather Conditions

Geomembrane placement shall not proceed when sheet temperature, measured by placing a thermometer on the surface of the sheet, is below 40°F or above 140°F. Deviations from these temperature criteria shall only occur when authorized by the Project Manager and with the concurrence of the CQA Consultant. Geomembrane placement shall not be done during any precipitation, fog, snow, in an area of ponded water, or in the presence of excessive winds.

The CQA Consultant shall verify that the above conditions are fulfilled and shall inform the Project Manager if the conditions are not fulfilled.

3.4.2.2.5 Anchorage System

Anchor trenches shall be excavated by the Earthwork Contractor (unless otherwise specified) to the lines and widths shown on the plans prior to geomembrane placement. The CQA Consultant shall verify that anchor trenches have been constructed according to the plans.

Slightly rounded corners will be provided in trenches where the geomembrane adjoins the trench to avoid sharp bends in the geomembrane. Loose soil shall

not underlie the geomembrane in the trenches. Seaming shall continue through the anchor trench.

Backfilling of anchor trenches shall be performed in accordance with Technical Specifications and Section 3.4.2.5 of the CQA Manual.

3.4.2.2.6 Method of Placement

The following is the responsibility of the Geosynthetics Installer; the CQA Consultant shall document that these conditions are satisfied:

- Equipment used does not damage the geomembrane by handling, traffic, excessive heat, leakage of liquids, or other means;
- The prepared surface underlying the geomembrane has not deteriorated since previous acceptance, and is still acceptable immediately prior to geomembrane placement;
- Geosynthetic material immediately underlying the geomembrane are clean and free of debris;
- Personnel working on the geomembrane do not smoke, wear damaging shoes, or engage in other activities that could damage the geomembrane;
- The method and equipment used to unroll the panels does not cause scratches or crimps in the geomembrane and does not damage the compacted soil liner or GCL;
- The method used to place the panels minimizes wrinkle (especially differential wrinkle between adjacent panels);
- Adequate temporary loading and/or anchoring (e.g., sand bags, tires), not likely to damage the geomembrane, has been placed to prevent uplift by wind (in case of high winds, continuous loading, e.g., by adjacent sand bags, is recommended along the edges of panels to minimize the risk of wind flow under the panels); and
- Direct contact with the geomembrane is minimized; i.e., the geomembrane is protected by geotextiles, extra geomembrane, or other suitable materials, in areas where excessive traffic may be expected.
- Panels should be deployed such that minimal adjustments are required.

- The Earthwork Contractor and Geosynthetics Installer shall be responsible each day for taking all actions needed to prevent run on of stormwater above and beneath the geomembrane. Run on beneath the geomembrane may necessitate removal of underlying soils, depending on the soil condition as determined by the CQA Consultant. Once liner installation has started, the Owner will not be responsible for costs associated with repair of compacted soil liner damage due to stormwater run on.

The CQA Consultant shall inform the Project Manager if the above conditions are not fulfilled.

3.4.2.2.7 Damage

The CQA Consultant shall visually observe each panel, after placement and prior to seaming, for damage. The CQA Consultant shall advise the Project Manager which panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels or portions of damaged panels, which have been rejected, shall be marked and their removal from the work area recorded by the CQA Consultant. Repairs shall be made according to procedures described in the technical specifications and CQA Plan.

As a minimum, the CQA Consultant shall document that:

- The panel is placed in such a manner that it is unlikely to be further damaged; and
- Any tears, punctures, holes, thin spots, etc. are either marked for repair or the panel is rejected.

3.4.2.3 Field Seaming

Field seaming is the responsibility of the Geosynthetics Installer and shall be performed in accordance with the following:

At the Pre-Construction Meeting, the Geosynthetics Installer will provide the CQA Consultant with a list of proposed seaming personnel and their professional records. This document will be reviewed and approved by the Project Manager and CQA Consultant. Seaming personnel shall meet the requirements listed in Section 3.1.6.5 of this CQA Manual.

Approved processes for field seaming are extrusion seaming and fusion seaming. Proposed alternate processes shall be documented and submitted to the Owner for approval. Only seaming equipment which has been specifically approved by make and model shall be used. The Geosynthetics Installer shall submit seaming equipment documentation to the Project Manager and the CQA Consultant for the CQA report.

The flowing is the responsibility of the Installer; the CQA Consultant shall verify that these conditions are met:

- The Geosynthetics Installer maintains on-site the number of spare operable seaming apparatus decided at the Pre-Construction Meeting;
- Equipment used for seaming is not likely to damage the geomembrane;
- The extruder is purged prior to beginning seam unit heat-degraded extrudate has been removed from the barrel;
- For cross seams, the edge of the cross seam is ground to a smooth incline (top and bottom) prior to seaming;
- The electric generator is placed on a flat smooth base and a rub sheet such that no damage occurs to the geomembrane;
- A smooth insulating plate or fabric is placed beneath the hot seaming apparatus after usage.

3.4.2.3.1 Extrusion Seaming

The extrusion seaming apparatus shall be equipped with gauges giving the relevant temperatures of the apparatus such as the temperatures of the extrudate, nozzle, and preheat.

The Geosynthetics Installer shall provide documentation on the extrudate to the Project Manager and the CQA Consultant, and shall certify that the extrudate is compatible with the design specifications, and is comprised of the same resin as the geomembrane sheeting, except in the case of LLDPE, where the extrudate shall be comprised of HDPE resin.

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

3.4.2.3.2 Fusion Seaming

The fusion seaming apparatus must be automated vehicular mounted devices, equipped with gauges giving the applicable temperatures. Pressure settings shall be verified by the Geosynthetics Installer prior to each seaming period.

The CQA Consultant shall log ambient temperatures, sheet temperatures, and seaming apparatus temperatures, speeds, and pressures.

3.4.2.3.3 Seam Preparation

The following is the responsibility of the Geosynthetics Installer; the CQA Consultant shall verify that these conditions are met:

- Prior to seaming, the seam area is clean and free of moisture, dust, dirt, oils, greases, debris of any kind, and foreign material. If necessary, the material to be joined must be wiped with a clean cloth just prior to seaming;
- A rub sheet must be used to protect the liner while cutting any materials;
- If seam overlap grinding is required, the process is completed according to the Geomembrane Manufacturer's instructions within 1 hour of the seaming operation, and in a way that does not damage the geomembrane;
- As a general guidance, the panels of geomembrane shall have a finished overlap; of a minimum of 3 inches for extrusion seaming and 6 inches for fusion seaming, but in any event sufficient overlap will be provided to allow peel tests to be performed on the seam;
- No solvent or adhesive is used unless the product is approved in writing by the Owner (samples will be submitted to the Owner for testing and evaluation);
- The procedure used to temporarily bond adjacent panels together shall not damage the geomembrane (in particular, the temperature of hot air at the nozzle of any seaming apparatus is controlled such that the geomembrane is not damaged).
- No abrading is visible when welding is complete;
- Seams are aligned with the fewest possible number of wrinkle and "fishmouths" and
- No metal objects that could potentially damage the liner are permitted for use on the lined area.

The CQA Consultant shall observe all appropriate temperatures and conditions, and shall log and report to the Project Manager any deviation.

3.4.2.3.4 Weather Conditions for Seaming

The required weather conditions for seaming are as follows:

- The sheet temperatures shall be measured by the Geosynthetics Installer using a thermometer placed on the surface of the geomembrane sheet;
- Unless authorized in writing by the Project Manager, (extrusion or fusion welding) seaming shall be attempted at a sheet temperature below 40°F or above 140°F; and
- The geomembrane shall be dry and protected from wind.

If the Geosynthetics Installer wishes to use methods, which may allow seaming at ambient temperatures below 40°F or above 140°F, the Geosynthetics Installer shall

demonstrate and certify in writing that such methods produce seams, which are entirely equivalent to seams produced at acceptable ambient temperatures. The Geosynthetics Installer shall also demonstrate that the overall quality of the geomembrane is not adversely affected.

The CQA Consultant shall verify that the above guidelines regarding weather are adhered to, and will advise the Project Manager and Engineer of Record accordingly.

3.4.2.3.5 Pre-Weld Testing

Test welds shall be made on fragment pieces of geomembrane liner to verify that seaming conditions are adequate and in accordance with Table 3.4-3 (HDPE) and Table 3.4-6 (LLDPE). Such test welds shall be made upon each start of work for each seamer, upon every four (4) hours of continuous seaming, every time seaming equipment is changed, if significant changes in geomembrane temperature and weather condition are observed, and at the discretion of the CQA Consultant. A passing test weld shall be made for each seaming device and technician. A change in technician or machine on a previously passed test weld warrants the welding of a new passing test weld. A test weld shall also be made in the event that the sheet temperature varies more than 18°F since the last passing test weld. Test welds shall be made under the same conditions as actual seams. If seaming apparatus is turned off for more than 30 minutes, a new passing test weld must be completed for that specific seaming apparatus.

The Geosynthetics Installer shall provide the tensiometer required for shear and peel testing of test welds in the field. The tensiometer shall be automatic and shall have a direct digital readout. The tensiometer shall be calibrated prior to use. The Geosynthetics Installer shall provide the Project Manager with the calibration certification.

The test weld sample shall be at least 5 feet long by 1 foot wide (after seaming) with the seam centered lengthwise. Seam overlap will be as indicated in Subsection 3.4.2.3.3.

Six specimens, each 1-inch wide shall be cut from the test weld sample by the Geosynthetics Installer. Three specimens shall be tested in shear and three in peel using a field tensiometer. For each fusion specimen, both tracks shall be tested. A passing welded seam is achieved in peel and shear when the specimen meets the criteria of Table 3.4-3 (HDPE) and Table 3.4-6 (LLDPE).

If a specimen fails, the entire operation shall be repeated. If the additional specimen fails, the seaming apparatus and seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful full test welds are achieved.

The CQA Consultant shall observe test weld procedures. The remainder of the successful test weld sample shall be assigned a number and marked accordingly by the CQA Consultant, who will also log the data, hour, ambient temperature, number of seaming unit, name of seamer, and pass or fail description. The remainder of the successful test weld

samples shall be archived at the site until the Permitting Agency has approved the final documentation.

3.4.2.3.6 General Seaming Procedure

Unless otherwise specified, the general seaming procedure used by the Installer shall be as follow:

- For fusion seaming, a movable protective layer of plastic may be required to be placed directly below each overlap of geomembrane that is to be seamed. This is to help prevent any moisture build-up between the sheets to be seamed.
- In general, seams should be oriented parallel to the line of maximum slope, i.e., oriented up and down not, across the slope. In corners and odd-shaped geometric locations, the number of field seams shall be minimized.
- All production field seaming shall be hot wedge fusion welding. Extrusion welding is permitted only in areas where hot wedge fusion welding is not possible. Solvent welding or adhesive tape is not acceptable for either temporary or permanent seams. The CQA Consultant and Owner reserve the right to reject any proposed seaming method they believe is unacceptable.
- The composition of the extrudate shall be identical to the lining material and shall be manufactured from the same resin and same additives and proportions thereof as the geomembrane sheet so as to ensure the best possible bonding of extrudate to the geomembrane sheet. Each extrusion welder shall be completely purged of heat-degraded extrudate prior to beginning a seam.
- All foreign matter (dust, dirt, moisture, oil, etc.) shall be removed from the edges of panels to be bonded. If an extrusion weld is required, the bonding surfaces must be thoroughly cleaned by mechanical abrasion or alternative methods approved by the CQA Consultant to remove surface debris, cure, and prepare the surfaces for bonding. No solvents will be allowed to clean the geomembrane. Mechanical abrasion shall occur within one hour prior to extrusion welding the seam.
- No extrusion welding should be attempted above 140°F sheet temperature for extrusion and fusion welding. If seaming is to be performed when the ambient air temperature is below 40°F, preheating of the geomembrane will be required and acceptable test welds, which duplicate as closely as possible actual field conditions, shall be achieved. Preheating may be achieved by natural and/or artificial means (shelters and heating devices). Between 40°F and 50°F ambient air temperature, seaming is possible if the geomembrane is preheated by either the sun or a hot air device provided no excessive cooling of the geomembrane results from environmental conditions. No preheating is required above 50°F. In all cases, the geomembrane will be dry and protected from wind damage.
- While welding a seam, the Geosynthetics Installer shall monitor temperature gages of the welding device to assure that proper settings are maintained. The welding equipment used shall be capable of continuously monitoring and controlling the temperatures and pressures in the zone of contact where the

machine is actually welding the lining material so as to ensure that changes in environmental conditions will not affect the integrity of the weld.

- All cross-butt seams between two rows of seamed panels shall be welded during the coolest time of the day to allow for contraction of the geomembrane.
- All "T" joints shall have the overlap from the fusion welder seam trimmed back to allow an extrusion fillet weld. The Geosynthetics Installer shall then grind 2 inches minimum on either side of the fusion welded seam and extrusion weld a patch over all of the prepared area.
- At the end of each day or installation segment, all unseamed edges shall be adequately anchored by sandbags or other approved devices. Sandbags securing the geomembrane on the sideslopes should be connected by a rope fastened at the top of the slope by a temporary anchor. If high winds are expected, boards along the edge of unseamed panels, with weighted sandbags on top, should be used to anchor the geomembrane on the bottom of the cell. Staples, U-shaped rods, or other penetrating anchors may not be used to secure the geomembrane on the sideslopes.
- If required, a firm substrate will be provided by using a flat board or similar hard surface directly under the seam overlap to achieve proper support.
- Wrinkles at the seam overlaps will be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut wrinkles will be seamed and any portion where the overlap is inadequate will then be patched with an oval or round patch of the same geomembrane extending a minimum of 6 inches beyond the cut in all directions.
- Seaming will extend to the outside edge of panels to be placed in the anchor trench.
- The CQA Consultant should observe all test weld procedures. The remainder of the successful test weld sample will be assigned a number and marked accordingly by the CQA Consultant, who will also log the date, hour, ambient temperature, number of seaming units, name of seamer, and pass or fail description. The sample itself should be retained in the Owner's archives. In addition, at least one tested specimen from each test as selected by the CQA Consultant will be retained by the CQA Consultant. The CQA Consultant will transmit these specimens to the Owner following substantial completion of the geomembrane installation. No field seaming shall take place without the Master Seamer being present.

The CQA Consultant shall verify that the above seaming procedures are followed, and shall inform the Project Manager if they are not.

3.4.2.3.7 Non-Destructive Seam Continuity Testing

The Geosynthetics Installer shall non-destructively test 100 percent of the field seams over their full length using a vacuum test unit (for extrusion seams only), air pressure test (fusion seams), or other approved method. The testing shall be carried out to the accepted standards of the industry. The purpose of non-destructive tests is to check the

continuity of seams. It does not provide any information on seams strength. Continuity testing shall be carried out as the seaming work progresses (maximum of 3,000 lineal feet of seam), not at the completion of all field seaming, unless otherwise approved by the Project Manager. The Geosynthetics Installer shall complete any required repairs in accordance with technical specifications and the CQA Plan. Non-destructive testing shall not be permitted before sunrise or after sunset unless the Geosynthetics Installer demonstrates capabilities to do so.

Air Pressure Testing:

Unless otherwise specified, the general air pressure testing procedure used by the Geosynthetics Installer shall be as follows:

- Seal both ends of the seam to be tested.
- Insert needle of other approved pressure feed device into the airspace created by the double fusion welds.
- Inflate the test channel to 30 to 35 psi, close valve, and observe initial pressure after approximately 2 minutes.
- Initial pressure settings are read after a 2 minute "relaxation period". Initial pressure setting shall be between 30 to 35 psi. The purpose of the "relaxing period" is to permit the air temperature and pressure to stabilize.
- Observe and record the air pressure 5 minutes after "relaxing period" ends and initial pressure setting is used. If loss of pressure exceeds 10 percent, or if the pressure does not stabilize, the Geosynthetics Installer shall locate the faulty area and repair it in accordance with the Technical Specifications and Section 3.4.2.4 of the CQA Manual.
- At the conclusion of the pressure test, the end of the seam opposite the pressure gauge is cut. A decrease in a gauge pressure must be observed or the air channel will be considered "blocked" and the test will have to be repeated after the blockage is corrected.
- Remove needle or other approved pressure feed device and seal the resulting hole by extrusion welding.
- Test results will be recorded by the CQA Consultant.

Non-complying Air Pressure Test:

In the event of a non-complying air pressure test, the following procedure shall be followed:

- Check the seam and seals and retest the seam.
- If deviation with specified maximum pressure differential reoccurs, cut 1 inch samples from each end suspect area.
- Perform destructive peel tests on the samples using the field tensiometer.

- If all samples pass destructive testing, the installer may:
 - Cap-strip the suspect area; or
 - Further isolate the air pressure failure as agreed upon by the CQA Consultant and Project Manager.
- If one or more samples fail the peel tests, additional samples will be taken. When two passing samples are located, the suspect areas will be considered non-complying. In this section the seam shall be cap stripped, or the overlap left by the wedge welder will be heat tacked in place along the entire length of the seam will be extrusion welded. Test the entire length of the repaired seam by vacuum testing.
- If the seam is in non-compliance due to air channel blockage, the blockage shall be isolated, as agreed upon by the CQA Consultant.
- All sections shall be retested and repaired in accordance with this section.

Vacuum Testing:

Unless otherwise specified, the general vacuum testing procedure used by the Geosynthetics Installer shall be as follows:

- Turn on the vacuum pump to reduce the vacuum box to approximately 5 psi.
- Apply a generous amount of a solution of liquid soap and water to the area to be tested.
- Place the vacuum box over the area to be tested and apply sufficient downward pressure to "seat" the seal strip against the liner.
- Close the bleed valve and open the vacuum valve.
- Ensure that a leak tight seal is created between the vacuum box and the Geomembrane.
- For a period of not less than 10 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles.
- If no bubbles appear after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3-inch overlap, and repeat the process.

Non-Complying Vacuum Test:

In the event of a non-complying vacuum test, the following procedure shall be followed:

- Mark all areas where soap bubbles appear and repair the marked areas, as specified in this section.

CQA Responsibilities:

The CQA Consultant shall:

- Document all continuity testing;
- Record location, date, unit number, name of tester, and outcome of all testing; and
- Inform the Geosynthetics Installer and Project Manager of any required repairs.

When defects are located, the CQA Consultant shall:

- Observe the repair and retesting of the repair;
- Mark on the geomembrane that the repair has been made; and
- Document the results.

Non-Testable Areas:

The Geosynthetics Installer shall use the following procedures at locations where seams cannot be non-destructively tested:

- All such seams shall be cap-stripped with the same geomembrane material.
- If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested.
- If the seam cannot be tested prior to final installation, the seaming and cap-stripping operations shall be observed by the CQA Consultant and Geosynthetics Installer for uniformity and completeness.
- The seam number, date of observation, name of tester, and outcome of the test or observation shall be recorded by the CQA Consultant.

Destructive Testing:

The Geosynthetics Installer will not be informed in advance of the locations where the seam samples will be taken. The purpose of these tests is to evaluate seam strength.

Sampling Procedure:

Samples shall be cut by the Geosynthetics Installer as the seaming progresses in order to have passing laboratory test results before the geomembrane is covered by another material. The CQA Consultant shall:

- Observe sample cutting;
- Assign a number to each sample, and mark it accordingly;
- Record the sample location on the layout drawing; and
- Record the reason for taking the sample at this location (e.g., statistical routine, suspicious feature of the geomembrane).

All holes in the geomembrane resulting from destructive seam sampling shall be immediately repaired in accordance with repair procedures described in this Section of the CQA Plan. The continuity of the new seams in the repaired area will be tested.

Size of Samples:

The destructive sample will be 12 inches wide by 36 inches with the seam centered lengthwise. The sample for Laboratory testing shall be located between the two specimens for field testing. The sample shall be cut into three parts and distributed as follows:

- One portion to the Geosynthetics Installer for field testing, 12 inches x 12 inches;
- One portion to the Owner for archive storage, 12 inches x 12 inches;
- One portion for Geosynthetics CQA Laboratory testing, 12 inches x 12 inches.

Final determination of the sample sizes shall be made at the Pre-Construction meeting.

Geosynthetics CQA Laboratory Testing:

Destructive test samples shall be packaged and shipped, if necessary, by the CQA Consultant in a manner that will not damage the test sample. The Project Manager shall be responsible for storing the archive samples. Test samples shall be tested by the Geosynthetics CQA Laboratory.

Testing will include shear and peel and shall meet the requirements at Table 3.4-3 (HDPE) and 3.4-6 (LLDPE). At least five specimens will be tested for each test

method. The Geosynthetics CQA Laboratory shall provide test results, in writing, on more than 24 hours after they receive the samples. The Geosynthetic Laboratory shall document the results of seam testing. The CQA Consultant shall review laboratory test results as soon as they become available, and make appropriate recommendations to the Project Manager. Results from the Geosynthetics Installer's laboratory testing, if conducted, shall be presented to the Project Manager and the CQA Consultant for review.

Destructive Test Failure:

The following procedures shall apply whenever a sample fails a destructive test, whether that test is conducted by the Geosynthetics CQA Laboratory, the Installers Laboratory, or by the field tensiometer.

- The Geosynthetics Installer can reconstruct the seam between any two passed destructive seam test locations; or
- The Geosynthetics Installer can trace the seaming path to an intermediate location (at least 10 ft from the point of the failed test in each direction) and obtain full size destructive laboratory samples. If these destructive laboratory samples pass the tests, then the seam is reconstructed between these locations by capping or by extrusion welding the flap for fusion welds (see Section 3.4.2.4.1 for definitions). If the new samples fail the laboratory testing, then the process is repeated to establish the zone in which the seam should be reconstructed.

If a fusion type seam fails destructive testing and the Geosynthetic Installer chooses to cap the seam, only acceptable capping methods will be allowed.

All acceptable seams must be bounded by two locations from which destructive samples passing laboratory tests have been taken. In cases exceeding 150 feet of reconstructed seam, a sample shall be taken from the zone in which the seam has been reconstructed. This sample must pass destructive testing or the procedure outlined here must be repeated.

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

3.4.2.4 Defects And Repairs

Seams and non-seam areas of the geomembrane shall be examined by the CQA Consultant for identification of defects, holes, blisters, undispersed raw materials and any sign of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane will be clean at the time of examination. The surface shall be swept or washed by the Geosynthetics Installer if the amount of dust or mud inhibits examination.

3.4.2.4.1 Repair Procedures

Any portion of the geomembrane exhibiting a flaw, failing a destructive, or failing a non-destructive test, shall be repaired. Several procedures exist for the repair of these areas. The Project Manager and the CQA Consultant shall approve the final decision as to the appropriate repair procedure. The procedures available include:

- Patching - Apply a new piece of geomembrane sheet over, and at least 6 inches beyond the limits of a defect. The patch shall be extrusion seamed to the underlying geomembrane. This method should be used to repair large holes, tears, destructive test locations, undispersed raw materials, and contamination by foreign matter.
- Spot Seaming - Apply a "bead" of extrudate, maximum length of 6 inches, over a defect. Spot seaming should be used only to repair dents, pinholes, pressure test air holes, or other minor, localized flaws.
- Capping - Apply a new strip of geomembrane along the length of a delineated faulty seam. The cap strip shall extend at least 6 inches, beyond the limit of the seam and the edges will be extrusion seamed to the underlying geomembrane. This method should be used to repair lengths of extrusion or fusion seamed to the underlying geomembrane. This method should be used to repair lengths of extrusion or fusion seams.
- Welding Flap - Where an adequate flap exists, (at least 1-1/2 inches) it is permissible to extrusion weld the flap of a fusion seam. At the ends of this repair, the flap shall be cut to allow the extrusion weld to enclose the failed area.
- Replacement - The faulty seam is removed and replaced.

In addition, the following provisions shall be satisfied:

- Surfaces of the geomembrane which are to be repaired will be abraded no more than one hour prior to extrusion welding of the repair;
- All surfaces must be clean and dry at the time of the repair;
- All seaming equipment used in repairing procedures must be approved;

- The repair procedures, materials, and techniques will be approved in advance of the specific repair by the CQA Consultant and Geosynthetics Installer;
- Patches or caps will extend at least 6 inches beyond the edge of the defect, and all corners of patches will be rounded; and
- Seam repairs over 150 feet long will require a destructive test to be taken from the repair.

3.4.2.4.2 Verification of Repairs

Each repair shall be numbered and logged by the CQA Consultant and the Geosynthetics Installer. Each repair shall be non-destructively tested using the methods described in this section as appropriate. Repairs, which pass the non-destructive test, will be taken as an indication of an adequate repair. However, if the CQA Consultant suspects a repair to be questionable, although it passes non-destructive testing, a destructive test can be requested. Failed tests will require the repair to be redone and retested until a passing test result is achieved. The CQA Consultant shall observe non-destructive testing of repairs and shall record the date of the repair and test outcome.

3.4.2.4.3 Large Wrinkles

When seaming of the geomembrane is completed (or when seaming of a large area of the geomembrane is completed) and prior to placing overlying materials, the CQA Consultant shall observe the geomembrane wrinkles. The CQA Consultant will indicate to the Project Manager which wrinkle should be cut and resealed by the Geosynthetics Installer. The seam thus produced will be tested like any other repair.

3.4.2.5 Backfilling Of Anchor Trench

Anchor trenches will be adequately drained, to prevent ponding or otherwise softening of the adjacent soils while the trench is open. Anchor trenches shall be backfilled and compacted as soon as possible. General fill used when backfilling the trench shall be material with 100 percent of the particles finer than 12 inches. Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetics.

Unless otherwise approved by the Engineer, each lift of backfill material spread for compaction shall not exceed a loose lift thickness of 8 to 12 inches, depending upon material type. Each lift of backfill shall cover the length and width of the area to be backfilled, shall be uniform in thickness, and shall be spread and compacted as specified before the next lift is started unless otherwise permitted.

The CQA Consultant shall approve each lift before successive lifts are placed. The CQA Consultant shall observe the backfilling operation and advise the Project Manager of any problems.

3.4.2.6 Liner System Certification/Acceptance

The Geosynthetics Installer and the Manufacturer shall retain ownership and responsibility for the geosynthetics in the facility until acceptance by the Owner.

The liner system shall be accepted by the Owner when:

- The installation is finished;
- Verification of the adequacy of seams and repairs, including associated testing, is complete;
- Geosynthetics Installer's representative furnishes the Project Manager with documentation that the geomembrane was installed in general accordance with the Manufacturer's recommendations as well as the design plans and specifications. This will include leak detection testing as required by NC General Statute § 130A-295.6.(h)(1) in accordance with ASTM D 7007-09 – Standard Practices for Locating Leaks in Geomembranes covered with Water or Earth Materials.
- All documentation of installation is completed including the CQA Consultant final report; and
- Record Documentation, including record drawings, sealed by a Professional Engineer has been received by the Owner.

The CQA Consultant shall provide documentation that installation has proceeded in general accordance with this CQA Plan for the project except as noted to the Owner or Project Manager.

3.4.2.7 Materials In Contact With The Geomembranes

The quality assurance procedures indicated in this Subsection are only intended to verify that the installation of these materials does not damage the geomembrane. Additional quality assurance procedures provided in other sections of this CQA Manual are necessary to verify that the systems built with these materials are constructed to perform as designed.

3.4.2.7.1 Geocomposite

The CQA Consultant shall verify that the geocomposite is installed in accordance with the procedures described in Section 3.5 of the CQA Manual. Extreme care shall be exercised so as not to damage the geomembrane during placement of the geocomposite and the materials overlying the geocomposite.

3.4.2.7.2 Appurtenances

The Design Engineer shall provide design specifications for appurtenances to the Project Manager and the CQA Consultant.

The CQA Consultant shall verify that:

- Installation of the geomembrane in appurtenance areas, and connection of geomembrane to appurtenances have been made according to the design specifications;
- Extreme care is taken while seaming around appurtenances since neither non-destructive nor destructive testing may be feasible in these areas; and
- The geomembrane has not been visibly damaged while making connections to appurtenances.

The CQA Consultant will inform the Project Manager if the above conditions are not fulfilled.

3.5 GEOCOMPOSITE

3.5.1 Manufacturer's Documentation

Prior to deliver, the Geocomposite Manufacturer shall provide documentation, which demonstrates that the property values of the material meet design specifications. Delivered rolls of geocomposite shall be appropriately labeled.

3.5.1.1 Certification Of Property Values

The Geocomposite Manufacturer shall provide the Project Manager with a list of guaranteed minimum properties (as defined by the Design Engineer) for the type of geocomposite to be supplied. The Geocomposite Manufacturer shall provide the Project Manager with Quality Control Test Results signed by a responsible party that the geocomposite actually delivered have properties, which meet or exceed the guaranteed properties.

The CQA Consultant shall examine the Manufacturer's Quality Control Tests to verify that the property values listed on the certifications meet or exceed the Manufacturer's guaranteed minimum values and the design specifications given on Table 3.5-1 (Tables). Deviations shall be reported to the Project Manager.

3.5.1.2 Labeling

The Geocomposite Manufacturer shall identify all rolls of geocomposite. Each geocomposite roll shall have a weatherproof label, which contains the following:

- Manufacturer's name;
- Product identification;
- Lot number;
- Roll number;
- Roll dimensions; and
- Top and bottom geotextile roll numbers

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

3.5.2 Shipment And Storage

Geocomposite cleanliness is essential to performance; therefore, measures must be taken during shipment and storage to protect the geonet from dust and dirt. Geocomposite rolls shall be wrapped in plastic sheets or otherwise protected. Wrappings protecting the Geocomposite rolls should be removed less than one (1) hour prior to unrolling the geocomposite.

3.5.3 Conformance Testing of Geocomposite

Upon or prior to delivery of the rolls of geocomposite, the CQA Consultant shall remove and forward samples to the Geosynthetics CQA Laboratory for testing to verify conformance with the design specifications given on Table 3.5-1 (Tables).

3.5.3.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at a minimum frequency of one sample per 100,000 square feet of material. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted to assure that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample. If a roll is not identifiable by roll number, the CQA Consultant shall notify the Project Manager immediately. If the roll cannot be tracked, the Project Manager shall reject the roll.

Samples will be taken across the entire width of the roll and will not include the first 3 lineal feet. Unless otherwise specified, samples will be 3 feet long by the roll width. The CQA Consultant will mark the machine direction on the samples with an arrow.

3.5.3.2. Test Results

The results of the conformance testing shall be evaluated in accordance to the following procedure:

- If the average test values for the sample meet all of the values given in Table 3.5-1 and the Manufacturer's guaranteed minimum values, the sample passes.
- If the average test value for the sample does not meet one or more of the required values, the CQA Consultant will implement additional evaluation procedures. Additional tests required for further evaluation shall be done at no expense to the Owner.
- For the failing parameter(s), perform one additional test on the sample. This test may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Project Manager.
- If the test values for the additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
- If the test value does not meet requirements, reject the roll, collection samples from the closest numerical roll on both sides of the failed roll, and test for the failed parameter(s). If one or both of these tests do not meet requirements, those roll(s) will be rejected and the CQA Consultant and Project Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

3.5.4 Handling and Placement

The Geosynthetics Installer shall handle geocomposite in such a manner as to minimize damage and comply with the following:

- On slopes, the geocomposite shall be secured in the anchor trench and then rolled down the slope in such manner as to continually keep the geocomposite sheet in tension. If necessary, the geocomposite shall be positioned by hand after being unrolled to minimize wrinkles. Geocomposite can be placed in the horizontal direction (i.e., across the slope) in some special location (e.g., at the toe of the slope, or, if an extra layer of geocomposite required, this extra layer can be placed in the horizontal direction). Such locations shall be identified by the Design Engineer in the plans.
- In the presence of wind, geocomposite shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and remain until replaced with overlying material.

- Sandbags shall be filled with fine-grained material and must be handled with care to prevent rupture.
- Unless otherwise specified, geocomposite shall not be welded to geomembranes.
- The Geosynthetics Installer shall take necessary precautions to prevent damage to underlying layers during placement of the geocomposite. Care should be taken not to leave tools on or under the geocomposite.
- During placement of geocomposite, care shall be taken not to entrap dirt or excessive dust that could cause clogging of the drainage system, and/or stones that could damage the adjacent geomembrane.

The CQA Consultant shall note any deviation and report it to the Project Manager.

3.5.5 Stacking and Joining

Stacked geocomposite shall be placed in the same direction to prevent the stands of one layer from penetrating the channels of the lower layer, thereby significantly reducing the transmissivity. Geocomposite shall not be laid in direction perpendicular to the underlying geonet unless otherwise specified by the Design Engineer.

Adjacent geocomposite shall be joined according to the plans and design specifications. As a minimum, the following requirements shall be met:

- The geonet portion of adjacent rolls shall be overlapped by at least 4 inches. Ends of adjacent rolls shall be overlapped by at least 8 inches.
- These overlaps shall be secured by tying with plastic fasteners or polymer braid. Tying devices will be white or yellow for easy observation. Metallic devices are not allowed.
- Tying devices shall be placed every 5 feet down the slope, every 2 feet across the slope, every 6 inches in the anchor trench, and every 6 feet on horizontal surfaces.
- When more than one layer of geocomposite is installed, joints shall be staggered so that the joints do not lie above one another.
- The upper non-woven geotextile shall be continuously sewn using the procedures outlined in Section 3.6.5 of the CQA Manual unless otherwise directed by the Project Manager.

The CQA Consultant shall document the roll numbers placed and approximate installed square footage and shall note any deviation and report it to the Project Manager.

3.5.6 Repair

Any holes or tears in the geocomposite shall be repaired by placing a patch extending 2 feet beyond the edges of the hole or tear. The patch shall be secured to the original net by tying every 6 inches. Tying devices shall be as indicated in Section 3.5.5. If the hole or tear width across the roll is more than one-half the width of the roll, the damaged area shall be cut out and the two portions of the geonet shall be joined as indicated in Section 3.5.5.

The CQA Consultant shall observe any repair, note any deviation with the above requirements and report them to the Project Manager.

3.5.7 Placement of Materials on Geocomposite

The placement of materials on geocomposite shall be as soon as possible, such that:

- The geocomposite and underlying geomembrane are not damaged;
- Minimal slippage of the geocomposite on the underlying geomembrane occurs;
- No excess tensile stresses occur in the geocomposite; and
- **In sloped areas, placement of soil/aggregate is started at the toe and extended up the slope. Placement of soil/aggregate will never start at the top of the slope.**

If portions of the geocomposite are exposed, the CQA Consultant shall periodically place marks on the geocomposite and the underlying geomembrane and measure the elongation of the geocomposite during the subsequent construction activities. Before a subsequent layer of material is placed on the geocomposite, the CQA Consultant should observe the geocomposite and underlying liner to determine if any dirt, excessive dust, or any stones are entrapped in, or below the material. If so, the geocomposite must be cleaned or the geocomposite removed so that the liner can be cleaned.

Any deviation shall be noted by the CQA Consultant and reported to the Project Manager.

3.6 GEOTEXTILE

3.6.1 Manufacturer's Documentation

The following addresses the activities associated with the manufacture of geotextile used as filters, separators and composite drainage systems; the shipment, handling and delivery of geotextile to the site; conformance testing of geotextile; and the storage of

geotextile prior to installation. The word "geotextile" as used in this section primarily refers to non-woven geotextile.

Prior to delivery, the Geotextile Manufacturer shall provide documentation, which demonstrates that the property values of the material meet requirements. Delivered rolls of geotextile shall be appropriately labeled.

3.6.1.1 Certification Of Property Values

The Geotextile Manufacturer shall provide the Project Manager with a list of guaranteed "minimum average roll value" properties (as defined by the Design Engineer) for the type of geotextile to be supplied. The Geotextile Manufacturer shall provide the Project Manager with a written certification signed by a responsible party that the geotextiles actually delivered have properties which meet or exceed the guaranteed "minimum average roll values" properties given in Table 3.6-1 (Tables).

The CQA Consultant shall examine the Manufacturer's certifications to verify that the property values listed on the certifications meet or exceed the Manufacturer's guaranteed minimum values and the design specifications. Deviations shall be reported to the Project Manager.

3.6.1.2 Labeling

The Geotextile Manufacturer shall identify all rolls of geotextile. Each geotextile roll shall have a weatherproof label, which contains the following:

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

In addition, if any special handling of the geotextile is required, it shall be so marked on the top surface of the geotextile, e.g., "This Side Up". Rolls without proper identification shall be rejected by the Project Manager.

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

3.6.2 Shipment and Storage

During shipment and storage, the geotextile shall be protected from ultraviolet light exposure, precipitation, snow or other inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions. Geotextile rolls shall be wrapped in plastic sheets or

otherwise protected. Wrappings protecting the geotextile rolls should be removed less than one hour prior to unrolling the geotextile.

Geotextiles shall not be exposed to precipitation prior to being installed. Wet geotextiles are heavy which makes them difficult to deploy and can also effect liner welding when the geomembrane is adjacent to the geotextile. During cold weather, geotextiles must be protected from freezing.

The CQA Consultant shall observe rolls upon delivery and prior to installation, any deviation from the above requirements shall be reported to the Project Manager. Any damaged rolls shall be rejected and replaced at no cost to the Owner.

3.6.3 Conformance Testing of Geotextile

Prior to the deployment of the rolls of geotextile, the CQA Consultant shall remove and forward samples to the Geosynthetics CQA Laboratory for testing to verify conformance with the design specifications, Table 3.6-2 (Tables).

3.6.3.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at a minimum frequency of one sample per 100,000 square feet of material. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted to assure that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample. If a roll is not identifiable by roll number, the CQA Consultant shall inform the Project Manager immediately. If the roll cannot be tracked, the Project Manager shall reject the roll.

Samples will be taken across the entire width of the roll and will not include the first 3 lineal feet. Unless otherwise specified, samples will be 3 feet long by the roll width. The CQA Consultant will mark the machine direction on the samples with an arrow.

3.6.3.2 Test Results

The results of the conformance testing shall be evaluated in accordance to the following procedure:

- If the average test values for the sample meet all of the values given in the design specifications and the Manufacturer's guaranteed minimum values, the sample passes.
- If the average test value for the sample does not meet one or more of the required values, the CQA Consultant will implement additional evaluation procedures. Additional tests required for further evaluation shall be done at no expense to the Owner.

- For the failing parameter(s), perform one additional test on the sample. This test may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Project Manager.
- If the test values the additional test meets the required values, the roll and adjacent rolls pass and are acceptable.
- If the test values does not meet requirements, reject the roll, collect samples form the closest numerical roll on both sides of the failed roll and test for the failed parameter(s). If one or both of these tests do not meet requirements, those roll(s) will be rejected and the CQA Consultant and Project Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

3.6.4 Handling And Placement

The Installer shall handle geotextiles in such a manner as to minimize damage and shall comply with the following:

- Geotextile shall not be placed until the underlying layer has been properly documented and approved by the CQA Consultant
- After the wrapping has been removed, a geotextile shall not be exposed to sunlight for longer than the allowable time specified by the Geotextile Manufacturer.
- On slopes, the geotextiles shall be securely anchored and then rolled down the slope in such a manner as to continually keep the geotextile panel in tension.
- In the presence of wind, geotextiles shall be weighted with sandbags or the equivalent. Sandbags shall be installed during the placement and shall remain until replaced with the appropriate overlying material.
- Sandbags shall be filled with fine-grained material and must be handled with care to prevent rupture.
- Geotextile shall be kept continually under tension to minimize the presence of wrinkles in the geotextile.
- Geotextiles shall be cut using an approved geotextile cutter only. If in-place, special care must be taken to protect other materials form damage, which could be caused by the cutting of the geotextiles.
- The Geosynthetics Installer shall take necessary precautions to prevent damage to the underlying layers during placement of the geotextile.

- During placement of geotextiles, care shall be taken not to entrap stones, excessive dust, or moisture that could damage the geomembrane, generate clogging of drains or filters, or hamper subsequent seaming.
- After installation, the entire surface of the geotextile shall be examined, and harmful foreign objects, such as needles, shall be removed.
- If white geotextile is used, precautions will be taken against "snow blindness" of personnel.

The CQA Consultant shall witness the installation of all geotextile material and shall not any deviation and report it to the Project Manager. The CQA Consultant shall record roll numbers used and approximate square footage placed.

3.6.5 Seams and Overlaps

Where geotextiles are specified or indicated on the plans to be sewn, all seams shall be continuously sewn using thread, which is as chemically resistant and UV resistant as the geotextiles. Thread shall be approved by the CQA Consultant and Owner. Spot sewing is not permitted, except for repairs, and thermal bonding shall not be permitted without the written approval of the Project Manager. Geotextiles shall be overlapped a minimum of 6 inches prior to seaming. Horizontal seams shall be on side slopes steeper than 20 percent should be avoided, except as part of a patch. However, if horizontal seams are necessary, at least 100 feet shall be maintained between horizontal seams of adjacent panels. Seam overlaps shall be "flat" or "prayer" (Federal Standard Type SSa-1), and seams shall be single-row two thread chainstitch (stitch type 401). The Geosynthetics Installer shall pay particular attention that no material is inadvertently inserted beneath the geotextile.

The CQA Consultant shall inspect 100 percent of the seams for continuous and proper sewing and shall note any deviation and report it to the Project Manager.

3.6.6 Repairs

Any holes or tears in the geotextile shall be repaired by the Installer as follows:

- On slopes steeper than 20 percent: A patch made from the same geotextile shall be sewn into place and extend at least 12 inches beyond any damaged edge of the parent geotextile. Should any horizontal tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced.
- On slopes less than or equal to 20 percent: A patch made from the same geotextile shall be sewn in place with a minimum of 24 inches overlap in all directions.

Care shall be taken to remove any soil or other material, which may have penetrated the torn geotextile.

The CQA Consultant shall observe any repair, note any deviation with the above requirements and report them to the Project Manager.

3.6.7 Placement of Materials on Geotextiles

The Geosynthetics Installer shall place materials on the Geotextile in the following manner:

- Cause no damage to geotextile and underlying geosynthetics;
- Prevent slippage of the geotextile on underlying layers;
- Equipment used for placing the overlying material shall not be driven directly on the geotextile;
- On side slopes, the placement of soil on top of the geotextile shall proceed from the bottom of the slope upward;
- A minimum thickness of 1 foot of soil must be maintained between light, low ground pressure equipment (such as a wide pad Caterpillar D-6 or lighter) and the geotextile;
- A minimum thickness of 1.5 feet of soil must be maintained between rubber-tired vehicles and the geotextile unless approved by the Design Engineer and Owner; and
- In heavily trafficked areas such as access ramps, soil thickness shall be at least 3 feet.

The CQA Consultant shall observe the placement of all overlying material and any deviation shall be noted by the CQA Consultant and reported to the Project Manager.

3.7 POLYETHYLENE PIPE AND FITTINGS

3.7.1 Material Requirements

High Density Polyethylene (HDPE) pipe and its associated fittings and joints shall meet material acceptance and construction quality requirements as stated in this Section of the CQA Plan and in the design specifications.

3.7.1.1 Pipe

PE pipe shall consist of Standard Dimension Ratio (SDR) pipe, as specified in the design specification, and must conform to the requirements of ASTM D2837, Class PE3408 for a pressure rating of 140 psi at 73.4°F. HDPE pipe shall comply with the following standards:

- ASTM F714 - pipe S.T.D;
- ASTM D1248 - Type III, Class C, Category 5 - Grade P34
- ASTM D3350 – Cell Classification PE345434C
- ASTM D2837 – Class PE3408
- PPI - PE3408; and
- NSF - Listed STD No. 14.

The pipe and fittings shall be manufactured from pre-compounded resin manufactured by the pipe manufacturer, with a minimum of two percent carbon black to withstand outdoor exposure without loss of properties. In plant blending of non-compounded resins is not acceptable. HDPE pipe shall be furnished perforated or non-perforated as required by the Contract Drawings with each pipe length marked with the Manufacturer's Name/Trademark, size, material code, and SDR value. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification or from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes (other than manufactured perforation), foreign inclusions, or other deleterious defects, and shall be identical in color, density, melt index, and other physical properties.

3.7.1.2 Fittings

PE pipe fittings shall be furnished by the Manufacturer of the pipe with which they are used and shall conform to the requirements of ASTM D3261 for standard fittings.

3.7.1.3 Joints

Pipe joints shall be fusion welded, using only Manufacturer-approved methods and equipment. Unless otherwise approved, joints inside manholes shall be joined with mechanical transition couplings, electrofusion couplings or by extrusion welding.

3.7.2 Manufacturer's Documentation

The HDPE Pipe Manufacturer shall submit documentation, which demonstrates that the property values of the pipe meet the design specifications and that quality control are taken during manufacture.

3.7.2.1 Certification Of Property Values

Prior to the installation of HDPE Pipe Manufacturer will provide to the CQA Consultant:

- A properties sheet including, at a minimum, all specified properties measured using test methods indicated in the contract documents or equivalent;
- A list of quantities and descriptions of materials other than the base resin which comprise the pipe; and
- A certification that property values given in the properties sheet are guaranteed by the PE Pipe Manufacturer.

The CQA Consultant shall verify that:

- The property values certified by the HDPE Pipe Manufacturer meet the design specifications; and
- The measurements of properties by the HDPE Pipe Manufacturer are properly documented and that the test methods used are acceptable.

3.7.2.2 Quality Control Certificates

The PE Pipe Manufacturer shall provide the Project Manager and the CQA consultant with a quality control certificate for each lot/batch of HDPE Pipe provided. The quality control certificate shall be signed by a responsible party employed by the HDPE Pipe Manufacturer, such as the Production Manager.

The quality control certificate shall include:

- Lot/batch numbers and identification; and
- Sampling procedures and results of quality control tests.

The CQA Consultant shall:

- Verify that the quality control certificates have been provided at the specified frequency for all lots/batches of pipe, and that each certificate identifies the pipe lot/batch related to it; and
- Review the quality control certificates and verify that the certified properties meet the design specifications.

The CQA Consultant shall notify the Project Manager of any deviation.

