

January 15, 2014

Permit No.	Date	Document ID No.
43-03	January 15, 2014	20420

Mr. Ming-Tai Chao, P.E.
Environmental Engineer
NC DENR - Division of Waste Management
1646 Mail Service Center
Raleigh, North Carolina 27699

Received by an e-mail
Date: January 15, 2014
Solid Waste Section
Raleigh Central Office

RE: Permit Application
C&D Landfill (Permit No. 43-03) & Transfer Station (Permit No. 43-09T) Continued Operations
Harnett County Anderson Creek Landfill Facility
Spring Lake, North Carolina

Dear Mr. Chao:

On behalf of Harnett County, Smith Gardner, Inc. (S+G) would like to submit for your review the enclosed permit application for the continued operations of the Harnett County Anderson Creek Construction and Demolition Debris (C&D) Landfill and Transfer Station located near Spring Lake. This application follows the prior submittal of the facility operations manual in September 2013. Note that the operations manual, which covers the operation of the C&D landfill, the transfer station and the other activities at the site, has been revised in response to your comments provided by email on November 22, 2013.

Should you have any questions or require clarification or additional information, please contact me at your earliest convenience.

Sincerely,
SMITH GARDNER, INC.



Pieter K. Scheer, P.E.
Vice President, Senior Engineer
pieter@smithgardnerinc.com

Enclosure: Permit Application

cc: Ed Mussler, P.E., DWM
Dennis Shackelford, DWM
Robert Hearn, DWM
Amanda Bader, P.E., Harnett County
Randy Smith, Harnett County
Andrew Holland, Harnett County

Permit Application

Harnett County Anderson Creek Landfill Facility C&D Landfill and Transfer Station Continued Operations Harnett County, North Carolina

Prepared for:

**Harnett County Solid Waste Department
Lillington, North Carolina**



January 2014

Prepared by:

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577



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Permit Application

Harnett County Anderson Creek Landfill Facility C&D Landfill and Transfer Station Continued Operations Harnett County, North Carolina

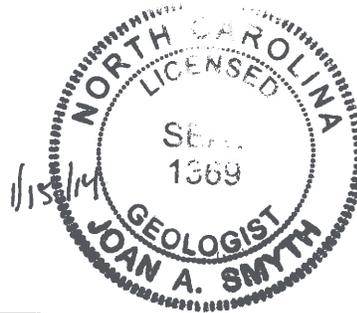
Prepared For:

**Harnett County Solid Waste Department
Lillington, North Carolina**

S+G Project No. HARNETT-AC-13-4



Joan A. Smyth, P.G.
Senior Hydrogeologist





Pieter K. Scheer, P.E.
Vice President, Senior Engineer



January 2014

NC LIC. NO. C-0828 (ENGINEERING)

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Applicant Certification

Name of Facility: Harnett County Anderson Creek Landfill
Application: C&D Landfill and Transfer Station Continued Operations

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision and that the information provided in this application is true, accurate, and complete to the best of my knowledge.

I understand that North Carolina General Statute 130A-22 provides for administrative penalties of up to fifteen thousand dollars (\$15,000.00) per day per each violation of the Solid Waste Management Rules. I further understand that the Solid Waste Management Rules may be revised or amended in the future and that the facility siting and operations of this solid waste management facility will be required to comply with all such revisions or amendments.

	<u>Amanda Bader, P.E.</u>	<u>1/15/14</u>
Signature	Name	Date

<u>County Engineer</u>	<u>Harnett County, NC</u>
Title	Business or Organization Name

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**Harnett County Anderson Creek Landfill Facility
C&D Landfill and Transfer Station Continued Operations
Harnett County, North Carolina**

Permit Application

Table of Contents

North Carolina Solid Waste Management (15A NCAC 13B.0400 et seq. and 15A NCAC 13B.0531 et seq.) rules addressed in each section of this document are shown in italics after each section.

Executive Summary

Attachment A	General Information
Attachment B	Facility and Engineering Plan <i>(15A NCAC 13B.0537 and .0539)</i>
Attachment C	Technical Specifications <i>(15A NCAC 13B.0539 and .0540)</i>
Attachment D	Construction Quality Assurance Manual <i>(15A NCAC 13B.0541)</i>
Attachment E	Operations Manual <i>(15A NCAC 13B.0402 and .0542)</i>
Attachment F	Closure and Post-Closure Plan <i>(15A NCAC 13B.0543)</i>
Attachment G	Water Quality Monitoring Plan <i>(15A NCAC 13B.0544)</i>
Attachment H	Landfill Gas Monitoring Plan <i>(15A NCAC 13B.0544)</i>
Attachment I	Permit Drawings <i>(15A NCAC 13B.0537, .0539, .0540, .0542, and .0543)</i>

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EXECUTIVE SUMMARY

General

The following is a Permit Application submitted on behalf of Harnett County for the continued operation of: 1) Phases I & II of the County's construction and demolition debris (C&D) landfill and 2) the County's municipal solid waste (MSW) transfer station at the County's Anderson Creek Landfill facility. This facility is permitted for the disposal of construction and demolition debris (C&D) and the transfer of municipal solid waste (MSW) under Solid Waste Permit Nos. 43-03 (C&D Landfill) and 43-09T (Transfer Station). The County also conducts several other solid waste management activities at the facility.