3.7.3 Fusion Process for Joints

The primary means of joining HDPE pipe shall be butt fusion. However, in certain instances where butt fusion is not suitable, due to space restrictions, electrofusion couplings or extrusion welding may be used in lieu of butt fusion. HDPE pipes and fittings shall be joined by the Pipe Installer using the procedures outlined below, unless otherwise specified.

3.7.3.1 Preparation

Delivered pipes and fittings shall be examined by the Pipe Installer. The Installer shall verify that pipes and fittings are not broken, cracked, or contain otherwise damage or unsatisfactory material.

Prior to fusing, the Installer shall verify that the fusion surface area is clean and free of moisture, dust, dirt, debris of any kind, and foreign material.

The CQA Consultant shall notify the Project Manager of any deviation.

3.7.3.2 Weather Conditions For Butt-Fusion

Butt-fusion of HDPE pipe joints is normally done in uncontrolled atmospheres. Fusion of the HDPE joints shall be performed at temperatures above 32°F, unless otherwise authorized in writing by the Project Manager.

3.7.3.3 General Butt-Fusion Procedure

Unless otherwise specified, the general butt-fusion procedure used by the Installer shall be as follows:

- Be sure that the surfaces of the fusion tools, pipe and fittings are free of moisture and debris;
- Heat the surfaces to be joined - both the pipe and fittings - simultaneously at the prescribe temperatures for a specified time;

- Remove the heater - bring melted surfaces together; and
- Hold until solidified.

These steps are described in more detail below.

- With a clean rag, wipe both inside and outside surfaces of the two ends to be joined to remove dirt and foreign material;
- Install pipe in fusion machine, allowing pipe ends to protrude 1 to 2 inches past face of jaw;
- Slide facer so that it can be placed between pipe ends. Cut pipe until the stops on each side of the facer are against the clamp bushings at the front and rear. Separate the two pipe ends by opening pipe jaws, turn off motor, and move facing unit to storage position. The ends are properly faced when both stationary and movable clamps are against the stops on each side of the facing unit.
- Bring the two pipe sections together and feel for any high-low difference at the junction of the two ends. If necessary, tighten the appropriate inside clamp until the two sections are aligned as closely as possible. After facing pipe ends, if any adjustment is made on one or both inside clamps, the facing unit should be re-installed and the pipe ends given several turns with the cutter until the motor speeds up, before continuing with heating and fusing.
- Separate the two pipe sections. Slide heater to position where it will come between pipe ends. Bring the movable pipe section against the heater until both pipe ends are in firm contact with the heater.
- During the heating period, as the pipe ends melt while against the heater, the molten plastic will expand and form a melt bead around the end of the pipe. The melt bead will vary in width from about 1/16 to 3/16 of an inch, depending on pipe size but should be 3/16 of an inch for 6 inch nominal diameter pipes or greater. The melt bead should be the same size around the pipe.
- After melting has been completed, separate the pipe ends just enough to remove the heater and immediately bring the pipe ends together with the pressure recommended by the manufacturer.
- Maintain the pressure and allow the joint to cool for 30 to 90 seconds per inch of pipe diameter before removing from machine.

- Remove fused pipe sections from fusion machine. Allow joint to cool at least 20 minutes after removal before subjecting it to testing, bending or backfilling stresses. Reposition fusion machine so that the end of the newly fused section lies in the stationary clamps while a new pipe section is placed in the movable clamps. Repeat fusion procedure.

The CQA Consultant shall verify that the general butt-fusion procedure has been followed by the pipe installer. If a different joining method is proposed, the Owner and CQA Consultant shall approve it in advance.

3.7.4 Pressure Testing of Joints

The joints of non-perforated HDPE pipes shall be tested by the Pipe Installer using the pressure test procedure given in ASTM C924. Other non-destructive test methods may be used only when approved by the Owner.

3.7.4.1 Segment Testing: Pre-Installation

- Similar sized of polyethylene piping shall be butt welded together into testing segments not to exceed 2,000 feet. Segments shall be fitted with a cap on one end and testing apparatus on the other.
- The segment to be tested should be laid on the ground surface and allowed time to reach constant and/or ambient temperature before initialing the test.
- The test should be performed during a period when the pipe segment will be out of direct sunlight when possible, i.e., early morning, late evening, or cloudy days. This will minimize the pressure changes, which will occur during temperature fluctuations.
- The test pressure shall be minimum 10 psi.
- Contractor shall submit verification and results of gauge calibration prior to (no more than 40 days) completion of project.
- The test periods shall not be less than 1 hour. The allowable pressure drop observed during the test shall not exceed one percent of the test pressure. Test pressure shall be corrected for temperature changes before determining pass or failure.
- Owner shall be notified before testing procedure and shall have the option of being present during the test.

- Contractor will furnish equipment for this testing procedure. This shall consist of a polyethylene flange adapter with a PVC blind flange equal in size to the blower inlet valve. Tapped and threaded into the blind flange will be a temperature gauge 32°F to 212°F, a pressure gauge 0 to 15 psi, a "tire valve" to facilitate an air compressor hose, and a ball valve to release pipe pressure at completion of test. Polyethylene reducers shall be utilized to adapt test flange to size of pipe being tested.

3.7.4.2 Test Failure

The following steps shall be performed when a pipe segment fails the 4-hour test:

- The pipe and all fusions shall be inspected for cracks, pinholes or perforations.
- All blocked risers and capped ends shall be inspected for leaks
- Leaks shall be verified by applying a soapy water solution and observing soap bubble formation.

All pipe and fused joint leaks shall be repaired by cutting out the leaking area and refusing the pipe.

After all leaks are repaired, a retest shall be performed in accordance with Section 3.7.4.1.

3.7.4.3 Final Test

A final test shall be made on the completed inner conveyance pipeline in accordance with Section 3.7.4.1 and 3.7.4.2.

The completed systems when tested should be in its proper trench location and allowed time to reach constant and/or ambient temperature before initiating the test. Following construction HDPE pipe installed for the leachate collection system must be remotely inspected by camera for final certification and acceptance.

3.7.4.4 Test Reporting

All testing shall be reported in writing to the Owner and shall include the following information:

- Date and time
- Person performing test
- Name of Owner representative
- Pipe length, size(s), and location

- Test pressure at test start and finish.
- Ambient temperature at test start and finish.

The following information shall be reported in writing if a failure occurs:

- Nature of all leaks found, and
- Details of repair.

The CQA Consultant shall report any deviation of testing methods or test results to the Project Manager.

3.8 SURVEYING

3.8.1 Introduction

Surveying of lines and grades shall be conducted on an ongoing basis during construction of the soil layers and geosynthetics placement. Surveying shall be performed to provide documentation for record plans, verify quantities of soils and geosynthetics, and assist the Earthwork Contractor to comply with the required grades. Surveying conducted at the site shall be part of the construction quality assurance program.

3.8.2 Survey Control

One or more permanent benchmark(s) will be established for the site at location(s) indicated on the drawings. The vertical and horizontal controls for this benchmark will be established within normal land surveying standards. The benchmark(s) horizontal and vertical position(s) shall be tied to the North Carolina State Plane Coordinate System and the National Geodetic Vertical Datum of 1929.

3.8.3 Surveying Personnel

Surveying will be performed under the direct supervision of a qualified, licensed Land Surveyor, who may also be the Senior Surveyor on-site. The survey crew will consist of the Senior Surveyor and as many Surveying Assistants as are required to satisfactorily undertake the work. Surveying personnel will be experienced in the provision of these services, including detailed, accurate documentation.

3.8.4 Precision and Accuracy

The survey instruments used for this work shall be precise and accurate to meet the needs of the project. Survey instruments shall be capable of reading to a precision of 0.01 of a foot and with a setting accuracy of 10 seconds. Calibration certificates for survey instruments shall be submitted to the CQA Consultant prior to initiation of surveying activities.

3.8.5 Lines and Grades

When required, the following surfaces shall be surveyed to determine the lines and grades achieved during construction:

- Surface of excavation/structural fill (prior to compacted soil liner placement);
- Surface of the finished compacted soil liner (including edges, bottom, and limits of pipe trenches and slump);
- Surface and limits of geosynthetics;
- Anchor trench;
- Alignment and inverts of piping and tanks (both inside and outside the landfill); and
- Profiles, cross-sections, inverts for ditches, roads, and sedimentation basins.

3.8.6 Frequency and Spacing

Surveying shall be performed as soon as possible after completion of a given installation to facilitate progress and avoid delaying the next installation. In addition, spot checks during construction will be necessary to assist the Earthwork Contractor in complying with the required grades.

The following spacings and locations shall be provided, as minimum, for survey points:

- Surfaces, with slopes less than 10 percent will be surveyed on a square grid not wider than 100 feet linear;
- On slopes greater than 10 percent, a square grid not wider than 100 feet will be used, but in any case, a line at the crest, midpoint, and toe of the slope will be taken; and
- A line of survey points no farther than 100 feet apart will be taken along any slope break (this will include the inside edge and outside edge of any bench on a slope).
- Along linear features, survey sections or points should be at 50-foot centers.

3.8.7 Tolerances

Acceptable tolerances on survey coordinates, within the waste containment areas, shall be 0 to -0.2 feet on subgrade elevations, and 0 to +0.2 feet on soil liner and protective cover/leachate collection layers, provided minimum permit conditions and state regulations are adhered to (i.e., thickness, grades, etc.). Surveying tolerances may need to be more stringent in the sump area to measure accurate construction of the leachate management system. More stringent tolerances may be required at the sump location to ensure all piping correctly aligns.

3.8.8 Documentation

The Senior Surveyor shall retain original field survey notes. The surveyor should produce record plans for the CQA Consultant as the job progresses. The results from the field

surveys will be documented on a set of record plans. At a minimum these plans shall show the final elevations of the surfaces listed in Section 3.8.5 of the CQA Manual at a scale of 1 inch equal 100 feet with contour intervals no greater than 2 feet.

Survey results will be certified by a land surveyor licensed by the state at the location of work.

3.9 DOCUMENTATION (15A NCAC 13B .0541(b)(4)

3.9.1 Introduction

An effective CQA Plan depends largely on recognition of all construction activities that should be monitored, and on assigning responsibilities for the monitoring of each activity. This is most effectively accomplished and verified by the documentation of quality assurance activities. The CQA Consultant shall document that quality assurance requirements have been addressed and satisfied.

The CQA Consultant shall provide the Project Manager with signed descriptive remarks, data sheets, and logs to verify that all monitoring activities have been carried out. The CQA Consultant shall also maintain at the job site a complete file of design plans, design specifications, the CQA Plan, checklists, test procedures, daily logs, and other pertinent documents.

3.9.2 Daily Recordkeeping

Standard reporting procedures shall include preparation of a daily report which, at a minimum, shall consist of a daily summary report including memoranda of meetings and/or discussions with the Owner and/or site contractors, observation logs, and test data sheets. Other forms of daily recordkeeping to be used as appropriate include construction problem and solution data sheets and photographic reporting data sheets.

3.9.2.1 Daily Summary Report

The CQA Consultant shall prepare a daily summary report, which may include the following information as appropriate:

- Date, project name, location, and other identification;
- Data on weather condition;
- Information on meetings held or discussions which took place:
 - Names of parties to discussion;
 - Relevant subject matter or issues;
 - Decisions reached; and
 - Activities planned and their schedule.
- A reduced-scale site plan showing all proposed work areas and test locations;

- Descriptions and locations of ongoing construction;
- Descriptions and locations of work being tested and/or observed and documented; as well as test results;
- Calibrations or recalibration of test equipment and actions taken as a result of recalibration, or reference to specific observation logs and/or test data sheets;
- Off-site materials received, including quality verification documentation;
- Decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard quality.

3.9.2.2 Construction Problem and Solution Report

The CQA Consultant, as required by the Owner, shall prepare reports describing special construction situations or clarifications to technical specifications or construction deficiencies.

These reports may include the following information as appropriate:

- A detailed description of the clarification, or construction deficiency;
- The location and probable cause of the situation or construction deficiency;
- Documentation of the corrective action taken to address the situation or deficiency;
- Final results of any responses;
- The signature of the CQA Consultant Engineer of Record, Regional Engineer, and the Project Manager indicating concurrence.

The Project Manager shall be made aware of any significant recurring non-conformance with the design specifications. The Project Manager shall then determine the cause of the non-conformance and recommend appropriate changes in procedures or specifications to the Regional Engineer. If these changes are significant in nature, they will be submitted to the Design Engineer for approval. When this type of evaluation is made, the results shall be documented, and any revision to procedures design specification, or permit specifications will be approved by the Regional Engineer, Design Engineer, and if necessary, the Permitting Agency.

3.9.2.3 Photographic Reporting Data Sheets

Photographic reporting data sheets, where use, shall be cross-referenced with observation logs and test data sheets and/or construction problem and solution reports.

These photographs will serve as a pictorial record of work progress, problems, and mitigation activities. The basic file shall contain color prints; negatives shall be stored in a separate file in chronological order. These records will be presented to the Project Manager upon completion of the project.

3.9.2.4 Design And/Or Specification Changes And Clarifications

Design and/or permit specifications changes or clarification may be required during construction. In such cases, the CQA Consultant shall notify the Regional Engineer and Project Manager. The Regional Engineer shall then notify the Permitting Agency, if necessary.

Significant design and/or permit specifications changes shall be made only with the written agreement of the Regional Engineer and the Design Engineer, and shall take the form of an addendum to the specifications. The CQA Consultant shall document clarifications to specifications as they are made.

3.9.3 Reports

The CQA Consultant shall prepare periodic reports, which summarize construction activities and the results of observations and tests. Progress reports shall be prepared at regular time intervals to document the status of the work. Certifications shall be prepared at the completion of major construction activities.

At the completion of the work, final documentation shall be prepared and shall include a professional engineer's seal and supporting field and laboratory test results.

3.9.3.1 Final Record Documentation

At the completion of the work, the CQA Consultant shall submit to the Regional Engineer the signed Final Record Documentation. Record Documentation shall describe activities associated with the construction of the item including construction procedures and observations and tests performed by CQA personnel. The report shall be organized into sections discussing the major components of liner construction, including subgrade, compacted soil liner, synthetic liner, protective cover, leachate collection layer, and leachate management system (i.e., force main, piping, etc.). At a minimum, the Final Report shall include:

- Summaries of all construction activities;
- Observation logs and test data sheets including sample location plans and supporting field and laboratory test results;
- Construction problems and solutions reports;
- Changes from design and material specifications;
- Record plans; and
- A summary statement sealed and signed by a professional engineer registered in the state of where the permit was issued.

The record plans shall include scale plans depicting the location of the construction and details pertaining to the extent of construction (e.g., depths, plan dimensions, elevations, soil component thicknesses, etc.). A qualified land surveyor shall prepare surveying and base maps required for development of the record plans.

Green Recycling Solutions LLC

Construciton Quality Assurance (CQA) For Construction of
Maysville Construction & Demolition Debris Landfill
Maysville, North Carolina

TABLES

TABLE 3.2-1A
LABORATORY TEST METHODS
FOR THE EVALUATION OF SOIL AND AGGREGATE

<u>Common Test Name</u>	<u>Parameter Defined</u>	<u>Standard Method</u>
Sieve and Hydrometer Analysis	Particle Size Distribution of Coarse and Fine Grained Soils	ASTM D422
Atterberg Limits	Liquid and Plastic Limits, Plasticity Index	ASTM D4318
Standard Proctor Density	Moisture/Density Relationship Using 5.5 lb (2.46 kg) Rammer and 12 inch (305 mm) Drop	ASTM D698
Modified Proctor Density	Moisture/Density Relationship Using 10 lb (4.54 kg) Rammer and 18 inch (457 mm) Drop	ASTM D1557
Moisture Content	Water Content of Soil by Mass	ASTM D2216
Permeability: Flexible Wall Permeameter	Permeability (Hydraulic Conductivity) on Undisturbed or Remolded Samples of Soil	ASTM D5084
Permeability: Constant Head	Permeability (Hydraulic Conductivity) of Granular Soils	ASTM D2434
Carbonate Content	Carbonate Content	ASTM D3042 or ASTM D4373

Note:

Not all tests are required for this site, refer to the permit, technical specifications, and Table 3.2-2 in the CQA Plan.

TABLE 3.2-1B
FIELD TEST METHODS
FOR THE EVALUATION OF SOIL AND AGGREGATE

<u>Common Test Name</u>	<u>Parameter Defined</u>	<u>Standard Method</u>
Visual Classification	Maximum Particle Size, General Material Characteristics	ASTM D2488
USDA Classification	Classification of Ability to Support Vegetation	USDA Method
Nuclear Density Gauge	In-Place Density and Moisture Content	ASTM D2922 and ASTM D3017
Moisture Content	In-Place Moisture as Check on Nuclear Densometer Measurements	ASTM D2216
Sand Cone Density	In-Place Density as Check on Nuclear Densometer Measurements	ASTM D1556
Drive Tube Sample	In-Place Density as Check on Nuclear Densometer Measurements	ASTM D2937
Lift Depth Check	Thickness of Placed Soils or Aggregates	Visual Confirmation

Note:

Not all tests are required for this site, refer to the permit, technical specifications, and Table 3.2-2 in the CQA Plan.

TABLE 3.2-2
MINIMUM TEST FREQUENCIES
FOR SOIL AND AGGREGATE MATERIALS

<u>Liner Component</u>	<u>Required Test</u>	<u>Minimum Frequency⁽¹⁾</u>	<u>Sample Size⁽²⁾</u>	<u>Acceptance Criteria⁽³⁾</u>
Excavation to Subgrade	Visual Observation	As required	N/A	Subgrade does not pump or rut excessively once area is proof rolled.
	Standard Proctor Density	As required to provide representative values for in-situ soils	50 lb.	Determination of laboratory value for comparison to field tests.
	Nuclear Density Gauge In-Place Density and Moisture Content	Native material - 1 per 15,000 sf	N/A	≥95% standard proctor maximum dry density moisture no greater than 10% above optimum
Structural Fill Placed to Subgrade	Visual Observation	Borrow Areas: As required Stockpiles: As required Placed Material: As required	N/A	Substantially free of debris, large rocks, plant materials, or other deleterious material. Final surface: firm, smooth, and uniform.
	Sieve Analysis	Placed Material: 1 per 10,000 cy	5-10 lb	Max. 6 in. particle size Max. 50% passing #200 sieve
	Standard Proctor Density	Placed Material: As required	50 lb	Determination of window of acceptable moisture content given required dry density.
	Nuclear Density Gauge In-Place Density and Moisture Content	Placed Material: 1 per 100 foot grid per lift	N/A	≥95% Standard Proctor maximum dry density
	Moisture Content	Placed Material: 1 per day that nuclear densometer is used	Varies	Check of nuclear densometer measurements to determine if recalibration is necessary.
	Sand Cone Density or Drive Tube Sample	Placed Material: 1 per day that nuclear densometer is used	Varies	Check of nuclear densometer measurements to determine if recalibration is necessary.

TABLE 3.2-2 (con't.)

**MINIMUM TEST FREQUENCIES
FOR SOIL AND AGGREGATE MATERIALS**

<u>Liner Component</u>	<u>Required Test</u>	<u>Minimum Frequency⁽¹⁾</u>	<u>Sample Size⁽²⁾</u>	<u>Acceptance Criteria⁽³⁾</u>
Soil Liner (Base Liner) or Clayey Soil (Cap) ⁽⁴⁾	Visual Observation	Borrow Areas: As required	N/A	Substantially free of debris, large rocks, plant materials, or other deleterious material. Final surface: firm, smooth, and uniform.
	Sieve and Hydrometer Analysis	Placed Material: 1 per 5,000 cy	5-10 lb	Max. ¾-inch particle size. Gradation consistent with permeability test samples.
	Atterberg Limits	Placed Material: 1 per 5,000 cy	5-10 lb	Plasticity Index: consistent with permeability test samples.
	Standard Proctor Density	Placed Material: As required	5-10 lb	Determination of window of acceptable moisture content given required dry density.
	Nuclear Densometer In-Place Density and Moisture Content	Placed Material: 1 per 100 foot grid per lift	N/A	Within moisture/density limits established by pre-construction and test pad testing.
	Moisture Content	Placed Material: 1 per day that nuclear densometer is used	Varies	Check of nuclear densometer measurement to determine if recalibration is necessary.
	Sand Cone Density or Drive Tube Sample	Placed Material: 1 per day that nuclear densometer is used	Varies	Check of nuclear densometer measurement to determine if recalibration is necessary.
	Permeability: Flexible Wall Permeameter	Placed Material: 1 per lift per 50,000 sf	Varies on sampling technique	$k \leq 1.0 \times 10^{-7}$ cm/sec for Base Liner. $k \leq 1.0 \times 10^{-5}$ cm/sec for Base Liner with GCL $k \leq 1.0 \times 10^{-5}$ cm/sec for Cap
	Survey	As-Built Conformation, completed layer	N/A	Per Section 3.8 and Drawings.
	Lift Depth Check	Placed Material: As required	N/A	≤ 6-inch compacted lift thickness. ≥ 24-inch thickness for completed Base Liner. ≥ 18-inch thickness for completed Base Liner with GCL ≥ 18-inch thickness for completed Cap

TABLE 3.2-2 (con't.)

**MINIMUM TEST FREQUENCIES
FOR SOIL AND AGGREGATE MATERIALS**

<u>Liner Component</u>	<u>Required Test</u>	<u>Minimum Frequency⁽¹⁾</u>	<u>Sample Size⁽²⁾</u>	<u>Acceptance Criteria⁽³⁾</u>
Protective Cover	Visual Observation	Placed Material: As required	N/A	Substantially free of debris, large rocks, plant materials, or other deleterious materials.
	Sieve Analysis	Placed Material: 1 per 5,000 cy	5-10 lbs.	Max. 6 in. size. Min. 30% passing #4 sieve.
	Lift Depth Check	Placed Material: As required	N/A	Per Drawings.
	Survey	As-Built Conformation	N/A	Per Section 3.8 and Drawings.
Drainage Sand	Visual Observation	Placed Material: As required	N/A	Substantially free of debris, large rocks, plant materials, or other deleterious material.
	Sieve Analysis	Placed Material: 1 per 2,000 cy	5-10 lb	Max. 3 in. size. Max. 5% retained on 3/4 in. sieve. Max 5% passing #200 sieve.
	Constant or Falling Head Permeability	Placed Material: 1 per 5,000 cy	50 lb	$k \geq 1.0 \times 10^{-3}$ cm/sec.
	Carbonate Content	Placed Material: 1 per cell unless borrow source changes	50 lb	<15% by weight.
	Lift Depth Check	Placed Material: As required	N/A	Per Drawings.
	Survey	As-Built Conformation	N/A	Per Section 3.8 and Drawings.

TABLE 3.2-2 (con't.)

**MINIMUM TEST FREQUENCIES
FOR SOIL AND AGGREGATE MATERIALS**

<u>Liner Component</u>	<u>Required Test</u>	<u>Minimum Frequency⁽¹⁾</u>	<u>Sample Size⁽²⁾</u>	<u>Acceptance Criteria⁽³⁾</u>
Coarse Aggregate	Visual Observation	Placed Material: As required	N/A	Substantially free of debris, large rocks, plant materials, or other deleterious material.
	Sieve Analysis	Placed Material: 1 per 1,000 cy	5-10 lb	Gradation meeting requirements for AASHTO No. 57 or AASHTO No. 67 Stone.
	Constant or Falling Head Permeability	Placed Material: 1 per 5,000 cy	50 lb	$k \geq 1.0 \times 10^{-2}$ cm/sec.
	Carbonate Content	Placed Material: 1 per cell unless borrow source changes	50 lb	<15% by weight.

Notes:

- (1) See Section 3.2.2 for further definition of sampling frequency.
- (2) In general, where the symbol "N/A" (not applicable) is used, the test is performed on in-place materials.
- (3) See technical specifications for further definition of acceptance criteria.
- (4) Minor variations shall be allowed in acceptance criteria for clay liner in order to maintain permeability less than or equal to 1.0×10^{-7} cm/sec. Under no circumstances shall acceptance criteria be enforced which result in permeability greater than 1.0×10^{-7} cm/sec.

SECTION 3.3 ATTACHMENTS

TABLE 3.3-1

REQUIRED GEOSYNTHETIC CLAY LINER PROPERTIES

<u>Material Property</u>	<u>Value</u>	<u>Units</u>	Test Method	Test Frequency
Swell Index	24	ml	ASTM D5890	1 per 100,000 lb or 1 per lot
Fluid Loss	18	ml	ASTM D5891	1 per 100,000 lb or 1 per lot
Bentonite Content ⁽¹⁾	0.75	lbs/ft ²	ASTM D5993	1 per 40,000 ft ² or 1 per lot
GCL Peel Strength	3.5	lbs/in	ASTM D6496	1 per 40,000 ft ² or 1 per lot
Permeability ⁽²⁾	5.0 x 10 ⁻⁹	cm/sec	ASTM D5084	1 per 100,000 ft ² or 1 per lot

Notes:

(1) At a 0 percent moisture content or oven dried condition.

(2) Engineer shall determine permeability test pressure and gradients.

TABLE 3.3-2
REQUIRED MATERIAL CONFORMATION TESTING
GEOSYNTHETIC CLAY LINER

<u>Material Property</u>	<u>Value</u>	<u>Units</u>	Test Method	Test Frequency
Bentonite Content ⁽¹⁾	0.75	lbs/ft ²	ASTM D5993	1 per 100,000 ft ² or 1 per lot
GCL Peel Strength	3.5	lbs/in	ASTM D6496	1 per 100,000 ft ² or 1 per lot
Permeability ⁽²⁾	5.0×10^{-9}	cm/sec	ASTM D5084	1 per 250,000 ft ² or 1 per lot

Notes:

- (1) At a 0 percent moisture content or oven dried condition.
- (2) Engineer shall determine permeability test pressure and gradients.

TABLE 3.4-1**REQUIRED 60 MIL TEXTURED HDPE GEOMEMBRANE PROPERTIES**

<u>Material Property</u>	<u>Value</u>	<u>Units</u>	<u>Test Method</u>	<u>Test Frequency</u>
Thickness	$\geq 57/51^{(1)}$	mil	ASTM D5994	1 per 100,000 ft ² or 1 per lot ⁽⁷⁾
Asperity Height ⁽²⁾	≥ 16	mil	GM 12	1 per 200,000 ft ² or every 2 nd lot ⁽⁷⁾
Density	≥ 0.94	N/A	ASTM D1505/ D792	1 per 100,000 ft ² or 1 per lot ⁽⁷⁾
Tensile Properties (each direction) ⁽³⁾			ASTM D638; Type IV	1 per 100,000 ft ² or 1 per lot ⁽⁷⁾
1. Tensile Strength at Yield	≥ 132	lb/in.		
2. Tensile Strength at Break	≥ 132	lb/in.		
3. Elongation at Yield	≥ 13	percent		
4. Elongation at Break	≥ 350	percent		
Tear Resistance	≥ 45	lb	ASTM D1004	1 per 45,000 lb
Puncture Resistance	≥ 120	lb	ASTM D4833	1 per 45,000 lb
Stress Crack Resistance ⁽⁴⁾	≥ 300	hr	ASTM D5397	1 per GRI GM 10
Carbon Black Content	2-3	percent	ASTM D1603	1 per 100,000 ft ² or 1 per lot ⁽⁷⁾
Carbon Black Dispersion	9 of 10 Category 1 of 2 1 of 10 Category 3	N/A	ASTM D5596	1 per 200,000 ft ² or every 2 nd lot ⁽⁷⁾
Oxidative Induction Time (OIT)/ High pressure OIT	≥ 100	min	ASTM D5885	1 per 400,000 ft ² or every 4 th lot ⁽⁷⁾
Oven Aging at 85°C/ High Pressure OIT - percent retained after 90 days	≥ 80	percent	ASTM D5721/ ASTM D5885	1 per formulation
UV Resistance/ High Pressure OIT - percent retained after 1600 hrs ⁽⁵⁾⁽⁶⁾	≥ 50	percent	GM 11/ ASTM D5885	1 per formulation

Notes:

- (1) The first value represents the minimum average thickness measurements of 10 measurements the second value represents the lowest allowable individual thickness measurement.
- (2) Of 10 readings; 8 out of 10 must be ≥ 7 mils, and lowest individual reading must be ≥ 5 mils.
- (3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
 - Yield elongation is calculated using a gage length of 1.3 inches.
 - Break elongation is calculated using a gage length of 2.0 inches.
- (4) The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials. The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
- (5) The condition of the test should be 20 hr. UV cycles at 75°C followed by 4 hr. condensation at 60°C.
- (6) UV resistance is based on percent retained value regardless of the original HP-OIT value.
- (7) Whichever results in the greater number of samples tested.

TABLE 3.4-2**REQUIRED 60 MIL TEXTURED HDPE SEAM PROPERTIES**

<u>Material Property</u>	<u>Value</u>	<u>Test Method</u>	<u>Test Weld Frequency</u>	<u>Destructive Seam Frequency</u>
Bonded Shear Strength	100 percent of yield strength of parent material and FTB	ASTM D6392/ ASTM D4437	1 per 4 hours	1 per 500 ft seamed
Seam Peel Adhesion	65 percent of yield strength of parent material and FTB	ASTM D6392/ ASTM D4437	1 per 4 hours	1 per 500 ft seamed

Notes:

1. For laboratory testing only, a maximum of 1 non-FTB (film tear bond) per 5 specimens is acceptable provided that strength requirements are met on that sample.
2. For double-fusion welded seams, both tracks shall be tested to meet compliance with the minimum seam values specified.
3. Strain Rate: 2in./min. and 1 inch wide strips.
4. Test Welds shall be made upon start of work for each seamer, every four (4) hours of continuous seaming, every time seaming equipment is changed, if significant changes in geomembrane temperature and weather conditions are observed, and at the discretion of the CQA Consultant.

TABLE 3.5-1

**REQUIRED MATERIAL PROPERTIES
GEOSYNTHETIC DRAINAGE COMPOSITE**

<u>Material Property</u>	<u>Value</u>	<u>Units</u>	<u>Test Method</u>	<u>Test Frequencies</u>
Geonet Density	$\geq 0.940^{(1)}$	gm/cm ³	ASTM D1505	1 per 100,000 ft ²
Geonet Thickness	≥ 0.25	inches	ASTM D5199	1 per 100,000 ft ²
Geonet Mass per Unit Area	≥ 0.16	lbs/ft ²	ASTM D3776	1 per 100,000 ft ²
Geonet Carbon Black Content	2-3	percent	ASTM D1603	1 per 100,000 ft ²
Geonet Tensile Strength at Break	≥ 55	lbs/in	ASTM D5035	1 per 100,000 ft ²
<hr/>				
Drainage Composite Transmissivity @ 10,000 psf ⁽²⁾	$\geq 5 \times 10^{-4}$	m ² /sec	ASTM D4716	1 per 200,000 ft ²
Drainage Composite Ply Adhesion	≥ 150	g/in	ASTM F904	1 per 200,000 ft ²

Notes:

- (1) Must be less than or equal to the specific density of the geomembrane.
- (2) Transmissivity will be measured in the laboratory using water at 20°C with a gradient of 0.25, between the materials specified in the permit (i.e., 60-mil HDPE geomembrane and Protective Cover material), and will be tested after a seating period of 24 hours (minimum).
- (3) Geotextile to meet properties of Table 3.6-1, 10 oz/sy for the base liner drainage composite and 6 oz/sy for the enhanced liner system and cap drainage composite.

TABLE 3.5-2**REQUIRED MATERIAL CONFORMANCE TESTING
GEOSYNTHETIC DRAINAGE COMPOSITES**

<u>Material Property</u>	<u>Value</u>	<u>Units</u>	<u>Test Method</u>	<u>Test Frequencies</u>
Transmissivity @ 10,000sf ⁽¹⁾	$\geq 5 \times 10^{-4}$	m ² /s	ASTM D4716	1 per 250,000 ft ²
Ply Adhesion	≥ 150	g/in	ASTM F904	1 per 250,000 ft ²

Note:

- (1) Transmissivity will be measured in the laboratory using water at 20°C with a gradient of 0.25, between the materials specified in the permit (i.e., 60-mil HDPE geomembrane and Protective Cover material), and will be tested after a seating period of 24 hours (minimum).

TABLE 3.6-1
REQUIRED MATERIAL PROPERTIES
GEOTEXTILES

<u>Material Property</u>	<u>Minimum Average Roll Values</u>		<u>Units</u>	<u>Test Method</u>	<u>Test Frequencies</u>
	<u>6 oz/sy</u>	<u>10 oz/sy</u>			
Mass per Unit Area	6	10	oz/yd ²	ASTM D5261	1 per 100,000 ft ²
Grab Tensile Strength	150	250	lbs	ASTM D4632	1 per 100,000 ft ²
Grab Elongation	50	50	percent	ASTM D4632	1 per 100,000 ft ²
Puncture Strength	90	125	lbs	ASTM D4833	1 per 100,000 ft ²
Trapezoidal Tear Strength	70	100	lbs	ASTM D4533	1 per 100,000 ft ²
Apparent Opening Size ⁽¹⁾	70-100	70-120	sieve size	ASTM D4751	1 per 100,000 ft ²
Permittivity	1.3	1.3	sec ⁻¹	ASTM D4491	1 per 100,000 ft ²

Notes:

- (1) Required only on material, which is to be used in filter applications.

TABLE 3.6-2
REQUIRED MATERIAL CONFORMANCE TESTING
GEOTEXTILES

<u>Material Property</u>	<u>Minimum Average Roll Values</u>		<u>Units</u>	<u>Test Method</u>	<u>Test Frequencies</u>
	<u>6 oz/sy</u>	<u>10 oz/sy</u>			
Mass per Unit Area	6	10	oz/yd ²	ASTM D5261	1 per 100,000 ft ²
Grab Tensile Strength	150	250	lbs	ASTM D4632	1 per 100,000 ft ²
Puncture Strength	90	125	lbs	ASTM D4833	1 per 100,000 ft ²
Trapezoidal Tear Strength	70	100	lbs	ASTM D4533	1 per 100,000 ft ²

Green Recycling Solutions LLC

Construciton Quality Assurance (CQA) For Construction of
Maysville Construction & Demolition Debris Landfill
Maysville, North Carolina

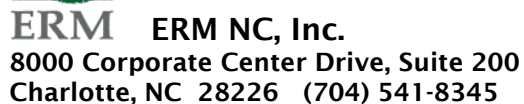
SAMPLE CQA FORMS



DAILY LOG	DATE			
	NO.			
	SHEET		OF	

FIELD ACTIVITY DAILY LOG

[illegible]

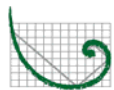


SHEET OF

PROJECT NAME:	INVENTORY DATE:
PROJECT NO.:	TECHNICIAN:
OWNER:	WEATHER CONDITIONS:
STORAGE AREA:	

GEOSYNTHETIC PRODUCT DESIGNATION:	
GEOSYNTHETIC MATERIAL TYPE:	
SHIPMENT NUMBER:	DELIVERY DATE:
GENERAL COMMENTS ON ROLL CONDITION:	GENERAL COMMENTS ON STORAGE CONDITIONS:

[illegible]



ERM ERM NC, Inc.
8000 Corporate Center Drive, Suite 200
Charlotte, NC 28226 (704) 541-8345

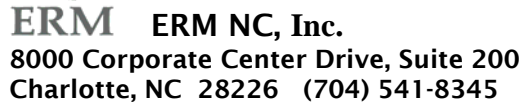
DRIVE CYLINDER DENSITY TEST

PROJECT NAME:		TESTED BY:			
PROJECT NO.:		CALCULATED BY:			
DATE:		CHECKED BY:			
TEST NUMBER					
STATION					
ELEVATION					
LIFT THICKNESS					
NUMBER OF PASSES					
DRIVE CYLINDER NO.					
WEIGHT OF SOIL AND DRIVE CYLINDER (g) <i>A</i>					
TARE WEIGHT OF CYLINDER (g) <i>B</i>					
WEIGHT OF SOIL (g) <i>C=A-B</i>					
WEIGHT OF SOIL (LB) <i>D=C/453.6</i> <i>g/lb</i>					
CYLINDER VOLUME (IN ³) <i>V</i>					
WET UNIT WEIGHT (LB/FT ³) <i>WD= D/V</i>					
WET WEIGHT OF SOIL (g) <i>E</i>					
DRY WEIGHT OF SOIL (g) <i>F</i>					
TARE OF MOISTURE PAN (g) <i>G</i>					
% MOISTURE <i>%M=(E-F)/(F-G)*100</i>					
WET DENSITY <i>WD</i>					
DRY DENSITY <i>DD = WD/(1+%M/100)</i>					
% MOISTURE <i>%M</i>					
MAXIMUM OBTAINABLE DENSITY					
OPTIMUM MOISTURE					
% RELATIVE COMPACTION					
MEETS SPECIFICATION Y/N					
REMARKS:					

Proctor Curve Sample Used: _____
Maximum Dry Density _____pcf

Optimum Moisture Content: _____%

_____ Required % of Maximum Dry Density: _____pcf
Acceptable Moisture Range: _____ to _____%



DATE _____

PROJECT NO.: _____ CHECKED BY: _____

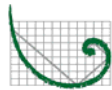
MATERIAL DESCRIPTION: _____

GCL DEPLOYMENT LOG

PANEL DATE	ROLL NO.	LENGTH	WIDTH	SQUARE FOOTAGE
TOTAL SQUARE FOOTAGE				



MATERIAL DESCRIPTION: _____



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8000 Corporate Center Drive, Suite 200
Charlotte, NC 28226 (704) 541-8345

SHEET
NO. _____ OF _____
DATE _____

PROJECT NAME: _____
PROJECT NO.: _____ TECHNICIAN _____
MATERIAL _____
DESCRIPTION: _____

GEOMEMBRANE DEPLOYMENT LOG

PANEL NO.	PANEL DATE	ROLL NO.	LENGTH	WIDTH	SQUARE FOOTAGE
TOTAL SQUARE FOOTAGE					



GEOMEMBRANE DEFECT LOG

TECHNICIAN _____
SHEET OF

[illegible]

Repair Type: P - Patch, T - Weld, CAP - Cap Strip, DS - Destructive Sample, B - Bead



GEOMEMBRANE DESTRUCTIVE TESTING SUMMARY

TECHNICIAN

SHEET OF

10/04/2013 DIN20046 Page 511 of 627



GEOMEMBRANE NON-DESTRUCTIVE TESTING SUMMARY

TECHNICIAN

SHEET OF

10/04/2013 DIN20046 Page 512 of 627



SHEET _____ OF _____

PROJECT NAME:	TECHNICIAN:	Passing Peel = Fusion: ____ ppi Extrusion: ____ ppi Passing Shear = Fusion: ____ ppi Extrusion: ____ ppi
PROJECT NO.:	GEOMEMBRANE TYPE:	
INSTALLER:		

10/04/2013 DIN20046 Page 513 of 627



PROJECT NAME: _____

PROJECT NUMBER: _____

TECHNICIAN: _____

SHEET _____ OF _____

10/04/2013 DIN20046 Page 514 of 627

**OPERATIONS PLAN
CONSTRUCTION & DEMOLITION DEBRIS LANDFILL
(CDLF)**

**GREEN RECYCLING SOLUTIONS LLC
MAYSVILLE, NORTH CAROLINA**

Owner: Green Recycling Solutions LLC

Operator: Green Recycling Solutions LLC

This Operations Plan has been prepared in accordance with the State of North Carolina Department of Environment and Natural Resources, Division of Waste Management, Solid Waste Management Rule .0542 – Operational Requirements for C&D Landfill Facilities.

This Plan has been prepared for:

Green Recycling Solutions LLC

Maysville, North Carolina

This plan has been prepared by:

**ERM NC Inc.
8000 Corporate Center Drive, Suite 200
Charlotte, North Carolina 28226**



**June 2013
(Revised September 30, 2013)**

OPERATIONS PLAN

Table of Contents

	<u>Page</u>
1.0 LANDFILL OPERATIONS AND MAINTENANCE	1
1.1 Landfill Cell Sequencing	1
1.2 Stormwater Management	2
1.3 Leachate Management	2
1.4 Placement of Waste and Cover Requirements	3
1.5 Waste Acceptance and Disposal	4
1.6 Facility Personnel Training	6
1.7 Inspection Procedures	7
1.8 Record Keeping	7
2.0 FACILITY OPERATIONS AND MAINTENANCE	9
2.1 Erosion and Sedimentation Control	9
2.2 Access and Safety Requirements	10
2.3 Dust, Litter, Odor and Vectors	10
2.4 Landfill Signage	11
2.5 Air Criteria & Fire Control	11
2.6 Compliance Survey	12
2.7 Operational Record & Recordkeeping	12
2.8 Explosive Gases Control	13
2.8.1 Permanent Methane Monitoring Wells	13
2.8.2 Methane Monitoring Well Construction	14
2.8.3 Methane Monitoring Procedures and Frequency	14
2.8.4 Reporting Requirements and Response Plan	15
2.9 Leachate Management System	16
2.9.1 Leachate Management System Design	16
2.9.2 Sampling, Record Keeping & Reporting	17

APPENDIX

APPENDIX	Operations Plan Drawings
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1.0 LANDFILL OPERATIONS AND MAINTENANCE

Maysville C&D Landfill is owned and operated by Green Recycling Solutions of Maysville, NC. Operation and maintenance of the facility is the responsibility of the Facility Manager. The Operational Manager is responsible for operation and maintenance of the landfill. The facility is located on property owned by Green Recycling Solutions of Maysville within the Town Limits of Maysville, North Carolina.

In accordance with Rule .1625 of the North Carolina Division of Waste Management Rules, an Operation Plan is required along with drawings to describe the existing site conditions, progression of operations, leachate and stormwater controls, special waste areas, buffer zones and borrow areas. The Operations Plan Drawings are included in Appendix 6 and include:

- Site Development Plan – shows existing conditions, existing structures and buffer zones.
- Phasing Plans for Phase 1 (Cells 1, 2 & 3), Phase 2, Phase 3, Phase 4, Phase 5 and Phase 6 – shows the progression of Cell/Phase development and operations
- Borrow Area Grading Plan – Shows the proposed grades and remaining capacity for the Borrow area used for the facility located adjacent to the landfill.
- Refer to the Engineering Plan Drawings for details concerning Leachate collection and removal.

1.1 Landfill Cell Sequencing

The initial Phase of construction and landfill development includes the construction of Phase 1, Cell 1. Following the Phase 1 completion, Phase 2, Phase 3, Phase 4, Phase 5 and Phase 6 shall be developed in order. Phasing plans depicting the development of the Cells and Phases are included in Appendix 6 to show the progression of landfilling operations.

Cells 1, 2 and 3 within Phase 1 have been designed with one central sump location, post settlement cell floor slope of greater than 2.0% and a vertical separation from long term seasonal high water table of 4 feet minimum. Phases 2, 3, 4, 5 and 6 may contain a similar design based upon the current Facility wide hydrogeologic characterization. However, the final design of these Phases will be dependent upon the future design hydrogeologic studies. Therefore, the proposed base grades for the future Phases may be adjusted based on the results of further studies.

Once the facility receives a permit to operate a Cell (Phase 1, Cell 1, 2 or 3), operations will begin in the topographically high portions of the Cell and progress towards the leachate collection sump area. Perimeter berms shall be constructed along the proposed limits of Cells and Phases. In areas where further landfill development is proposed, a temporary berm will be constructed to contain leachate within the cell limits but allow for an efficient “tie-in” to future cells/phases. Details of the perimeter and temporary berms are shown in the Engineering drawings.

1.2 Stormwater Management

An erosion and sedimentation control plan has been designed for the construction, operation and closure of the C&D Landfill construction. Due to the small size of Cell development (between 1 to 2 acres) the primary erosion and sedimentation control is the installation of silt fence along the perimeter berm slopes. Based on a 25-year, 24-hour storm for this area, stormwater runoff conveyances and devices were designed for the peak flow condition (construction, operations or closure). Stabilized channels will intercept storm water runoff following initial treatment from the silt fence. These channels are long and contain storage for the 25-year, 24-hour storm event allowing for infiltration into the underlying soils. Therefore, based on the 25-year, 24-hour storm event the landfill will be non-discharging storm water to waters of the United States.

During landfilling operations, the waste and daily cover shall be sloped to promote drainage away from the landfill. The subsequent runoff shall be intercepted by the erosion and sedimentation control devices and routed to the storm water stabilized channels.

Proposed grading for Phases 2, 3, 4, 5 and 6 has not been finalized due to on-going water level measurements throughout the Phase footprints. Stormwater segregation within Cell footprints may be necessary within these Phases if final base grades warrant.

1.3 Leachate Management

A leachate collection system will be constructed above the composite liner system in each Cell. The leachate collection system will consist of a geocomposite drainage media that rests on the 60-mil high density polyethylene liner to collect and transport leachate along the Cell floor. A network of leachate collection pipes surrounded by #57 washed stone will be placed at various locations along the Cell floor to intersect flow of leachate along the top of protective cover and the geocomposite. The leachate collection pipes will transport the collected leachate to the sump area for each Cell. At each sump area, a stainless steel pump will rest on the Cell floor housed in a high density polyethylene side-wall riser pipe to remove leachate from within the Cell and transport into the leachate storage tank placed near the sump area. Leachate will be pumped and hauled to a permitted waste water treatment plant (Town of Maysville or Pollocksville).

The leachate collection and removal system is designed so that no more than 12-inches of hydraulic head will act on the liner system during normal operating conditions.

Cleanouts will be installed at the ends of the header pipes to provide necessary flushing and camera inspection of the system for maintenance as needed. All leachate collection lines shall be cleaned at least once a year, except that the Department may allow leachate collection lines to be cleaned once every two years if: (i) the facility has continuous flow monitoring; and (ii) the permit holder demonstrates to the Department that the leachate collection lines are clear and functional based on at least three consecutive annual cleanings.

During the design of Cells 1, 2 and 3, the “HELP” model was used to generate leachate quantities for various stages of operation throughout this Phase. Based on the results of “HELP” model analysis, the peak leachate generation rate will occur when Cells are newly constructed and activated for operations. Since each Cell has a dedicated pump, sidewall riser and storage tank, the storage tanks are sized for each individual Cell during this phase of operation. The resulting peak daily leachate generation rate is 56,840 gallons per acre of open landfill during this initial operational phase. The average daily leachate generation rate for this phase of operations is 1,258 gallons per acre per day.

1.4 Placement of Waste and Cover Requirements

Waste placement shall proceed beginning with Cell 1 and proceed further into Cells 2 and 3. Following filling of Phase 1, operations will continue into Phases 2, 3, 4, 5 and 6. Initial waste placement in the Phase 1, Cell 1 will begin in the topographically high areas of the Cell and progress towards the leachate collection sump area.

The initial “fluff” lift shall be a minimum 8-foot thick lift when placed across the Cell floor. Thereafter, waste shall be placed in approximately 12-foot maximum lifts placed in 2 to 3-foot increments by spreading across the previous lift prior to compaction. This process shall continue until proposed final grades are achieved.

Waste shall be compacted as densely as achievable to provide a foundation layer for subsequent waste lifts and to maximum airspace. A minimum of four passes with a “trash compactor” or heavy dozer is recommended to achieve appropriate density. Additional passes may be required depending on the waste type. The daily working area for waste disposal shall be kept to a minimum to conserve weekly cover requirements.

A minimum five (5) percent slope should be maintained on the surface of landfilling operations to promote drainage to the perimeter slopes. No standing water shall be created in, surrounding or above disposed waste.

Disposed waste shall be covered weekly with a minimum of six (6) inches of soil. If the working area exceeds one half of an acre, (6) inches of soil cover will be placed above exposed waste. Alternative materials or an alternative thickness of cover may be approved by the Division if the owner or operator demonstrates that the alternative material or thickness controls disease vectors, fires, odors, blowing litter, and scavenging without presenting a threat to human health and the environment. A C&DLF owner or

operator may apply for approval of an alternative cover material. If approval is given by the Division, approval would extend to all C&DLF units at one specific facility.

If an area of the landfill has not reached proposed final waste grades and will not be active for a period of three months or more, intermediate cover consisting of twelve (12) inches of soil shall be placed over the area. Intermediate cover areas shall be stabilized by seeding to promote vegetation.

1.5 Waste Acceptance and Disposal

As defined by the State of North Carolina 15A NCAC 13B .0542, Maysville C&D Landfill may accept only those solid waste types it is permitted to receive. The landfill owners will notify the Division within 24 hours of attempted disposal of any waste the C&DLF is not permitted to receive, including waste from outside the area the landfill is permitted to serve..

Asbestos waste must be managed in accordance with 40 CFR 61, which is hereby incorporated by reference including any subsequent amendments and additions. Copies of 40 CFR 61 are available for inspection at the Department of Environment and Natural Resources, Division of Waste Management. The regulated asbestos waste must be covered immediately with soil in a manner that will not cause airborne conditions and must be disposed of separate and apart from other solid wastes, as shown on Operation drawings:

- (a) In a defined isolated area within the footprint of the landfill, or
- (b) In an area not contiguous with other disposal areas. Separate areas must be designated so that asbestos is not exposed by future land-disturbing activities.

Waste water treatment sludges must not be accepted for disposal. Wastewater treatment sludge may be accepted, with the approval of the Division, for utilization as a soil conditioner and incorporated into or applied onto the vegetative growth layer. The wastewater treatment sludge must neither be applied at greater than agronomic rates nor to a depth greater than six inches.

Waste Exclusions. The following waste must not be disposed of in a C&DLF unit:

- (1) Containers such as tubes, drums, barrels, tanks, cans, and bottles unless they are empty and perforated to ensure that no liquid, hazardous or municipal solid waste is contained therein,
- (2) Garbage as defined in G.S. 130A-290(a)(7)
- (3) Hazardous waste as defined in G.S. 130A-290(a)(8), to also include hazardous waste from conditionally exempt small quantity generators,
- (4) Industrial solid waste unless a demonstration has been made and approved by the Division that the landfill meets the requirements of Rule .0503(2)(d)(ii)(A),
- (5) Liquid wastes,

- (6) Medical waste as defined in G.S. 130A-290(a)(18).
- (7) Municipal solid waste as defined in G.S. 130A-290(a)(18a),
- (8) Polychlorinated biphenyls (PCB) wastes as defined in 40 CFR 761,
- (9) Radioactive waste as defined in G.S. 104E-5(14),
- (10) Septage as defined in G.S. 130A-290(a)(32),
- (11) Sludge as defined in G.S. 130A-290(a)(34),
- (12) Special wastes as defined in G.S. 130A-290(a)(40),
- (13) White goods as defined in G.S. 130A-290(a)(44), and
- (14) Yard trash as defined in G.S. 130A-290(a)(45),

The following wastes cannot be received if separate from C&DLF waste: lamps or bulbs including but not limited to halogen, incandescent, neon or fluorescent; lighting ballast or fixtures; thermostats and light switches; batteries including but not limited to those from exit and emergency lights and smoke detectors; lead pipes; lead roof flashing; transformers; capacitors; and copper chrome arsenate (CCA) and creosote treated woods.

Waste accepted for disposal in a C&DLF unit must be readily identifiable as C&D waste and must not have been shredded, pulverized, or processed to such an extent that the composition of the original waste cannot be readily ascertained except as specified below.

C&D waste that has been shredded, pulverized or otherwise processed may be accepted for disposal from a facility that has received a permit from an authorized regulatory authority which specifies such activities are inspected by the authority, and whose primary purpose is recycling and reuse of the C&D material. A waste screening plant and waste acceptance plan must be made available to the Division upon request.

The owner or operator of a C&DLF must not knowingly dispose any type or form of C&D waste that is generated within the boundaries of a unit of local government that by ordinance:

- (A) Prohibits generators or collectors of C&D waste from disposing that type or form of C&D waste
- (B) Requires generators or collectors of C&D waste to recycle that type or form of C&D waste.

Green Recycling Solutions LLC maintains a waste screening program at the recycling/recovery facility. Reference the permitted operations plan for the recycling/recovery facility for details concerning the waste screening process.

The facility operator shall notify the Division of Waste Management within 24 hours of attempting to dispose of waste products not approved for disposal at the facility. No hazardous, liquid or infectious waste shall be accepted and disposed of in the landfill.

1.6 Facility Personnel Training

Personnel at the Maysville C&D Landfill Facility shall be trained to perform their position related tasks affectively. Individuals shall be trained in the following categories dependent upon their job description:

- Operation and Maintenance of the Leachate Collection Pumps and Control Panels
- Leachate flow volumes, sampling and recordation
- Recordation of Waste Loading (Qualitative and Quantitative)
- Identification of Hazardous Waste
- Identification of Liquid Waste
- File Management and Record Keeping
- Control of Accidental Fires

The facility and operations managers shall be familiar with all aspects of training for landfill operations and maintenance. In accordance with NC General Statute 130A-309.25 - Training of operators of solid waste management facilities, the following shall apply for Manager and Operator Training:

(a) The Department shall establish qualifications for, and encourage the development of training programs for, operators of incinerators, operators of landfills, coordinators of local recycling programs, and other solid waste management facilities.

(b) The Department shall work with accredited community colleges, vocational technical centers, State universities, and private institutions in developing educational materials, courses of study, and other such information to be made available for persons seeking to be trained as operators of solid waste management facilities.

(c) A person may not perform the duties of an operator of a solid waste management facility after 1 January 1998, unless he has completed an operator training course approved by the Department. An owner of a solid waste management facility may not employ any person to perform the duties of an operator unless the person has completed an approved solid waste management facility operator training course.

(d) The Commission may adopt rules and minimum standards to effectuate the provisions of this section and to ensure the safe, healthy, and lawful operation of solid waste management facilities. The Commission may establish, by rule, various classifications for operators to address the need for differing levels of training required to operate various types of solid waste management facilities due to different operating requirements at the facilities.

(e) This section does not apply to any operator of a solid waste management facility who has five years continuous experience as an operator of a solid waste management facility immediately preceding January 1, 1998, provided that the operator attends a course and completes the continuing education requirements approved by the

Department. (1989, c. 784, s. 2; 1993, c. 29, s. 1; 1995 (Reg. Sess., 1996), c. 594, s. 19; 1997-443, s. 15.49(a).)

1.7 Inspection Procedures

The Maysville C&D Landfill Facility will only receive waste from the Green Recycling Solutions C&D Recycling/Recovery Facility. All incoming waste is thoroughly inspected at the Recycling/Recovery Facility including maintenance of inspection records. Refer to the Recycling/Recovery Facility Operations Plan for further details.

1.8 Record Keeping

The Maysville C&D Landfill Facility maintains an on-site operating record in accordance with the NCDENR- Division of Waste Management Rule .0542 that includes the following:

- Waste inspection records
- Waste determination records
- Personnel Training records
- Waste screening program
- Waste amounts received along with source
- Methane gas monitoring results
- Methane gas remediation plans (if required)
- Groundwater Monitoring
 - Approved Groundwater Monitoring Plan
 - Groundwater monitoring analytical Results
 - Notice of Statistically Significant changes in constituents (if required)
 - Report of Explanation for change in Statistically Significant changes if change is not due to the Landfill Facility
 - Notice of Appendix II Constituents detected (if required)
 - Report of each sampling event
 - Permit modification to document selection of corrective action (if required)
 - Report justifying alternative corrective measures (if required)
 - Report documenting completion of corrective measures (if required)
- Closure and Post-Closure Monitoring Plan and Results
- Closure Cost Estimate and Financial Assurance Documentation
- Asbestos Disposal Recordation in accordance with 40 CFR 61
- Operations Plan
- Leachate Management Plan

Files containing the previously listed items shall be kept in the operating record for the active life of the landfill and the post-closure care period. All information contained in the operating record must be furnished to the Division of Waste Management upon

request or made available for inspection. Additional records to be maintained on-site for the Facility include:

- Solid Waste Facility Permits
- EPA Generator I.D. / Permits
- NPDES Stormwater Permit, Monitoring and Sampling
- Industrial User Pretreatment Discharge Permit
- Erosion & Sedimentation Control Plan, Permit and Inspections
- Division of Waste Management Inspections
- Applications for Permits and Operations Plans
- SPCC Plan and Updates
- Special Waste Acceptance Records

2.0 FACILITY OPERATIONS AND MAINTENANCE

This Section of the Operations Plan addresses the operational and maintenance requirements that are not specific to a specific landfill Phase or Cell. These requirements apply to the operations within the Facility boundary.

2.1 Erosion and Sedimentation Control

Each phase of landfill development requiring the disturbance or clearing of natural lands requires an erosion and sedimentation control plan designed for the 25-year, 24-hour storm event. The erosion and sedimentation control governing authority for Maysville C&D Landfill is the State of North Carolina - NCDENR. The erosion and sedimentation control plan serves to stabilize disturbed areas and contain runoff sediments on-site.

For the development of the Phase 1, the erosion and sedimentation control plan will utilize silt fence and stabilized channels surrounding the Phase 1 footprint. Stabilized channels will convey and store stormwater runoff for infiltration into the underlying soils.

Following each significant rainfall event, all sediment and erosion control devices should be inspected for integrity. All devices should be inspected for erosion damage and repaired immediately. Once the sediment levels in the stabilized channels have reached one third of the basin storage capacity, the accumulated sediments will be removed from the basin and may be applied as weekly cover in the landfill. Any trash or debris found in the basins will be removed and transported to the recycling/recovery facility for processing.

Embankment slopes shall be periodically inspected for erosion damage. Provisions for stabilized vegetation on embankment slopes shall be made within 30 working days or 120 calendar days following completion of any phase of landfill development. If vegetation growth is not adequate after the first growing season, apply additional fertilizer prior to the next growing season. Vegetation should be mowed at least twice a year. If erosion damage occurs within a stabilized area, the damaged area shall be filled with soil to original grade, seeded and mulched. If needed, a manufactured erosion mat shall be installed to temporarily stabilize the area until vegetation is stabilized.

The landfill shall not cause a discharge of pollutants into waters of the United States, including wetlands, that violates any requirement of the Clean Water Act, including but not limited to, NPDES requirements pursuant to Section 402. The landfill shall not cause a discharge of a non-point source pollutant to the waters of the United States, including wetlands, that violates any requirement of a local government or state-wide water quality management plan that has been approved in accordance with Sections 208 or 319 of the Clean Water Act.

Drainage Control and Water Protection

The Maysville C&D Landfill will be graded to divert surface water from the operational area. Surface water will not be impounded over or in waste and solid waste will not be disposed of in water. Leachate will be contained onsite or treated prior to discharge. An NPDES permit may be required prior to discharge of leachate from surface waters.

The Maysville C&D Landfill shall not cause a discharge of pollutants into waters of the United States, including wetlands, that violates any requirement of the Clean Water Act, including but not limited to, NPDES requirements pursuant to Section 402. The landfill shall not cause a discharge of a non-point source pollutant to the waters of the United States, including wetlands, that violates any requirement of a local government or state-wide water quality management plan that has been approved in accordance with Sections 208 or 319 of the Clean Water Act.

2.2 Access and Safety Requirements

The Maysville C&D Landfill facility maintains controlled access with chain-link fencing and locking gates located at the entrance to the site near US Highway 17. Landfill personnel are located at the scales near the entrance to the facility between all hours of operation and public access to assure compliance with Facility operations.

Access roads into and around the site consist of all weather construction and are maintained in good condition. Speed limits are posted along facility access roads to promote driver safety. Dust control measures must be implemented as needed.

Personnel and public entering the landfill are required to wear hard hats and high visibility safety vests in and around the active areas.

The Facility prohibits the removal of solid waste from the landfill unless the unit has included in its operational plan a recycling program which has been approved by the Division. The general public is prohibited from removal activities on the working face.

With the exception of asbestos contained in fiber drums, barrels and drums shall not be disposed of in the landfill unless they are verified as empty and perforated sufficiently so as not to contain hazardous or liquid waste.

2.3 Dust, Litter, Odors and Vectors

Potential nuisances involved with landfill operations include dust, odor and litter. Dust is kept to a minimum with utilizing on-site water trucks to wet the access and haul roads on-site. Wind blown dust may also be minimized by seeding areas that will remain inactive to promote vegetation. Odor is controlled with the application of weekly cover over disposed waste. If odor continues to be a concern, masking agents may be used or cover applied more vigorously. Odor should not be of concern based on the nature of accepted waste limited to primarily C&D waste.

Constant policing and “good housekeeping” practices are carried out by landfill personnel to reduce potential litter. Potential disease vectors that may be drawn to landfilling operations are primarily rodents, insects and birds that are categorized as “scavengers”. To deter the presence of these vectors, waste is covered weekly with soil or alternative cover to limit the accessibility of a food source. Standing water shall not be allowed in the landfill disposal footprint that may promote insect population. Vectors should not be of concern based on the nature of accepted waste limited to primarily C&D waste.

2.4 Landfill Signage

Facility signs will be posted along the access road leading to the scalehouse and recycling/recovery facility. The existing signs display information for:

- Facility Name and Owner
- Hours of Operation
- Permit Number
- Emergency Contact
- No hazardous or non-permitted waste may be accepted without written approval from the North Carolina Division of Waste Management
- Additional Facility Specific Information

Signs must be posted which at a minimum list liquid, hazardous and municipal solid waste as being excluded from the C&DLF unit.

Directional, informational and traffic signs will be posted along access roads to efficiently direct haulers and visitors to the working face of the landfill or other appropriate facilities at a safe speed.

2.5 Air Criteria and Fire Control

Owners and operators for all C&DLF units must ensure that the units do not violate any applicable requirements developed under a State Implementation Plan (SIP) approved or promulgated by the U.S. EPA Administrator pursuant to Section 110 of the Clean Air Act, as amended.

Open burning of solid waste, except for the approved burning of land clearing debris generated on-site or debris from emergency clean-up operations, is prohibited at Maysville C&D Landfill. Prior to any burning, a request must be sent to the Division for review. The Division will determine the burning to be approved if it is one of the two types of burning as referenced above. A notation of the date of approval and the name of the Division personnel who approved the burning must be included in the operating record. Heavy equipment and readily available soils are in place to control accidental small fires. Any fire that occurs at the Landfill shall be reported to the Division of Waste Management within 24 hours of occurrence and the Landfill operations or facility

manager shall submit a written notice of fire to the Division within 15 days. Written notification must include the suspected cause of fire or explosion, the response taken to manage the incident, and the action(s) to be taken to prevent the future occurrence of fire or explosion.

In the event a large fire occurs at the landfill facility, the Maysville Fire and EMS shall be contacted by dialing 911. "Hot" loads that are delivered to the landfill shall be directed away from the landfill area, dumped, and the fire department notified. The load shall be sprayed with water until extinguished and combustion is not a threat. The load will then be transported to the landfill for disposal.

2.6 Compliance Survey

The Division of Waste Management may request a compliance survey during landfill operations. The Maysville C&D landfill will perform a survey of compliance within 60 days of receipt of the Division's written request. The survey will include active or closed portions of unit or units at the facility in order to determine whether operations are being conducted in accordance with the approved design and operational plans. A report must be submitted to the Division within 90 days following the receipt of Division's written request. The report results will include a map produced by the survey.

A survey shall be required by the Division if there is reason to believe that operations are being conducted in a manner that deviates from the plan listed in the effective permit, or as verification that operations are being conducted in accordance with the plan listed in the effective permit. Any survey performed pursuant to this paragraph must be performed by a registered land surveyor duly authorized under North Carolina law to conduct such activities.

2.7 Operation Record and Recordkeeping

The owner and operator of a C&D Landfill unit must record and retain at the facility, or in an alternative location near the facility, the following information:

- a) Records of random waste inspections, monitoring results, certifications or training, and training procedures required by Rule .0544 of 15A NCAC 13B.
- b) Amounts and weights of solid waste received at the facility to include, consistent with G.S.130A-309.09D, county of generation,
- c) Any demonstration, certification, finding, monitoring, testing, or analytical data required by rules.0544 through .0545 of 15A NCAC 13B,
- d) Any closure or post-closure monitoring, testing, or analytical data as required by Rule .0543 of 15A NCAC 13B,
- e) Any cost estimates and financial assurance documentation required by Rule .0546 of 15A NCAC 13B,
- f) Notation of date and time of placement of cover material, and
- g) All audits records, compliance records and inspection reports.

All information contained in the operating record must be furnished to the Division according to the permit or upon request, or be made available for inspection by the Division. Based on the nature of the C&D Landfill serving one waste generator, Green Recycling Solutions Recycling/Recovery Facility, the operating records associated with waste inspections, receipts and generators will be maintained at the Recycling/Recovery Facility.

The operating record must also include:

- a) A copy of the approved operation plan required by this rule and the engineering plan required by Rule .0539 of 15A NCAC 13B
- b) A copy of the current Permit to Construct and Permit to Operate; and
- c) The Monitoring Plan, in accordance with Rule .0544 of 15A NCAC 13B, included as appendices to the Operations Plan.

2.8 Explosive Gases Control

An explosive gases monitoring program is proposed for the Maysville C&D Landfill Facility. This program will be implemented in accordance with the North Carolina Division of Waste Management Rule .0544. The program consists of quarterly air quality sampling within facility structures and within permanent gas monitoring wells. The purpose of the program is to protect the health and safety of personnel and public at the facility and detect methane gas migration off-site. The following describes the monitoring program, devices implemented, sampling frequency, sampling procedures, recordation and reporting.

2.8.1 Permanent Gas Monitoring Wells

Permanent gas monitoring wells are proposed between the landfill footprint and the facility boundary and structures to detect the horizontal migration of explosive gases from the landfill. The gas monitoring wells will be placed no further than 800 feet apart along the perimeter of the landfill and at varying distances from the landfill depending on location of facility boundary and nearby structures. Prior to implementing the permanent gas monitoring wells, a temporary monitoring system shall be used. This temporary system will consist of "punching" probe holes in the ground with a metal rod that is approximately 1/2-inch in diameter and 3 feet deep, then placing a methane and hydrogen sulfide gas detection instrument (with a minimum 30-inch metal extension) into the hole and recording the results of the instrument's readings. The probe locations will be in the immediate vicinity of ground water monitoring wells OWB-8 and OWB-15 as shown on the Groundwater Monitoring Plan and Potentiometric Plan. This area will be the likely location for permanent monitoring well construction.

The locations and spacing of the wells shall be determined based on a temporary monitoring system, soil conditions, hydrogeologic conditions, and location of facility structures. The wells should be installed to the top of groundwater elevations.

2.8.2 Gas Monitoring Well Construction

The gas monitoring wells extend to depths that are a minimum of three (3) feet below the depth of the liner system of the nearest landfill Cell. Depths of the wells are shallow to avoid intersecting the seasonal high water table. The wells will be constructed of Schedule 40 PVC casing attached to a section of 0.01-inch machine slotted PVC screen. The screen section shall be surrounded with No. 78M stone (Pea Gravel) to fill the eight-inch annulus of the borehole. The Pea Gravel shall extend a minimum of two feet above the machine slotted screen. A minimum 2-foot thick bentonite seal shall be installed above the Pea Gravel section. The bentonite seal shall be hydrated prior to filling the remaining annulus space with Portland cement to the ground surface. A 4-inch X 4-inch locking protective steel casing will be installed over the PVC casing stick-up. A minimum 2-foot X 2-foot concrete pad will be installed around the protective casing sloped to drain rainwater away from the well. The wells shall be installed by a North Carolina Certified Well Driller. A schematic of methane monitoring well construction will be submitted to the Division following final design after based on the temporary monitoring system. The well heads will be equipped with flexible tubing and a stopcock valve for sampling purposes.

2.8.3 Gas Monitoring Procedures and Frequency

The gas monitoring program shall be performed by Maysville C&D Landfill personnel properly trained to use an explosimeter (gas meter). The explosimeter used shall be a CES-Landtec GEM2000 or equivalent for methane and hydrogen sulfide detection. Gas monitoring wells and facility structures will be monitored quarterly for concentrations of methane and hydrogen sulfide gas using an explosimeter. The following testing procedures shall be used each quarter:

Gas Monitoring Well Testing Procedure

1. Calibrate the explosimeter in accordance with the manufacturer's recommendations for methane and hydrogen sulfide calibration. Calibration shall be performed in area known to be free of methane and hydrogen sulfide gas.
2. Aspirate to purge the explosimeter 4 to 5 times prior to each reading in an area known to be free of methane gas.
3. Open the cover of the gas monitoring well
4. Insert the explosimeter into the PVC casing approximately 1 to 2 feet below the top of the PVC casing.
5. Aspirate the explosimeter 5 to 7 times immediately before gas is evacuated from the well.
6. Record the percent methane and hydrogen sulfide (volume by air) and percent of lower explosive limit (LEL).

Gas Monitoring for Facility Structures

1. Calibrate the explosimeter in accordance with the manufacturer's recommendations for methane calibration. Calibration shall be performed in area known to be free of methane gas.
2. Aspirate to purge the explosimeter 4 to 5 times prior to each reading in an area known to be free of methane gas.
3. For Structures Built Upon Concrete Slabs: Place the explosimeter tube near penetrations through interior walls such as floor drains, electrical outlets, switches or any cracks in concrete slab or around the base of the walls if none of the previously mentioned items are present. Aspirate the explosimeter 5 to 7 times at each location. Record the percent methane and hydrogen sulfide (volume by air) and percent of lower explosive limit (LEL). Purge the explosimeter prior to performing another reading.
4. For Structures with a Crawl Space: Perform testing as described in item 3 above with the addition of performing testing at the opening and vents of the crawl space. Insert the explosimeter 2 to 3 feet into the crawl space area and aspirate 5 to 7 times at each location. Record the percent methane and hydrogen sulfide (volume by air) and percent of lower explosive limit (LEL). Purge the explosimeter prior to performing another reading.

Permanent gas monitors may be installed within structures to monitor the presence of methane and/or hydrogen sulfide gases.

2.8.4 Reporting Requirements and Response Plan

The results of the quarterly gas monitoring shall be recorded for each well and facility structure and placed in the operating record. Regulations require that explosive gases be controlled such that concentrations of gases are less than 25 percent of the Lower Explosive Limit (LEL) for methane and hydrogen sulfide in structures and below the LEL at the facility boundary. If monitoring results exceed either of these requirements, the following procedures shall be followed:

1. Immediately report levels to the Landfill Manager
2. Evacuate and restrict access to facility structures or exterior areas that have recorded the non-compliance gas levels.
3. Prohibit use of equipment and materials that may cause sparks or an open flame.
4. Turn off the main electrical supply switch or breaker at the structure containing high gas levels.
5. The Landfill Manager shall direct qualified and properly equipped response teams (or subcontracted response) to locate the gas source for capping or isolation.
6. Do not allow re-entry or normal operations until the gas levels are acceptable.

Within seven days of detecting non-compliance gas levels, the recorded gas levels shall be placed in the operating record along with the actions taken to protect on-site personnel and public health. Within seven days of detecting non-compliance gas levels the landfill manager will contact the Division of Waste Management to report an exceedance of gas concentration levels. Within 60 days of detecting non-compliance gas levels, a remediation plan for the gas release shall be implemented to avoid reoccurrence. This plan shall also be placed in the operating record and the Division of Waste Management shall be notified of the implementation of remediation plan. The Division may grant an extension of time if warranted.

2.9 Leachate Management System

A leachate collection system will be constructed above the composite liner system in each Cell. The collection system for each Cell is connected to a dedicated sidewall riser with pump and external leachate storage tank. Leachate will be pumped and hauled from each storage tank to permitted waste water treatment plants as needed for treatment. Leachate shall be sampled semi-annually concurrently with groundwater sampling and analyzed for Appendix I constituents, pH, BOD, COD, TDS, phosphate nitrate and sulfate.

2.9.1 Leachate Management System Design and Maintenance

The leachate collection system within landfill cells will consist of a geocomposite drainage media that rests on a 60-mil high density polyethylene liner to collect and transport leachate along the Cell floor. A network of leachate collection pipes surrounded by #57 washed stone will be placed at various locations along the Cell floor to intersect flow of leachate along the top of protective cover and the geocomposite. The collection pipe will convey leachate to the sump area for extraction. At each sump area, a stainless steel pump will rest on the Cell floor housed in a high density polyethylene sidewall riser pipe to remove leachate from within the Cell and transport into the leachate storage tank located near each sump area. Leachate will be pumped and hauled from each storage tank to permitted waste water treatment plants as needed for treatment.

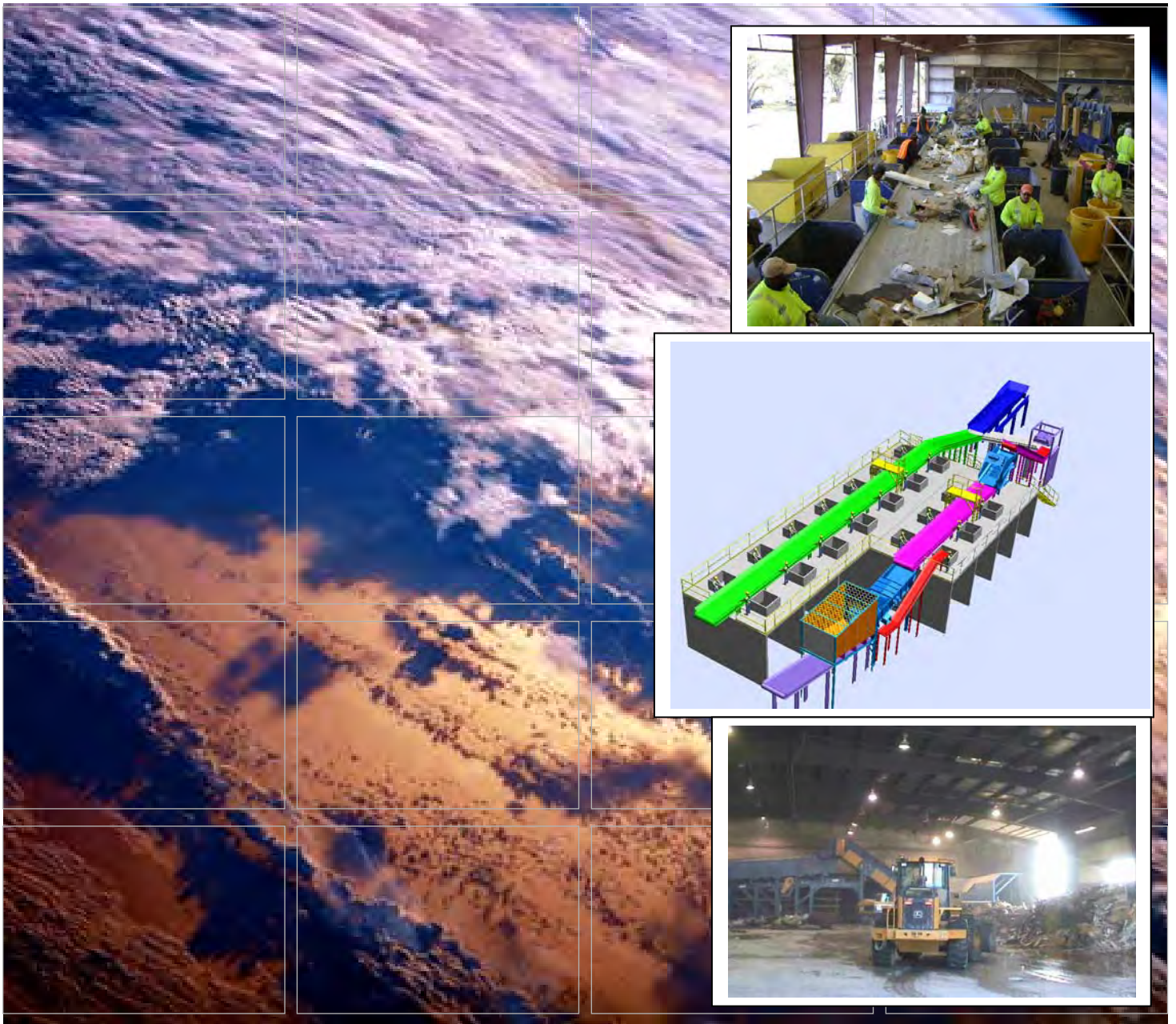
Periodic maintenance of the system requires inspection of all the associated pumps, valves, fittings and control panels to ensure that the leachate management system components are in “good working condition”. If required, the leachate transmission piping may be flushed with water to remove accumulated sediments. The same is true for the leachate collection system within individual landfill Cells. The systems contain cleanouts at the ends of header lines that may be “back-flushed” with water to maintain the efficiency of the system.

Any components that are found to not be in “good working condition” shall be replaced or repaired immediately.

2.9.2 Sampling, Record Keeping & Reporting

Leachate shall be sampled semi-annually concurrently with groundwater sampling and analyzed for Appendix I constituents, pH, BOD, COD, TDS, phosphate nitrate and sulfate. Documentation of sampling and corresponding analytical results shall be placed in the operating record.

The facility will also record the amounts of leachate generated based on levels recorded in the storage tanks and leachate received by the WWTP's. Documentation of this recordation shall be placed in the operations record.



Green Recycling Solutions LLC

Operations Plan – Maysville C&D Recycling & Recovery Facility *Maysville, North Carolina*

July 2012

OPERATIONS PLAN – GREEN RECYCLING SOLUTIONS LLC

MAYSVILLE, NORTH CAROLINA

TABLE OF CONTENTS

1.0	GENERAL FACILITY OPERATIONS	1
1.1	OVERVIEW	1
1.2	CONTACT	1
1.3	FACILITY OPERATING HOURS	1
1.4	ACCESS CONTROL	3
1.4.1	<i>Physical Restraints</i>	3
1.4.2	<i>Security</i>	3
1.5	SIGNAGE	3
1.6	PERSONNEL REQUIREMENTS	4
1.7	HEALTH AND SAFETY	4
1.7.1	<i>Personal Hygiene</i>	5
1.7.2	<i>Personal Protective Equipment (PPE)</i>	5
1.7.3	<i>Mechanical Equipment Hazard Protection</i>	6
1.7.4	<i>Employee Health and Safety</i>	6
1.7.5	<i>Physical Exposure</i>	6
1.8	COMMUNICATIONS	6
1.9	UTILITIES	7
1.10	LITTER CONTROL	7
1.11	FIRE PREVENTION AND CONTROL	7
1.12	SEVERE WEATHER CONDITIONS	8
1.12.1	<i>Ice Storms</i>	8
1.12.2	<i>Electrical Storms</i>	8
1.12.3	<i>Windy Conditions</i>	8
1.12.4	<i>Violent Storms</i>	8

1.13	RECORD KEEPING PROGRAM	8
1.14	FINANCIAL ASSURANCE	9
2.0	DEBRIS HANDLING OPERATIONS	10
2.1	OVERVIEW	10
2.2	ACCEPTABLE DEBRIS	10
2.3	PROHIBITED WASTES	10
2.4	DEBRIS SCREENING PROGRAM	11
2.5	FACILITY OPERATIONS	12
2.5.1	Operating Capacity	12
2.5.2	Service Area	14
2.5.3	Disposal Facilities	14
2.5.4	Mobile Equipment Requirements	15
2.6	RECYCLING OPERATIONS	15
2.6.1	General Procedures	15
2.6.2	Recycling/Source Separation	16
2.6.3	Containers	17
2.6.4	Markets	17
2.6.5	Down-Stream Processing and Storage	18
3.0	ENVIRONMENTAL MANAGEMENT	19
3.1	OVERVIEW	19
3.2	SURFACE WATER CONTROL	19
3.3	LEACHATE MANAGEMENT	20
3.4	VECTOR CONTROL	20
3.5	DUST CONTROL	20

FIGURES

1-1 SITE LOCATION PLAN

TABLES

2-1 PRELIMINARY FACILITY SIZING

2-2 MATERIAL RECOVERY RATES

APPENDICES

- 1. METAL TECH SYSTEMS C&D DEBRIS RECOVERY SYSTEM - DESCRIPTION**
- 2. METAL TECH SYSTEMS C&D DEBRIS RECOVERY SYSTEM - PRELIMINARY PLANS**
- 3. SITE PLANS (PREPARED BY PARKER & ASSOCIATES)**
- 4. PRELIMINARY BUILDING PLANS (PREPARED BY STILLWATER ENGINEERING)**

1.0 GENERAL FACILITY OPERATIONS

1.1 OVERVIEW

This Operations Plan was prepared for the operations of the proposed Green Recycling Solutions LLC ("Green Recycling") construction and demolition debris (C&D) materials recovery and recycling facility ("Facility") located at 11710 Highway 17 in Maysville, North Carolina. The Facility will be located adjacent to a proposed C&D Landfill that will also be owned and operated by Green Recycling. A separate Operations Plan for the C&D Landfill portion of the Facility shall be referenced for specific landfill related items. A site location plan is included as Figure 1-1 on the following page.

This Operations Plan may be updated by Facility management and authorized personnel as dictated by changing site conditions or typical operations. A copy of this Operations Plan will be maintained at the Facility and will be available for review, inspection and training at all times.

1.2 CONTACT

All correspondence and questions concerning the operation of the Facility should be directed to the contact listed below. For fire or police emergencies, dial 911.

Green Recycling Solutions LLC (Operator)
11710 Highway 17
Maysville, North Carolina 28555
Phone: (910) 938-5900
Contact: James Maides
Email: JAMESMAIDES@CSBENC.com

1.3 FACILITY OPERATING HOURS

Proposed hours of operation will be 7:00 AM to 6:00 PM Monday through Friday and Saturday 7:00 AM to 6:00 PM, excluding official holidays, which shall include New Year's Day, Independence Day, Thanksgiving Day, and Christmas Day, unless otherwise mutually agreed to from time to time between Green Recycling, the Town of Maysville, and the DWM regional office. The facility will typically be closed for normal operation on Sundays. Maintenance and other activities may be performed on any day or time. In the event of disaster or other emergency situations, the supervisor may request approval from the DWM regional office to allow additional temporary operating hours.

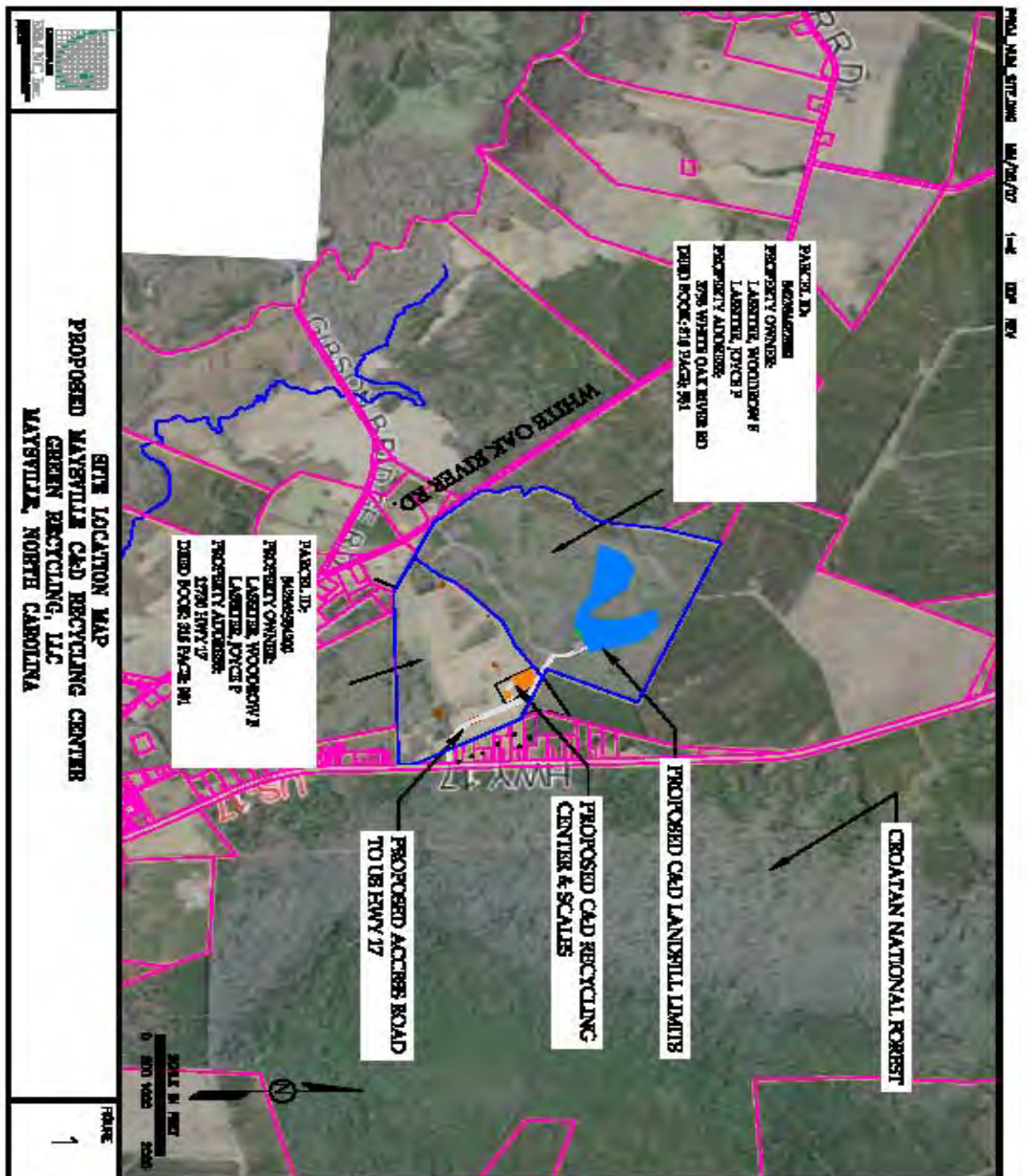


Figure 1-1 – Site Location Plan

1.4 ACCESS CONTROL

Access to process and storage areas of the facility will be controlled by a combination of fences, gates, and natural barriers and strictly enforced operating hours. An attendant will be on duty at all times when the facility is open for public use to enforce access restrictions.

1.4.1 Physical Restraints

The site will be accessed by an entrance from US Highway 17. Waste will be screened at the scales by the scale house operator. All waste will have been weighed prior to being processed on the site. The entrance will have a gate which will be securely locked during non-operating hours.

1.4.2 Security

Haulers will be stopped at the scale house for scanning and documentation of incoming loads. Drivers will be required to identify the contents of the load and origin. Incoming loads on closed trailers or trucks will be inspected upon unloading at the tipping floor. Unacceptable materials will not be permitted. Deliveries of unacceptable materials will be directed to leave the site. Frequent inspections of gates and fences will be performed by facility personnel. Evidence of trespassing, vandalism, or illegal activities will be reported to the Owner. The facility will be securely locked during non-operating hours.

1.5 SIGNAGE

Prominent signage containing the information required by the North Carolina Division of Waste Management (DWM) and Health Hazards Control Unit will be placed at the main facility entrance. The signs will provide information as follows;

- Operating hours,
- Emergency contact information,
- Permit number,
- Operating procedures for customers and/or visitors,
- List of acceptable debris,
- List of unacceptable wastes, and
- Traffic directional signs for vehicles which are tipping and are picking up recycled products.

Service and maintenance roads for use by operations personnel will be clearly marked and barriers (e.g., traffic cones, barrels, etc.) will be provided as required.

PERSONNEL REQUIREMENTS

The anticipated personnel requirements for operation and maintenance of the facility are listed as follows:

1. General Manager & Office Staff (3): Overall management of the Facility
2. Scale House Attendant (1): Receiving and weight for incoming loads, identification of load content and screening for prohibited waste
3. Operators (2): Management of tipping floor and recycling areas and screening for prohibited waste
4. Commercial Drivers (1): Transfer of processed C&D material (subject to change in response to actual volume of debris received)
5. Labor (12): General labor and operational staff around the site

One member of the supervisory staff, trained and certified in facility operations, will be on site at all times during all operating hours of the facility in accordance with G.S. 130 A-309.25 of the North Carolina Code. Each facility employee will participate in an annual training course (led by supervisory staff). As part of this training, personnel learn to recognize loads which may contain prohibited wastes. All personnel will receive a minimum of two-hour asbestos awareness training. A minimum number of personnel will be required to operate the facility efficiently. A scale house attendant, laborers to work on the tipping floor and processing line(s), equipment operators, and a site supervisor are anticipated to be employed for the daily operation of the facility.

HEALTH AND SAFETY

All aspects of the operation of the facility were developed with the health and safety of operations staff, customers, and neighbors in mind. Prior to commencement of operation of the facility, a member of the operating staff will be designated as the site safety officer. This individual, together with the facility's management will modify the site safety and emergency response program to remain consistent with National Solid Waste Management Association and Occupational Safety and Health Administration (OSHA) guidance. All personnel will receive a minimum of two-hour asbestos awareness training.

Processing equipment will be appointed with protection from moving parts, pinching, electrical connections, and sharp objects. Automated and/or manual emergency shut-off controls will also be provided. Safety devices for mobile equipment will include equipment rollover protective cabs, seat belts, audible reverse warning devices, hard hats, safety shoes, and first aid kits. Equipment exhaust should be vented at an appropriate height in excess of the breathing zone. Other personal protective equipment (gloves, hearing protection,

coveralls, or boots) will be required based on an employee's duties. Management and lead personnel will be encouraged to complete the American Red Cross Basic First Aid course to aid on site in case of an emergency. All personnel should be familiar with the equipment and duties of their position such that they will be able to identify potential hazards.

Each facility employee will participate in monthly safety meetings with topics relevant to worker safety at the Facility. Each facility employee will participate in an annual training course in health and safety (led by supervisory staff). All training shall be documented and attested to by signatures of the trainer and trainee.

Each employee of Green Recycling will be required to submit to pre-hiring drug and alcohol tests by a third party testing company.

The following are some general requirements for the health and safety of workers at the Facility.

1.7.1 *Personal Hygiene*

The following items are recommended as a minimum practice:

- Wash hands before eating, drinking, or smoking,
- Wear appropriate personal protective equipment,
- Wash, disinfect, and bandage any cuts, no matter how small, and
- Maintain closely trimmed fingernails.

1.7.2 *Personal Protective Equipment (PPE)*

Prior to the issuance of personal protective equipment (PPE) a job hazard analysis will be performed by a qualified industrial hygienist. PPE must be evaluated as to the level of protection necessary for particular operating conditions and then made available to facility employees. The list below includes PPE typically used and/or required in a solid waste management facility workplace.

- Safety shoes with steel toes
- Hearing protection in areas where exposure to high noise levels is expected
- Hard hat
- Gloves
- High-visibility vest and/or other clothing

Following use, PPE should be disposed of or adequately cleaned, dried, or readied for reuse.

1.7.3 *Mechanical Equipment Hazard Protection*

The loaders and other equipment should be operated with care and caution. All safety equipment such as horns, backup alarms, and lights shall be functional or taken out of service until repaired. A Lockout-Tagout program shall be used to identify equipment in need of or under repair and ensure that operation is “off-limits” prior to maintenance or repair. All operators shall be trained in the proper operation of equipment.

1.7.4 *Employee Health and Safety*

Review the following periodically with each employee:

- Consider safety first when planning and conducting activities,
- Post emergency contact phone numbers,
- Post route to nearest emergency medical facility,
- Post evacuation plan,
- Provide easy and visible access to the Right to Know materials, and
- Provide easy and visible access to the first aid kits and fire extinguishers.

1.7.5 *Physical Exposure*

Facility personnel may come in contact with fluids, solids, and airborne constituents found at the recycling center. Routine training should be conducted regarding the individual and collective materials used in the recycling process and their associated hazards. Training concerning safe work practices around these potential exposures should include use of PPE and proper disposal procedures. All personnel will receive a minimum of two-hour asbestos awareness training.

The tipping floor, sorting areas, and unloading areas must be maintained in a clean, sanitary condition.

1.8 *COMMUNICATIONS*

The scale house, office and sorting building have telephones in case of emergency and to conduct day-to-day business. The scale house and office will communicate with equipment operators and supervisors at the facility by radio or cell phone.