The Phases I & II C&D landfill unit currently occupies approximately 7.0 acres (waste footprint). This application includes plans for a small 0.4 acre extension of the current waste footprint as well as a vertical expansion. This additional capacity is anticipated to extend the life of the landfill until approximately mid to late 2014 (see calculations in Facility and Engineering Plan (**Attachment A**)) which should allow the County sufficient time to re-assess long-term development of the landfill.

Attachments

This submittal has been prepared in accordance with the requirements of the North Carolina Solid Waste Management Rules for transfer stations (15A NCAC 13B.0400 et seq.) and C&D landfills (15A NCAC 13B.0531 et seq.), which are enforced by the Division of Waste Management (DWM) of the North Carolina Department of Environment and Natural Resources (DENR). Included in this submittal are the following documents (*with applicable rule(s) in italics*):

A. General Information

This attachment includes general information related to the facility including contacts, a description of the facility, and property information.

B. Facility and Engineering Plan (.0537 and .0539)

The Facility and Engineering Plan presents plans for the development and the engineering design of Phases I and II of the C&D landfill. Along with the Technical Specifications and Project Drawings, has been prepared to comply with the requirements of 15A NCAC 13B.0537 and .0539.

C. Technical Specifications (.0539 and .0540)

The Technical Specifications provide a detailed description of the materials and construction requirements for components of the subgrade and final cover system for the C&D landfill, and related site development and infrastructure. This document has been prepared to comply with the requirements of 15A NCAC 13B.0539 and .0540.

D. Construction Quality Assurance (CQA) Manual (.0541)

The Construction Quality Assurance (CQA) Manual has been prepared to provide the Owner, Engineer, and CQA Engineer the means to govern the construction quality and to satisfy landfill certification requirements under current North Carolina Solid Waste Management rules. This document has been prepared to comply with the requirements of 15A NCAC 13B.0541.

E. Operations Manual (.0402 and .0542)

The Operations Manual outlines and describes protocols for facility operation and maintenance and was prepared to provide facility personnel with a clear understanding of how the Design Engineer assumed that the completed facility would be operated. Along with the Project Drawings, the Operations Manual has been prepared to comply with the requirements of 15A NCAC 13B.0402 and 0542. Note that the operations manual includes information related to all activities at the facility.

F. Closure and Post-Closure Plan (.0543 and .0546)

The Closure and Post-Closure Plan was prepared to outline the requirements for closure and post-closure activities at the landfill and includes a cost analysis for each. Along with the Project Drawings, this document has been prepared to comply with the requirements of 15A NCAC 13B.0543 and .0546.

G. Water Quality Monitoring Plan (.0544)

The Water Quality Monitoring Plan (WQMP) has been updated to reflect current conditions and specifies the procedures and requirements to satisfy the requirements of 15A NCAC 13B.0544. The WQMP has been certified by a Licensed Geologist and includes information related to groundwater monitoring system, sampling and analysis protocols and requirements, and detection monitoring requirements.

H. Landfill Gas Monitoring Plan (.0544)

The Landfill Gas (LFG) Monitoring Plan was prepared to specify the procedures and requirements to satisfy the requirements of 15A NCAC 13B.0544. The LFG Monitoring Plan includes information related to the LFG monitoring system including general monitoring and contingency requirements.

I. Permit Drawings (.0537, .0539, .0540, .0542, and .0543)

The Permit Drawings include a site plan, grading plans, phasing plans, cross sections, and details related to the C&D landfill. These drawings have been prepared to comply with the requirements of 15A NCAC 13B.0537, .0539, .0540, and .0543.

General Information

Harnett County Anderson Creek Landfill Facility Harnett County, North Carolina

Prepared for:

Harnett County Solid Waste Department
Lillington, North Carolina

January 2014

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577



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Harnett County Anderson Creek Landfill Facility

Harnett County, North Carolina

General Information

1. Facility Name:

Harnett County Anderson Creek Landfill

2. Owner Contact Information:

Harnett County Solid Waste Department
103 E. Ivey Street
P.O. Box 2773
Lillington, NC 27546
Phone: (910) 814-6156
Fax: (910) 814-8263

Anderson Creek Landfill Facility
1086 Poplar Drive
Spring Lake, NC 28390
Phone: (910) 893-5626