In an emergency the facility will make an announcement over the loud-speaker system and employees will be trained to congregate at a rally point. Emergency telephone numbers will be displayed in the scale house and office.

Fires and non-conforming waste incidents shall be reported to the Regional Waste Management Specialist within twenty-four hours followed by a written notification to be submitted within fifteen days.

1.9 UTILITIES

Electrical power, water, and telephone will be provided at the scale house and office. Water will also be available at the tipping floor and processing equipment in the event that asbestos containing materials are identified. Restrooms will be provided at the site.

1.10 LITTER CONTROL

The perimeter fence will act as a barrier to keep litter contained within the site. Facility operators will inspect materials entering the facility. If unacceptable materials are delivered to the facility, the operators will deny the load or unacceptable materials will be returned on the same truck. Litter sorted out during processing will be contained in an appropriate receptacle for delivery to an approved disposal facility. Windblown materials must be collected by the end of the day and reasonable effort will be made so that no windblown material may be allowed to leave the facility boundary. The material will be collected in the event that this happens

1.11 FIRE PREVENTION AND CONTROL

Due to the risk of fire and health and safety of personnel, incentives will be in place to discourage smoking on the premises. However, smoking is limited to personnel breaks and only in designated areas screened and located well away from the tipping floor, the processing line, and the storage of processed materials. Fire lanes will be maintained and passable at all times.

The possibility of fire within the facility or a piece of equipment must be anticipated in the daily operation of the facility. Fire suppression equipment shall be provided to control accidental fires and arrangements have been made with the local fire protection agency to ensure any incident at the facility will be handled with the appropriate equipment. A combination of factory installed fire suppression systems and/or portable fire extinguishers will be operational on all heavy pieces of equipment at all times. For larger or more serious outbreaks, local fire and emergency agencies will be called (dial 911).

Green Recycling Solutions, LLC will verbally notify the DWM within 24 hours of discovery of a fire within the recycling area. Additionally, written documentation describing the fire, the actions carried out to extinguish the fire, and a strategy for preventing future occurrences will be provided to the DWM within fifteen days following any such occurrence.

1.12 SEVERE WEATHER CONDITIONS

Unusual weather conditions can directly affect the operation of the facility. Some of these weather conditions and recommended operational responses are as follows.

1.12.1 Ice Storms

An ice storm can make access to the facility dangerous, prevent movement and, thus, may require closure of the facility until any ice deemed unsafe is removed or has melted.

1.12.2 Electrical Storms

The open recycling areas of the facility are susceptible to the hazards associated with lightning. If necessary, recycling activities will be temporarily suspended during severe lightning. All personnel will be removed to a safe area

1.12.3 Windy Conditions

Facility operations during a particularly windy period may require that the active tipping area and sorting operations be temporarily suspended.

1.12.4 Violent Storms

In the event of hurricane, tornado, or severe summer and/or winter storm warning issued by the National Weather Service, facility operations may be temporarily suspended.

1.13 RECORD KEEPING PROGRAM

The Owner will maintain the following information in an operating record at the site:

1. Debris inspection records;
2. Tonnage records including source of generation and scale certifications;
3. List of generators and haulers that have attempted to dispose of restricted wastes;
4. Employee training procedures and records of training completed;
5. Annual facility reports (to be submitted by August 1 of each year for the previous July 1 through June 30); and
6. Reports of asbestos testing, sampling data, analytical results, and acceptance or refusal of the materials.

Operating records will be presented, upon request, to the DWM for inspection. A copy of the current Operations Manual will be available at the facility for use at all times.

1.14 FINANCIAL ASSURANCE

A closure cost estimate equal to the cost to hire a third party to remove and clean up a week's worth of C&D waste from the facility has been provided below. A bond in this amount will be held for financial assurance.

Closure Cost Estimate:

Assumptions

- 163,875 tons per year potential
- Closure based on 163,875 tons or 3,151 tons per week
- 3,151 tons divided by 20.5 tons/load = 154 loads
- \$102.5 /load cost to load and haul
- 24 man-hours @ \$15/hr cleanup = \$360
- 24 man-hours @ \$30/hr broom tip floor = \$720

Summary of Costs

Disposal costs	3151 tons x \$49/ton = \$154,399.00
Load and Hauling costs	154 loads x \$102.5/load = \$15,785.00
Clean up and broom floor costs	\$360 + \$720 = \$1,080.00
Total Estimated Cost of Closure	= \$171,264.00

2.0 *DEBRIS HANDLING OPERATIONS*

2.1 *OVERVIEW*

This section describes the required debris handling operations for the Green Recycling, Recycling facility. In addition to the C&D debris received at this facility, the facility also processes new construction debris such as lumber, ferrous and non-ferrous metals, etc. These materials are stored at the facility until there are sufficient quantities for pick up or delivery to various recycling contractors or end-users. The list of acceptable debris is shown below. Debris may be received from industrial sources if the material is 100% recyclable or the unrecyclable residual from industrial sources is kept physically separated from residuals to be taken to approved C&D landfills. A copy of the Site Plans prepared by Parker & Associates is included in Appendix 3 for reference.

2.2 *ACCEPTABLE DEBRIS*

The facility will be permitted to accept construction and demolition debris including the following that may be recycled at the facility:

- clean wood (treated, untreated, and engineered wood products);
- aggregates and inerts (clean concrete, asphalt pavement, brick, block, stones and soil);
- drywall;
- roofing shingles;
- clean metals;
- white goods;
- plastics;
- cardboard and paper;
- carpet and padding;
- Modular buildings, mobile home buildings, trailer campers; and
- other wastes as approved by the Solid Waste Section of the Division of Waste Management.

2.3 *PROHIBITED WASTES*

Only wastes, as defined in Section 2.2 above or approved by the DWM may be accepted. No other wastes may be accepted. Asbestos containing materials will not be accepted. Suspect asbestos-containing materials found to contain greater than 1 percent asbestos will not be accepted.

In order to assure that prohibited wastes are not entering the facility, a screening program will be implemented. Only waste that is initially received and processed at the recycling center will be disposed of at the Facility landfill.

Debris entering the facility will be screened by trained personnel. These individuals have been trained to recognize indications of suspicious wastes, including: hazardous placards or markings; liquids, powders, or dusts; asbestos containing materials; sludge; bright or unusual colors; drums or commercial size containers; and “chemical” odors. The screening program for visual and olfactory characteristics of prohibited wastes is an ongoing part of the facility operation.

All vehicles must stop at the scale house located at the entrance of the facility and visitors are required to sign-in. All debris transportation vehicles are weighed and the content of the load assessed by the scale attendant’s inquiry, photographic equipment, and scanners. The scale attendant requests from the driver of the vehicle a description of the debris it is carrying to ensure that unacceptable waste is not allowed into the facility. The attendant then visually checks the vehicle as it crosses the scale. Signs informing users of the acceptable and unacceptable types of waste are posted at the scale house. Once passing the scales, the vehicles are routed to the tipping floor.

Facility staff trained to identify wastes that are unacceptable will inspect the debris discharged at the tipping floor. If unacceptable waste (other than asbestos) is found upon unloading on the tipping floor, the load will be isolated, reloaded, and the generator/hauler will be logged and escorted out of the facility. Periodically, minor wastes may be encountered while sorting and processing (i.e. random bag of household waste, litter, etc.). Containers will be staged on-site such that these minor wastes will be placed in a container to be disposed at an appropriate licensed facility.

In accordance with the requirements from the State of North Carolina, Division of Epidemiology, a facility representative who has successfully completed an approved asbestos contractor/supervisor training class will be present at, or readily available to, the facility during hours of operation. Any incoming waste including recognizable suspect asbestos containing material must be accompanied by a report from an accredited asbestos inspector indicating the materials do not contain asbestos. Recognizable suspect asbestos-containing materials will not be unloaded without proper documentation. If unacceptable waste is found upon unloading on the tipping floor, the load will be isolated, wetted, and covered until it can be determined whether the material contains asbestos. Water will be available throughout the facility to eliminate dust production and migration. Sampling suspect material will be completed by a North Carolina accredited asbestos inspector. If asbestos-containing material is found to have entered the waste stream, the area around the material should be properly marked and the material wetted and covered. North Carolina accredited personnel will be required to clean-up the contaminated site in accordance with applicable regulations and transport the asbestos-containing waste to a proper disposal

facility. The facility will have an accredited inspector and abatement contractor respond should a suspect load be received. If asbestos containing materials have contaminated the staging area or pick line, all work will stop and the Health Hazards Control Unit will be notified.

2.5 FACILITY OPERATIONS

2.5.1 Operating Capacity

The maximum operating capacity (design capacity) for the recycling facility is estimated to be approximately 575 tons per day of C&D debris. Expected Facility capacity for each year of operation is presented in [Table 2-1](#) below. The anticipated annual waste stream arriving at the facility is 300 tons per day, and reaches the maximum of 575 tons per day for operational years 24 through 30.

As the facility begins operation, the expected recycling/recovery rate is 63% of waste received. The recycling rate is expected to steadily increase to a maximum of 87% of waste received at operational year 9, which continues through year 30.

The recycling rate figures are based on results seen at similar facilities in Florida which use the same equipment and operations for recycling. The anticipated waste received at the Facility is based upon current disposal rates of C&D waste by the larger construction and contracting companies in the proposed service area.

Table 2-1 – Preliminary Facility Sizing

Year	Avg. Daily C&D Waste (Tons)	Total C&D/YR Waste Received (Tons)	Percentage of C&D Waste Recovered	C&D Waste to Landfill (Tons)	C&D Landfill Airspace Required (CY)
1	300	85,500	0.63	31,635	42,180
2	310	88,350	0.68	28,272	37,696
3	325	92,625	0.70	27,788	37,050
4	350	99,750	0.72	27,930	37,240
5	400	114,000	0.85	17,100	22,800
6	400	114,000	0.85	17,100	22,800
7	450	128,250	0.85	19,238	25,650
8	450	128,250	0.85	19,238	25,650
9	475	135,375	0.87	17,599	23,465
10	475	135,375	0.87	17,599	23,465
11	475	135,375	0.87	17,599	23,465
12	500	142,500	0.87	18,525	24,700
13	500	142,500	0.87	18,525	24,700
14	500	142,500	0.87	18,525	24,700
15	500	142,500	0.87	18,525	24,700
16	525	149,625	0.87	19,451	25,935
17	525	149,625	0.87	19,451	25,935
18	525	149,625	0.87	19,451	25,935
19	525	149,625	0.87	19,451	25,935
20	550	156,750	0.87	20,378	27,170
21	550	156,750	0.87	20,378	27,170
22	550	156,750	0.87	20,378	27,170
23	550	156,750	0.87	20,378	27,170
24	575	163,875	0.87	21,304	28,405
25	575	163,875	0.87	21,304	28,405
26	575	163,875	0.87	21,304	28,405
27	575	163,875	0.87	21,304	28,405
28	575	163,875	0.87	21,304	28,405
29	575	163,875	0.87	21,304	28,405
30	575	163,875	0.87	21,304	28,405
TOTALS		4,199,475		623,637	831,516

The expected recycling rates for each type of material in the initial years of operation are presented in [Table 2-2](#) below. As shown in the table, wood is anticipated to be the largest single type of material by weight received at the Facility in the first year.

Table 2-2 – C&D Recovery Rates

Waste Stream Material	Anticipated Waste Stream (%)	Material Received (tons/hour)	Recycling Rate (%)	Recovered Material (tons/hour)	Unrecovered Material (tons/hour)
Wood	34%	8.5	75%	6.38	2.13
Concrete	17%	4.25	75%	3.19	1.06
Drywall	5%	1.25	70%	0.88	0.38
Dirt and Soil	18%	4.5	85%	3.83	0.68
Ferrous Metal	5%	1.25	95%	1.19	0.06
Cardboard	4%	1	80%	0.80	0.20
Roofing/Shingles	3%	0.75	75%	0.56	0.19
Plastic	2%	0.5	80%	0.40	0.10
MSW	2.25%	0.5625	0%	0.00	0.56
Other Building Material	8%	2	50%	1.00	1.00
Non-Ferrous Metal	0.75%	0.1875	90%	0.17	0.02
Fiber for Fuel	1%	0.25	95%	0.24	0.01
TOTALS	100%	25		18.62	6.38
WEIGHTED AVG.			74.48%		

The first column (% Anticipated Waste Stream) is our projected expectation of the percentages of the material we will find in the debris stream measured by weight. The second column (% Recycling Rate) is the percentage of that stream that we project we will recover for sale.

It is the intent that processed materials will not be stored on site for more than 90 days, however:

- Some materials have lower volume (such as PVC pipe) which may require longer storage time to acquire enough material to sell in bulk; and
- Some materials (such as brick chips and ball field dust) which are seasonal in their markets may be stored longer to meet a seasonal demand.

2.5.2 *Service Area*

The anticipated service area for the facility is generally anticipated to be concentrated in Jones County and its surrounding counties including Craven, Carteret, Onslow, Duplin and Lenoir. Debris will not be accepted from out-of-state.

2.5.3 *Disposal Facilities*

Residual C&D debris which cannot be recycled will be disposed in the proposed adjacent C&D landfill or other properly permitted facility. Only acceptable C&D waste which has

been screened and sorted at the Facility will be placed in the adjacent landfill (if it is not recoverable).

Residual municipal solid waste (MSW) generated by the facility will be disposed at a permitted MSW facility.

2.5.4 *Mobile Equipment Requirements*

Green Recycling will maintain on-site equipment required to perform the necessary recycling activities. Periodic maintenance of all equipment and minor and major repair work will be performed within designated maintenance zones or off-site. Generally, loading, hauling, dumping, mixing, and lift equipment may be used for various tasks at the facility.

The anticipated equipment requirements for operation and maintenance of the site are listed in the following table:

DESCRIPTION	PRIMARY FUNCTION (ALLOCATION)
Excavator	Loading and sorting
Front End Loader	Loading, recycling, storage, and site cleanup
Transfer Truck	Collection and transfer of C&D material

2.6 *RECYCLING OPERATIONS*

The facility's recycling building is used to store, separate, and contain co-mingled recyclable materials or pre-sorted materials such as new construction materials. The facility will utilize equipment as defined in the *Mobile Equipment Requirements* section to facilitate hand sorting of materials and bins for storage. A detailed summary of proposed equipment is included Appendix 1 with Preliminary Plans included in Appendix 2; both provided by MetalTech Systems.

2.6.1 *General Procedures*

Waste transfer operations will be conducted in accordance with this plan. Specifically, the facility operations are anticipated as follows:

1. Collection vehicles enter through the main entrance from US Highway 17.
2. Collection vehicles are weighed, recorded and logged upon entering the scale house. The content of the vehicles is assessed by the scale attendant by visual inspection and questioning.
3. Collection vehicles which do not appear to contain unacceptable wastes are directed to discharge their load onto the tipping floor of the recycling center. Collection

vehicles which are found to contain unacceptable wastes are escorted from the Facility, and the name(s) of the generator and/or hauler are logged.

4. Facility staff trained to identify unacceptable wastes will inspect the debris discharged at the tipping floor. If unacceptable wastes are identified upon unloading, the load will be isolated and reloaded, the collection vehicle will be escorted from the Facility, and the name(s) of the generator and/or hauler are logged. If asbestos-containing wastes are suspected, it is managed in accordance with the procedures outlined in the *Debris Screening Program* section above.
5. All waste at the Facility will then be processed at the recycling center. The tipping floor and loading areas must be maintained in a clean, sanitary condition at all times and must be cleaned at least daily. Waste will not be stored on the tipping floor after operating hours except for the equivalent of four 30 yard containers of material staged to process the next day. Unprocessed debris may be stored on-site a maximum of 5 working days. Storage of unprocessed debris will be placed in trucks or containers and stored under a weather proof cover or tarped if exposed to the weather. Storage of waste will be handled in a manner not to cause any nuisance, such as odor or attraction of vectors.
6. Plastics, concrete, aggregates and other inert materials, and recoverable materials will be placed in containers, except for wood.
7. Non-recyclable materials to be transported to a landfill or other disposal facilities will be securely placed in containers or trucks, placed under a weather proof cover or tarped if exposed to the weather, and removed within 5 days.

2.6.2 *Recycling/Source Separation*

As a means of capturing recyclable materials and/or debris screening, source separation will be conducted as follows:

- 1) Materials placed on the tipping floor will be separated using mobile equipment.
- 2) All materials to be recycled and/or processed may stay on the floor until the end of operating hours except for the equivalent of four 30 yard containers of material staged to process the next day.
- 3) Materials to be processed using stationary sorting equipment will be loaded onto a conveyor, whereupon recyclable materials will be sorted into containers using a combination of a vibratory finger screen, 12-station picking line, magnetic separator, and secondary finger screen, amongst other equipment.
- 4) Concrete (cement and asphaltic/bituminous): may be delivered and stockpiled at the limits of the recycling area. The concrete debris will be crushed and subsequently stockpiled

in this same area until it is removed from the site for sale as fill, aggregate, etc. as markets allow.

5) Source separated wood, wood pallets and cardboard may be unloaded directly onto the sorted clean wood pile and cardboard containers, respectively.

2.6.3 Containers

Containers, generally 36"x48", used for holding recyclables and unacceptable waste will be stored in the recycling area. The containers will be removed from the processing area to designated storage areas as they are filled.

2.6.4 Markets

1) The final destination of the recyclable materials may vary depending upon market demand and prices for such materials. In general, materials which have valid markets will be recycled; however, market fluctuation is anticipated. In any case, no more than one week design volume of unprocessed debris, sorted recycled materials, and residual material shall be stored at the recycling facility. Should the Facility require larger storage capacity based on increased business demand, the Facility will be required to increase its closure bond. Recycled materials sensitive to moisture and/or likely to generate leachate shall be covered with tarpaulins.

Anticipated end markets for the recyclable materials are as follows:

Metals - Delivered to local metals recycling facility.

Wood - Facility near site for boiler fuel

Concrete, Aggregates, and Inerts - Bricks may be banded and palletized for sale to landscaping contractors; concrete, asphalt, broken brick and block will be stockpiled until it is removed from the site for sale as fill, aggregate, etc. as markets allow.

Soils - recovered and sold to companies who mix soil with compost and sell product to contractors and landscapers. Soil may also be transported to the adjacent C&D Landfill for use as cover. Stone is recovered and sold to contractors.

Drywall Gypsum - is purchased by local farmers who use gypsum to amend soils.

Carpeting and Padding - Local recycling facility, as markets allow.

Baled Plastic - Delivered to local recycled plastics company

Baled Cardboard - Sale in local market for recycled paper products

Shingles - If certified as asbestos-free, will be transported to Jacksonville asphalt plant for use in asphalt production.

2.6.5 *Down-Stream Processing and Storage*

The site drawings show where these activities happen at the Facility.

- Wood will be shredded mechanically and screened for boiler fuel in the stockpile area. Shredded wood will be removed from the site within 5 days
- Drywall will be shredded with a slow speed shredder or broken up by an excavator with a thumb attachment or pulverized with the tracks of a track loader and screened. This activity will take place in the stockpile areas. Storage on site will not exceed 250 tons of separated drywall and 200 tons of processed drywall. Sheetrock will be kept dry except for moisture required to alleviate dust in the shredding process
- Plastics will be shredded mechanically or granulized. This activity will take place in the stockpile areas. Shredding may not be necessary based on market demands.
- Asphalt shingles will be received at the facility in accordance with “Section 2.4 – Debris Screening Program” in this Operations Plan , for identification of potential asbestos containing shingles. Asphalt shingles will be segregated on the sort line. Shingles will be stockpiled in the stockpile area for transportation to a permitted asphalt shingle shredding facility.
- Concrete and other inerts will be stockpiled for transportation off site. Soils recovered by screening will be tested periodically for heavy metals and asbestos. Soil will also be screened to recover stone. This activity will take place within the stockpile areas.
- Cardboard will be baled or transported loose in containers. This activity will take place on the main site.
- Modular buildings, mobile home buildings and trailer campers will be deconstructed on the tipping floor and the debris processed by hand or on the sort line. The Facility will have no more than two manufactured buildings on site at any one time.

3.0 ENVIRONMENTAL MANAGEMENT

3.1 OVERVIEW

This section reviews the overall environmental management tasks required for the successful operation of the facility.

3.2 SURFACE WATER CONTROL

As used herein, the definition of “surface water” is water which results from precipitation or site run-on that has not contacted the debris.

Proper control of surface water will accomplish the following goals:

- Tipping floor and recovery & recycling operations are contained under roof;
- Prevent run-on of surface water into debris handling areas;
- Prevent the run-off of surface water that has come into contact with the debris (i.e. leachate);
- Limit the erosion caused by surface waters; and
- Limit sediments carried off-site by surface waters.

An erosion and sedimentation control plan will be prepared and approved by NCDENR Division of Land Quality (Plans are included in Appendix 3). The plan will describe both short and long term engineered features and practices for preventing erosion and controlling sedimentation at this site. Sedimentation and erosion control activities must be conducted in accordance with the Sedimentation Control Act (NCGS 113A-50, et seq.) and rules promulgated thereunder (15A NCAC 4).

Erosion control measures have been designed within the drainage channels and at points of stormwater discharge. The erosion control maintenance plan includes the following:

- 1) Inspect all sedimentation and erosion control devices for stability and function each week and following each rainfall event.
- 2) Remove silt/sediment from sediment traps and stormwater infiltration ditches when accumulated volume has reached 50% of capacity.

3) Remove accumulated silt/sediment from behind temporary sediment fence when depth exceeds approximately 0.5 feet. Repair and replace silt fence as necessary.

3.3 ***LEACHATE MANAGEMENT***

The tipping floor and recycling & recovery operations will be contained under roof within a metal framed and metal skinned building. All in-coming materials will be unloaded on the tipping floor beneath the roof. The tipping floor will be sloped to a sump for collection of wash down water for periodic cleaning of the tipping floor. The sump will be plumbed to the on site sanitary sewer system (septic field and distribution). Pre-sorting activities and staged materials for the picking line will be covered by the roof. The loading/staging area for the sort line and the picking line will be covered under roof.

Containerized unprocessed waste will be covered at all times if exposed to weather.

3.4 ***VECTOR CONTROL***

Control of insects, rodents, and other vermin will be accomplished by periodic cleaning of the Facility. Spilled or wind-blown debris along the access road will be cleaned up daily. The Facility will be cleaned, as necessary, each day to maintain a sanitary operation. Effective vector control measures must be applied at all times.

3.5 ***DUST CONTROL***

Dust related to debris hauler traffic on the access roads in the stockpile areas will be minimized by using a water truck to limit dust on the gravel portion of the road, if necessary. Fugitive dust emissions are prohibited. The remainder of the facility contains concrete or asphalt pavement.

Contractors on-site to process concrete, brick, block, and sheetrock are required to comply with all applicable air quality requirements including 40 CFR Part 63, Subpart OOO, Standards of Performance for Nonmetallic Mineral Processing Plants.

APPENDICES

- 1. METAL TECH SYSTEMS C&D DEBRIS RECOVERY SYSTEM - DESCRIPTION***
- 2. METAL TECH SYSTEMS C&D DEBRIS RECOVERY SYSTEM - PRELIMINARY PLANS***
- 3. SITE PLANS (PREPARED BY PARKER & ASSOCIATES)***
- 4. PRELIMINARY BUILDING PLANS (PREPARED BY STILLWATER ENGINEERING)***

APPENDIX 1

METAL TECH SYSTEMS C&D DEBRIS RECOVERY SYSTEM - DESCRIPTION

Equipment Operations – Supplied by Metal Tech Systems

MetalTech Systems - C&D Debris Recovery System

Description of Operation:

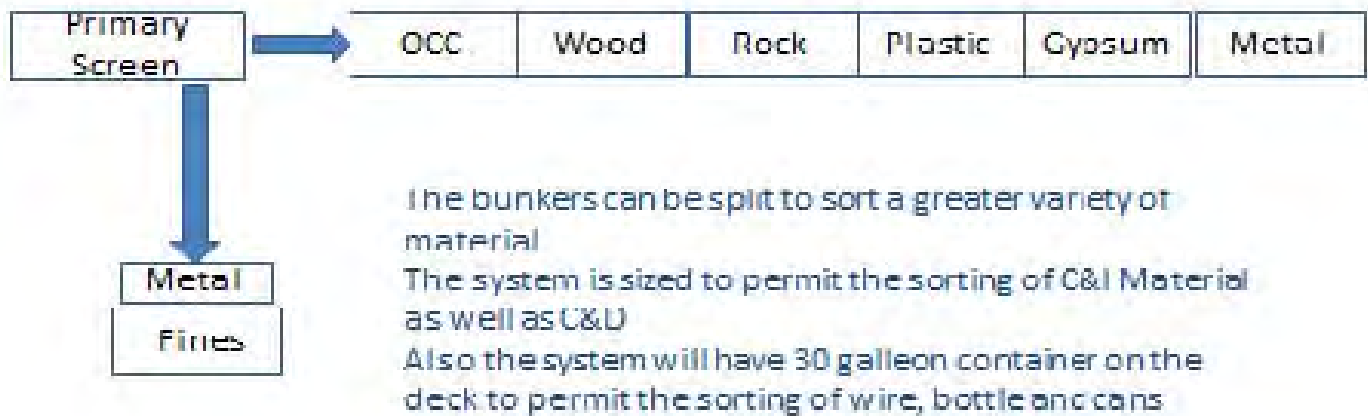
The System will process C&D debris material at a rate of up to 250 cubic yards per hour that is loaded onto a *Vibratory Finger Screen*, manufactured by **General Kinematics Corporation**. The main *Vibratory Finger Screen* will separate the material by size. The plus 2-1/2" material from the main screen will go to the *A-Line Picking Conveyor* to be positively sorted. The minus 2-1/2" material will drop to a *Unders Belt Conveyor* with an *Overhead Magnet* to remove ferrous metal and be deposited on a bunker.

Operational Notes:

Material Weight and Volume: The operational volume is assumed to be 500 pounds per cubic yard. The requested operational tonnage of 36 tons per hour is approximately 144 cubic yards an hour. The C&D System as designed by MTS has the capacity to exceed that volume since down time and other operational interruptions were not calculated into the loading specification. The Finger Screen and A-Line Picking Conveyor are sized for future expansion of up to 450 yards per hour. The System could be downsized for economic reasons but given the desire to create new markets and expected increased volume the more robust system seems a reasonable choice.

Primary Screen: The primary screen selected for the System is a General Kinematics Vibratory Finger Screen. The original intent of the screen was to have 6" finger decks with a B-Line to handle the minus 6" material. It is the recommendation of MTS is that the Primary Finger Deck has a minimum of a 2-1/2" screen sizing. The Vibratory Screen would have the ability to increase the size of the decking if the decision to add a B-line is undertaken. Also the Finger Screen would have several drops in the decking to promote the agitation and rolling of the material. The specification for the screen will be determined at the proposal review meeting but the changes discussed above will not affect pricing.

Green Recycling Solutions, LLC Flow Diagram



Fines Material: The fines material was specified as being $\frac{3}{4}$ ". It is our opinion that Green Recycling Solutions, LLC as owner of the landfill may be able to use a larger sized material as ADC. The costs of having a secondary screening process if required may be reduced by using a much smaller screen or even a used piece of equipment instead of using a primary screen to create the ADC. The results would be to obtain a useable and economic ADC. We would not recommend using a trommel as the only screen since it is best used on more homogeneous materials for extracting the dirt portion of the waste stream later in the sorting processing.

MetalTech Systems - C&D Debris Recovery System

Equipment Description:

Item 1 – Finger Screen

One (1) MODEL FNGR-C 72 X 36.0 **SYNCRO-COIL® FINGER-SCREEN®** CONVEYOR, 72" wide by 60" deep by 36'-0" long with Counterpoise Design "D" balancing. Unit is to be installed on a 6° decline, and designed to handle 250 CYPH of C&D material at 10-30 PCF.

DESCRIPTION:

Trough Construction:

Trough will be fabricated of 5/16" thick mild steel formed to make a vertical sided trough 72" wide by 60" deep by 36'-0" long. The first 6'-4" will be a 3/8" thick load distribution plate followed by eight (8) removable **FINGER-SCREEN®** sections each approximately 3'-9" long having tapered slot openings.

The last portion of the deck will be a solid plate to ease discharge of oversize material.

Minus 3" material passing through **FINGER-SCREEN®** sections will be conveyed on a lower deck, and will discharge at the end of the unit.

Trough Supporting System:

The **SYNCRO-COIL®** conveyor has a synchronized frequency trough supporting system comprised of heavy-duty coil springs and stabilizer arms. The coil reactor springs are fabricated of high grade alloy spring steel, 100% shot peened; magnaglo inspected, and kept within conservative stress limits far below their normal fatigue stress range.

The stabilizer arms are high strength alloy castings fitted with heavy-duty steel encased rubber torsion bushings at each of the articulation points. Both springs and arms are held in place by domestically manufactured and certified high tensile bolts, hardened washer and lock nuts.

Eccentric Drive:

Unit will be equipped with exclusive, patented, heavy-duty **SYNCRO-CUSHION®** drive wherein a solid, single piece, alloy steel machined eccentric shaft, with a fixed eccentric, operates in heavy-duty self-aligning bearings to provide suitable trough stroke. Bearings are specially designed for vibratory service and feature special internal fit.

Drive trough connection will be equipped with alloy steel coil springs which permit the shaft oscillating action to fully synchronize with the natural frequency of the reactor spring system, thereby reducing drive thrusts to a minimum, reducing starting torque and eliminating high stress concentration in the drive bracket connection.

This "cushioned drive" design allows repeated starts and stops of the unit under a full product load, and accommodates surge loading, or other system upset conditions, without overstressing the various drive components.

Motor:

Unit will be provided with a 50 HP, 1200 RPM, T.E.F.C., Nema Design "B" normal torque motor wound for 230/460 volt, 3 phase, 60 cycle power supply.

Base:

The unit will be equipped with a rugged fabricated steel base comprised primarily of standard structural members arranged for mounting in an elevated location

Counterpoise Dynamic Balancing:

Unit will be dynamically counter-balanced by a positively driven balancer mass which moves 180° out-of-phase with the trough mass. The weight of the balancer is determined by consideration of the normal vibrating weight of the trough, and the various live load conditions that may occur. The balancer assembly is mounted to a coil spring reactor system similar to that supporting the trough. A single **SYNCRO-CUSHION®** eccentric drive assembly and coil spring equipped pivot linkage assembly work together to maintain the correct out-of-phase relationship to assure full balancing under all loading conditions.

Item 2- A- Line Picking Conveyor

One (1) 72" wide by 99' center to center long Variable Speed Pick Belt Conveyor.

Description:

Design: Slider bed in picking areas and troughing belt on inclined section

Speed: 60 FPM with VFD for variable speed operation

Length: 99' long

Width: 72"

Motor: 7.5 HP, 1800 RPM, 230/460V, 60 Hz, 3 phase

Belting: Black heavy-duty belting 2-ply

Safety Guards: All rotating parts guarded in accordance with OSHA regulations

Head Pulley: Drum Type, crowned, 14" dia. x 75" face, 3/8" herringbone lagging, 3-7/16" bearings and shafting

Tail Pulley: Wing Type, crowned, 14" dia. x 75" face, 2-15/16" bearings and shafting

Take-up Frame: 9" travel, wide slot type

☐ **Exact length of the conveyor and engineering specifications are subject to final design criteria. The stated sizes and material are used to indicate type and class of material used in construction. The length of the incline section may vary with design criteria for material loading height.**

Item 3 - Picking Platform

One (1) Elevated Picking Platform consisting of:

- ☐ Heavy-Duty structural steel picking platform with support structure
- ☐ Bunker spacing is 12' wide x 12' tall
- ☐ Access Non-Skid Stairways, Handrails, toe kicks, and solid decking platform panels
- ☐ Twelve (12) 36" x 48" picking boxes spaced for center of bunker

Item 4- Unders Transfer Conveyor

One (1) 36" wide **Idler Transfer Conveyor** consisting of the following:

Type: Idler

Material: C&D Debris (Unders, minus 2-1/2")

Material density: Estimated at 10 to 30 Lb. /ft³

Speed: 250 FPM

Length 38' inclined

Width: 36"

Motor: Baldor or equal Heavy Duty Motor, 1800 RPM, 230/460V, 60Hz, 3 Ph., TEFC

Reducer: Dodge Shaft Mount Speed Reducer

Shafting 3-7/16" cold rolled precision shafting

Bearings: Rex Type E Pillow Block

Belting: Black HEAVY DUTY 1/4" Chevron Cleated 3PLY-330 PIW 3/16" x BB

Fastener System: FLEXCO Bolt Hinged Fastener 375 Stainless Steel

Pulleys: Head: 14" Dia. Heavy Duty Stainless Steel Drum Pulley crown faced and lagged 3/8" thick diamond pattern complete with XT Hubs and bushings.

Tail: 12" Dia. Wing type, crown faced - Self-cleaning with XT Hubs and bushings

Frame: Structural channel stringers with angle cross members and tubing supports.

Take-up: Telescopic Screw Take-up

Safety Guards: All rotating parts guarded in accordance with OSHA regulations

Paint: Industrial Blue

Item 5- Overhead Magnet- (Unit 3)

One (1) Dings Model 15PCM-36 in Line Self Cleaning Permanent Magnet

36 inch belt width, 250 FPM belt speed, 6 to 8 inch material depth, 30 PCF. Magnet to be suspended inline at the head pulley at 12 to 13 inches.

Item 6 - Control Panel

One (1) Integral control panel assembly for the MetalTech Sorting System will consist of a single control panel enclosure mounted within 15' of the picking platform and One (1) remote operator push button station.

The control panel will contain a main disconnect for the System and all necessary fuses, fuse blocks, circuit breakers, motor starting equipment, terminal blocks, push buttons and pilot lights required for complete interlock operation. The variable speed picking belt is supplied with a variable frequency drive to enable the speed of the belt to be adjusted to the load.

Starting and stopping of the system will be initiated by push button control by the operator located on the face of the control panel. Speed control for the variable speed picking belt will also be located on the face of the control panel.

The remote operator push button station will allow for the starting, stopping and pausing of the system.

Field disconnect switches will be provided for each motor and located near the respective motor for each of the machines. Pull cord Stop switches will be provided on the variable speed picking belt.

All control equipment and enclosures will be suitable for indoor or outdoor use.

NOTE: System components will be shipped in the most complete manner as possible to allow for quick and efficient installation and operation once delivered

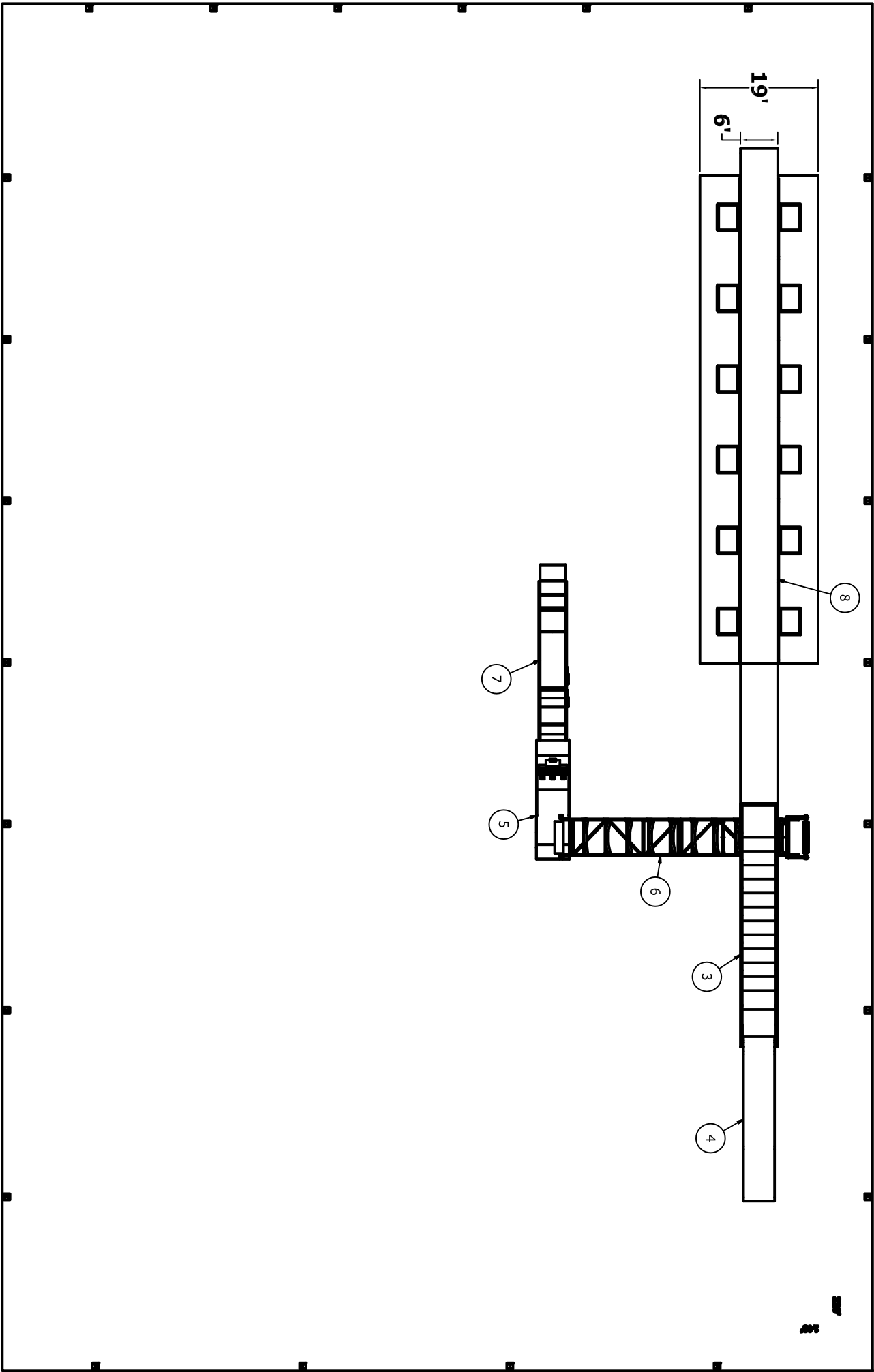
APPENDIX 2

METAL TECH SYSTEMS C&D DEBRIS

RECOVERY SYSTEM - PRELIMINARY PLANS

(Plans have been reduced to 11" X 17" for reference purposes only)

PARTS LIST		
ITEM	QTY	DESCRIPTION
3	1	Primary Screen
4	1	Apron - Feed Conveyor
5	1	Secondary Screen
6	1	36" Fines Transfer Conveyor
7	1	B-Line Destoner
8	1	Idler/Sliderbed Picking Conveyor



MTS
MetalTech Systems
Engineering Services
P.O. BOX 3217
Pawleys Island, SC 29585

PROJECT

SHEET TITLE

GRS Building Layout

GA_V3 - Plan View

REVISIONS			
NO.	DATE	DESCRIPTION	

APPROVED

DATE

02/13/2012

CHECKED

DRAWN

Michael Hewitt

SCALE

FREE

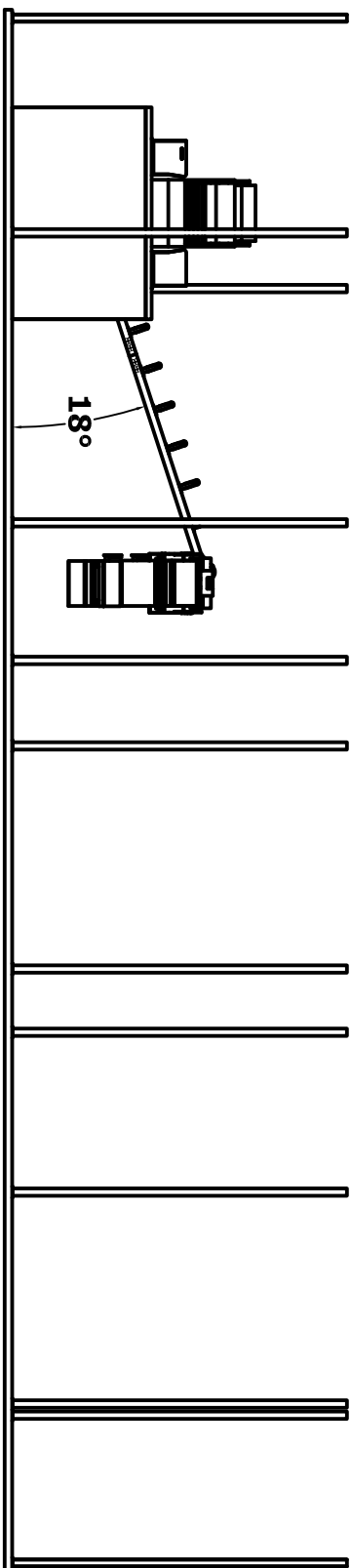
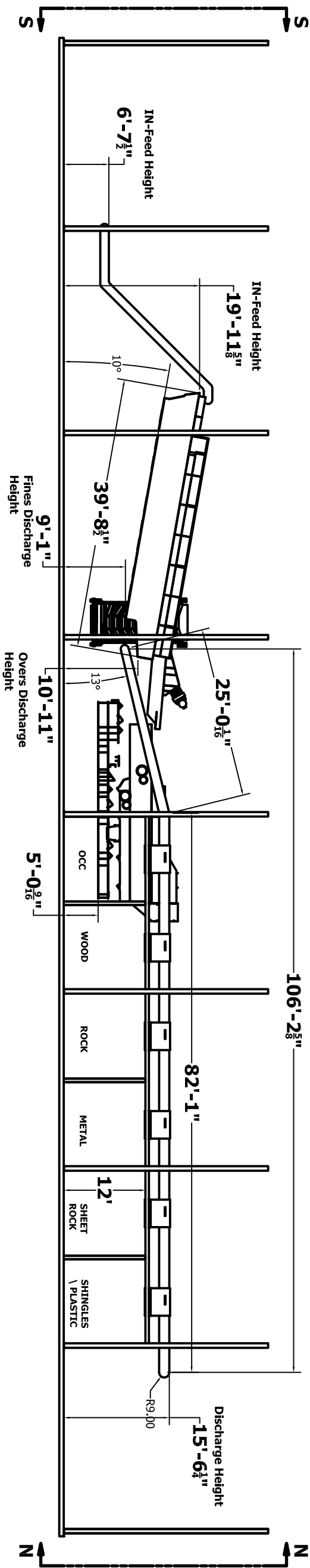
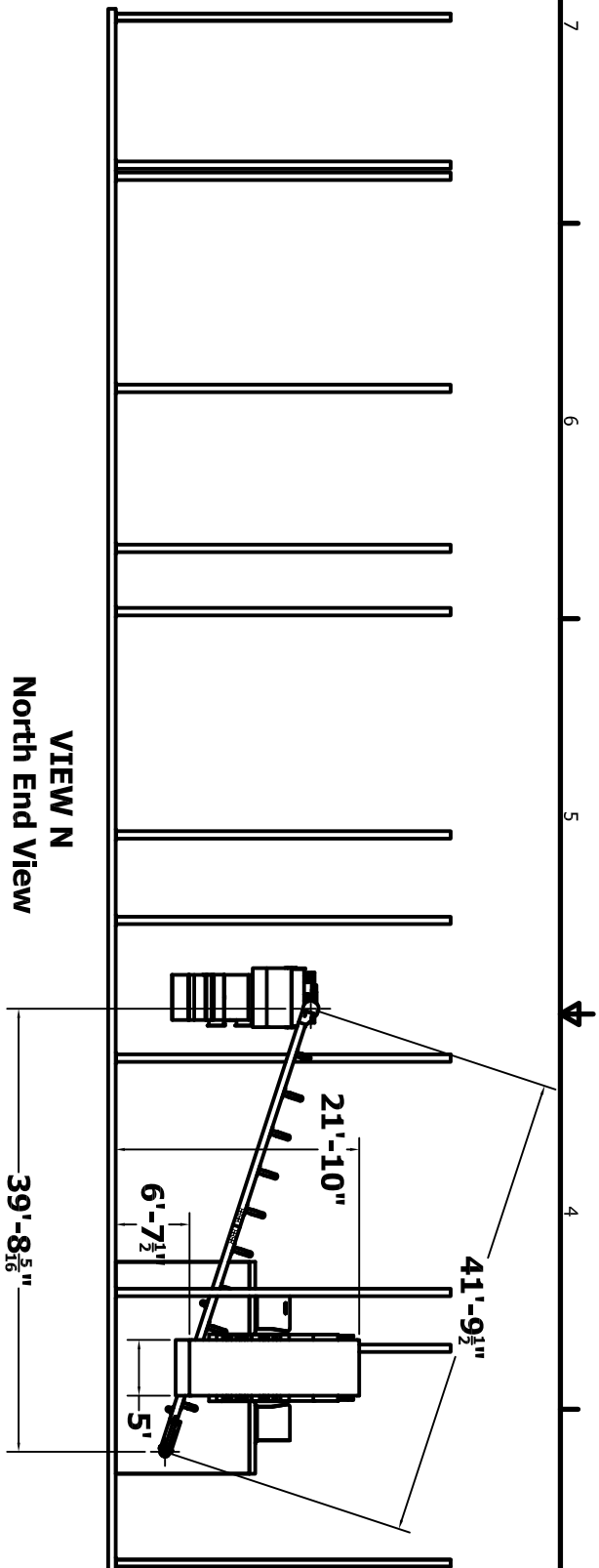
PROJECT NUMBER