Contacts: Amanda Bader, P.E., County Engineer
abader@harnett.org

Randy Smith, Solid Waste Operations Manager
rsmith@harnett.org

Andrew Holland, Solid Waste Operations Crew Leader
mholland@harnett.org

3. Consulting Engineer Contact Information:

Smith Gardner, Inc.
14 N. Boylan Ave.
Raleigh, NC 27603
Phone: (919) 828-0577
Fax: (919) 828-3899

Contacts: Pieter Scheer, P.E., Vice President, Senior Engineer
pieter@smithgardnerinc.com

Joan A. Smyth, P.G., Senior Hydrogeologist
joan@smithgardnerinc.com

4. Permit/Annual Fee Invoices:

Direct to Amanda Bader, P.E., County Engineer
(See Contact Information in #2 above)

5. Facility Description:

Harnett County, North Carolina (County) currently owns and operates the Anderson Creek Landfill facility at 1086 Poplar Drive in Spring Lake. The facility is permitted for the disposal of construction and demolition debris (C&D) and the transfer of municipal solid waste (MSW) under Solid Waste Permit Nos. 43-03 (C&D Landfill) and 43-09T (Transfer Station). The County also conducts several other solid waste management activities at the facility. A brief site development history is as follows:

MSW Landfill Units

The Anderson Creek Landfill facility has two (2) existing closed unlined municipal solid waste (MSW) landfill units located in the southeast portion of the site. Operations in the initial MSW landfill unit were initiated in 1980. NC Solid Waste Permit 43-03 was issued for the site in March 1984. The County ceased disposal in the unlined MSW landfill units prior to October 9, 1993 and these units were closed in accordance with the then current rules. Closure of these areas was completed in 1994.

Construction and Demolition Debris (C&D) Landfill Units

The Anderson Creek Landfill facility has two (2) existing closed construction and demolition debris (C&D) landfill units. One of these units is located between the closed MSW landfill units and was operated along with the MSW landfill units. The other closed C&D landfill unit is located to the west of the larger closed MSW landfill unit. This area was operated during the period of 1994-1996 and contains approximately 2,547 tons of waste according to site records. Both C&D landfill units were closed in accordance with the then current rules.

The Anderson Creek Landfill facility has an existing active C&D landfill unit (Phases I & II). This landfill unit initially received a permit to operate on April 17, 1997. Prior to that time, an unknown quantity of land clearing and inert debris (LCID) generated from Hurricane Fran (September 1996) was disposed of in this area.

Refer to **Drawing S1 (Attachment I)** of the permit application) which shows existing and proposed landfill units and solid waste management activities.

Transfer Station

The Anderson Creek Landfill facility has a transfer station for transfer of MSW to a regional landfill (currently the Waste Industries Sampson County Disposal Landfill; backup is Johnston County MSW Landfill). This facility received a permit to construct and operate on February 27, 2007 and was subsequently constructed. Operation of the transfer station began in December 2007.

Prior to the operation of the current transfer station, a transfer station was operated at the site of the current convenience center. This transfer station was permitted and operated under Solid Waste Permit No. 43-05T.

6. Property Information:

The current landfill facility boundary includes the following properties owned by Harnett County:

Deed Book Information*:		Acreage
Deed Book	Pages	
621	166-167	58.00**
879	316-317	77.96
880	48-49	85.30
932	630-631	2.00
Total Acreage:		223.26

*Reference: Harnett County Register of Deeds website: (<http://rod.harnett.org/>)

** Acreage from map prepared by Bennett Surveys, Inc. (recorded in Plat Book 2004 Page 896). This acreage was a correction of that shown on the deed (59.65 acres).

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Facility and Engineering Plan

Harnett County Anderson Creek Landfill Facility Harnett County, North Carolina

Prepared for:

**Harnett County Solid Waste Department
Lillington, North Carolina**

January 2014

NC LIC. NO. C-0828 (ENGINEERING)

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Harnett County Anderson Creek Landfill Facility Harnett County, North Carolina

Facility and Engineering Plan

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1.0 INTRODUCTION

Harnett County, North Carolina (County) currently owns and operates the Anderson Creek Landfill facility at 1086 Poplar Drive in Spring Lake. Access for the facility is and will continue to be off of Poplar Drive. The facility is permitted for the disposal of construction and demolition debris (C&D) and the transfer of municipal solid waste (MSW) under Solid Waste Permit Nos. 43-03 (C&D Landfill) and 43-09T (Transfer Station). The County also conducts several other solid waste management activities at the facility. Refer to **Drawing S1 (Existing Conditions) (Attachment I)** which shows the existing conditions and **Section 2.1**, which describes facility services.