GRS GA

DWG NO

SHEET

1 OF 4



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PROJECT

GRS Building Layout

FEET	TITLE
GA_V3	Elevation Views

DATE 02/10/2015

CHECKED

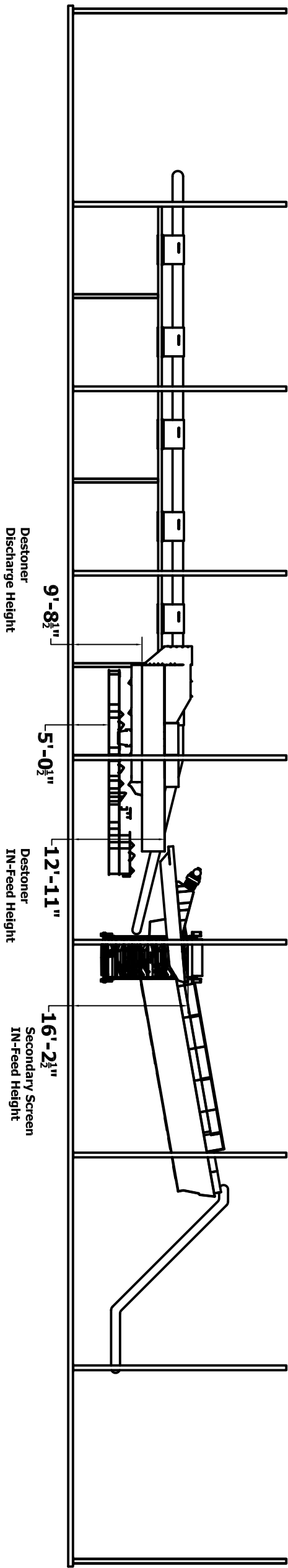
DRAWN

PHILIPPA L. HEWITT
SCALE

PROJECT NUMBER

DWG NO

SHEET

[illegible]APPROVED

DATE	02/13/2012
CHECKED	

DRAWNMichael HewittFR

PROJECT NUMB	GRS GA
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DWG NO

3 OF 4

PROJECT

GRS Building Layout

SHEET TITLE

GA_V3 - Rear Elevation View

PROJECT

GRS Building Layout

SHEET TITLE

GA_V3 - ISO View

REVISIONS

REV	DATE	DESCRIPTION

APPROVED

DATE

02/13/2012

CHECKED

DRAWN

Michael Hewitt

SCALE

FREE

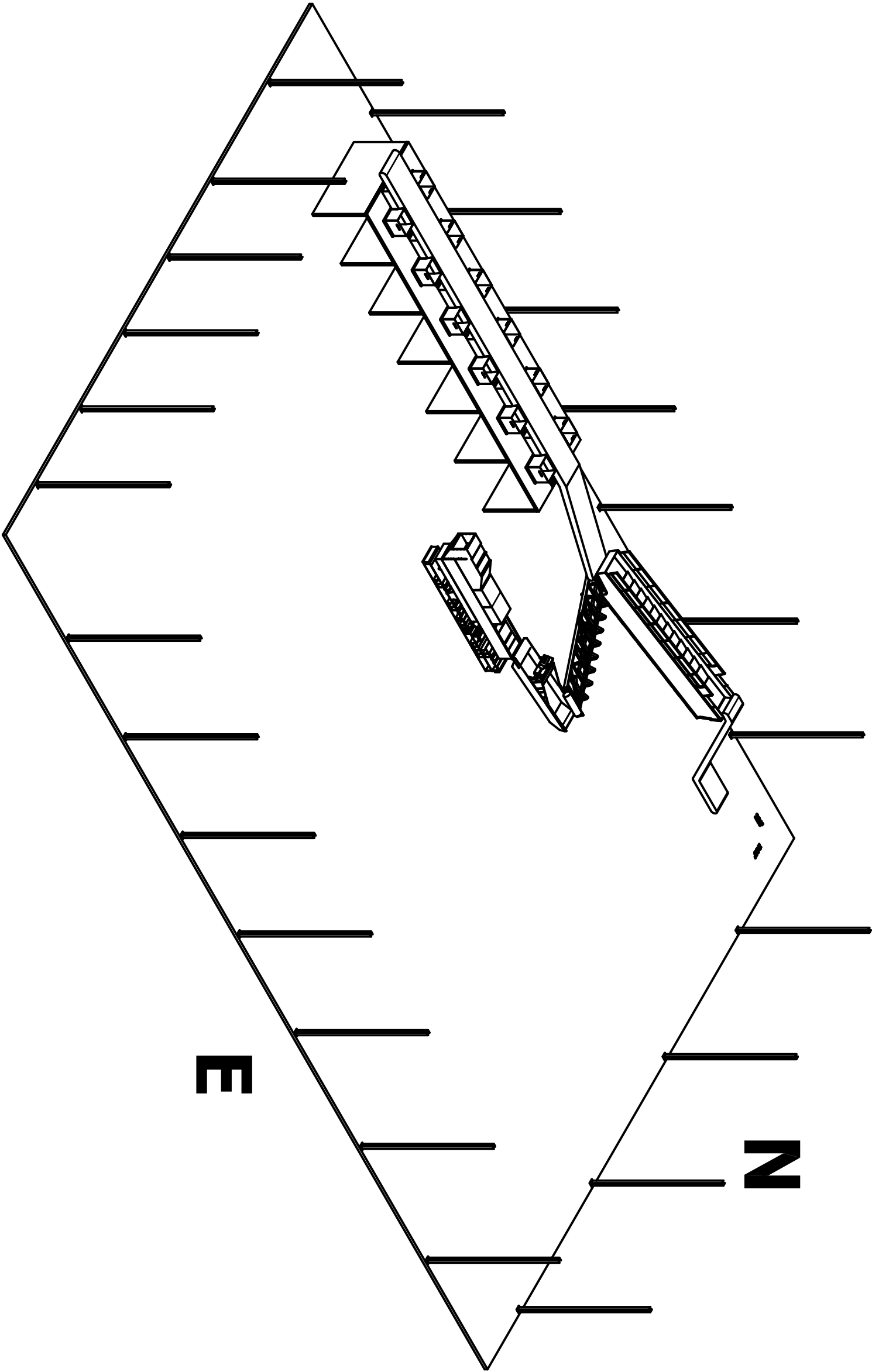
PROJECT NUMBER

GRS GA

DWG NO

SHEET

4 OF 4



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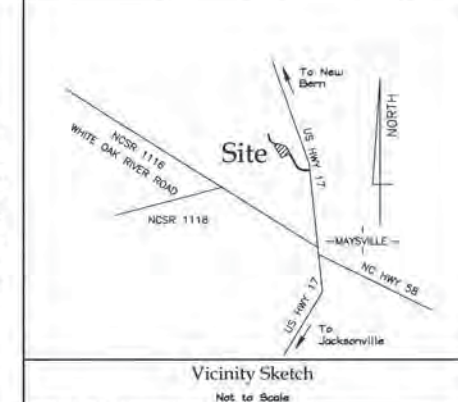
APPENDIX 3

SITE PLANS (PREPARED BY PARKER & ASSOCIATES)

(Plans have been reduced to 11" X 17" for reference purposes only)

LEGEND
C.C. - Concrete
D.B. - Deed Book
Ex. - Existing
FFE - Finished Floor Elevation
M.B. - Map Book
Pg. - Page
R - Radius
R/W - Right-of-way
Typ. - Typical

Existing Fence
Chain Link
Hedlands
Hedlands

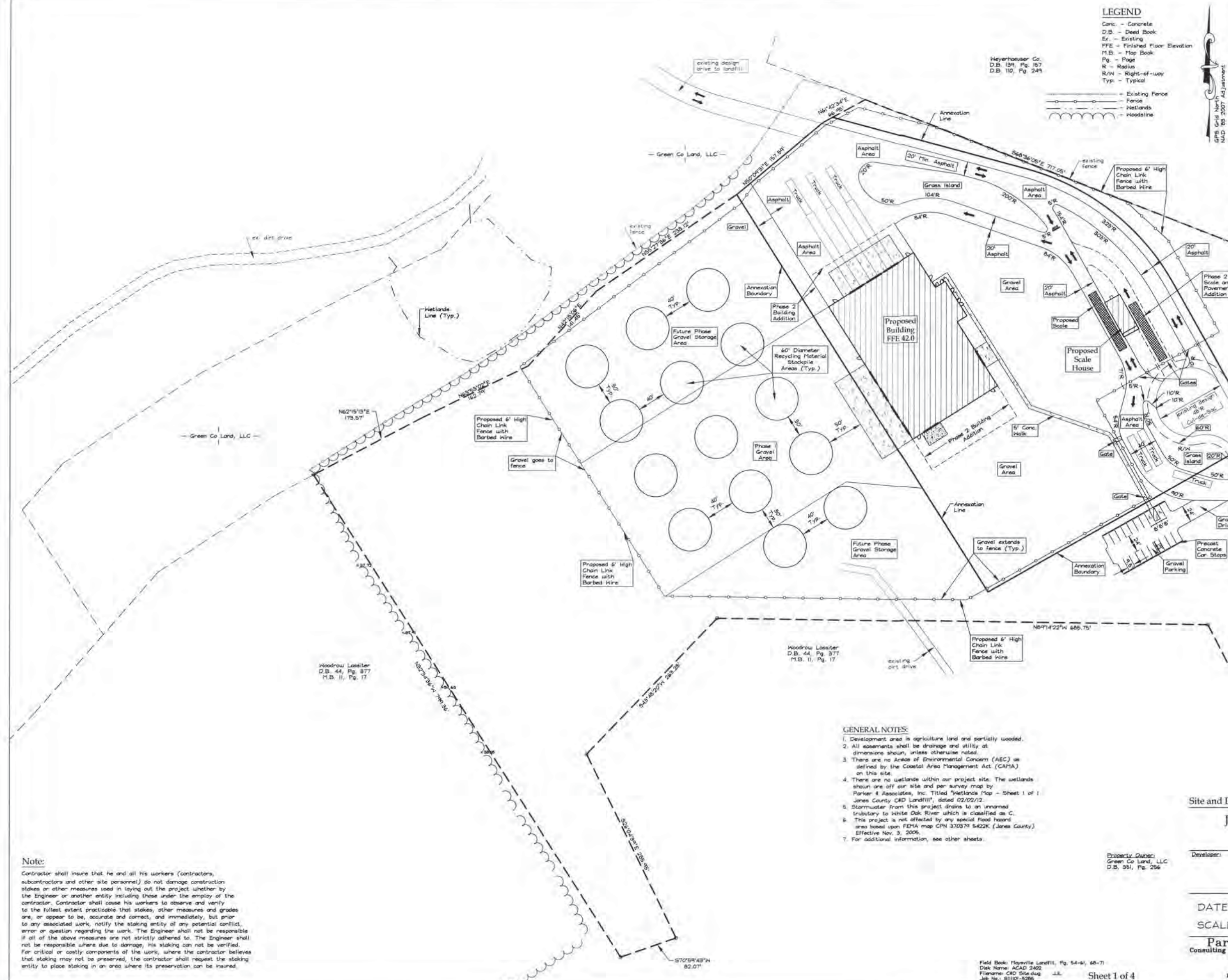


TRACT DATA - OVERALL

Total Acreage	26.86 Ac.
Proposed Use	Recycling Center
Water Service	Jones County
Septic Service	Septic

TOWN OF MAYSVILLE ANNEXATION AREA TRACT DATA

Acreage	6.01 Ac.
Number of Lots	1
Proposed Use	Recycling Center
Water Service	Jones County
Septic Service	Septic
Zone	Industrial
Number of Employees	15-30
Number of Parking Spaces Proposed	20 (2 B/C)
Number of Parking Spaces Required	2 Spaces per 3 Employees = 20 Spaces



- GENERAL NOTES:**
1. Development area is agriculture land and partially wooded.
 2. All easements shall be drainage and utility at dimensions shown, unless otherwise noted.
 3. There are no Areas of Environmental Concern (AEC) as defined by the Coastal Area Management Act (CAMA) on this site.
 4. There are no wetlands within our project site. The wetlands shown are off our site and per survey map by Parker & Associates, Inc. titled "Wetlands Map - Sheet 1 of 1 Jones County C&D Landfill", dated 02/02/12.
 5. Stormwater from this project drains to an unnamed tributary to White Oak River which is classified as C.
 6. This project is not affected by any special flood hazard area based upon FEMA map CPN 370379 5422K (Jones County) Effective Nov. 3, 2005.
 7. For additional information, see other sheets.

Note:
Contractor shall insure that he and all his workers (contractors, subcontractors and other site personnel) do not damage construction stakes or other measures used in laying out the project, whether by the Engineer or another entity including those under the employ of the contractor. Contractor shall cause his workers to observe and verify to the fullest extent practicable that stakes, other measures and grades are, or appear to be, accurate and correct, and immediately, but prior to any associated work, notify the staking entity of any potential conflict, error or question regarding the work. The Engineer shall not be responsible if all of the above measures are not strictly adhered to. The Engineer shall not be responsible where due to damage, his staking can not be verified. For critical or costly components of the work, where the contractor believes that staking may not be preserved, the contractor shall request the staking entity to place staking in an area where its preservation can be insured.

Site and Dimensional Plan
Jones County C&D Recycling Center
White Oak Twp., Onslow Co., North Carolina

Developer: Green Recycling Solutions, LLC
166 Center Street
Jacksonville, North Carolina 25546
(910) 938-5900

DATE: 05/14/12
SCALE: 1"=60'

Parker & Associates, Inc.
Consulting Engineers - Land Surveyors - Land Planners
P.O. Box 975 - 28541-0975
306 New Bridge Street - 28540
Jacksonville, North Carolina
Phone (910) 455-2414 - Fax (910) 455-3441
Firm License Number: F-0168

GRAPHIC SCALE: 1"=60'
0 30 60 120 180
FEET

Field Book: Maysville Landfill, Pg. 54-61, 60-71
Disk Name: ACAD 2402
Filename: C&D Site.dwg
Job No.: S11101-5205

Sheet 1 of 4



TRACT DATA - OVERALL

Total Acreage 26.98 Ac.
Proposed Use Recycling Center
Water Service Jones County
Sewer Service Septic

TOWN OF MAYSVILLE ANNEXATION AREA TRACT DATA

Acreage 8.01 Ac.
Number of Lots 1
Proposed Use Recycling Center
Water Service Jones County
Sewer Service Septic
Some (Indicate)
Number of Employees 13-15
Number of Parking
Spaces Proposed 20 (40' R/W)
Number of Parking
Spaces Required 3 spaces per 3 employees
= 20 Spaces

Site Benchmark

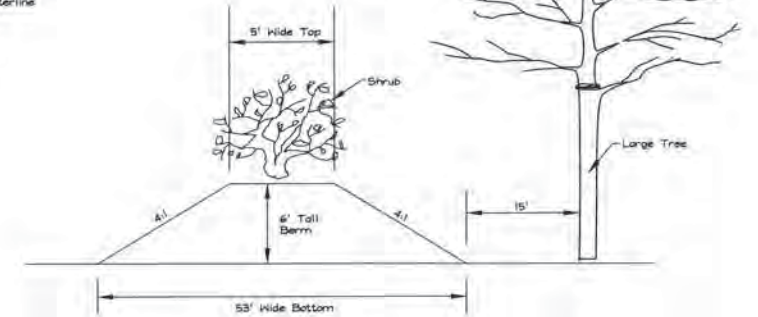
Description R/R Spike in base of 24" Pine
Datum NAVD '86
Elev. 40.34

LEGEND

D.B. - Deed Book
Ex. - Existing
Inv. - Invert
M.B. - Map Book
Pg. - Page
R - Radius
RCD - Rock Check Dam
RRA - Rip Rap Apron
R/W - Right-of-Way
ST - Sediment Trap
Typ. - Typical
Flow Arrow

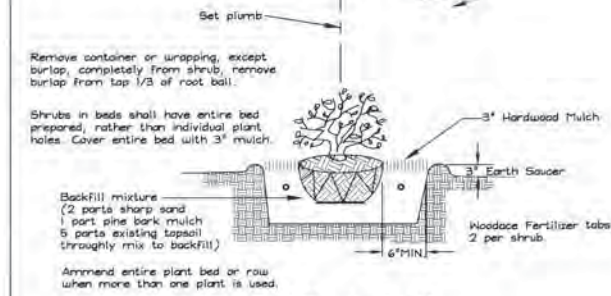
40' R - Proposed Spot Elevation

Ditch/Suole
Existing Ditch
Existing Fence
Existing Waterline
Fence
Waterline
Wetlands
Woodline



Berm & Landscaping Buffer Detail

Not to Scale



Shrub Planting Detail

Not to scale

Berm Landscaping Chart

Shrubs

Quantity	Key	Common Name	Botanical Name	Plant Type	At Maturity Height	Spread
10	ST	Shiny Blagayna	Eleagnus pungens	Evergreen	10' - 25'	15' - 20'
50	W	Wax Myrtle	Myrica pensylvanica	Evergreen	10' - 15'	8' - 10'
100 Total						

Note: Plant shrubs on top of berm 20' apart.

Berm Landscaping Chart

Large Canopy Trees

Quantity	Key	Common Name	Botanical Name	Tree Type	At Maturity Height	Spread
10	WC	Western Red Cedar	Juniperus Virginiana	Evergreen	30' - 40'	10' - 15'
10	PD	Pine Oak	Quercus Palustris	Deciduous	60' - 80'	40' - 50'
10	SW	Southern Magnolia	Magnolia Grandiflora	Evergreen	40' - 60'	25' - 30'
10	LP	Loblolly Pine	Pinus Taeda	Evergreen	70' - 80'	30' - 40'
10	LD	Loblolly Pine	Quercus Virginiana	Evergreen	30' - 50'	50' - 60'
40 Total						

Note: Plant large trees 1M from base of berm, spaced at 20'.

Landscaping Notes:

- Each large tree at the time of planting shall be a minimum of 2 inches in caliper and 6 feet in height.
- Each shrub at the time of planting shall be a minimum of 3 gallons.
- The developer may substitute landscaping species as long as landscaping ordinances are met. Substitutions should be confirmed with the Engineer.

Field Book: Maysville Landfill, Pg. 54-61, 68-71
Disk Name: ACAD 2402
Filename: C&D Site.dwg
Job No.: 511101-5265

Sheet 2 of 4

Canopy Tree Planting Detail

Not to scale

Overall Plan

Jones County C&D Recycling Center

White Oak Twp., Onslow Co., North Carolina

Developer:

Green Recycling Solutions, LLC

166 Center Street
Jacksonville, North Carolina 28546
(910) 456-5400

DATE: 05/14/12

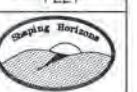
SCALE: 1"=100'

GRAPHIC SCALE: 1"=100'



Parker & Associates, Inc.

Consulting Engineers - Land Surveyors - Land Planners
P.O. Box 978 - 28541-0978
300 New Bridge Street - 28540
Jacksonville, North Carolina
(910) 456-2414 - Fax (910) 456-3441
Firm License Number: 7-0108



Settlement control devices and structure shall be installed, maintained and amended as needed to provide effective control of accelerated sedimentation until the contributing watersheds are stabilized.

2. Construction Sequence:

- A. Notify Owner, Engineer and NCDEM, Land Quality Section prior to beginning construction.
- B. Install stabilized construction entrances prior to beginning construction.
- C. Limits of clearing will be as shown. Clear only enough to install sill fence. Once sill fence is installed, complete clearing. Sill fence shall be installed at the down slope edge of clearing immediately after clearing.
- D. Sill fence shall be maintained until the lot is stabilized completely.
- E. Strip topsoil and stockpile for reuse.
- F. Construct swales and install rock check dams and sediment traps immediately.
- G. Construct building pad.
- H. Install storm drain piping and yard inlets.
- I. Rough grade drives, parking and stockpile areas. Haul off all unsuitable undercut materials.
- J. Install water and sewer services.
- K. Fine grade drive, parking and stockpile areas. Subgrade to pass prefinal test prior to CABC. Once CABC over compressed subgrade CABC to pass prefinal and density test prior to asphalt. Install asphalt surface course. Density and thickness testing required on asphalt. Density tests shall comply with NC DOT standards. Testing results shall be submitted to Engineer prior to acceptance.
- L. Maintain erosion control measures as needed to assure full functionality.
- M. Temporary seeding, mulch, fertilizer, and mulch all disturbed areas after completing any phase of the grading work within the following time schedule.
 - 1) Slopes steeper than 3:1 and perimeter dikes, swales, ditches and slopes, and areas near IGH waters - within 7 days
 - 2) Slopes 3:1 or flatter, and all other areas with slopes flatter than 4:1 - within 14 days.If temporary seeding is used to temporarily stabilize an area upon final grading of the job the permanent seed, fertilizer and mulch shall be completed. See detail for seeding specifications.

3. Seeding Specifications:

Apply lime and fertilizer and work into 4 - 6 inches of soil. Seed mixture shall be distributed uniformly and covered with a clean straw mulch. All mulch shall be crimped or asphalt tacked to hold in place. Material and application rates as follows, and are generally considered minimums. *Mulch rate to be doubled is crimped:

Harvest	Application Rate
Line	000 lbs./ac.
Fertilizer (N-P-K)	750 lbs./ac.
Much	2 tons/ac.
Asphalt Tack	435 gal./ac. (MXX)
Permanent Seeding	
Common Bermuda	
Established Sept. 1 - April 1	100 lbs./ac.
Established April 1 - Sept. 1	75 lbs./ac.
Rebait Pessum	60 lbs./ac.
Rye Grain (Sept. 1 - April 1, May 1)	20 lbs./ac.
German Millet (April 1 - Sept. 1, May 1)	50 lbs./ac.
Temporary Seeding	
Dec. 1 - April 1	
Rye Escapade	50 lbs./ac.
Rye Grain	120 lbs./ac.
April 15 - Aug. 15	
German Millet	50 lbs./ac.
Aug. 15 - Dec. 15	
Rye Grain	120 lbs./ac.

4. Contractor shall inspect erosion control measures, and comply with NPDES General Permit, at least once a week and after every 0.5" rainfall event and amend measures as needed. See Erosion Control Permit and General Permit for additional information.

5. Contractor is responsible for maintaining all erosion control measures and amend measures and shall amend measures as required to prevent accelerated erosion from taking place on this site until site is restabilized and accepted by Architect and Owner.

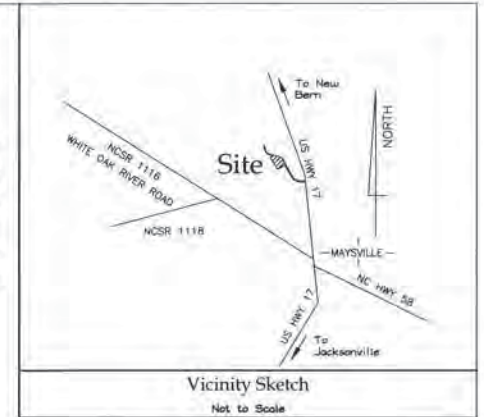
6. Contractor shall request inspection, from Owner, Engineer and NCCDEN-LOS of site work and erosion control measures prior to removal of measures.

7. Upon restabilization of all disturbed areas and slopes, and areas are accepted, contractor shall remove all temporary erosion control facilities, regrade, grass and mulch the areas to restabilize. These areas will not be subject to erosion control measures. Areas that are not stabilized, all areas are stabilized. If areas do not stabilize contractor shall request the above until all areas are stabilized.

8. For additional information, see other plans and specifications.

2" SCH 40

Description R/R. Spike in base of 24" Pine
Datum NAVD '88
Elev. 40.34
See Overall Plan sheet 3 of 4 for location.



B.O. - Blow Off
 C.O. - Clean Out
 Conc. - Concrete
 D.B. - Dead Block
 D.I. - Ductile Iron
 E. Existing
 FFE - Finished Floor Elevation
 F.H. - Fire Hydrant
 G.V. - Gate Valve
 Inv. - Invert
 M.B. - Map Book
 Pg. - Page
 P.T. - Plug Tap
 R - Radius
 RCD - Rock Check Dam
 RRA - Rip Rap Apron
 R/RN - Right-of-Way
 S.S. - Sewer Service
 ST - Sediment Trap
 Typ. - Typical
 WM - Water Meter
 WS - Water Service
 TI w/RE - Tarp Inlet With
 Temporary Rock Filter
 - Flow Arrow
 (E) - Pipe Label
 (42.7) - Proposed Spot Elevation
 (3) - Swale Label
 - Ditch/Swale
 - Existing Ditch
 - Existing Fence
 - Fence
 - Septic Supply Line
 - Interlands
 - Wooding

For Continuation of existing design of road & water
See plans Titled "Town of Maysville
2011 COBG - Economic Development Project
Road and Water Improvements
to serve Green Recycling Solutions
Recycling Center and CAD Landfill"
by Parker & Associates, Inc.

5-14-12

White Oak Twp., Onslow Co., North Carolina

166 Center Street
Jacksonville, North Carolina 28546
(910) 938-5900

SCALE: 1"=60'

GRAPHIC SCALE 1"=60'

0 30 60 120 180

FEET

306 New Bridge Street - 28540
Jacksonville, North Carolina
Phone (910) 455-2414 - Fax (910) 455-3441

Firm License Number: F-0108

10/04/2013 DIN20046 Page 575 of 627

The sketches to be constructed for this project are assigned to the Departments of Transportation Certification-Paving and Quality Management System-Maintenance, Inspection, and Maintenance. The Certification, at the regional level, provides test results in 1) Subgrade, 2) Base and 3) Pavement. The Contractor shall submit that all construction and paving is performed in accordance with the N.C. Department of Transportation Standards Specifications for Roads and Structures, latest edition, 2000, and the Asphalt Applications and Manual, and Quality Management System Manual. The Contractor shall submit test results for all items (liquid, void, voided, and D.O.T.) allowable range on tolerance, as applicable. Subgrade shall be tested for density, and shall be profiled by the Testing Division of the Engineer or Surveyor who will issue the Final Certification. Base and pavement shall both be tested for density and thickness. If Task 6 is completed, administering the construction file shall also provide the contractor with a copy of the project file. The contractor shall properly conduct GPS equipment and use it in accordance with GPS Requirements (Appendix I) for this project as well as when on the plane. Note that underway or future lanes is greater than that for internal streets.

- 1 Topography shown is from actual survey by Parker & Associates, Inc. dated April 2012.
- 2 Development area is agriculture land and partially wooded.
- 3 All easements shall be drainage and utility at direction of owner, unless otherwise noted.
- 4 There are no Areas of Environmental Concern (AEC) as defined by the Coastal Area Management Act (CAMA) on this site.
- 5 There are no wetlands within our project site. The wetlands shown are off our site and per survey map by Parker & Associates, Inc. Titled Wetlands Map - Sheet 1 of Jones County C&D Landfill", dated 02/02/12.
- 6 Stormwater from this project drains to an unnamed tributary to White Oak River which is classified as a C.
- 7 This project is not affected by any special flood hazard zones. Upon FEMA map CPM 370794 5422K (Jones County), Effective Nov. 3, 2009.
- 8 For additional information, see other sheets.

Contractor shall insure that he and all his workers (contractors, subcontractors and other site personnel) do not damage construction stakes or other measures used in laying out the project whether by the Engineer or another entity including those under the employ of the contractor. Contractor shall cause his workers to observe and verify to the fullest extent practicable that stakes, other measures and grades are not to be eroded, moved, damaged, or otherwise destroyed. If to any associated work, notify the staking entity of any potential conflict, error or question regarding the work. The Engineer shall not be responsible if all of the above measures are not strictly adhered to. The Engineer shall not be responsible where due to damage, his staking can not be verified. For critical or costly components of the work, where the contractor believes that the staking is not correct, the contractor shall request the staking entity to place staking in an area where its preservation can be insured.

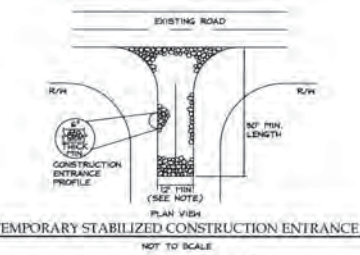
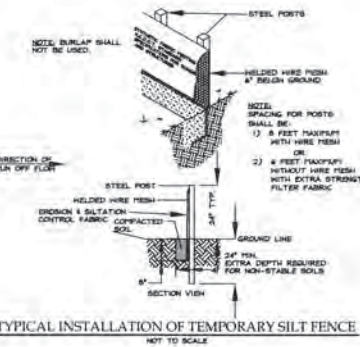
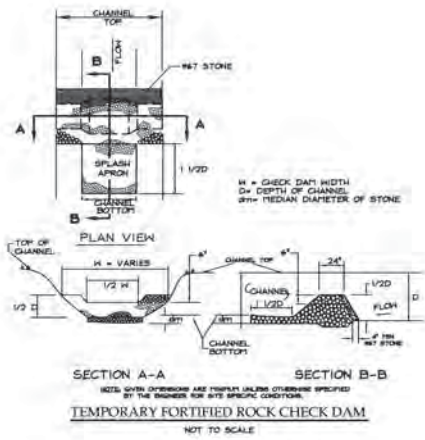
Total Acreage	26.86 Ac.
Proposed Use	Recycling Center
Water Service	Jones County
Sewer Service	Septic

Age.....	6-01 Ac.
Number of Lots.....	1
Proposed Use.....	Recycling center
Water Service.....	Jones County
Septic Service.....	Septic
Zone.....	Industrial
Number of Employees.....	16-30
Number of Trucks.....	
Spaces Proposed.....	20 (2 H/C)
Number of Trucks.....	
Spaces Required.....	2 Spaces per 3-Employees = 20 Spaces

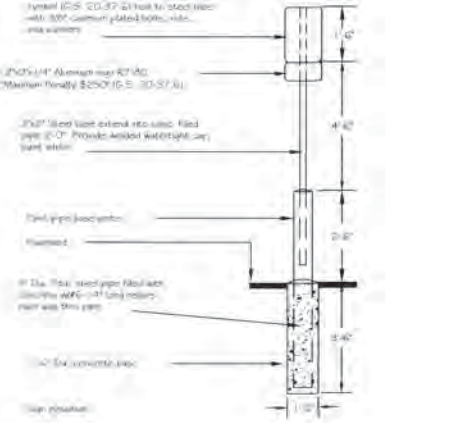
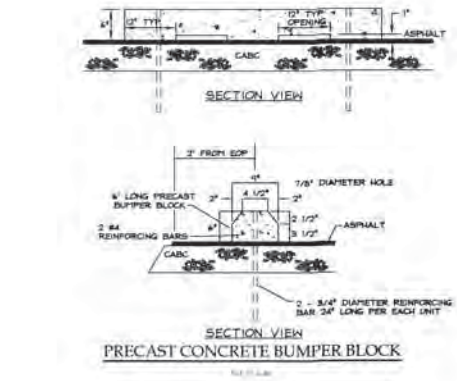
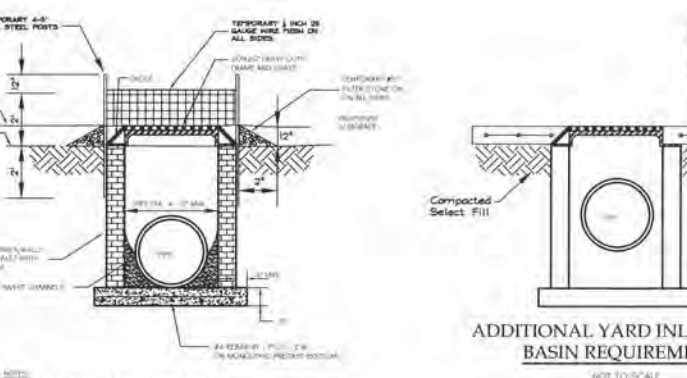
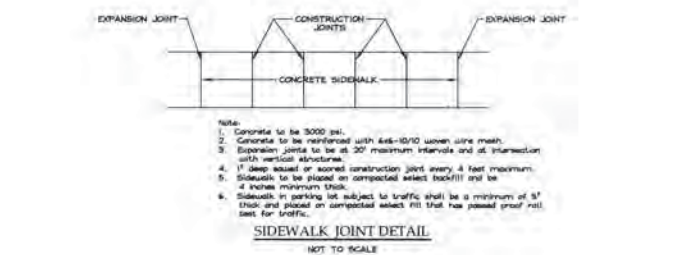
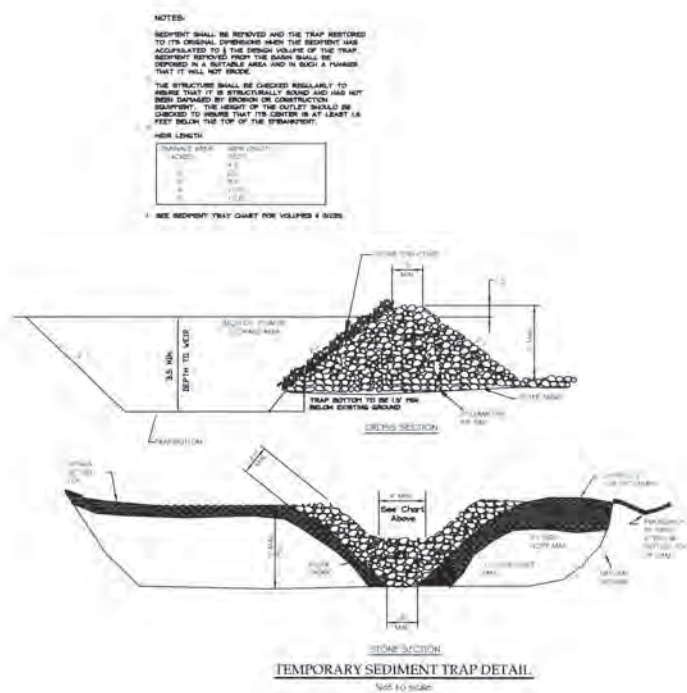
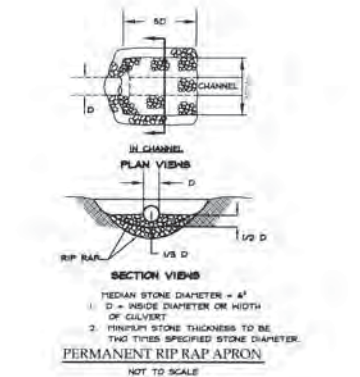
Property Owner:
Green Co Land, LLC
D.B. 351, Pg. 256

Field Book: Moyersville Landfill, Pg. 54-61, 68-71
Disk Name: ACAD 2402
Filename: CAD Site.dwg J.E.
Job No.: S11101-5265 She

Sheet 3 of 4



- Construction Specifications**
- Stone size - Use FPMAS size No. 2 (2-1/2" to 1") or AASHTO designation 14A, size No. 2 (2-1/2" to 1-1/2"). Use crushed stone.
 - Length - As effective, but not less than 50 feet.
 - Thickness - Not less than 4.5 inches.
 - Width - Not less than full width of all points of ingress or egress. Minimum of 12'.
 - Flowing - When necessary, wheels shall be cleaned to remove sediment prior to entrance onto public right-of-way. When washing is required, it shall be done on an area stabilized with crushed stone which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch, or watercourse through use of sandbags, gravel, boulders, or other approved methods.
 - Maintenance - The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto public right-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or cleanup of any measures used to trap sediment. All sediment, spilled, dropped, washed, or tracked onto public right-of-way must be removed immediately.



Drainage Pipe Chart

PIPE	AREA (sq. ft.)	Q10 (cfs)	DIAMETER (inches)	GRADE (ft / ft)	LENGTH (ft)	OUTLET VELOCITY (ft/s)
1	0.69	5.4	18" RCP	0.0035	160	4.1
2	2.12	13.0	24" RCP	0.0035	164	4.1
3	3.21	18.8	30" RCP	0.0035	164	4.1
4	4.70	24.0	36" RCP	0.0035	168	5.6
5	6.82	34.0	42" RCP	0.0035	90	—
6	1.17	7.6	2-15" RCP	0.0035	112	—
7	1.54	10.0	24" RCP	0.0025	90	—
8	1.95	12.6	24" RCP	0.0035	90	—
9	2.39	15.6	30" RCP	0.0025	40	—
10	2.70	17.9	30" RCP	0.0025	132	4.1
11	0.41	2.7	15" RCP	0.0035	90	—
12	0.88	5.3	18" RCP	0.0035	90	—
13	1.23	8.0	24" RCP	0.0025	90	—
14	1.61	10.6	24" RCP	0.0025	104	8.1

Q=Q10
Q=Variable
to=5 min.
110=7.17 in/hr.

RCP = Reinforced Concrete Pipe
CFS = Cubic Feet per Second
LF = Linear Feet
FPS = Feet per Second

Swale Calculations Chart

Section	Area (acres)	Q10 (cfs)	Grade Slope (ft/ft)	Channel Slope (ft/ft)	Velocity (ft/s)	Volume (cfs)
1 - 1	0.40	3.3	3:1	0.018	5.6	1.9
2 - 2	0.55	3.2	3:1	0.0145	5.6	1.9
3 - 3	0.37	2.1	3:1	0.0075	2.6	1.3
4 - 4	0.67	3.9	3:1	0.005	4.6	1.3
5 - 5	0.61	4.7	3:1	0.003	2.9	1.3
6 - 6	3.99	11.5	3:1	0.003	2.9	1.3
7 - 7	4.21	24.2	3:1	0.003	3.3	2.7
8 - 8	4.38	25.6	3:1	0.003	3.4	2.7
9 - 9	11.1	67.9	3:1	0.002	3.7	1.9

Q=Q10
Q=Variable
110=7.17 in/hr.

Friction Factors
n=0.20 Bare Earth
n=0.50 Grass
n=1.48 B-2/3 n=1/2

- Note:**
- See site plan for typical section locations.
 - Line bottom of all ditches and swales with American Excelsior Duxie blanket.

Sediment Trap Chart

Sediment Trap	Disturbed Area (Acres)	Volume (Cubic Yards)	Size (Length x Width x Depth)
1	0.40	54	36" x 10' x 4'
2	0.55	74	30" x 10' x 4'
3	0.37	50	36" x 10' x 4'
4	0.67	90	48" x 10' x 4'
5	0.61	108	48" x 10' x 4'
6	3.99	157	72" x 15' x 4'
7	4.21	296	100" x 20' x 4'
8	4.38	437	115" x 25' x 4'
9	11.1	360	122" x 20' x 4'
10	0.42	83	36" x 10' x 4'
11	0.42	83	36" x 10' x 4'

Design Standard = 111.3 CY Sediment Trap Volume per Disturbed Area.

Design Standard = 111.3 CY Sediment Trap Volume per Disturbed Area.

Property Owner:
Green Co Land, LLC
P.O. Box 351, Pg. 256

Detail Sheet

Jones County C&D Recycling Center

White Oak Twp., Onslow Co., North Carolina

Developer:

Green Recycling Solutions, LLC

166 Center Street
Jacksonville, North Carolina 28546
(910) 938-5900

DATE: 05/14/12

SCALE: AS NOTED

Parker & Associates, Inc.
Consulting Engineers - Land Surveyors - Land Planners

P.O. Box 978 - 28541-0978
308 New Bridge Street - 28540
Jacksonville, North Carolina
Phone (910) 455-2414 - Fax (910) 455-8441
Firm License Number: T-1008



Field Book: Playville Landfill, Pg. 54-61, 64-71
Disk Name: ACAD 2402
Filename: CAD Site.dwg
Job No.: 511101-5265

Sheet 4 of 4

APPENDIX 4

PRELIMINARY BUILDING PLANS (PREPARED BY STILLWATER ENGINEERING)

(Plans have been reduced to 11" X 17" for reference purposes only)

JONES COUNTY C&D LANDFILL

MAYSVILLE, NORTH CAROLINA

APPENDIX B - RECYCLE BUILDING

2012 APPENDIX B
BUILDING CODE SUMMARY
FOR ALL COMMERCIAL PROJECTS
(EXCEPT 1 AND 2-A AND 3-BUILDINGS AND OTHERS)

2012 FORM B - NC CODE 108 - 2012 Construction - 2012
2012 FORM B - NC CODE 108 - 2012 Construction - 2012
2012 FORM B - NC CODE 108 - 2012 Construction - 2012

2012 APPENDIX B
BUILDING CODE SUMMARY
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2012 FORM B - NC CODE 108 - 2012 Construction - 2012

SHEET #	SHEET NAME	TITLE SHEET & APPENDIX B	DESCRIPTION
1	T-1		CIVIL
2	S-1		STRUCTURAL
3	S-2		FLOOR PLAN - RECYCLE BUILDING
4	S-3		FOUNDATION PLAN - RECYCLE BUILDING
5	S-4		ELEVATIONS - SCALE HOUSE/OFFICE
6	S-5		FLOOR PLAN - SCALE HOUSE/OFFICE
7	S-6		ROOF PLAN & DETAILS - SCALE HOUSE/OFFICE
8	M-1		MECHANICAL PLAN
9	P-1		PLUMBING PLAN
10	E-1		ELECTRICAL PLAN

VICINITY MAP

2012 APPENDIX B
BUILDING CODE SUMMARY
FOR ALL COMMERCIAL PROJECTS
(EXCEPT 1 AND 2-A AND 3-BUILDINGS AND OTHERS)

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FOR ALL COMMERCIAL PROJECTS
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BUILDING CODE SUMMARY
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9	P-1		PLUMBING PLAN
10	E-1		ELECTRICAL PLAN

REVISIONS

PRELIMINARY
NOT FOR CONSTRUCTION

STILLWATER
ENGINEERING
INCORPORATED

P.O. BOX 477
13471-A US HWY 17
HAMPSTEAD, N.C. 28443
(910) 270-9889 PH/FAX
FIRM LICENSE C-2448

stillwaterengineering@charter.net

PREPARED FOR:

GREEN RECYCLING SOLUTIONS
166 CENTER STREET
JACKSONVILLE, NC 28546
PHONE: (910) 937-0003

TITLE SHEET & APPENDIX B

JONES COUNTY C&D LANDFILL
11710 HIGHWAY 17
MAYSVILLE, N.C. 28555
JONES COUNTY

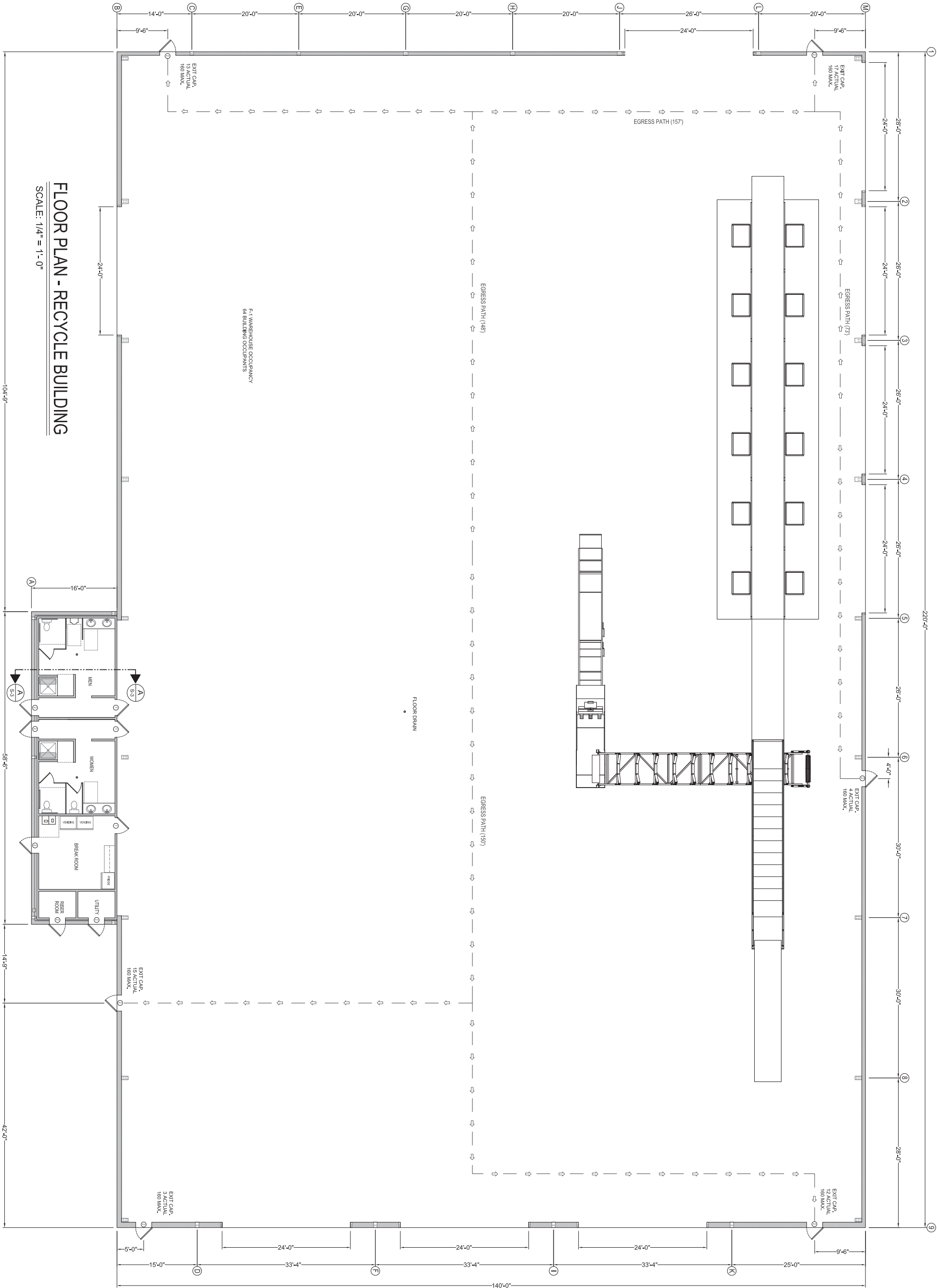
PROJECT #
E-12-6

DATE
3-20-12

SCALE
SHOWN

SHEET
T-1

1 of X



FLOOR PLAN - RECYCLE BUILDING

SCALE: 1/4" = 1'-0"

PROJECT #	E-12-6
DATE	3-20-12
SCALE	SHOWN
DRAWN BY	NKS
SHEET	S-1
	2 of X

FLOOR PLAN - RECYCLE BUILDING

JONES COUNTY C&D LANDFILL
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MAYSVILLE, N.C. 28555
JONES COUNTY

PREPARED FOR:

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166 CENTER STREET
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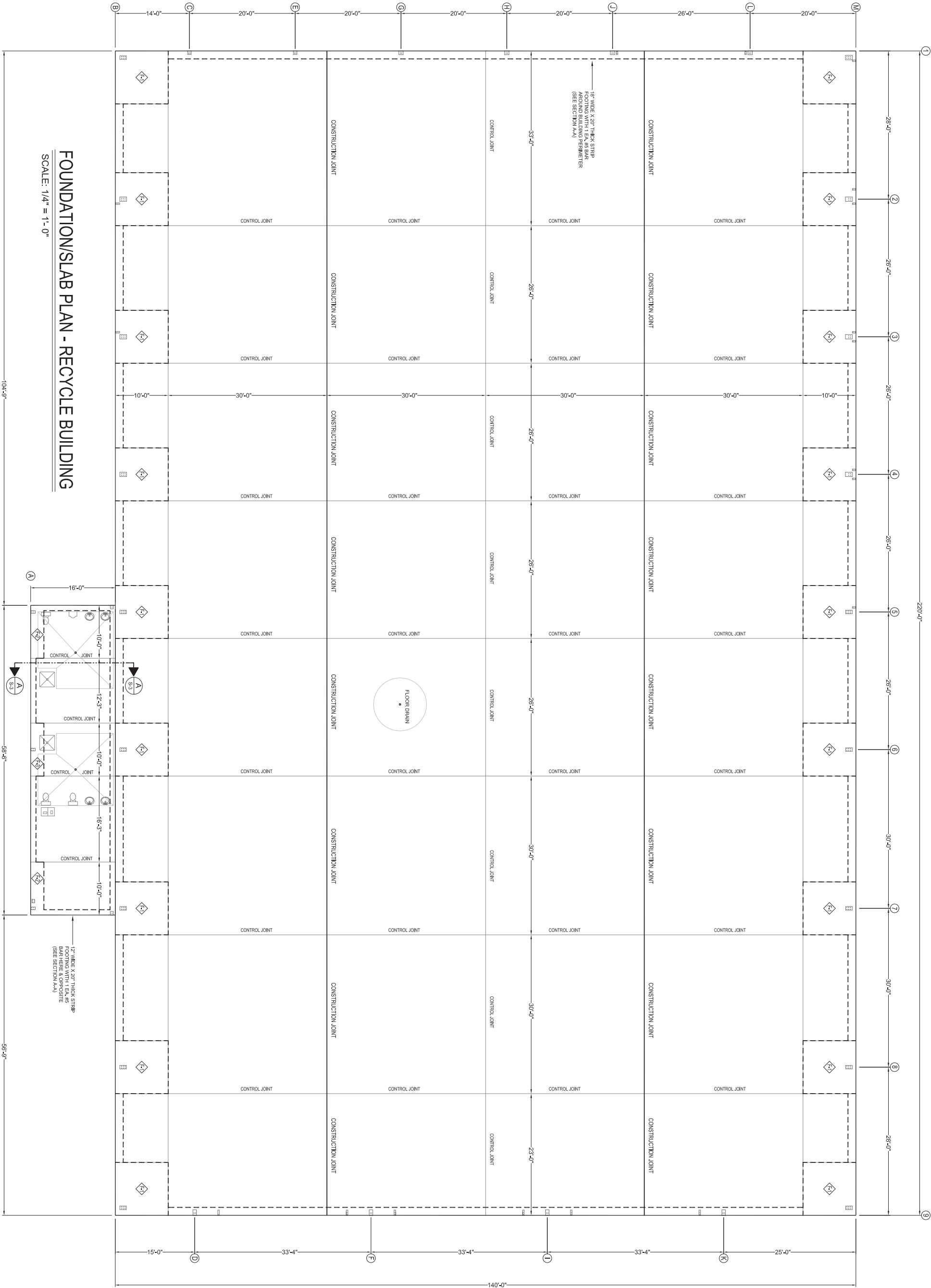
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stillwaterengineering@charter.net

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FOUNDATION PLAN - RECYCLE BUILDING

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JONES COUNTY

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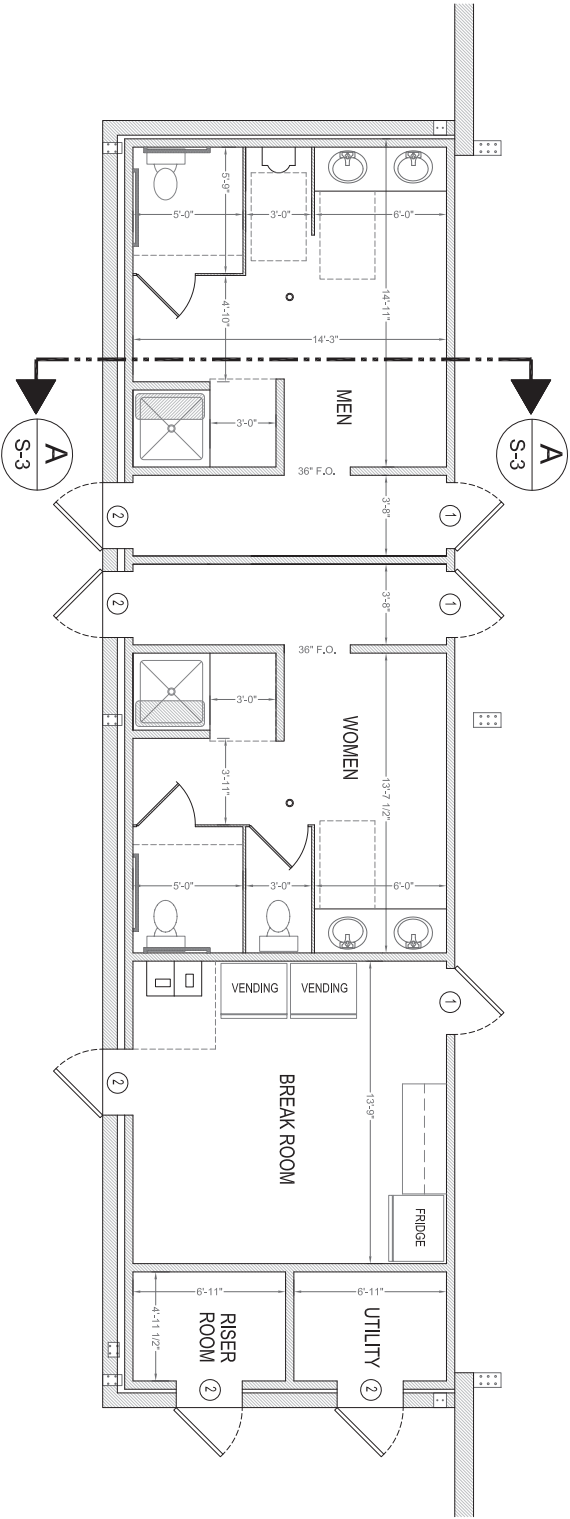
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REVISIONS

NO.	DESCRIPTION	DATE

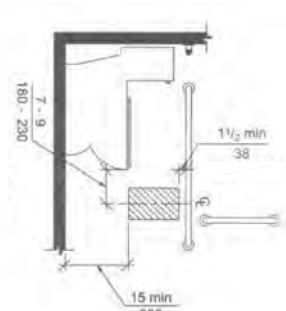
PROJECT #
E-12-6
DATE
3-20-12
SCALE
SHOWN
DRAWN BY
NKS

SHEET
S-2
3 of X



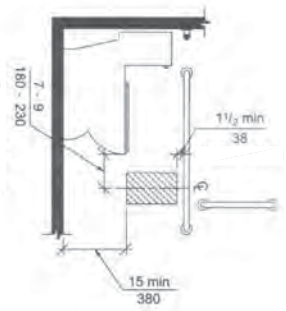
ENLARGED REST ROOM AREA - RECYCLE BLDG.

SCALE: 1/4" = 1'-0"



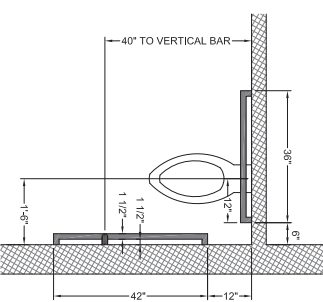
TISSUE DISPENSER LAYOUT

SCALE: NTS



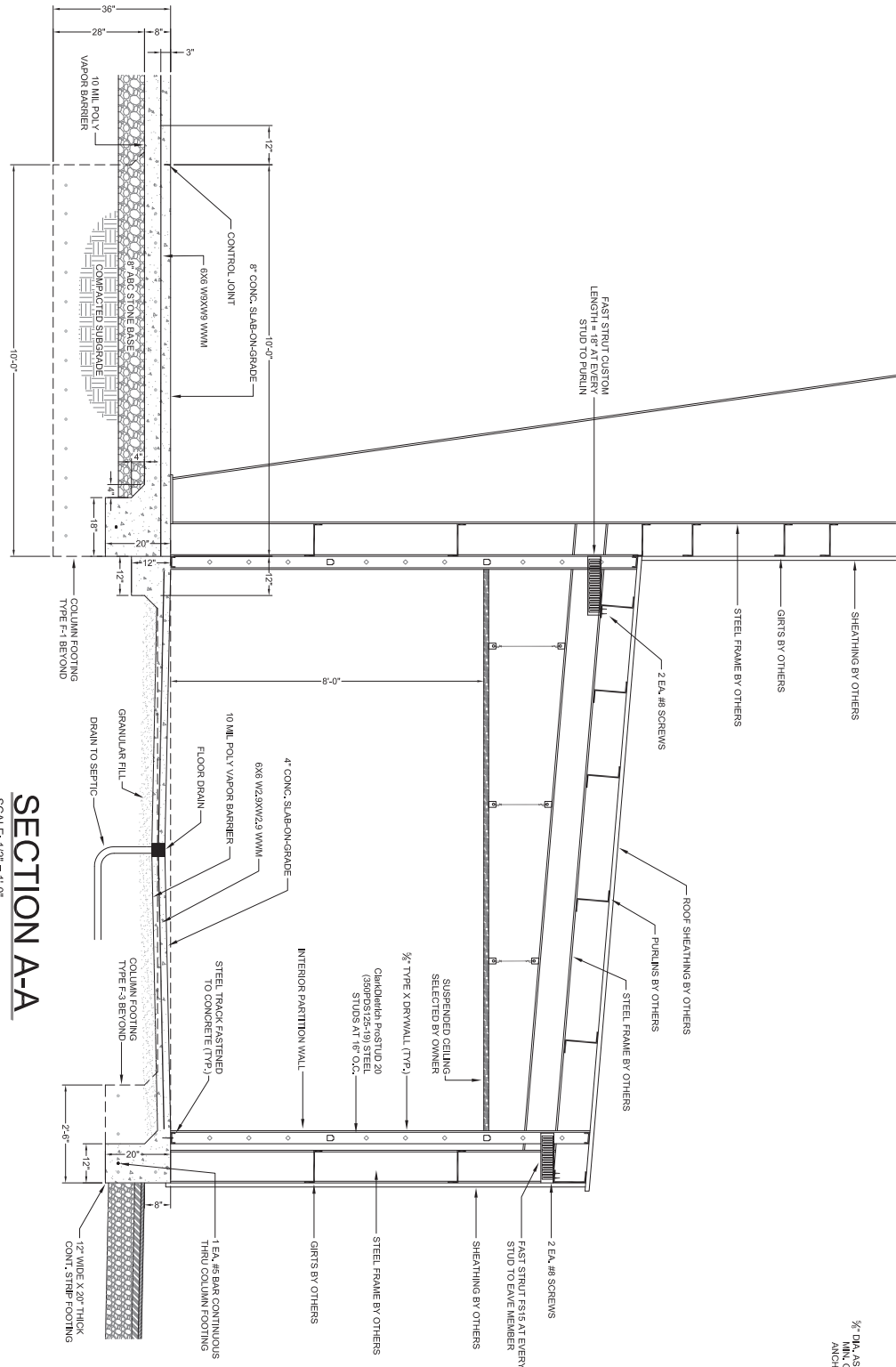
GRAB BAR PROFILE

SCALE: NTS



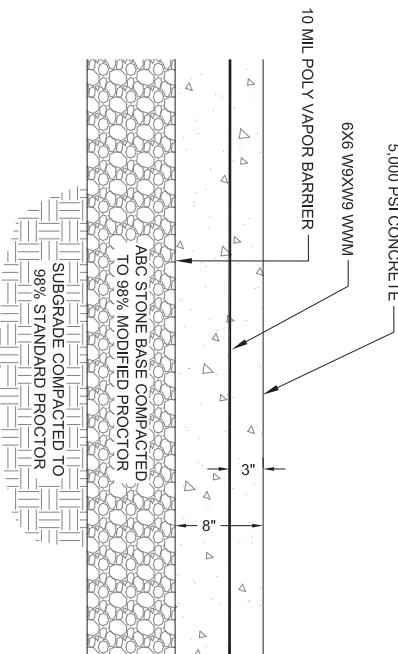
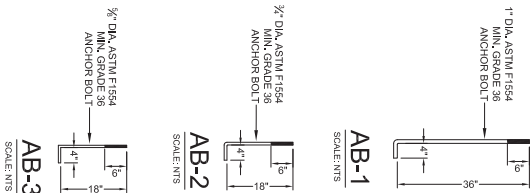
GRAB BAR PLAN

SCALE: NTS



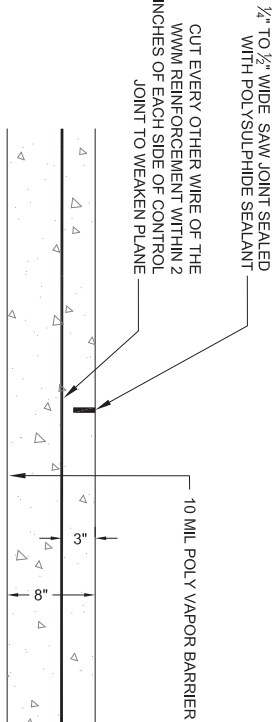
SECTION A-A

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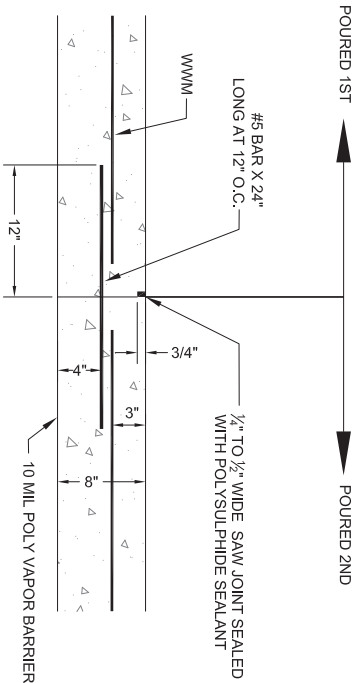
MAIN SLAB SECTION

N.T.S.



TYPICAL CONTROL JOINT

N.T.S.



TYPICAL CONSTRUCTION JOINT

N.T.S.

PROJECT #
E-12-6
DATE
3-20-12
SCALE
SHOWN
DRAIN BY
NKS


SHEET
S-3
4 of X

ENLARGED FLOOR PLAN & DETAILS

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MAYSVILLE, N.C. 28555
JONES COUNTY

PREPARED FOR:

GREEN RECYCLING SOLUTIONS
166 CENTER STREET
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REVISIONS	

RECYCLE BUILDING NOTES:

1. IF ANY NOVELTIES OR DISCREPANCIES ARE DISCOVERED BETWEEN THESE DRAWINGS AND THE NORTH CAROLINA STATE BUILDING CODE, 2012 EDITION (HEREIN REFERRED TO AS THE "CODE"), THEN CONTACT THE CONTRACTOR FOR CLARIFICATION.
2. CONTRACTOR SHALL VERIFY ALL DIMENSIONS PRIOR TO BEGINNING ANY WORK OR CONSTRUCTION OF THE STRUCTURE IN ACCORDANCE WITH THE PERMITS.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS, APPROVALS, APPROVED METHODS, PROCEDURES AND SEQUENCES OF CONSTRUCTION, ARE THE RESPONSIBILITY OF THE CONTRACTOR. CONTRACTOR SHALL FULFILL ALL NECESSARY PRECAUTIONS TO MAINTAIN AND INSURE THE INTEGRITY OF THE STRUCTURE AT ALL STAGES OF CONSTRUCTION.
5. CONTRACTOR SHALL OBTAIN AND BEAR THE COST OF ALL PERMITS OR ANY IMPACT FEE REQUIRED.
6. CONTRACTOR SHALL VERIFY THE EXISTENCE AND LOCATION OF ANY EXISTING UTILITIES PRIOR TO BEGINNING CONSTRUCTION.
7. REMOVE & ELLIMINATE SHALL BE A PERMITS-ENGINEERED TEST FRAME BUILDING DESIGNED BY OTHERS. COLUMN RECTIONS AND ANCHOR BOLT DIMENSIONS/MATERIALS WERE PROVIDED TO SULLIVANER ENGINEERING BY CHAIRMAN BUILDING SYSTEMS. SULLIVANER ENGINEERING IS RESPONSIBLE FOR EQUIPMENT/STANDARD DESIGN AND LOAD PLAN ONLY. ALL EQUIPMENT IS BY OTHERS. EQUIPMENT LOADS WERE PROVIDED TO SULLIVANER ENGINEERING BY MAHARISHI DESIGN GROUP INC.
8. CONTRACTOR SHALL CONDUCT INSPECTIONS WITH TOTAL CODE ENFORCEMENT DISCREPANCY.
9. EACH DESIGNER IS RESPONSIBLE FOR PROVIDING APPENDIX B INFORMATION FOR THEIR DISCIPLINE.
- TESTING & SPECIAL INSPECTIONS:**
1. CONTRACTOR SHALL HIRE QUALIFIED PERSONNEL, TO PERFORM ANY TESTING AND/OR SPECIAL INSPECTIONS REQUIRED. OWNER AND ENGINEER SHALL BE PROVIDED A COPY OF ALL TESTING REPORTS.
2. CONTRACTOR SHALL PROVIDE FOR STRUCTURAL PULL IN PROVIDE A BUILDING SHALL BE TESTED. BE PLACED IN LIFTS NO GREATER THAN 1% LOOSE OR 0.5% COMPACTED PULL SHALL BE TESTED BY QUALIFIED PERSONNEL. TESTING SHALL BE PERFORMED AS SPECIFIED IN GEOTECHNICAL ENGINEERING REPORT BY ECS CAROLINAS, LLP.
3. CONTRACTOR SHALL EMPLOY A GEOTECHNICAL ENGINEER TO VERIFY BEARING CAPACITY IN OPEN FOOTINGS.
4. CONCRETE SHALL BE TESTED IN ACCORDANCE WITH THE LATEST EDITION OF ACI 318.
5. STEEL SHALL BE TESTED IN ACCORDANCE WITH THE LATEST EDITION OF AISC 360.
6. ALL CONCRETE AND STEEL SHALL BE TESTED AT ONE (1) PERIOD. ONE (1) CONCRETE SHALL BE TESTED 7 DAYS, TWO (2) CONCRETES SHALL BE TESTED AT 28 DAYS AND THE FINAL CONCRETE SHALL BE TESTED AT 90 DAYS.
7. ALL STEEL SHALL BE TESTED AT 28 DAYS AND THE FINAL CONCRETE SHALL BE SAVED AS A RESERVE. ADDITIONAL CONCRETES MAY BE MADE AND TESTED AT THE REQUEST OF OWNER/CONTRACTOR.

TESTING & SPECIAL INSPECTIONS:

1. CONTRACTOR SHALL HIRE QUALIFIED PERSONNEL, TO PERFORM ANY TESTING AND SPECIAL INSPECTIONS REQUIRED. OWNER AND ENGINEER SHALL BE PROVIDED A COPY OF ALL TESTING REPORTS.
2. TESTING EQUIPMENT TO BE REQUIRED FOR STRUCTURAL TILT IN REINCE & CONCRETE SHALL BE PLACED IN LIFTS NO GREATER THAN 4' LOOSE OR 6' COMPACTED TILT. SHALL BE TESTED BY QUALIFIED PERSONNEL. TESTING SHALL BE PERFORMED AS SPECIFIED IN GEOTECHNICAL ENGINEERING REPORT BY EGS CANADIAN LLP.
3. A GEOTECHNICAL ENGINEER TO TEMP READING
4. CAPACITY, NO OPEN FOOTINGS
5. A CONCRETE SHALL BE TESTED IN ACCORDANCE WITH THE LATEST EDITION OF AC 318.
6. ONE (5) SET OF POUR IN CONCRETE TEST SHALL BE DONE EACH DAY, PER 250 CY OF CONCRETE PLACED WITH IN MIN OF ONE (1) SET/PER DAY.
7. ALL TESTING SHALL BE SIGNED AS A WITNESS. ADDITIONAL WITNESSES MAY BE MADE AND TESTED AT THE REQUEST OF OWNER/CONTRACTOR.

FOUNDATION NOTES:

1. FOUNDATIONS SHALL BEAR ON UNDISTURBED SOIL WITH A MIN. NET ALLOWABLE BEARING CAPACITY OF 2,000 PSF.
2. IF FOUNDATION IS BEARING ON FILL SOILS, FILL MUST BE SUITABLE STRUCTURAL FILL COMPACTED TO A MIN. OF 95% STANDARD PROCTOR, DESIGNED BY SOIL COMPACTOR TO BE VERIFIED BY GEOTECHNICAL ENGINEER.
3. ALL BACKFILL SHALL BE SUITABLE STRUCTURAL FILL THAT IS FREE OF ORGANIC MATTER AND NOT SUBJECT TO SETTLEMENT.
4. FOUNDATIONS SHALL BE PROTECTED FROM FREEZING AND THAWING OF SOILS TO SUPPORT CONCRETE SLAB-ON-GRADE.
5. REMOVAL ALL TOPSOIL, ORGANIC MATERIAL, ROOTS, STUMPS, LIMBS ETC.) FROM FOUNDATION AND BUILDING PAD AREAS.
6. SOIL BEARING CAPACITY FOR FOUNDATION SHALL BE DETERMINED BY ENGINEER.

ACCESSIBILITY REQUIREMENTS:

1. CONTRACTOR SHALL ENSURE THAT ALL ACCESSIBILITY REQUIREMENTS ARE MET IN ACCORDANCE WITH ICC/ANSI A117.1-2009, NORTH CAROLINA BUILDING CODE, 2012 EDITION ADA, AND LOCAL CODES FOR ACCESSIBLE ROUTES, CLEARANCES, BUILDING FACILITIES, THRESHOLDS, DOOR HARDWARE, PLUMBING FIXTURES, SANITARY DISPENSERS, ETC.

CONCRETE NOTES:

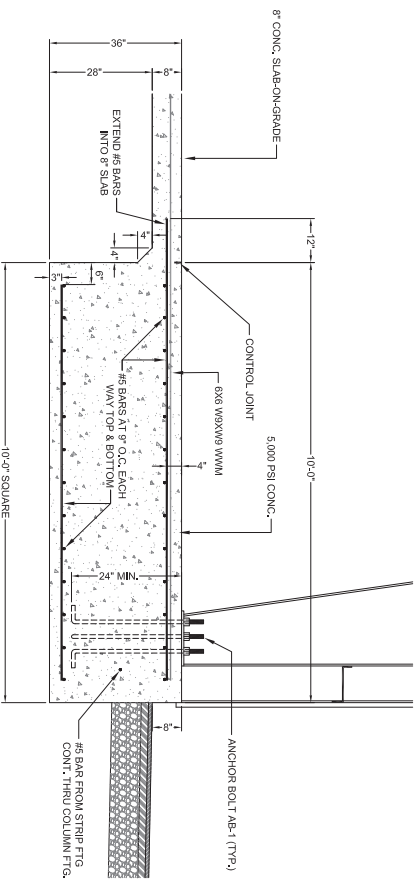
- [illegible]

RESTROOM PARTITIONS:

1. RESTROOM PARTITIONS SHALL BE INSTALLED SUCH THAT ALL NORTH CAROLINA BUILDING CODE 2012 EDITION (NCBCA117.12-09) AND ADA REQUIREMENTS ARE MET.
2. ALL PARTITIONS SHALL BE FLOOR TO CEILING.
3. INSTAL PARTITIONS IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS.
4. INSTAL BLOCCING BETWEEN TRUSSES AS REQUIRED TO SECURE PARTITIONS TO CEILING.
5. PARTITIONS SHALL BE MECHANICALLY ANCHORED TO FLOOR.

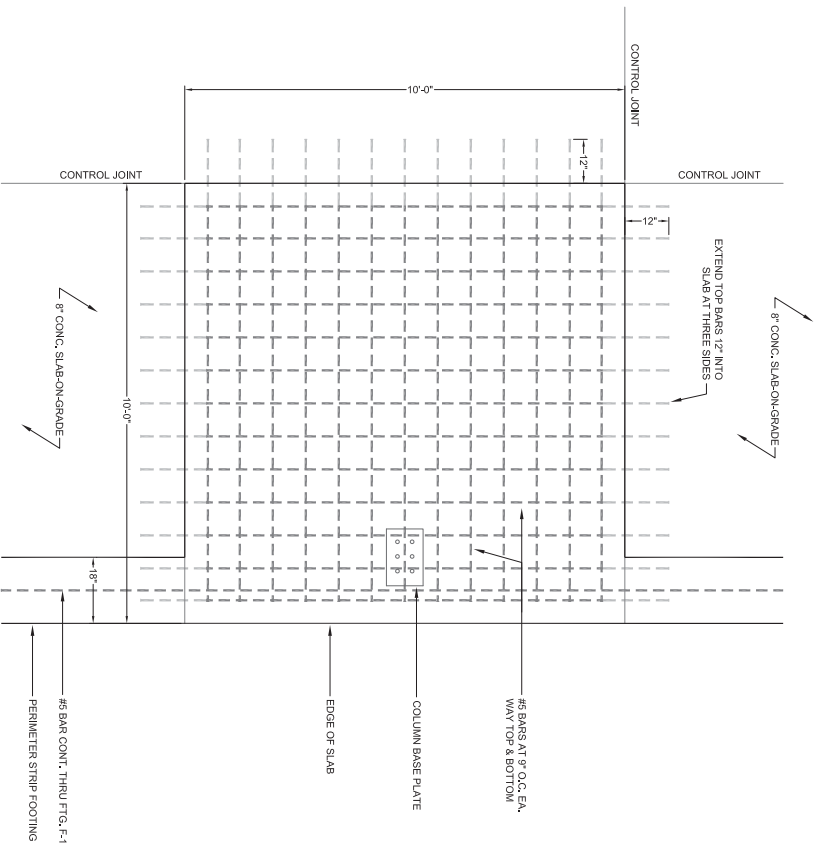
DOORS AND WINDOWS:

- A) WINDOWS SHALL BE SUPPLIED AND INSTALLED IN ACCORDANCE WITH WINDOW SCHEDULE.
- B) WINDOWS SHALL HAVE LOW-E GLASS AND A "U" FACTOR OF 0.26 AS SPECIFIED BY MANUFACTURER.
- C) CONTRACTOR SHALL COORDINATE COLOR WITH OWNER PRIOR TO ORDERING.
- D) WINDOWS SHALL BE AT LEAST P-30 AS DEFINED BY MANUFACTURER.
- E) ACCESSORIES SHALL BE SUPPLIED AND INSTALLED IN ACCORDANCE WITH DOOR SCHEDULE.
- F) ALL DOORS SHALL HAVE A "U" FACTOR OF 0.34 AS A MINIMUM.
- G) ALL DOOR HARDWARE SHALL BE ACCESSIBLE. DOOR HARDWARE SPECIFIED SHALL BE APPROVED BY OWNER, PRIOR TO ORDERING/HARDWARE. EXTENSION DOORS SHALL NOT BE KEYS OR LOCKABLE. ALL INTERIOR DOORS SHALL BE KEYS OR LOCKABLE.
- H) ALL DOORS SHALL BE SUPPLIED AND INSTALLED IN ACCORDANCE WITH DOOR SCHEDULE.
- I) REQUIREMENTS FOR THE 101 MPH WIND ZONE PER MANUFACTURERS SPECIFICATIONS.



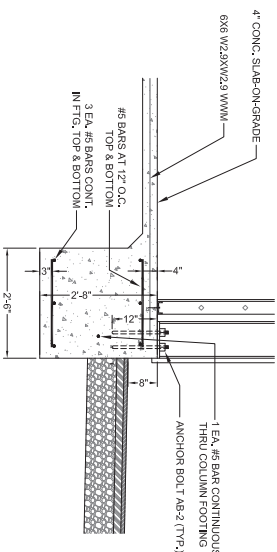
F-1 FOOTING SECTION

SCALE: 1/2" = 1'-0"



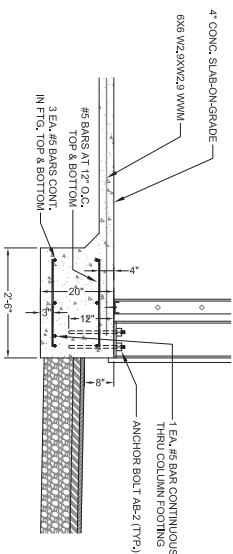
F-1 FOOTING PLAN VIEW

SCALE: 1/2" = 1'-0"



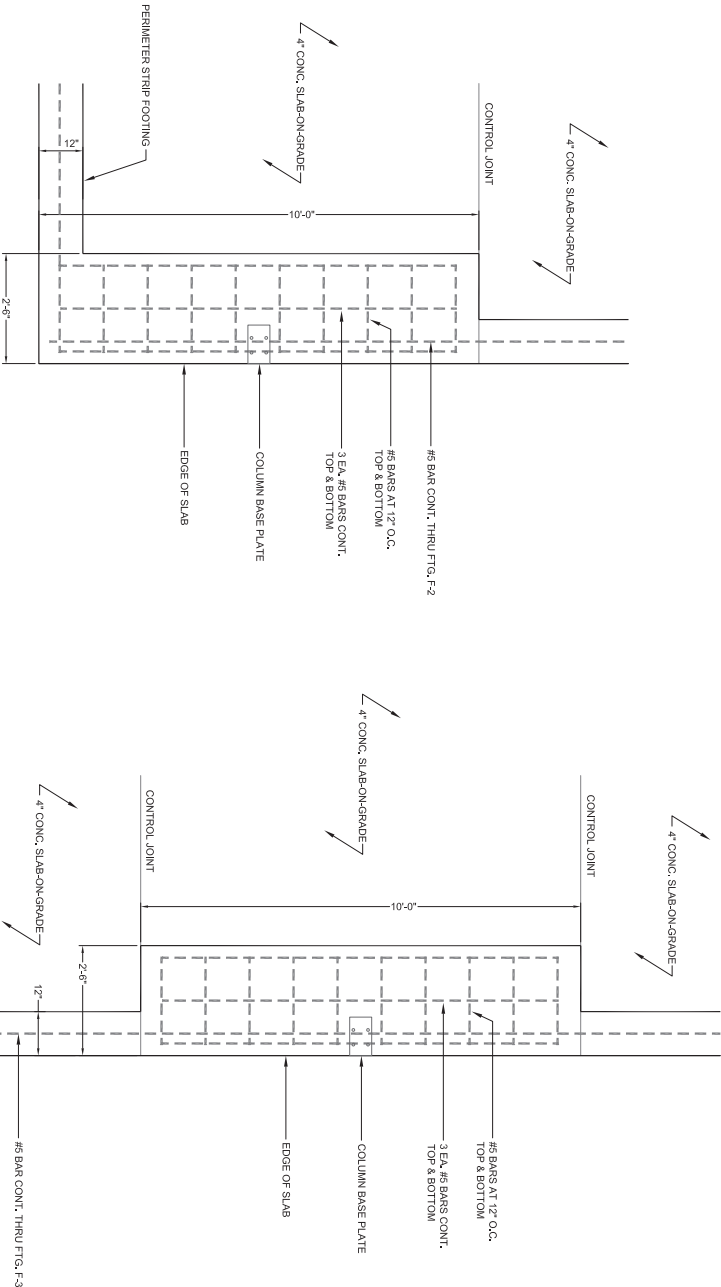
F-2 FOOTING SECTION

SCALE: 1/2" = 1'-0"



F-3 FOOTING SECTION

SCALE: 1/2" = 1'-0"



F-3 FOOTING PLAN VIEW

SCALE: 1/2" = 1'-0"

DOOR SCHEDULE - RECYCLE BUILDING						HARDWARE	
DOOR	UNIT WIDTH (CLEAR OPENING)	UNIT HEIGHT	UNIT TYPE	GLASS PERFORMANCE	MANUFACTURER/MODEL #	COLOR	LOCKS & LATCHES
①	3'-6" (32")	6'-6"	INTERIOR	N/A	SELECTED BY OWNER	SELECTED BY OWNER	ACCESSIBLE - SELECTED BY OWNER
②	3'-6" (32")	6'-6"	EXTENSION STEEL (U=0.34)	U (MIN.) = 0.285 SHPOCOVER: 0.1765	SELECTED BY OWNER	SELECTED BY OWNER	ACCESSIBLE - SELECTED BY OWNER

RECYCLE BLDG. NOTES & FOOTING DETAILS

JONES COUNTY C&D LANDFILL
11710 HIGHWAY 17
MAYSVILLE, N.C. 28555
JONES COUNTY

PREPARED FOR:

GREEN RECYCLING SOLUTIONS
166 CENTER STREET
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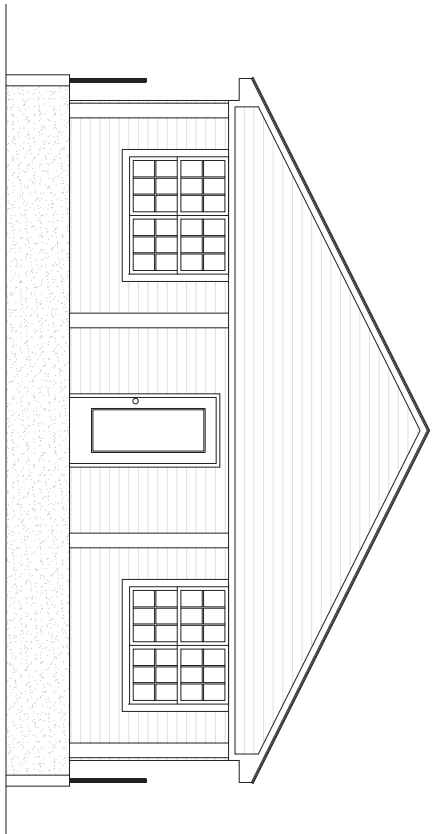
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REVISIONS

PROJECT #	E-12-6
DATE	3-20-12
SCALE	SHOWN
DRAWN BY	NKS

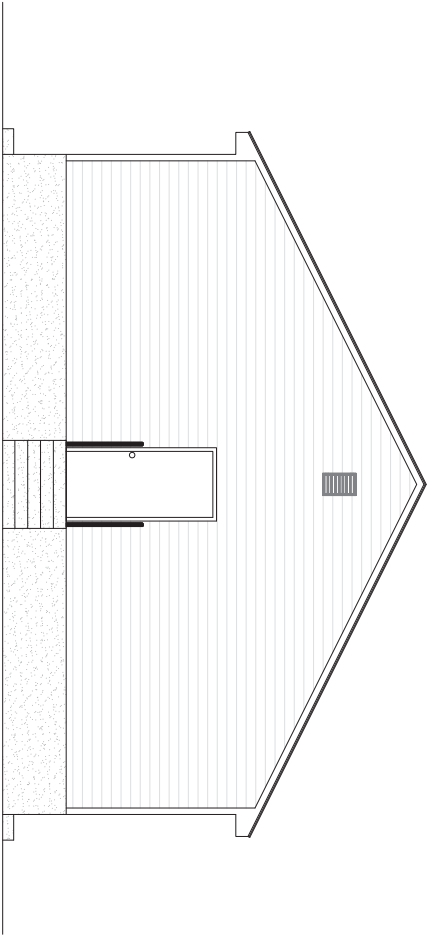
S-4

4 of X



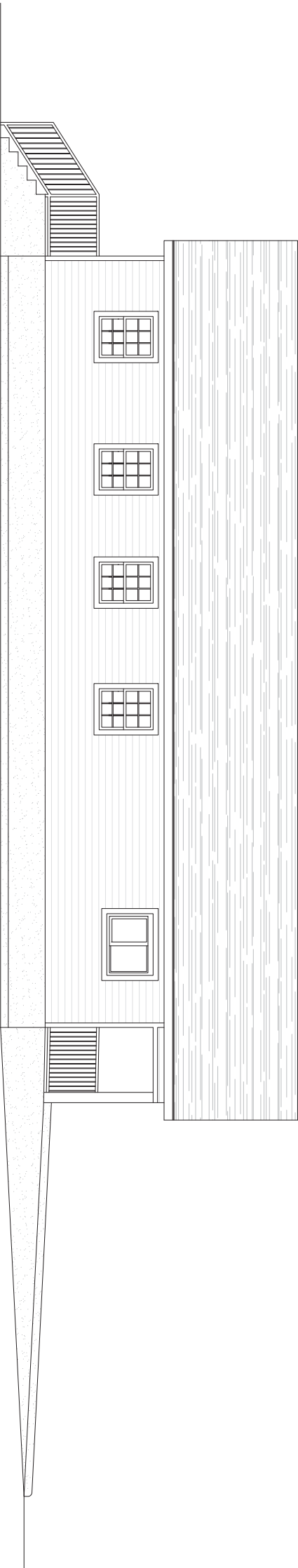
FRONT ELEVATION - SCALE HOUSE/OFFICE

SCALE: 1/4" = 1'-0"



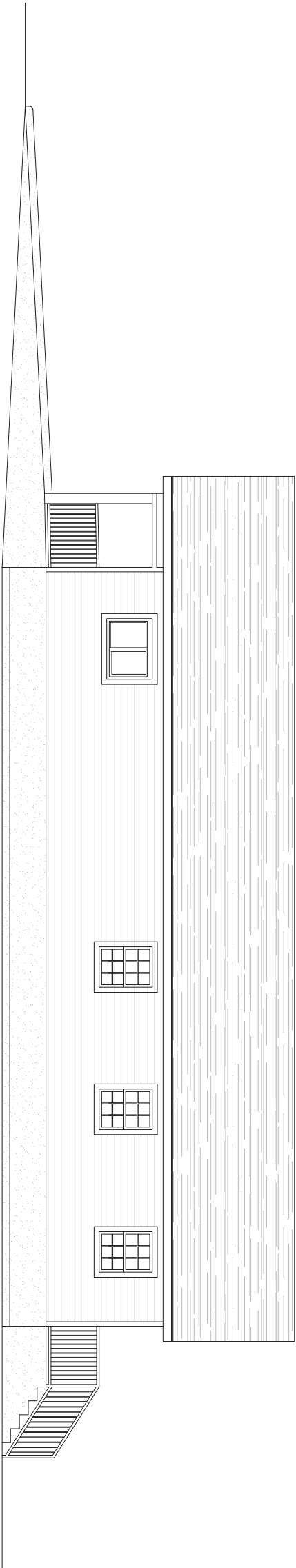
REAR ELEVATION - SCALE HOUSE/OFFICE

SCALE: 1/4" = 1'-0"



LEFT SIDE ELEVATION - SCALE HOUSE/OFFICE

SCALE: 1/4" = 1'-0"



RIGHT SIDE ELEVATION - SCALE HOUSE/OFFICE

SCALE: 1/4" = 1'-0"

PROJECT #	E-12-6
DATE	3-20-12
SCALE	SHOWN
DRAWN BY	NKS
SHEET	S-5
5 of X	

ELEVATIONS - SCALE HOUSE/OFFICE

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11710 HIGHWAY 17
MAYSVILLE, N.C. 28555
JONES COUNTY

PREPARED FOR:

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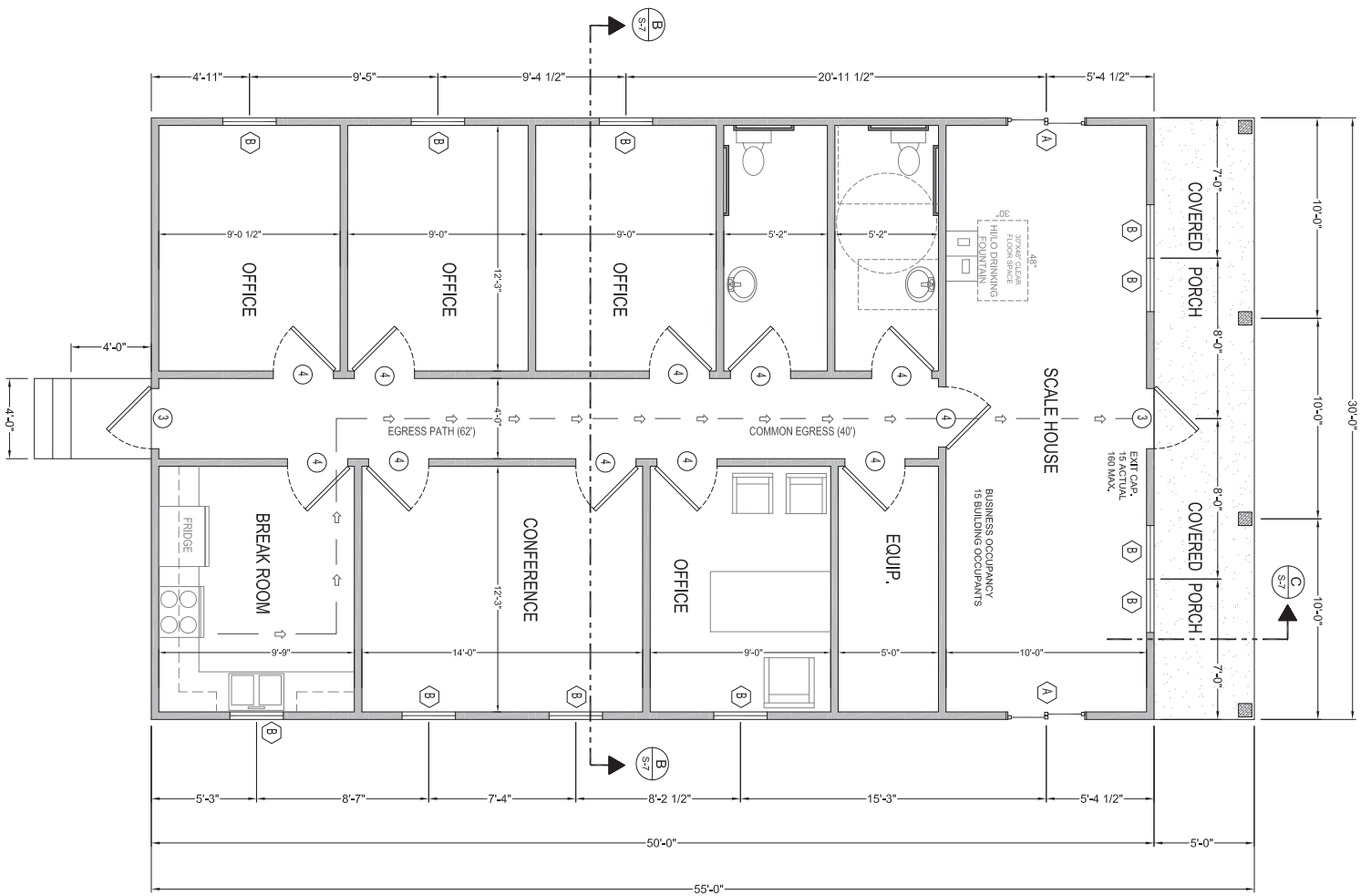
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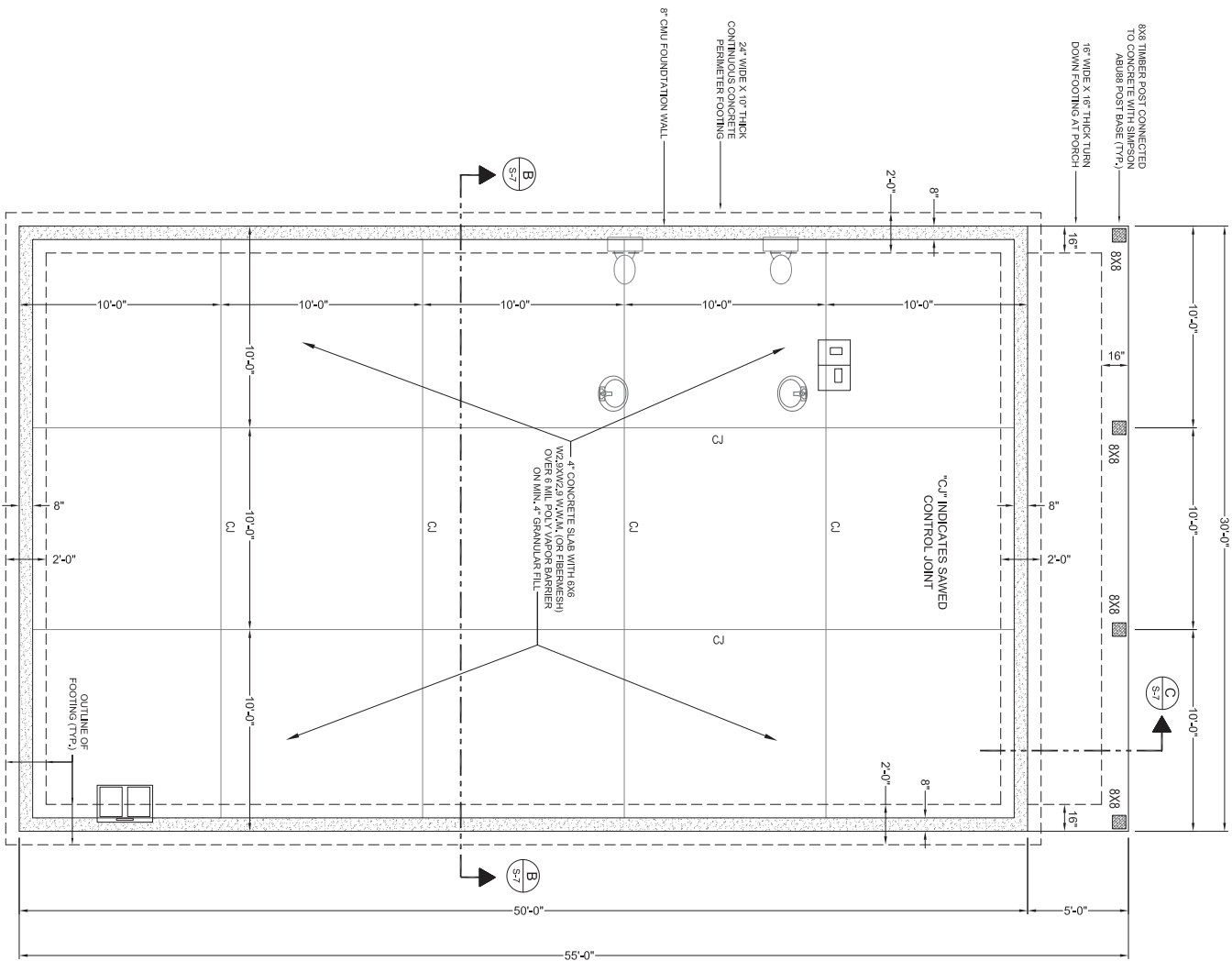
WINDOW SCHEDULE - SCALE HOUSE/OFFICE BUILDING						
WINDOW	UNIT WIDTH	UNIT HEIGHT	UNIT TYPE	GLASS PERFORMANCE	MANUFACTURER/MODEL #	COLOR
A	2'-6"	3'-0"	SIDING SERVICE	U (WIN) = 0.280 SHIP-COVER: 0.765	SELECTED BY OWNER	SELECTED BY OWNER
B	2'-6"	3'-0"	DOUBLE HUNG	U (WIN) = 0.200 SHIP-COVER: 0.765	SELECTED BY OWNER	SELECTED BY OWNER
C	2'-6"	4'-0"	DOUBLE HUNG	U (WIN) = 0.200 SHIP-COVER: 0.765	SELECTED BY OWNER	SELECTED BY OWNER

DOOR SCHEDULE - SCALE HOUSE/OFFICE BUILDING							HARDWARE	
DOOR	UNIT WIDTH (CLEAR OPENING)	UNIT HEIGHT	UNIT TYPE	GLASS PERFORMANCE	MANUFACTURER/MODEL #	COLOR	LOOKS & LATCHES	
③	3'x7' (27")	6'-6"	EXTERIOR (U=0.34)	U (MIN.) = 0.28) SHCOEFF. 0.795	SELECTED BY OWNER	SELECTED BY OWNER	ACCESSIBLE - SELECTED BY OWNER	
④	3'x7' (27")	6'-6"	INTERIOR	NA	SELECTED BY OWNER	SELECTED BY OWNER	ACCESSIBLE - SELECTED BY OWNER	



FLOOR PLAN - SCALE HOUSE/OFFICE

SCALE: 1/4" = 1'-0"



FOUNDATION PLAN - SCALE HOUSE/OFFICE

SCALE: 1/4" = 1'-0"

PROJECT # E-12-6	SHEET S-6
DATE 3-20-12	
SCALE SHOWN	
DRAWN BY NKS	
6 of X	

FLOOR/FOUND. PLANS - SCALE HOUSE/OFFICE

JONES COUNTY C&D LANDFILL
11710 HIGHWAY 17
MAYSVILLE, N.C. 28555
JONES COUNTY

PREPARED FOR:

GREEN RECYCLING SOLUTIONS
166 CENTER STREET
JACKSONVILLE, NC 28546
PHONE: (910) 937-0003



STILLWATER
ENGINEERING
INCORPORATED

stillwaterengineering@charter.net

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HAMPSTEAD, N.C. 28443
(910) 270-9889 PH/FAX
FIRM LICENSE C-2448

PRELIMINARY
NOT FOR CONSTRUCTION

REVISIONS

1. IF ANY CONFLICTS OR DISCREPANCIES ARE DISCOVERED BETWEEN THESE DRAWINGS AND THE LOCAL GOVERNMENT STATE BUILDING CODE, 2021 EDITION (HEREIN REFERRED TO AS THE "LOCAL CODE"), THE ENGINEER FOR CONTRACTOR SHALL BE RESPONSIBLE FOR CORRECTING THE DISCREPANCY. THE ENGINEER FOR CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING NECESSARY PERMITS AND FOR OBTAINING OR OBTAINING OF ANY OTHERS. ACCORDING TO ANY MATTERS, THE STRUCTURE IS NOT LOCATED WITHIN ANY FLOOD ZONE.

2. METHODS, PROCEDURES AND REQUIREMENTS OF CONSTRUCTION ARE THE RESPONSIBILITY OF CONTRACTOR. CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO MAINTAIN THE STRUCTURE AND THE EXISTING UTILITIES AND THE EXISTING UTILITIES SHALL BE PROTECTED. CONTRACTOR SHALL OBTAIN AND MARK THE LOCATION OF ALL PERMITS OR ANY IMPACT FEATURES REQUIRED.

3. CONTRACTOR SHALL VERIFY THE EXISTENCE AND LOCATION OF ANY EXISTING UTILITIES PRIOR TO BEGINNING WORK. CALL 811 BEFORE YOU DIG.

4. CONTRACTOR SHALL COORDINATE WITH LOCAL CODE ENFORCEMENT AGENCIES. CONTRACTOR SHALL COORDINATE WITH ALL INSPECTIONS WITH LOCAL CODE ENFORCEMENT.

5. EACH DESIGNER IS RESPONSIBLE FOR PROVIDING APPENDIX B INFORMATION FOR THEIR DISCIPLINE.

TESTING & SPECIAL INSPECTIONS:

1. CONTRACTOR SHALL HIRE QUALIFIED PERSONNEL TO PERFORM ANY TESTING AND/OR ALL TESTING REPORTS. CONTRACTOR AND ENGINEER SHALL BE PROVIDED A COPY OF ALL TESTING REPORTS.

2. COMPACTION TESTING WILL BE REQUIRED FOR STRUCTURAL FILL IN SCALE HOUSE/GEOTECH BUILDING. SHALL BE PLACED IN LIFTS NO GREATER THAN 8" LOOSELY COMPACTED. FILL SHALL BE TESTED BY QUALIFIED PERSONNEL, A MIN. OF ONE (1) CAPACITY TEST IS REQUIRED PER LIFT FOR EACH BUILDING PAD.

3. DENSITY TESTS SHALL BE REQUIRED FOR ALL GEOTECHNICAL EXCAVATION TO VERIFY BEARING CAPACITY IN OPEN FOOTINGS.

4. CONCRETE SHALL BE TESTED IN ACCORDANCE WITH THE LATEST EDITION OF ACI 318 A.

5. CONCRETE SHALL BE TESTED IN ACCORDANCE WITH THE LATEST EDITION OF ACI 318 A. FOR ALL (1) SETS OF FOUR (4) CONCRETE TEST CYLINDERS SHALL BE MADE FOR EACH FOOTING AND ONE (1) FOR SLAB OF SCALE HOUSE/GEOTECH BUILDING, ONE CYLINDER FOR EACH SET SHALL BE USED AS A SUBSTITUTE FOR EACH SET. ADDITIONAL CYLINDERS MAY BE MADE AND TESTED AT THE REQUEST OF OWNER/CONTRACTOR.

6. SPECIAL INSPECTIONS SHALL BE PERFORMED AS REQUIRED BY CODE.

1. WOOD MEMBERS IN THESE DRAWINGS, SUCH AS ANY TRUSS AND BLOCKING, SHALL BE SPRUCE-PINE-FIR, GRADE NO. 2 OR BETTER, IF ANY WOOD MEMBER IS EXPOSED TO THE ELEMENTS, IT SHALL BE TREATED.
2. ALL WOOD MEMBERS SHALL BE PROTECTED IN ACCORDANCE WITH CODE AND SHALL MEET THE REQUIREMENTS OF AIAH, USE CATEGORY UC4A, GRADING CATEGORY I&A.
3. ALL WORK IS TO BE IN STRICT ACCORDANCE WITH THE 2018 CALIFORNIA BUILDING CODE, 2021 EDITION CODE, INCLUDING WOOD CONNECTIONS AND DETAILS NOT SHOWN.
4. HANDMADE/ARTISAN EXPOSED TO WEATHER SHALL BE HOT GALVANIZED STEEL CONNECTIONS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
5. ALL STEEL MEMBERS SHALL BE PROTECTED IN ACCORDANCE WITH CODE UNLESS NOT OTHERWISE SPECIFIED.
6. DO NOT USE EFFECTIVE LUMBER.
7. ALL SHEATHINGS SHALL BE APA RATED STRUCTURAL SHEATHING, FASTEN SHEATHINGS AS SHOWN ON PLANS.
8. FLASHING SHALL BE PROVIDED AT ALL ROOF PENETRATIONS.
9. I.V. BEAMS SHALL BE LAMINATED VENER LUMBERS WITH A MIN. $E = 2,500$ PSI AND $E = 1,500$ PSI.
10. MANUFACTURER'S RECOMMENDATION, SPECIAL ATTENTION IS DIRECTED TO THE MANUFACTURER'S REQUIREMENTS FOR FASTENING TOGETHER ALL THE MEMBERS, NOTING AND/OR CUTTING OF MEMBERS, CONNECTION REQUIREMENTS AND MINIMUM BEARING REQUIREMENTS. I.V. BEAMS AT EXTERIOR OF BUILDING SHALL BE PERMANENTLY PROTECTED FROM WEATHER.
11. ALL TRUSSES SHALL BE CONNECTED TO THE DOUBLE TOP PLATE (OR BAND) WITH THE SPECIFIED HANGING TEES.
12. PRE-ENGINEERING TRUSSES SHALL BE DESIGNED, FABRICATED, AND ERECTED IN ACCORDANCE WITH TRUSS PLATE INSTITUTE (T.P.I.) STANDARDS. TRUSS MANUFACTURER SHALL PROVIDE SHOP DRAWINGS THAT CLEARLY INDICATE BRACING SIZES AND LOCATIONS. SHOULD TRUSS MANUFACTURER HAVE ANY QUESTIONS REGARDING LOAD POINTS, SECTIONS, ETC., THE TRUSS DESIGNER SHALL CONTACT ENGINEER FOR CLARIFICATION.
13. ALL TRUSSES SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN NORTH CALIFORNIA.
14. CONTRACTOR SHALL SUBMIT PRE-ENGINEERED TRUSS DRAWINGS TO ENGINEER FOR APPROVAL PRIOR TO ORDERING.

1. GAG THE BRINE IN THE ULTRA HIGH STRENGTH ROOF JOISTS SHALL INSTALLED WITH REINFORCED JOIST BRACE AND SHALL BE FASTENED (EVAHANCED) ALONG PATTERNS TO THE ROOF DECK IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS FOR 130MM GAG BRACE.
2. MANUFACTURER'S ULTRA HIGH STRENGTH ROOF JOISTS LIMITED WARRANTY FOR ADDITIONAL DETAILS.
- 2.1. WINDBOARDS
- A) WINDBOARDS SHALL BE SUPPLIED AND INSTALLED IN ACCORDANCE WITH WINDOW SCHEDULE.
- B) WINDBOARDS SHALL HAVE ONE GLASS AND "V" FACTOR OF 0.26 AS SPECIFIED BY MANUFACTURER.
- C) CONTRACTOR SHALL COORDINATE COLOR WITH OWNER PRIOR TO ORDERING.
- D) WINDBOARDS SHALL BE AT LEAST 30% AS DEFINED BY MANUFACTURER.
3. DOORS
- A) DOORS SHALL BE SUPPLIED AND INSTALLED IN ACCORDANCE WITH DOOR SCHEDULE.
- B) ALL DOORS SHALL HAVE A "V" FACTOR OF 0.3 AS A MINIMUM.
- C) ALL DOOR HANDWAYS SHALL BE ACCESSIBLE DOOR HANDWAYS SPECIFIED SHALL BE APPROVED BY OWNER PRIOR TO ORDERING/GRADING. EXTERIOR DOORS WITH HANDWAYS SHALL MEET OR EXCEED THE PERSONS ACCESSIBLE REQUIREMENTS FOR THE 130MM WIND BOW ZONE PER MANUFACTURERS SPECIFICATIONS.

1. FOUNDATION SHALL BEAR ON UNDISTURBED SOIL WITH A MIN. NET ALLOWABLE BEARING CAPACITY OF 2,000 PSF.
2. IF FOUNDATION IS BEARING ON FILL SOILS, FILL MUST BE SUITABLE STRUCTURAL FILL COMPACTION TO A MIN. 95% STANDARD PROCTOR DENSITY OF SOIL COMPACTED TO BE VERIFIED BY GEOTECHNICAL ENGINEER.
3. FOUNDATION SHALL BE CONSTRUCTED WITH 12" MIN. THICK CONCRETE SLAB, AND SHALL BE CONNECTED TO 8% STAINLESS STEEL TIE, THIS IS FREE OF ORGANIC MATERIAL, AND SHALL BE CONNECTED TO 8% STAINLESS PROCTOR. THIS INCLUDES BACKFILL, USED TO SUPPORT CONCRETE SLAB ON GRADE.
4. REMOVE ALL TOPSOIL, AND ORGANIC MATERIAL, ROOTS, STUMPS, LIMBS, ETC.) FROM FOUNDATION AND BUILDING PAD AREAS.
5. SOIL BEARING CAPACITY FOR FOUNDATION SHALL BE VERIFIED BY ENGINEER.

CONCRETE/MASONRY NOTES:
1. CONTRACTOR SHALL ENSURE THAT ALL ACCESSIBILITY REQUIREMENTS ARE MET IN ACCORDANCE WITH ICCANS 117.1-2009, NORTH CAROLINA BUILDING CODE, 2012 EDITION, ADA, AND LOCAL CODES FOR ACCESSIBLE ROUTES, CLEARANCES, BUILDING FACILITIES, THRESHOLDS, DOOR HARDWARE, PLUMBING FIXTURES, SANITARY DISPENSERS, ETC.

[illegible]


SCALE: 1/2" = 1'-0"

SCALE: 1/4" = 1'-0"

SCALE: 1/2" = 1'-0"

REVISIONS	

PRELIMINARY
NOT FOR CONSTRUCTION

 STILLWATER
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ROOF PLAN & DETAILS - SCALE HOUSE/OFFICE

JONES COUNTY C&D LANDFILL
11710 HIGHWAY 17
MAYSVILLE, N.C. 28555
JONES COUNTY

PROJECT #	E-12-6
DATE	3-20-12
SCALE	AS SHOWN
DRAWN BY	NKS

S-7

7 of X

CLOSURE / POST-CLOSURE PLAN

GREEN RECYCLING SOLUTIONS LLC MAYSVILLE C&D LANDFILL

This Facility Plan has been prepared in accordance with the State of North Carolina, Department of Environment and Natural Resources, Division of Waste Management, Rule ..0543 of the North Carolina Administrative Code (NCAC), Title 15A, Chapter 13, Subchapter 13B.

This Plan has been prepared on behalf of:

Green Recycling Solutions LLC
Maysville, North Carolina

This Plan has been prepared by:

ERM NC, Inc.
80000 Corporate Center Drive, Suite 200
Charlotte, North Carolina 28226

June 2013

CLOSURE / POST-CLOSURE PLAN
BFI WASTE SYSTEMS OF NORTH AMERICA, INC.
CMS LANDFILL V – LATERAL EXPANSION

Table of Contents

<u>Section</u>	<u>Page No.</u>
1.0 Closure Plan	1
1.1 Final Cover System	1
1.2 Estimate of Largest Partial Closure	2
1.3 Estimate of Maximum Waste Inventory On-site	2
1.4 Landfill Closure Sequence	3
1.4.1 Determination of Closure Area	3
1.4.2 Notification of Intent to Close	3
1.4.3 Development of Closure Schedule	3
1.4.4 Final Cover Construction	4
1.4.5 Certification of Closure Construction	4
1.4.6 Recordation of Deed	4
1.5 Gas Venting System	4
1.6 Financial Assurance	5
2.0 Post Closure Care Plan	6
2.1 Maintenance and Monitoring	6
2.1.1 Final Cover System	6
2.1.2 Leachate Collection System	7
2.1.3 Groundwater Monitoring Wells	7
2.1.4 Landfill Gas Monitoring and Controls	8
2.2 Individual Responsible for Post-Closure Maintenance	8
2.3 Planned Use Following Closure	9
2.4 Notification	9
2.5 Certification of Post Closure	9
2.6 Financial Assurance	9

APPENDIX Closure / Post Closure Cost Estimates

CLOSURE / POST CLOSURE PLAN GREEN RECYCLING LLC MAYSVILLE C&D LANDFILL

SECTION 1.0 – CLOSURE PLAN

Section .0543 of the North Carolina Department of Environmental and Natural Resources (NC DENR), Solid Waste Regulations requires that a closure plan be included in the permit application that details the activities that will be performed to satisfy the requirements of Section .0543. All construction and demolition debris landfill (C&DLF) owners/operators shall prepare a closure plan that describes the steps necessary to partially close a C&DLF at any point during its active life as well as the steps necessary to facilitate final closure. Partial closure refers to the closure of a landfill phase, while final closure is the closure of the entire landfill. In providing this information, the closure plan will assist Green Recycling Solutions LLC, Maysville C&D Landfill towards achieving the goals of closure implementation, which are: to prevent exposure of the disposed solid waste, minimize leachate generation, and control the emission of landfill gas in order to protect human health and the environment. Specifically, this closure plan establishes: design criteria for the final cover system, a description of the landfill gas collection system, a closure sequence and construction schedule, construction costs, and other important information relating to closure.

In accordance with Sections .0543, the Maysville C&D Landfill shall notify the Division that this closure plan has been prepared and placed in the operating record prior to permit issuance. The closure plan shall be reviewed and updated if any changes occur at the facility that require a deviation from the approved closure plan.

1.1 FINAL COVER SYSTEM

The final cover system has been designed in accordance with Section .0543(c)(1) to minimize storm water infiltration into the landfill and to resist erosive forces. The final cover system consists of an erosion layer, protective soil layer, drainage layer and a barrier layer. The multi-layered final cover system will provide permeability less than or equal to the permeability of the bottom liner system of the proposed landfill.

The final cover system will consist of the following layers (listed from top to bottom) for the landfill cap (areas with a proposed 5 percent slope):

- A 6-inch **Erosion (Vegetative Soil) Layer** consisting of soil capable of supporting native plant growth and designed to maintain vegetative growth over the landfill;
- An 18-inch **Protective Soil Layer** to prevent damage due to freezing or puncture to the Drainage and Barrier Layers;

- A **Drainage Layer** consisting of double-sided heat-bonded geocomposite. The geocomposite is designed to horizontally drain storm water that has percolated through the Erosion and Protective Soil Layers in order to prevent the build-up of water over the Barrier Layer (thus minimizing infiltration); and
- A **Barrier Layer** consisting of a 40-mil Textured Linear Low Density Polyethylene (LLDPE) geomembrane placed over a minimum 12-inch layer of prepared clean fill soils.

Due to the highly elastic nature of the LLDPE membrane, the final cover system will accommodate the differential settlement anticipated to occur during the post-closure period. In accordance with Section .0543(c)(2)(a), the post settlement surface slopes will be no less than five (5) percent to promote positive drainage across the cover system surface and at a maximum slope not greater than twenty five (25) percent (pre-settlement) to facilitate construction and prevent erosion.

Elements included in the closure activities are illustrated on the Final Contours Plan and detail sheets of the design plan set.

1.2 ESTIMATE OF LARGEST PARTIAL CLOSURE

Section .0546 requires that the closure plan include an estimate of the largest area of the MSWLF unit ever requiring a final cover at any time during the active life of the facility. The largest area of the Maysville C&D Landfill requiring closure at any time will be 6.2 acres. This closure area will occur at the completion of Phase 2 when partial closure of Phases 1 and 2 would be required.

1.3 ESTIMATE OF MAXIMUM INVENTORY OF WASTE ON SITE

The maximum amount of waste that is expected to be landfilled at the Green Recycling Solutions LLC Maysville C&D Landfill consisting of Phases 1, 2, 3, 4, 5 and 6 was calculated using AutoCAD by comparing the top of operational / protective cover grades with the proposed final cover elevations. The total available airspace, tonnage and subsequent time frames are listed below. These reported quantities are subject to change based on final permitting of future Phases.

	<u>AC</u>	<u>Airspace (CY)</u>	<u>Tons</u>	<u>Years</u>
Phase 1	4.09	99,219	64,492	5
Phase 2	2.11	150,163	97,606	5
Phase 3	3.65	103,705	67,408	5
Phase 4	3.12	140,758	91,493	5
Phase 5	2.32	76,686	49,846	5
Phase 6	<u>1.27</u>	<u>31,571</u>	<u>20,521</u>	<u>5</u>
Totals	16.6	602,102	391,366	30

Therefore, based on the current Facility Plan and anticipated waste streams for the facility, the anticipated remaining operating capacity for the landfill would be on the order of 30 years disposing of approximately 391,366 tons.

1.4 LANDFILL CLOSURE SEQUENCE

The landfill facility will be developed such that one cell will be in operation while another cell is being constructed. Closure activities will be initiated in phases according to the filling sequence shown on the Phasing Plans in the Facility Plan and will be coordinated with the erosion and sedimentation control plan designed for the facility. Partial closure will occur after a landfill Phase has reached the proposed closure grades indicated on the Plans. Partial closure will continue until all of the proposed Phases are brought to final grade. At that time, final closure of the entire facility will begin. The steps for implementing the closure process are described in the following subsections. The procedure applies to both partial closure and final closure.

1.4.1 DETERMINATION OF CLOSURE AREA

Maysville C&D will determine the location and acreage of areas to be closed. Closure procedures should not be implemented until an adequate area of the landfill has reached final grade. An estimate of landfill area that has reached final grade should be determined periodically based on annual topographic surveys performed at the site.

1.4.2 NOTIFICATION OF INTENT TO CLOSE

In accordance with Section .0543(c)(4) prior to beginning closure of each C&DLF unit, Maysville C&D Landfill will notify the Division that a notice of intent to close the unit has been placed in the operating record.

1.4.3 DEVELOP CLOSURE SCHEDULE

When an area has reached final grades, Maysville C&D landfill shall initiate the closure process no later than 30 days after the final receipt of waste. This will be dependent upon inclement weather and seasonal encumbrances for proposed construction. However, if

the area has not reached permitted final grades and there is reasonable likelihood that additional waste will be received, then closure activities must begin no later than one year after the most recent receipt of wastes. The Department may grant extensions beyond the one-year deadline for beginning closure if Maysville C&D Landfill demonstrates the area has additional capacity and the facility has implemented measures to protect human health and the environment.

Maysville C&D Landfill shall complete all closure activities of each C&DLF unit in accordance with the closure plan within one hundred eighty (180) days following the beginning of closure as specified in Section .0543 (c)(6) . Extensions of the closure period may be granted by the Division if Maysville C&D landfill demonstrates that closure will, of necessity, take longer than one hundred eighty (180) days and the facility has implemented procedures to prevent threats to human health and the environment from the unclosed C&DLF unit.

1.4.4 FINAL COVER CONSTRUCTION

The final cover system at the Maysville C&D Landfill facility shall be constructed in accordance with the requirements of the CQA/CQC Plan (Section 3), Technical Specifications (Section 2.3), and Engineering Drawings, incorporated by reference as part of this Closure Plan.

1.4.5 CERTIFICATION OF CLOSURE CONSTRUCTION

In accordance with Section .0543 (c)(7), following closure of each C&DLF unit, Maysville C&D Landfill shall notify the Division that a certification, signed by the project engineer, a North Carolina registered professional engineer, verifying that closure has been completed in accordance with the closure plan, has been placed in the operating record.

1.4.6 RECORDATION OF DEED

In accordance with Section .0543 (c)(8), following closure of all C&DLF units, Maysville C&D Landfill shall record a notation on the deed to the landfill facility property, or some other instrument that is normally examined during title search, and notify the Department that the notation has been recorded and a copy has been placed in the operating record. The notation on the deed shall, in perpetuity, notify any potential purchaser of the property that the land has been used as a landfill facility and that its future use is restricted under Section .0543 (c)(8)(B), to the planned post-closure property uses presented in the post-closure plan.

1.5 GAS VENTING SYSTEM

A gas venting system is proposed for implementation into the final closure cap system for the Maysville C&D Landfill. Landfill gases are not anticipated to be of concern based on the recovery and recycling of wood products for boiler fuel at the recycling/recovery facility. The waste within the landfill is not expected to contain organic materials that may decay and produce typical landfill gases. As a precaution and for long term

planning, the venting system has been incorporated into the design of the landfill facility and included in the design plan set.

1.6 FINANCIAL ASSURANCE

In accordance with Rule .0546, the owner and operator of each C&DLF unit must establish financial assurance for closure of the C&DLF unit. The owner and operator must provide continuous coverage for closure until released from financial assurance requirements by demonstrating compliance with Division of Waste Management Rules for final closure certification. The owner and operator must increase the closure cost estimate and the amount of financial assurance if changes to the closure plan or C&DLF unit conditions increase the maximum cost of closure at any time during the remaining active life. The owner or operator may reduce the closure cost estimate and the amount of financial assurance if the cost estimate exceeds the maximum cost of closure at any time during the remaining life of the C&DLF unit. Prior to any reduction of the closure cost estimate or the amount of financial assurance by the owner or operator, a written justification for the reduction must be submitted to the Division for review. The Division shall date and stamp the justification "approved" if the conditions of this paragraph are met. The reduction justification and the Division approval must be placed in the C&DLF's operating record. No reduction of the closure cost estimate or the amount of financial assurance shall be allowed without Division approval.

Financial assurance will be updated annually as portions of the landfill are closed and new Cells are activated. For the purpose of this Closure Plan, a closure cost estimate to include Phase 1 closure over 4.1 acres has been prepared. A copy of this estimate is included at the end of this Closure Plan.

SECTION 2.0 – POST CLOSURE CARE PLAN

Post-closure care will begin immediately following final closure of the landfill and continue for a period of 30 years. The post-closure care period may be decreased from the minimum time period of 30 years specified in the regulations if CMS Landfill V can demonstrate that the facility poses no threat to human health or the environment. However, the Division of Waste Management reserves the right to increase the post-closure care period if it is deemed necessary to protect human health and the environment.

The purpose of the plan is to provide the necessary information for preserving the integrity of the landfill facility during the post-closure period. This post-closure plan specifically addresses maintenance activities for the final cover, landfill gas venting and monitoring systems, leachate collection and conveyance systems, groundwater monitoring wells, and erosion and sedimentation control system to be installed at the Maysville C&D Landfill. This plan also addresses certification and financial assurance requirements.

2.1 MAINTENANCE AND MONITORING

Following final closure of each C&DLF unit, Green Recycling Solutions LLC shall conduct post-closure care for a minimum of thirty (30) years, except as provided under section .0543(e). At a minimum, post-closure care shall consist of the activities as detailed below.

2.1.1 FINAL COVER SYSTEM

Inspection of the final cover system will take place quarterly. The inspection will consist of a field reconnaissance of the entire final cover system. Items of concern to be noted by the inspector include, but are not limited to: signs of erosion (ruts, sediment deposits, etc.), patches of distressed or dead vegetation, animal burrows, settlement and/or ponded water, upheaving, stained soil due to leachate seeps and/or flowing leachate, cracks in the cover, damaged gas wells and tree saplings (especially species with tap roots). Following each inspection, a summary report of the condition of the final cover and the items requiring repair or maintenance shall be recorded on an inspection form and filed in the post-closure log book for the facility. Areas that require further attention should be photographed and delineated on a map of the facility and attached to the inspection report. Since post-closure inspection personnel will most likely change during the post-closure period, the post-closure log book should be kept in a standardized format as part of the operating record of the facility so that new inspection personnel may easily review the results of past post-closure inspections of the site.

Action should be taken immediately to address any items of concern identified during the inspection. Obvious repair items should be performed under the supervision of the post-closure maintenance manager. If an item of concern requires further investigation to determine a course of action, the Engineer responsible for closure design should be contacted for consultation.

Maintenance required for the final cover is minimal. The vegetative cover should be mowed at least twice a year to suppress weed and brush growth. If vegetative cover is not adequate in any particular area, fertilizer should be applied and the area re-seeded in order to re-establish vegetation. Insecticides may be used to eliminate insect populations that are detrimental to the vegetation. Animal burrows and eroded or depressed areas should be filled in with compacted soil and reseeded.

2.1.2 LEACHATE COLLECTION SYSTEM

Post-closure maintenance shall include maintaining and operating the leachate collection system in accordance with the requirements current Division of Waste Management Regulations. The Division may allow Green Recycling Solutions LLC to stop managing leachate if the facility demonstrates to the Department's satisfaction that leachate no longer poses a threat to human health and the environment.

Inspection of the accessible items of the leachate collection system (i.e. risers, pumps, control panels and tanks) will be made on a quarterly basis. Inspection of the collection lines will be performed concurrent with the annual cleaning service. Inspections will be made by a qualified inspector who is knowledgeable in the construction and operation of leachate collection systems. The inspector is responsible for manually operating each pump to ensure that they are working properly. The high and low level alarms shall be checked at this time, and the overall condition of the wiring and support structures shall also be inspected. The flow meter calibration shall be checked (and scheduled for recalibration as required) quarterly and flow meter measurements shall be recorded and placed in the post-closure logbook. A summary report of the condition of the pump stations and metering facilities shall be recorded in the post-closure log book, including photographs of any items of concern.

The leachate storage tanks shall be inspected for damage on a quarterly basis. The tanks should be checked for damage and checked for proper operation.

All leachate collection and conveyance system piping will be pressure cleaned and flushed as needed to remove the build-up of biological growth and sediments that may impede the flow of leachate.

If problems with the leachate collection system are discovered, or abnormally high or low flows are recorded from the pump station, assessment and/or repairs shall begin immediately.

2.1.3 GROUNDWATER MONITORING WELLS

Inspection of the groundwater monitoring wells will take place semi-annually during sampling events. The inspection will consist of verifying the condition of the monitoring wells to ensure that they are providing representative samples of the groundwater being collected. The inspector should note the following:

- 1) The total depth of the well should be recorded every time a water sample is collected or a water level reading is taken to determine if sediment has accumulated at the

bottom. If sediment build-up has occurred, the sediment shall be removed by pumping or bailing.

- 2) If turbid samples are collected from a well, redevelopment of the well will be performed.
- 3) The aboveground protective casing shall be inspected for damage. The protective casing shall be of good structural integrity and free of any cracks or corrosion. The lockable cover and lock shall also be inspected at this time.
- 4) The surface seals shall be inspected for settling and cracking. If the seal is damaged in any way, the seal shall be replaced.
- 5) The well casing and cap shall be inspected. The casing and cap shall be of good structural integrity and free of any cracks or corrosion. Any debris shall be removed from around the cap to prevent it from entering the well.

The condition of the groundwater monitoring system shall be recorded on the inspection form and filed in the post-closure logbook following each sampling event. Monitoring of the groundwater wells shall be conducted as described in the groundwater monitoring plan.

2.1.4 LANDFILL GAS MONITORING AND CONTROLS

Inspection of the landfill gas monitoring and control system shall take place at least quarterly. The inspection shall consist of verifying the condition and operation of the gas venting wells and monitoring probes. The full depth of all wells and monitoring probes shall be checked for blockage that may be caused by settlement or cracks in the casing. The summary of each inspection of the landfill gas monitoring and control system should be recorded in the post-closure log book along with photographs of any items of concern. Testing of the monitoring probes and on-site buildings shall be conducted as described in the Operations Plan.

If any wells or probes are determined to be inoperable, they should be flushed and pressure cleaned. If all attempts to repair a well or probe are unsuccessful, a replacement will be installed.

2.1.5 SURFACE WATER MONITORING

Stormwater sampling in accordance with NPDES requirements for closed landfills shall continue in accordance with NPDES General Permit NCG 120000.

2.2 INDIVIDUAL RESPONSIBLE FOR POST-CLOSURE MAINTENANCE

The Green Recycling Solutions LLC Owner, currently Mr. James Maides, will be responsible for operations and maintenance of the site during the post-closure period. The Owner can be reached at the following address:

Green Recycling Solutions, LLC
166 Center Street
Jacksonville, NC 28546
(910) 938-5900

Over the course of the post-closure period, the individual responsible for providing the post-closure services is subject to change. The Division shall be informed of the individual serving as responsible party if changes occur.

2.3 PLANNED USE FOLLOWING CLOSURE

Post-closure use of the property shall not disturb the integrity of the final cover, liner, or any other components of the containment system, or the function of the monitoring systems. The Division may approve any disturbance of these systems if the owner or operator demonstrates that disturbance of the final cover, liner or other component of the containment system, including any removal of waste, will not increase the potential threat to human health or the environment.

There are no planned uses for the landfill site after closure. The property will continue to be owned and maintained by Green Recycling Solutions LLC with public access prohibited. If at some later date, Green Recycling Solutions LLC wishes to propose alternative end uses for the facility, this plan will be revised accordingly.

2.4 NOTIFICATION

Green Recycling Solutions LLC shall notify the Division that a post-closure plan has been prepared and placed in the operating record prior to permit issuance. The post-closure plan shall be updated if any changes occur at the facility that require a deviation from the approved post-closure plan.

2.5 CERTIFICATION OF POST-CLOSURE

Following completion of the post-closure care period for each C&DLF unit, Green Recycling Solutions LLC shall notify the Division that a certification, signed by an independent registered professional Engineer, verifying that post-closure care has been completed in accordance with the post-closure plan and has been placed in the operating record.

2.6 FINANCIAL ASSURANCE

A detailed cost estimate for post-closure care is included at the end of this Plan. The cost estimate is based on 30 years of post-closure care of the entire facility. Each year, the estimate will be adjusted for inflation and to reflect any changes to the post-closure plan.

APPENDIX

**PHASE 1 CLOSURE COST ESTIMATE
PHASE 1 POST CLOSURE CARE ESTIMATE
PHASE 1 CORRECTIVE ACTION/REMEDIATION ESTIMATE**

FINAL CLOSURE COST ESTIMATE - PHASE 1
GREEN RECYCLING SOLUTIONS LLC
MAYSVILLE C&D LANDFILL, PHASE 1

TOTAL AREA	4.09 ACRES	178,160 SQ FT
AREA TO BE CAPPED	4.09 ACRES	178,160 SQ FT
AREA FOR LFG SYST.	4.09 ACRES	178,160 SQ FT

1. FINAL CAP SYSTEMS					TOTAL COST
a. SOIL	THICKNESS (FT)	AREA (SQ. FT)	VOLUME (CY)	COST/CY	
1. FOUNDATION LAYER	1.0	178,160	6,599	\$ 4.00	\$26,394.07
2. VEGETATIVE/PROTECTIVE LAYER	2.0	178,160	13,197	\$ 4.00	\$52,788.15
b. LINER MATERIALS	COST/SQ. FT (INSTALLED)		AREA (SQ. FT)		
1. GEOMEMBRANE					
a. TEXTURED 40-MIL LLDPE	\$	0.75	178,160		\$133,620.00
c. OTHER MATERIALS	COST/SQ. FT (INSTALLED)		AREA (SQ. FT)		
1. GEOCOMPOSITE DRAINAGE LAYER	\$	0.75	178,160		\$133,620.00
	COST/Ac (INSTALLED)		AREA (Ac)		
2. SUBDRAINS	\$	1,500	4.09		\$6,135.00
(Includes edgedrains, reducers and flared ends)					
d. TESTING / DOCUMENTATION					
1. CQA / ENGINEERING	RATE		HOURS/WEEK	NO. WEEKS	
a. ENGINEER	\$	150.00	22	12	\$39,600.00
b. TECHNICIAN	\$	58.00	60	12	\$41,760.00
c. LAB TESTING	AS NEEDED				\$37,666.00

2. SEDIMENT / EROSION CONTROL STRUCTURES				TOTAL COST
b. GRASS LINED DITCHES	LENGTH (FT)	COST / FT		
	1000	\$ 3.50		\$3,500.00
c. DIVERSION BERMS	LENGTH (FT)	COST / FT		
	1,000	\$ 10.00		\$10,000.00
c. OUTLET PROTECTION APRONS	NO. OF APRONS	COST / APRON		
	4	\$ 800.00		\$3,200.00

3. GAS CONTROLS			TOTAL COST
	COST / ACRE	AREA (ACRES)	
a. METHANE VENTING WELLS, AND CQA SERVICES	\$ 7,500.00	4.09	\$30,675.00

4. LANDSCAPING			TOTAL COST
	COST / ACRE	AREA (ACRES)	
a. SEEDING / FERTILIZING / MULCHING	\$ 2,100.00	4.09	\$8,589.00

5. MOBILIZATION / DEMOBILIZATION		TOTAL COST
a. GRADING CONTRACTOR	LUMP SUM	\$40,000.00
b. GEOMEMBRANE CONTRACTOR (INCLUDED IN ABOVE COSTS)		\$25,000.00

6. ENGINEERING, TESTING & DOCUMENTATION		TOTAL COST
INCLUDED IN ABOVE COSTS	LUMP SUM	\$0.00

7. ADMINISTRATION		TOTAL COST
(ANNOUNCEMENTS, DEEDS, FEES)	AS NEEDED	\$5,150.00

8. LABOR		TOTAL COST
INCLUDED IN ABOVE COSTS		\$0.00

TOTAL ESTIMATED CLOSURE COSTS \$597,697.22

**POST CLOSURE CARE COST ESTIMATE
GREEN RECYCLING SOLUTIONS LLC
MAYSVILLE C&D LANDFILL**

POST-CLOSURE CARE COSTS

1.	INSPECTIONS/RECORD KEEPING		
	Yearly inspections and reporting to DSWM.	\$	8,500.00 /yr.
2.	MONITORING		
a.	Explosive Gases		
	Quarterly monitoring	\$	990.00 /yr.
b.	Ground Water		
	Collection and Analysis	\$	10,500.00 /yr.
c.	Surface Water		
	Analytical Costs		
	(Field Sampling costs included in 2b above)	\$	1,500.00 /yr.
d.	Leachate		
	Assume two sampling events will be needed per year.	\$	4,000.00 /yr.
e.	Air Quality		
	Sampled at time of methane monitoring.		
	Additional cost	\$	1,000.00 /yr.
3.	LEACHATE COLLECTION AND TREATMENT		
	Pump & Haul with decreasing volumes (Averaged)	\$	5,500.00 /yr.
4.	MAINTENANCE		
a.	Leachate collection & removal system - annual cleaning	\$	2,500.00 /yr.
b.	Ground-water and gas monitoring wells	\$	1,000.00 /yr.
c.	Final cover (mowing, replace plantings, fill for erosion, etc.)	\$	3,500.00 /yr.
5.	FEES		
a.	License	\$	500.00
b.	Inspection/regulatory charges	\$	500.00
6.	ADMINISTRATION	\$	1,500.00
7.	LABOR COSTS		
	Miscellaneous repairs	\$	2,500.00
Total Annual Cost		\$	43,990.00

**ESTIMATED TOTAL POST-CLOSURE CARE COSTS
OVER 30-YEAR PERIOD**

\$ 1,319,700.00

**CORRECTIVE ACTION
REMEDATION COST ESTIMATE
CLOSURE / POST CLOSURE PLAN
GREEN RECYCLING SOLUTIONS LLC
MAYSVILLE C&D LANDFILL, PHASE 1**

ASSUMPTION: Leachate break out on a side slope

Cubic Yards of contaminated soil:	300 CY
No. of Assessment Monitoring Wells to be added:	2
No. of Monitoring Events:	2
No. of Occurances (assumed):	3

1.) WELL INSTALLATION

2 wells @ \$ 5,000 per well \$10,000.00

2.) EXCAVATION OF CONTAMINATED SOIL WITH OFF SITE DISPOSAL

300 CY @ \$ 8.00 per CY \$2,400.00

3.) REPLACEMENT OF EXCAVATED SOIL (BACKFILL AND COMPACT)

300 CY @ \$ 5.00 per CY \$1,500.00

4.) ENGINEERING / DOCUMENTATION OF REPAIRS

Lump Sum \$10,000.00

5.) GEOSYNTHETIC CONTRACTOR

Mobilization and Repair of Liner \$18,500.00

6.) GROUNDWATER SAMPLING

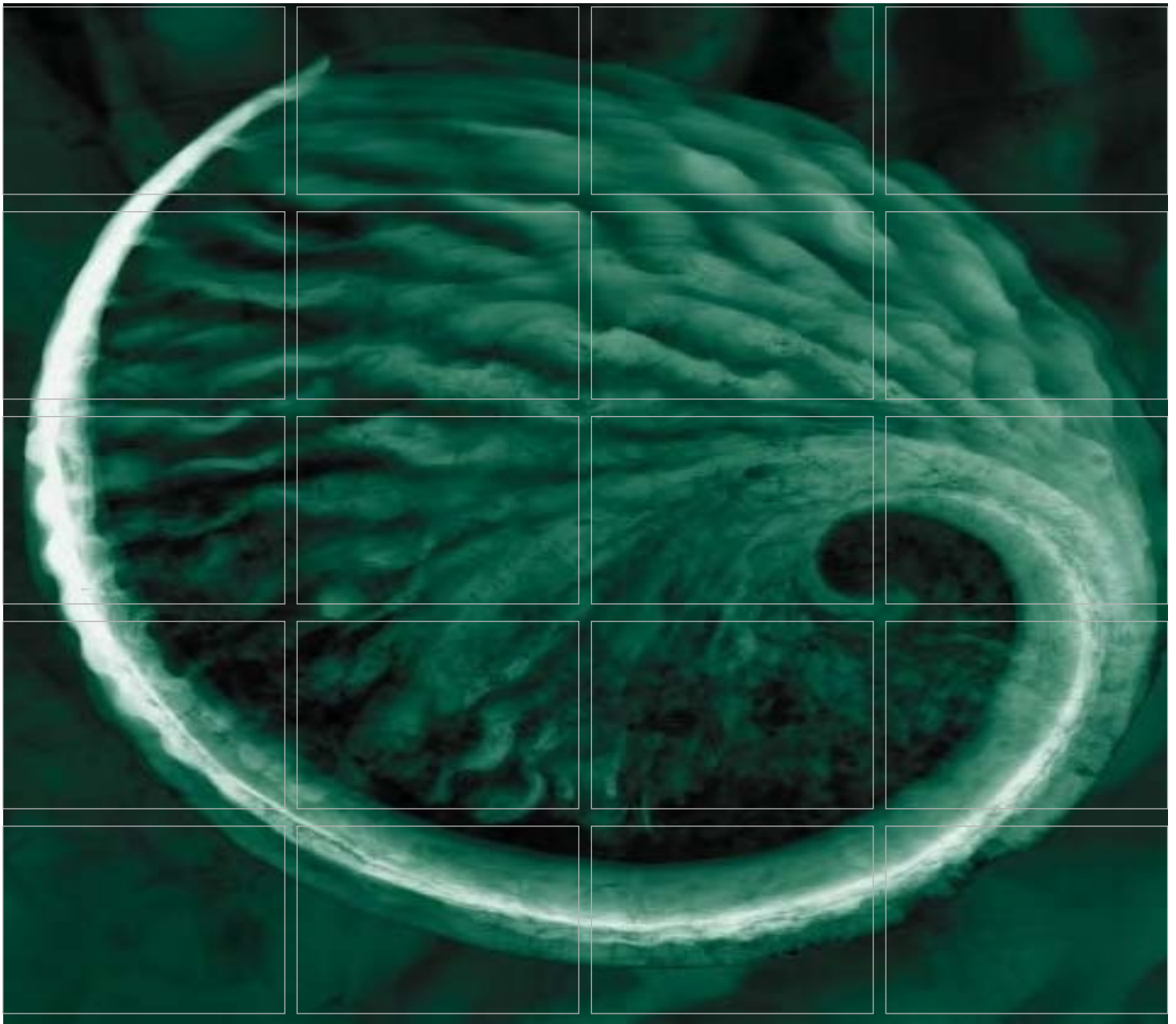
2 events @ \$ 3,500 per event \$7,000.00

7.) GROUNDWATER ASESMENT REPORT / STATISTICAL ANALYSIS

Lump Sum \$8,500.00

SUBTOTAL PER OCCURANCE \$57,900.00

3 OCCURANCES IN 30 YEARS \$173,700.00



Green Recycling Solutions LLC

Groundwater Monitoring Plan
Proposed Construction & Demolition
Debris Landfill – Phase 1
Maysville, North Carolina

June 2013

GROUNDWATER MONITORING PLAN
GREEN RECYCLING SOLUTIONS LLC
CONSTRUCTION & DEMOLITION DEBRIS (C&D) LANDFILL
MAYSVILLE, NORTH CAROLINA

PHASE 1, CELLS 1A - 1C

Table of Contents

Introduction	2
Background Information	2
Site Hydrogeologic Conditions	5
Monitoring Well Network	6
Monitoring Well Construction	6
Well Installation Procedures	7
Sampling, Analytical Testing & Reporting	7

Appendix

Appendix A Groundwater Potentiometric Plan
Appendix B Well Construction Records

GROUNDWATER MONITORING PLAN
GREEN RECYCLING SOLUTIONS LLC
CONSTRUCTION & DEMOLITION DEBRIS (C&D) LANDFILL
MAYSVILLE, NORTH CAROLINA

PHASE 1, CELLS 1A - 1C

Introduction

In accordance with 15A NCAC 13B .0544 MONITORING PLANS AND REQUIREMENTS FOR C&DLF FACILITIES, a Monitoring Plan must be submitted that contains information regarding the proposed groundwater monitoring system(s), sampling and analysis requirements, and detection monitoring requirements. The Plan shall include a sufficient number of detection wells and background water quality wells to effectively monitor water quality of the representative aquifer located below the landfill footprint. This Plan has been developed based on the Site Hydrogeologic Study information submitted to NCDENR – Division of Waste Management prepared by ERM NC, Inc. dated December 16, 2011.

Background Information

The proposed Green Recycling Solutions LLC, C&D Landfill is located within the physiographic region of the Inner Coastal Plain. "The Inner Coastal Plain Province consists of stair-step-like planar terraces that dip gently towards the ocean. At higher elevations, the land is dissected to form gently rolling hills and valleys. Elevations range from about 600 feet to 25 feet above mean sea level. The boundary between the Piedmont and Coastal Plain is the Fall Zone. This zone represents the elevational break between the resistant rocks of the Piedmont and the more easily eroded sediments of the Coastal Plain." (Ref: *North Carolina Geological Survey, Physiography of North Carolina*, M.A. Medina, J.C. Reid, and R.H. Carpenter, 2004). The site location is shown on the North Carolina Physiography Map (Figure - 1) for reference.

"The unconfined, surficial aquifer of much of the southeastern North Carolina Coastal Plain typically consists of variably thick, Pliocene, Pleistocene, and Holocene deposits. On the south side of the Neuse River, Pleistocene surficial deposits (sand, mud, shell, gravel) are thin (20 ft thick), and the top of the Cretaceous (Peedee) confining unit occurs at a depth of 132 ft. Between these surfaces is a thick sequence (110 ft) of muddy sand, sand and limestone that includes Paleocene (Beaufort Formation), Eocene (Castle Hayne Formation), and Oligocene (Riverbend/Belgrade Formations) deposits. These formations include a variety of siliciclastic and carbonate facies, some of which form porous and permeable aquifers." (Reference: *Shallow Aquifers and Confining Units in the*

Neuse River Basin, Surry to Suffolk Scarp, Fiscal Year 2003 Grant, NC-DENR Contract Number EW04035).

In Jones County, the Coastal Plain deposits consist primarily of limestone and unconsolidated sands and clays. Geologically, the proposed site is located within the Belgrade Formation (*Ref. North Carolina Geological Survey, Generalized Geologic Map of North Carolina, 1991*) as shown in Figure – 2. Generally, the surficial soils within the site area consist of silty sands and clayey sands with discrete areas of surface clays/silts that typically support wetland areas. Based on the predominance of silty and clayey sands observed in shallow borings advanced at the proposed site, the site is considered to be within the Haywood Landing Member of the Belgrade Formation.

The sandy soils within the upper 20-feet of soil strata includes the uppermost ground water aquifer for this region. The ground water level within the surficial aquifer may vary several feet based on significant rainfall events as this aquifer is primarily recharged by rainfall.

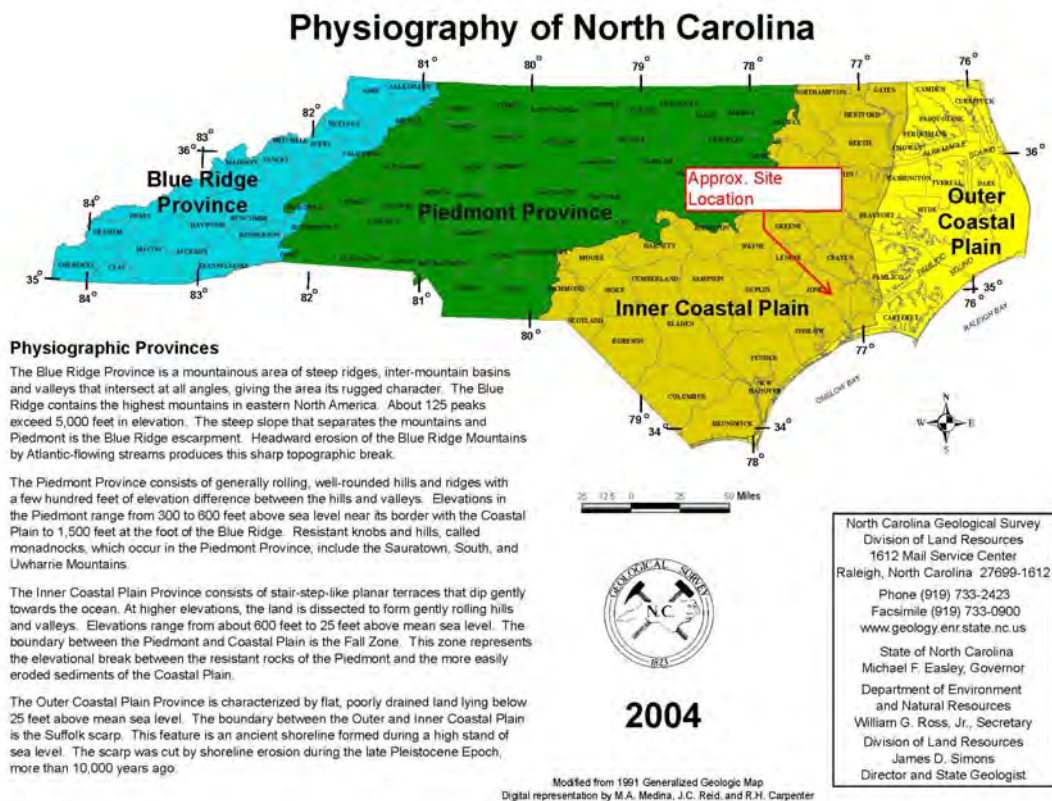


Figure 1

[illegible]

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Locally, Martin-Marietta operates a quarry in Belgrade, North Carolina (approximately 2.5 miles south of the site) for extraction of sand and rock. Reportedly, a limestone layer is encountered within the quarry at depths ranging from 40 to 60 feet below natural ground surface. The thickness of the limestone varies and is overlying deposits of sands. Similar reports have been identified for the Morton Trucking, US 17 mine located approximately 8 miles south of the site with a limestone layer encountered approximately 70 to 80 feet below natural ground surface approximately 14 to 18 feet thick. This mine also reports that sand deposits are beneath the limestone layer.

Site Hydrogeologic Conditions

The following is taken from the Site Hydrogeologic Study prepared by ERM NC, Inc. dated December 16, 2011. In summary, fifteen (15) soil test borings and observation wells were installed on site to gather subsurface information to identify and map the surficial aquifer for permitting and monitoring purposes. The Potentiometric Groundwater Plan previously submitted is included in Appendix A of this Plan for reference. The proposed limits and grades for development of Phase 1 of the landfill have been included on the Potentiometric Plan.

The site hydrogeology is characterized by a shallow surficial aquifer within the upper 10 feet of unconsolidated silts, clays and sands of the Inner Coastal Plain deposits. The water table is generally encountered at depths of 2 to 7 feet below land surface at the site. The groundwater flow conditions within the surficial aquifer at the site are characterized by very low hydraulic gradients and groundwater velocities. The groundwater contours indicate a subtle radial pattern of groundwater flow centered in the vicinity of the well OWB-11 located in the eastern portion of the site. The surficial soils in area around well OWB-11 are more sandy than the rest of the site and serve as a local preferential groundwater recharge area. In the western portion of the site, the general groundwater flow direction is southwestward toward the unnamed tributary to the White Oak River located approximately 2,550 feet west. The horizontal hydraulic gradient is essentially flat and the calculated groundwater velocities are on the order of 1 foot per year or less. The wetlands within the site study area do not appear to be connected to the surficial aquifer. Generally, water in the wetland areas is observed to occur at ground elevations that are 3 to 4 feet higher than the water table elevations measured in adjacent observation wells (i.e. the wetlands adjacent to well OWB-7). The groundwater elevation data indicate that observation wells located within the immediate vicinity of wetland boundaries (OWB-1, 4, 6, 7, 9 & 14) reflect water table elevations very similar to those in observation wells at locations removed from the vicinity of wetland boundaries. The wetland areas contain hydric soils (clays / silts) in localized

topographically depressed areas that collect and pool rainfall; independent of the ground water table.

The low gradients and groundwater velocities at the site combine to limit both groundwater movement from the site and discharge to the nearest natural drainage features. The low groundwater flow conditions are advantageous for effective monitoring of the site as it allows more time for detection of and response to potential releases before offsite migration can occur from the C&DLF units.

There are no known drinking water supply wells, groundwater receptors or groundwater discharge features within 2,000 feet of proposed facility boundaries. All residences that are located within the study area along US Highway 17 or White Oak River Road are served by public water supply. Based on the lack of groundwater receptors and considering the limited groundwater flow regime at the site, the potential for offsite migration and impacts is considered to be low.

Monitoring Well Network

The proposed groundwater monitoring well network for Phase 1 of landfill construction, operation, closure and post-closure will consist of one (1) upgradient background quality monitoring well (OWB-10) and five (5) downgradient detection wells (OWB-1, OWB-2, OWB-3, OWB-4 and OWB-6). These wells were installed during the Site Hydrogeologic Study with the intent of incorporation into the groundwater monitoring plan. Based on the potentiometric contours developed for the site, OWB-10 is located in the highest potentiometric area available on site. Groundwater flow from this area occurs in a radial pattern as a result of rainfall recharge.

The five detection wells were chosen based on horizontal location in reference to the Phase 1 landfill limits and appropriate screened intervals within the representative surficial aquifer. Based on previous studies, groundwater flow will generally occur in an east to west-southwest pattern in the vicinity of Phase 1. The detection wells are located from 110 feet (OWB-3) to 170 feet (OWB-1) from the proposed waste boundary. Well OWB-5 located south of Phase 1, Cell 1 will be abandoned for construction of the first Cell and not available for inclusion in the monitoring well network.

Monitoring Well Construction

As stated previously, the monitoring wells included within the Phase 1 groundwater monitoring well network were previously installed during the Site Hydrogeologic Study in 2011. These wells were constructed in accordance with

North Carolina Well Constructions Standards so that they could be used as permanent monitoring wells. The construction records for these wells are included in Appendix B for reference.

The depth to seasonal high groundwater at each location and screened intervals for the existing wells are as follows:

Measured Seasonal High Water Table

<i>Well locations survey data supplied by Parker & Associates</i>							
Well OWB-#	Date Drilled	Ground Surface Elevation (MSL)	Top of PVC Elevation (MSL)	Well PVC Stick-Up (ft)	Well Depth (ft)	Screened Interval (ft)	Seasonal High Elev.
OWB-1	8/25/11	39.28	42.03	2.75	20.0	20.0 - 7.0	35.21
OWB-2	8/25/11	38.02	40.89	2.87	20.0	20.0 - 7.0	35.03
OWB-3	8/25/11	37.61	40.32	2.71	20.0	20.0 - 8.0	34.94
OWB-4	8/25/11	39.09	41.68	2.59	20.0	20.0 - 8.0	35.15
OWB-6	8/24/11	39.25	42.18	2.93	15.0	20.0 - 8.0	35.24
OWB-10	8/22/11	39.67	42.40	2.73	20.0	20.0 - 8.0	36.69

Following installation of the temporary observation wells on August 26, 2011, Hurricane Irene resulted in over 7 inches of rainfall at the site around August 27, 2011. A significant rise occurred in all wells installed at the site along with the nearby wells in the Division of Water Resources network (Reference Hydrogeologic Report Appendix 2). In general water table elevations rose approximately 6 to 7 feet following the storm event. With the transition into colder months and decreasing evapotranspiration, the water levels remained at or near the levels recorded following Hurricane Irene. Therefore the elevations captured during our groundwater level monitoring following a tropical rainfall event reflect long term seasonal high water levels.

Well Installation Procedures

The monitoring wells proposed for this groundwater monitoring plan have been installed in accordance with North Carolina Well Construction Standards. Refer to individual Well Construction Records in Appendix B for details.

Sampling, Analytical Testing & Reporting

Groundwater monitoring, sampling and reporting shall be executed in accordance with the current Solid Waste Section memorandums, templates and forms regarding groundwater monitoring and submitting reports to the Solid

Waste Section. These reports can be located on the Solid Waste Section's web page located at:

<http://portal.ncdenr.org/web/wm/sw/envmonitoring>

For reference the memoranda, templates and forms are currently:

- Memorandum - October 16, 2007 - Environmental Monitoring Data for North Carolina Solid Waste Management Facilities
- Memorandum - October 27, 2006 New Guidelines for Electronic Submittal of Environmental Monitoring Data
- February 23, 2007 - Addendum to October 27, 2006, North Carolina Solid Waste Section Memorandum Regarding New Guidelines for Electronic Submittal of Environmental Monitoring Data
- Solid Waste Section - Guidelines for Groundwater, Soil, and Surface Water Sampling
- Electronic Data Deliverable (EDD) Template (Last updated: May 5, 2010)
- Solid Waste Environmental Monitoring Data Form (Last updated: June 10, 2009)
- Constituent Look-up webpage (Solid Waste Section Limits) (Last updated: June 13, 2011)

Groundwater monitoring results shall be sent to Ms. Jaclynne Drummond by electronic format. The following link is the template for the submittal of groundwater monitoring data in EDD format.

http://portal.ncdenr.org/c/document_library/get_file?uuid=3246fa1e-e618-417e-a643-6f5b92bce754&groupId=38361

Contact information for Ms. Jaclynne Drummond is listed below:

Jaclynne Drummond
Compliance Hydrogeologist
NC Department of Environment and Natural Resources
Division of Waste Management - Solid Waste Section
1646 Mail Service Center
Raleigh, NC 27699-1646
919-707-8294 (phone/fax)

A background sampling event of monitoring wells will be performed prior to the acceptance of any waste at the landfill. Background and routine monitoring requirements for the Green Recycling Solutions LLC C&D Landfill groundwater wells will include laboratory analysis for the constituents included in Table 1 on the following page.

Table - 1 - Constituents for Analysis

Analytical Method: EPA 6010 Preparation Method: EPA 3010

Arsenic
Barium
Cadmium
Chromium
Copper
Iron
Lead
Manganese
Selenium
Silver
Zinc

Analytical Method: EPA 7470 Preparation Method: EPA 7470

Mercury

Analytical Method: EPA 8260

Acetone
Acrylonitrile
Benzene
Bromochloromethane
Bromodichloromethane
Bromoform
Bromomethane
2-Butanone
Carbon disulfide
Carbon tetrachloride
Chlorobenzene
Chloroethane
Chloroform
Chloromethane
1,2-Dibromo-3-chloropropane
Dibromochloromethane
1,2-Dibromoethane (EDB)
1,2-Dichlorobenzene
1,4-Dichlorobenzene
trans-1,4-Dichloro-2-butene
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
cis-1,2-Dichloroethene
trans-1,2-Dichloroethene
1,2-Dichloropropane
cis-1,3-Dichloropropene

Table - 1 - Constituents for Analysis (Continued)

trans-1,3-Dichloropropene

Ethylbenzene

2-Hexanone

Iodomethane

Methylene Chloride

4-Methyl-2-pentanone (MIBK)

Styrene

1,1,1,2-Tetrachloroethane

1,1,2,2-Tetrachloroethane

Tetrachloroethene

Toluene

1,1,1-Trichloroethane

1,1,2-Trichloroethane

Trichloroethene

Trichlorofluoromethane

1,2,3-Trichloropropane

Vinyl acetate

Vinyl chloride

Xylene (Total)

m&p-Xylene

o-Xylene

Total Dissolved Solids Analytical Method: SM 2540C

Total Dissolved Solids

Total Suspended Solids Analytical Method: SM 2540D

Total Suspended Solids

5 day Analytical Method: SM 5210B

BOD, 5 day

IC Anions 28 Days Analytical Method: EPA 300.0

Fluoride

Sulfate

Nitrogen, NO₂/NO₃ unpres Analytical Method: EPA 353.2

Nitrogen, Nitrate

Chloride Analytical Method: SM 4500-Cl-E

Chloride

COD Analytical Method: SM 5220D

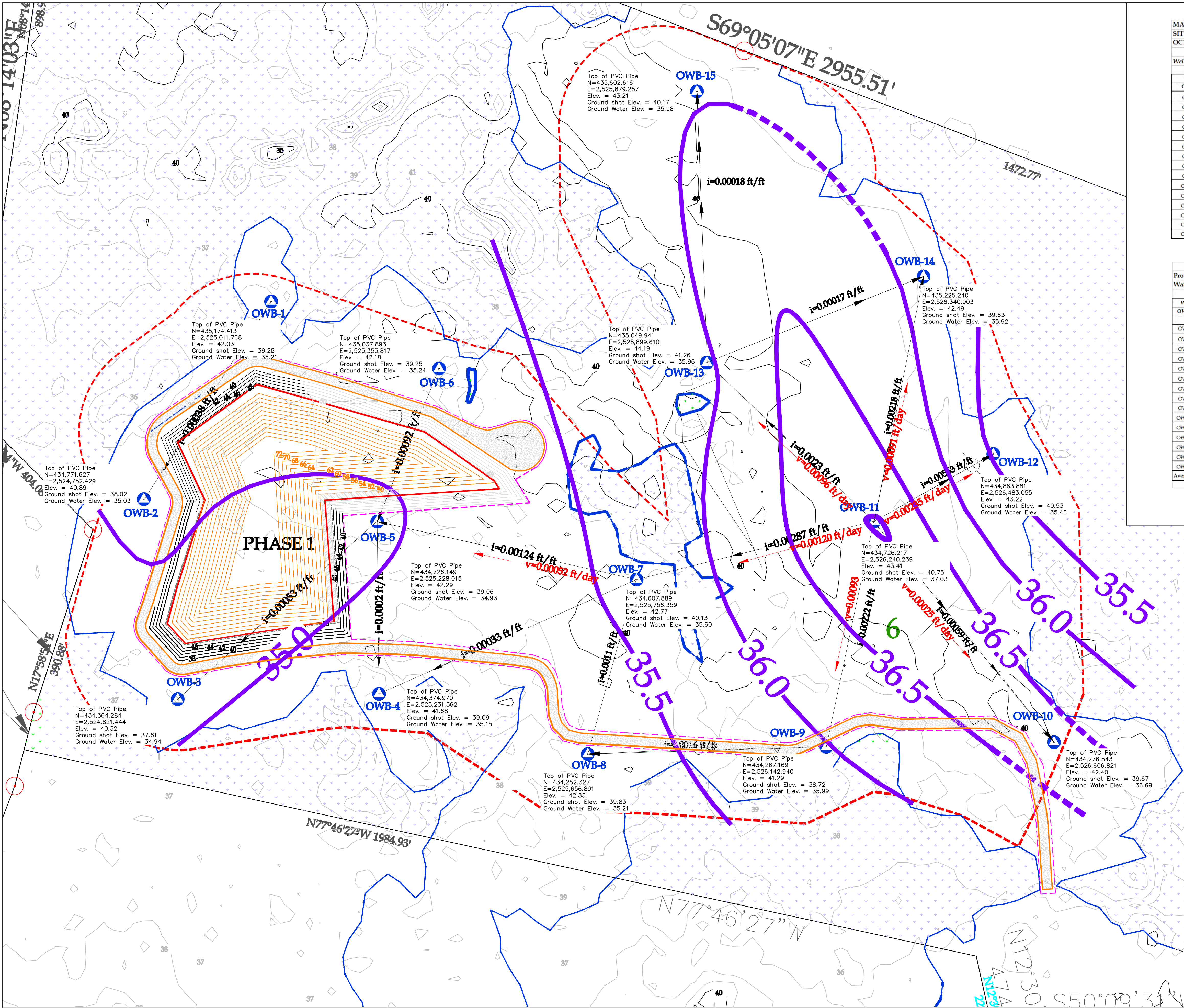
Chemical Oxygen Demand

TOC Analytical Method: SM 5310B

Total Organic Carbon

APPENDIX A

GROUNDWATER POTENTIOMETRIC PLAN



MAYSVILLE C&D LANDFILL SITE SUITABILITY - OBSERVATION WELL DATA OCTOBER 6, 2011									
Well locations survey data supplied by Parker & Associates									
Well	Date	Ground Surface	Top of PVC	Well PVC	Well	Screened	NC State Plane	NC State Plane	
OWB-#	Drilled	Elevation (MSL)	Elevation (MSL)	Stick-Up (ft)	Depth (ft)	Interval (ft)	Northings	Eastings	
OWB-1	8/25/11	39.28	42.03	2.75	20.0	20.0 - 7.0	435174.413	2525011.768	
OWB-2	8/25/11	38.02	40.89	2.87	20.0	20.0 - 7.0	434771.627	2524752.429	
OWB-3	8/25/11	37.61	40.32	2.71	20.0	20.0 - 8.0	434364.284	2524821.444	
OWB-4	8/25/11	39.09	41.68	2.59	20.0	20.0 - 8.0	434374.970	2525231.562	
OWB-5	8/24/11	39.06	42.29	3.23	15.0	19.0 - 7.0	434726.149	2525228.015	
OWB-6	8/24/11	39.25	42.18	2.93	15.0	20.0 - 8.0	435037.893	2525353.817	
OWB-7	8/24/11	40.13	42.77	2.64	15.0	34.0 - 21.0	434607.889	2525756.359	
OWB-8	8/23/11	39.83	42.83	3.00	20.0	20.0 - 8.0	434252.327	2525656.891	
OWB-9	8/23/11	38.72	41.29	2.57	15.0	3.0 - 15.0	434267.169	2526142.940	
OWB-10	8/22/11	39.67	42.40	2.73	20.0	20.0 - 8.0	434276.543	2526066.821	
OWB-11	8/23/11	40.75	43.41	2.66	15.0	15 - 3.5	434726.217	2526240.239	
OWB-12	8/23/11	40.53	43.22	2.69	20.0	20.0 - 8.0	434863.881	2526483.055	
OWB-13	8/24/11	41.26	44.19	2.93	20.0	20.0 - 8.0	435049.941	2525899.610	
OWB-14	8/23/11	39.63	42.49	2.86	20.0	20.0 - 8.0	435225.240	2526340.903	
OWB-15	8/24/11	40.17	43.21	3.04	20.0	20.0 - 8.0	435602.616	2525879.257	

Proposed Maysville C&D Landfill Water Table Elevations - Through 11-22-11													
Well	Top of PVC Elevation (MSL)	Groundwater Level Elevations											
		T.O.B.		24-Hr.		8/26/11		9/6/11		9/9/11		10/10/11	
OWB-#	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)	Elev.	Depth (ft)
OWB-1	42.03	13.55	28.48	13.92	28.11	13.92	28.11	7.21	34.82	6.82	35.21	7.80	34.23
OWB-2	40.89	13.62	27.27	13.62	27.27	13.62	27.27	6.33	34.56	5.86	35.03	7.02	33.87
OWB-3	40.32	12.75	27.57	12.79	27.53	12.79	27.53	5.79	34.53	5.38	34.94	6.54	33.78
OWB-4	41.68	13.93	27.75	13.86	27.82	13.86	27.82	6.89	34.79	6.53	35.15	7.68	34.00
OWB-5	42.29	15.05	27.24	15.00	27.29	14.30	27.99	7.52	34.77	7.36	34.93	8.22	34.07
OWB-6	42.18	13.70	28.48	13.78	28.40	13.82	28.36	7.31	34.87	6.94	35.24	7.91	34.27
OWB-7	42.77	15.55	27.22	14.85	27.92	14.75	28.02	7.69	35.08	7.17	35.60	8.58	34.19
OWB-8	42.83	15.05	27.78	14.97	27.86	14.99	27.84	7.93	34.90	7.62	35.21	8.68	34.15
OWB-9	41.29	13.89	27.40	13.10	28.19	13.11	28.18	5.58	35.71	5.30	35.99	5.22	36.07
OWB-10	42.40	13.68	28.72	13.70	28.70	13.70	28.70	6.68	35.72	5.71	36.69	7.15	35.25
OWB-11	43.41	13.62	29.79	13.65	29.76	13.64	29.77	6.93	36.48	6.38	37.03	7.61	35.80
OWB-12	43.22	16.25	26.97	15.13	28.09	15.15	28.07	8.07	35.15	7.76	35.46	8.40	34.82
OWB-13	44.19	15.15	29.04	15.34	28.85	15.37	28.82	8.51	35.68	8.23	35.96	9.27	34.92
OWB-14	42.49	14.40	28.09	14.09	28.40	14.06	28.43	6.86	35.63	6.57	35.92	7.65	34.84
OWB-15	43.21	14.61	28.60	14.56	28.65	14.65	28.56	7.40	35.81	7.23	35.98	8.59	34.62
Average W.T. Elevation		28.03		28.19		28.23		35.23		35.62		34.99	

- LEGEND**
- EXISTING CONTOUR (1-FT INTERVAL)
 - ACOE APPROVED WETLAND LIMITS
 - FACILITY BOUNDARY
 - WELL LOCATION
 - GROUNDWATER ELEVATION CONTOUR
 - i = GROUNDWATER GRADIENT
 - v = GROUNDWATER VELOCITY

NO.	DATE	APPR.	REVISION

NO.	DATE	APPR.	REVISION

MAYSVILLE C&D LANDFILL

GREEN RECYCLING SOLUTIONS LLC

DRAWN BY
DWW

DESIGN ENGINEER
DWW

MAYSVILLE, NC

PROJECT ENGINEER
DWW

PROJECT MANAGER
DWW

LICENSE #C-2205
8000 CORPORATE CENTER DRIVE, SUITE 200
CHARLOTTE, NORTH CAROLINA 28226
(704) 961-6465

NOT FOR CONSTRUCTION

SCALE
1"=100'

PROJECT NO.
0140408

DATE
DECEMBER 2011

AutoCAD 2007
POTENTIOMETRIC MAP.DWG

DRAWING NO.
1

REV. NO.

SHEET
1

OF
1

APPENDIX B

WELL CONSTRUCTION RECORDS



NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID # (if applicable) OBW-1

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/25/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE ° ' " DMS OR DD

LONGITUDE ° ' " DMS OR DD

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL N/A

Facility Name

Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()

Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 20.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING: Depth	Diameter	Thickness/Weight	Material
Top 0.0 Bottom 10.0 Ft.	2 INCH	SCH 40	PVC

Top Bottom Ft.

Top Bottom Ft.

8. GROUT: Depth	Material	Method
Top 0.0 Bottom 5.0 Ft.	PORTLAND BENTONITE	SLURRY

Top Bottom Ft.

Top Bottom Ft.

9. SCREEN: Depth	Diameter	Slot Size	Material
Top 10.0 Bottom 20.0 Ft.	2.0 in.	.010 in.	PVC

Top Bottom Ft. in. in.

Top Bottom Ft. in. in.

10. SAND/GRAVEL PACK:

Depth	Size	Material
Top 8.0 Bottom 20.0 Ft.	20-40	FINE SILICA SAND

Top Bottom Ft.

Top Bottom Ft.

11. DRILLING LOG

Top Bottom

Formation Description

0.0 / 1.0

WOOD/WEEDS/TOPSOIL

1.0 / 10.0

TAN/WHITE SILTY CLAY

10.0 / 15.0

BLACK SILTY SAND/SHELL

15.0 / 20.0

GRAY/GREEN CLAY SILT SAND/SHELL

12. REMARKS:

BENTONITE SEAL FROM 5.0 TO 8.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR 08/29/11 DATE

MIKE MCCONAHEY

PRINTED NAME OF PERSON CONSTRUCTING THE WELL



Non RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) OBW-2

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/25/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE " DMS OR DD

LONGITUDE " DMS OR DD

Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL N/A

Facility Name Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()

Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 20.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING: Depth	Diameter	Thickness/Weight	Material
Top <u>0.0</u> Bottom <u>10.0</u> Ft.	<u>2 INCH</u>	<u>SCH 40</u>	<u>PVC</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>

8. GROUT: Depth	Material	Method
Top <u>0.0</u> Bottom <u>5.0</u> Ft.	<u>PORTLAND BENTONITE</u>	<u>SLURRY</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>

9. SCREEN: Depth	Diameter	Slot Size	Material
Top <u>10.0</u> Bottom <u>20.0</u> Ft.	<u>2.0 in.</u>	<u>.010 in.</u>	<u>PVC</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>	<u> </u>

10. SAND/GRAVEL PACK: Depth	Size	Material
Top <u>8.0</u> Bottom <u>20.0</u> Ft.	<u>20-40</u>	<u>FINE SILICA SAND</u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>
Top <u> </u> Bottom <u> </u> Ft.	<u> </u>	<u> </u>

11. DRILLING LOG	Formation Description
Top <u>0.0</u> Bottom <u>1.0</u>	<u>WOOD/WEEDS/TOPSOIL</u>
<u>1.0</u> / <u>10.0</u>	<u>TAN/WHITE SILTY CLAY</u>
<u>10.0</u> / <u>15.0</u>	<u>BLACK SILTY SAND/SHELL</u>
<u>15.0</u> / <u>20.0</u>	<u>GRAY/GREEN CLAY SILT SAND/SHELL</u>
<u> </u> / <u> </u>	<u> </u>
<u> </u> / <u> </u>	<u> </u>
<u> </u> / <u> </u>	<u> </u>
<u> </u> / <u> </u>	<u> </u>
<u> </u> / <u> </u>	<u> </u>
<u> </u> / <u> </u>	<u> </u>

12. REMARKS:

BENTONITE SEAL FROM 5.0 TO 8.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR 08/29/11 DATE

MIKE MCCONAHEY
PRINTED NAME OF PERSON CONSTRUCTING THE WELL



Non RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) OBW-3

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/25/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE ° ' " DMS OR DD

LONGITUDE ° ' " DMS OR DD

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL

N/A

Facility Name

Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()

Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 20.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.

(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING: Depth		Diameter	Thickness/Weight	Material
Top <u>0.0</u>	Bottom <u>10.0</u>	Ft. <u>2 INCH</u>	<u>SCH 40</u>	<u>PVC</u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>	<u> </u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>	<u> </u>

8. GROUT: Depth		Material	Method
Top <u>0.0</u>	Bottom <u>5.0</u>	Ft. <u>PORTLAND BENTONITE</u>	<u>SLURRY</u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>

9. SCREEN: Depth		Diameter	Slot Size	Material
Top <u>10.0</u>	Bottom <u>20.0</u>	Ft. <u>2.0 in.</u>	<u>.010 in.</u>	<u>PVC</u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>	<u> </u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>	<u> </u>

10. SAND/GRAVEL PACK: Depth		Size	Material
Top <u>8.0</u>	Bottom <u>20.0</u>	Ft. <u>20-40</u>	<u>FINE SILICA SAND</u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>
Top <u> </u>	Bottom <u> </u>	Ft. <u> </u>	<u> </u>

11. DRILLING LOG		Formation Description
Top <u>0.0</u>	Bottom <u>1.0</u>	<u>WOOD/WEEDS/TOPSOIL</u>
Top <u>1.0</u>	Bottom <u>10.0</u>	<u>TAN/WHITE SILTY CLAY</u>
Top <u>10.0</u>	Bottom <u>15.0</u>	<u>BLACK SILTY SAND/SHELL</u>
Top <u>15.0</u>	Bottom <u>20.0</u>	<u>GRAY/GREEN CLAY SILT SAND/SHELL</u>
Top <u> </u>	Bottom <u> </u>	<u> </u>
Top <u> </u>	Bottom <u> </u>	<u> </u>
Top <u> </u>	Bottom <u> </u>	<u> </u>
Top <u> </u>	Bottom <u> </u>	<u> </u>
Top <u> </u>	Bottom <u> </u>	<u> </u>
Top <u> </u>	Bottom <u> </u>	<u> </u>

12. REMARKS:

BENTONITE SEAL FROM 5.0 TO 8.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR Mike McConahey DATE 08/29/11

MIKE MCCONAHEY
PRINTED NAME OF PERSON CONSTRUCTING THE WELL



NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) OBW-4

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/25/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE ° ' " DMS OR ° ' " DD

LONGITUDE ° ' " DMS OR ° ' " DD

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL

N/A

Facility Name

Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()
Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 20.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top	Bottom	Top	Bottom

7. CASING: Depth	Diameter	Thickness/Weight	Material
Top <u>0.0</u> Bottom <u>10.0</u> Ft. <u>2 INCH</u>		<u>SCH 40</u>	<u>PVC</u>
Top <u></u> Bottom <u></u> Ft. <u></u>			
Top <u></u> Bottom <u></u> Ft. <u></u>			

8. GROUT: Depth	Material	Method
Top <u>0.0</u> Bottom <u>5.0</u> Ft. <u>PORTLAND BENTONITE</u>		<u>SLURRY</u>
Top <u></u> Bottom <u></u> Ft. <u></u>		
Top <u></u> Bottom <u></u> Ft. <u></u>		

9. SCREEN: Depth	Diameter	Slot Size	Material
Top <u>10.0</u> Bottom <u>20.0</u> Ft. <u>2.0 in.</u> <u>.010 in.</u>			<u>PVC</u>
Top <u></u> Bottom <u></u> Ft. <u></u> <u></u>			
Top <u></u> Bottom <u></u> Ft. <u></u> <u></u>			

10. SAND/GRAVEL PACK: Depth	Size	Material
Top <u>8.0</u> Bottom <u>20.0</u> Ft. <u>20-40</u>		<u>FINE SILICA SAND</u>
Top <u></u> Bottom <u></u> Ft. <u></u>		
Top <u></u> Bottom <u></u> Ft. <u></u>		

11. DRILLING LOG

Top	Bottom	Formation Description
<u>0.0</u>	<u>1.0</u>	<u>WOOD/WEEDS/TOPSOIL</u>
<u>1.0</u>	<u>10.0</u>	<u>TAN/WHITE SILTY CLAY</u>
<u>10.0</u>	<u>15.0</u>	<u>BLACK SILTY SAND/SHELL</u>
<u>15.0</u>	<u>20.0</u>	<u>GRAY/GREEN CLAY SILT SAND/SHELL</u>
<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>

12. REMARKS:

BENTONITE SEAL FROM 5.0 TO 8.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C . WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR Mike McConahey DATE 08/29/11

MIKE MCCONAHEY
PRINTED NAME OF PERSON CONSTRUCTING THE WELL



Non RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID # (if applicable) OBW-6

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/24/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE ° ' " DMS OR DD

LONGITUDE ° ' " DMS OR DD

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL

N/A

Facility Name

Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

() Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 20.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING: Depth	Diameter	Thickness/Weight	Material
Top <u>0.0</u> Bottom <u>10.0</u> Ft. <u>2 INCH</u>		<u>SCH 40</u>	<u>PVC</u>
Top <u> </u> Bottom <u> </u> Ft. <u> </u>			
Top <u> </u> Bottom <u> </u> Ft. <u> </u>			

8. GROUT: Depth	Material	Method
Top <u>0.0</u> Bottom <u>5.0</u> Ft. <u>PORTLAND BENTONITE</u>		<u>SLURRY</u>
Top <u> </u> Bottom <u> </u> Ft. <u> </u>		
Top <u> </u> Bottom <u> </u> Ft. <u> </u>		

9. SCREEN: Depth	Diameter	Slot Size	Material
Top <u>10.0</u> Bottom <u>20.0</u> Ft. <u>2.0</u> in. <u>.010</u> in. <u>PVC</u>			
Top <u> </u> Bottom <u> </u> Ft. <u> </u> in. <u> </u> in. <u> </u>			
Top <u> </u> Bottom <u> </u> Ft. <u> </u> in. <u> </u> in. <u> </u>			

10. SAND/GRAVEL PACK: Depth	Size	Material
Top <u>8.0</u> Bottom <u>20.0</u> Ft. <u>20-40</u>		<u>FINE SILICA SAND</u>
Top <u> </u> Bottom <u> </u> Ft. <u> </u>		
Top <u> </u> Bottom <u> </u> Ft. <u> </u>		

11. DRILLING LOG	Formation Description
Top <u>0.0</u> Bottom <u>1.0</u>	<u>WOOD/WEEDS/TOPSOIL</u>
<u>1.0</u> / <u>10.0</u>	<u>TAN/WHITE SILTY CLAY</u>
<u>10.0</u> / <u>15.0</u>	<u>BLACK SILTY SAND/SHELL</u>
<u>15.0</u> / <u>20.0</u>	<u>GRAY/GREEN CLAY SILT SAND/SHELL</u>
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12. REMARKS:

BENTONITE SEAL FROM 5.0 TO 8.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C. WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR Mike McConahey DATE 08/29/11

MIKE MCCONAHEY
PRINTED NAME OF PERSON CONSTRUCTING THE WELL



Non RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2402

1. WELL CONTRACTOR:

MIKE MCCONAHEY

Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC

Well Contractor Company Name

176 COMMERCE BLVD

Street Address

STATESVILLE

NC

28625

City or Town

State

Zip Code

(704) 872-7686

Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT# N/A

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID # (if applicable) OBW-10

3. WELL USE (Check One Box) Monitoring ☒ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 08/23/11

4. WELL LOCATION:

WHITE OAK RIVER ROAD 28555

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: MAYSVILLE COUNTY JONES

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE ° ' " DMS OR DD

LONGITUDE ° ' " DMS OR DD

Latitude/longitude source: ☐ GPS ☐ Topographic map

(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

PROPOSED C&D LANDFILL

N/A

Facility Name

Facility ID# (if applicable)

WHITE OAK RIVER ROAD

Street Address

MAYSVILLE

NC

28555

City or Town

State

Zip Code

GREEN RECYCLING SOLUTIONS, LLC

Contact Name

166 CENTER STREET

Mailing Address

JACKSONVILLE

NC

28546

City or Town

State

Zip Code

()

Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 20.0 FEET

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 11.0 FT.

(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 FT. Above Land Surface*

*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): N/A METHOD OF TEST N/A

f. DISINFECTION: Type N/A Amount N/A

g. WATER ZONES (depth):

Top Bottom Top Bottom

Top Bottom Top Bottom

Top Bottom Top Bottom

7. CASING: Depth Diameter Thickness/ Weight Material

Top 0.0 Bottom 10.0 Ft. 2 INCH SCH 40 PVC

Top Bottom Ft.

Top Bottom Ft.

8. GROUT: Depth Material Method

Top 0.0 Bottom 5.0 Ft. PORTLAND BENTONITE SLURRY

Top Bottom Ft.

Top Bottom Ft.

9. SCREEN: Depth Diameter Slot Size Material

Top 10.0 Bottom 20.0 Ft. 2.0 in. .010 in. PVC

Top Bottom Ft. in. in.

Top Bottom Ft. in. in.

10. SAND/GRAVEL PACK:

Depth Size Material

Top 8.0 Bottom 20.0 Ft. 20-40 FINE SILICA SAND

Top Bottom Ft.

Top Bottom Ft.

11. DRILLING LOG

Top Bottom

Formation Description

0.0 / 1.0

WOOD/WEEDS/TOPSOIL

1.0 / 10.0

TAN/WHITE SILTY CLAY

10.0 / 15.0

BLACK SILTY SAND/SHELL

15.0 / 20.0

GRAY/GREEN CLAY SILT SAND/SHELL

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12. REMARKS:

BENTONITE SEAL FROM 5.0 TO 8.0 FEET

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

SIGNATURE OF CERTIFIED WELL CONTRACTOR

08/29/11

DATE

MIKE MCCONAHEY

PRINTED NAME OF PERSON CONSTRUCTING THE WELL

PROJECT: Proposed Maysville C&D Landfill		OWB-1	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/25/11	DATE FINISHED: 8/25/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 20	SCREEN INTERVAL (ft.): 10-20
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 13.55	FIRST: 13.92 COMPL. 2" Sch.40PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0					Above Grade Well Monument
1	4-4-5	N/A	Dark grey/Dark Brown, fine sandy SILT, dry		
2					10" diameter borehole Neat cement grout.
3					2" diameter Schedule 40 PVC casing
4					
5	2-6-8		Light/medium brown, clayey medium SAND, dry/slightly moist		Bentonite Chip Seal
6					
7					#2 filter pack sand
8					
9			SM - Light brown, coarse SAND with very little clay with a few rounded quartz pieces, very moist		
10	3-3-3				
11			Light brown, silty CLAY, slightly moist		
12					
13					
14					
15	4-4-3		SM - Black, clayey coarse SAND with small well rounded quartz pieces, wet		2" diameter, 0.010" slot, Schedule 40 PVC screen
16					
17					
18					
19			SP - Dark grey, clayey coarse SAND, wet		2" diameter Schedule 40 PVC end cap
20	woh-woh-woh				Slough
21					

PROJECT: Proposed Maysville C&D Landfill		OWB-2	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/25/11	DATE FINISHED: 8/25/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 20	SCREEN INTERVAL (ft.): 10-20
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 13.62	FIRST: 13.62 COMPL. 13.62 CASING: 2" Sch.40PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0					Above Grade Well Monument
1	4-4-4	N/A	Medium brown, clayey SILT, dry		
2					10" diameter borehole Neat cement grout.
3					2" diameter Schedule 40 PVC casing
4					
5	5-5-4		Light/medium brown, silty CLAY, dry/slightly moist		Bentonite Chip Seal
6					
7					#2 filter pack sand
8					
9					
10	3-3-3		SM - Medium brown, coarse SAND, very moist		
11					
12					
13					
14					
15	2-1-1				2" diameter, 0.010" slot, Schedule 40 PVC screen
16					
17			SP - Dark grey, clayey coarse SAND, very wet, small clay lenses		
18					
19					
20	wor-wor-1				2" diameter Schedule 40 PVC end cap
21					Slough

PROJECT: Proposed Maysville C&D Landfill		OWB-3	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/25/11	DATE FINISHED: 8/25/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 20	SCREEN INTERVAL (ft.): 10-20
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 12.75	FIRST: 12.79 COMPL. 12.79 CASING: 2" Sch.40PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0	2-3-4	N/A			Above Grade Well Monument
1			Dark/medium brown, silty CLAY, dry, tight		
2					10" diameter borehole Neat cement grout.
3	3-3-3				2" diameter Schedule 40 PVC casing
4			Light/medium brown, fine sandy CLAY, slightly moist, very fine sand		
5					
6					Bentonite Chip Seal
7	2-2-3		Black, silty CLAY, moist		#2 filter pack sand
8					
9					
10	woh-woh-1		SM - Light/medium brown, coarse SAND, very moist		
11					
12					
13					
14	woh-woh-woh				
15					2" diameter, 0.010" slot, Schedule 40 PVC screen
16			SP - Dark grey, clayey SAND, wet, small intermittent clay lenses		
17					
18					
19					
20					2" diameter Schedule 40 PVC end cap
21					Slough

PROJECT: Proposed Maysville C&D Landfill		OWB-4	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/25/11	DATE FINISHED: 8/25/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 20	SCREEN INTERVAL (ft.): 10-20
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 13.93	FIRST: 13.86 COMPL. 13.86 CASING: 2" Sch.40PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0			Dark grey, fine sandy SILT, dry		Above Grade Well Monument
1	4-5-5	N/A			
2			Light/medium grey, silty CLAY, slightly moist, tight		10" diameter borehole Neat cement grout.
3					
4					2" diameter Schedule 40 PVC casing
5	5-9-8		Light brown, clayey medium SAND, slightly moist		
6					
7					Bentonite Chip Seal
8					#2 filter pack sand
9					
10	2-3-3		SM - Light/medium brown, silty SAND, moist		
11					
12					
13					
14					
15	wor-wor-wor				2" diameter, 0.010" slot, Schedule 40 PVC screen
16					
17			SP - Dark grey, clayey coarse SAND, wet, small intermittent clay lenses		
18					
19					
20	wor-wor-wor				2" diameter Schedule 40 PVC end cap
21					Slough

PROJECT: Proposed Maysville C&D Landfill		OWB-6	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/24/11	DATE FINISHED: 8/24/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 20	SCREEN INTERVAL (ft.): 10-20
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 13.70	FIRST: 13.78 COMPL. 13.78 CASING: 2" Sch.40PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0					Above Grade Well Monument
1	3-3-3	N/A			
2			Medium grey, fine sandy SILT, dry		10" diameter borehole Neat cement grout.
3					
4					2" diameter Schedule 40 PVC casing
5	2-1-3		Light grey, silty CLAY, slightly moist		
6					
7					Bentonite Chip Seal
8					
9					#2 filter pack sand
10	3-2-3		SP - Black, silty coarse SAND, with a few well rounded pieces of quartz		
11					
12					
13					
14					
15	2-8-9		SP-SM - Light/medium grey, silty coarse SAND, with some shell material, wet		2" diameter, 0.010" slot, Schedule 40 PVC screen
16					
17					
18					
19			SP - Dark grey, fine sandy SILT with a small amount of clay, wet		2" diameter Schedule 40 PVC end cap
20	woh-woh-6				
21			Light grey, shell material, SAND with some gravel		Slough

PROJECT: Proposed Maysville C&D Landfill		OWB-10	
BORING LOCATION: Proposed Maysville C&D Landfill		GROUND SURFACE ELEVATION AND DATUM: TBD	
DRILLING CONTRACTOR: Geologic Exploration		DATE STARTED: 8/22/11	DATE FINISHED: 8/23/11
DRILLING METHOD: Hollow-stem auger		TOTAL DEPTH (ft.): 20	SCREEN INTERVAL (ft.): 10-20
DRILLING EQUIPMENT: Diedrich D-120 Truck Rig		DEPTH TO WATER: 13.68	FIRST: 13.70 COMPL. 2" Sch.40PVC
SAMPLING METHOD: Split Spoon		LOGGED BY: Chris Means	
HAMMER WEIGHT: 142 Lbs.	DROP: 32"	DRILLER: Mike McConahey	REG. NO. 2402

DEPTH (feet)	SAMPLES	OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Blows/ 6 Inches				
0	N/A	N/A			Above Grade Well Monument
1					
2			Dark grey/black, silty CLAY, dry		10" diameter borehole Neat cement grout.
3					
4	9-5-4				2" diameter Schedule 40 PVC casing
5			Light/medium brown, SILT with some rock fragments, dry		
6					
7					Bentonite Chip Seal
8	10-7-4		SM - Light grey, silty medium SAND, very moist		#2 filter pack sand
9					
10			SM - Dark tan, coarse SAND, wet		
11					
12	2-1-1				
13					
14					
15					2" diameter, 0.010" slot, Schedule 40 PVC screen
16	wor-woh-2		SM - Black, medium/coarse SAND, wet		
17					
18					
19					
20					2" diameter Schedule 40 PVC end cap
21					Slough