The Phases I & II C&D landfill unit currently occupies approximately 7.0 acres (waste footprint). This application includes plans for a small 0.4 acre extension (lateral expansion) of the current waste footprint as well as a vertical expansion (see **Drawings S2 and S3**). This additional capacity is anticipated to extend the life of the landfill until approximately mid to late 2014 (see calculations in **Appendix A**), which should allow the County sufficient time to re-assess long-term development of the landfill.

It is the intent of Harnett County to proceed with the construction of the lateral expansion upon approval of this application.

2.0 FACILITY SERVICES AND WASTE STREAM

2.1 Facility Services

Currently, the following activities or services are provided at the Harnett County Anderson Creek Landfill facility as shown on **Drawing S1 (Attachment I)**:

- Scales and scale house
- Maintenance building
- MSW transfer station
- Phases I and II C&D landfill
- Yard waste processing area
- White goods, scrap metal, and consumer electronics handling area; and
- Convenience center:
 - Small MSW loads
 - Recyclables
 - Used tires
 - Used vehicle oil filters
 - Automotive batteries
 - Pallets
 - Asphalt shingles.

2.2 Types of Waste

The Harnett County Anderson Creek Landfill facility accepts municipal solid waste (MSW) originating from residential, commercial, and industrial sources, construction and demolition debris (C&D) waste, and other wastes (i.e. white goods and tires). These wastes are segregated and directed to on-site facilities for disposal, transfer, or processing/handling area as described in **Section 2.5**.

2.3 Disposal Rates and Estimated Variances

Based on Solid Waste Management Annual Reports for the facility, the County disposed of an average of 11,660 tons per year (average of approximately 42 tons per day based on 280 days of operation per year) of C&D over the past five reporting years (FY 2008-09 through FY 2012-13). Minimum and maximum disposal quantities were 9,313 tons (FY 2008-09) and 16,204 tons (FY 2010-11), respectively. As documented during the prior local government approval process, the County has set a maximum disposal rate of 35,000 tons per year for the C&D landfill (average of 125 tons/day based on 280 operating days per year). For purposes of facility life expectancy calculations, a disposal rate of 15,000 tons per year is assumed.

2.4 Service Area

The landfill facility currently serves Harnett County.

2.5 Procedures for Waste Segregation

A brief description of procedures for waste segregation at the facility is as follows.

Wastes are segregated at the scale house. Operators at the scale house are trained to classify and segregate the waste stream. MSW and C&D wastes will be directed to the transfer station or C&D landfill unit, respectively. Yard wastes will be directed toward the yard waste processing area. Tires, white goods, and asphalt shingles will be directed to the appropriate processing/handling area where they will be temporarily stockpiled for collection by recycling contractors. Small loads and recyclables will be directed toward the citizen's convenience center.

Employees at the facility are trained in the safety procedures for the handling and detection of illegal waste. The screening of unacceptable waste will be done through the random checking of incoming loads by a County employee at the scale house and at the tipping area. When unacceptable waste is detected at the scale house, the load will be rejected and not permitted into the facility. If hazardous waste is found at the tipping area, identification of the truck or persons will be made (if possible) and documented, then the hazardous waste will be identified and placed in a hazardous waste container by appropriately trained personnel and taken to a designated hazardous waste staging area

for proper disposal. If this occurs, the event will be reported to the appropriate authorities.

Refer also to the facility Operations Manual (**Attachment E**) for more information.

2.6 Equipment Requirements

The County will maintain on-site equipment required to perform the necessary landfill activities. Periodic maintenance of all landfilling equipment and minor and major repair work will be performed at designated maintenance zones.

3.0 LANDFILL CAPACITY

3.1 Total Operating Capacity and Life Expectancy

Drawing S2 (Subgrade Extension Grading and Drainage Plan) and **Drawing S3** (Final Cover Grading and Drainage Plan), show subgrade and final cover grades, respectively, for the continued development of Phases I and II. The final cover side slopes will be at a 3H to 1V (maximum) slope, then transition at flatter slopes (5 to 8%) to the peak elevations.

The estimated gross and net operating capacities, life expectancies, and areas of existing and planned C&D landfill units are shown in **Table 1**. The net capacity for waste and corresponding life expectancy accounts for periodic cover and/or final cover. As noted in **Section 2.3**, life expectancies were calculated based on a disposal rate of 15,000 tons per year.

3.2 In-Place Ratio of Waste to Soil and Compaction Factor

The capacities obtained above were based on a 10 percent periodic cover ratio and a compaction factor of 1,000 pounds per cubic yard (pcy) which are typical for C&D landfills.

Note that changes in landfill operations (i.e. changes in compaction equipment/methods) may affect the values assumed above and, thus, alter the life of the landfill.

4.0 AVAILABLE SOIL RESOURCES AND REQUIRED SOIL QUANTITIES

4.1 Earthwork Quantities

The soils required to construct and operate the existing and planned C&D landfill units will be removed from on-site borrow sources. The soils removed during excavation of landfill units may be used for structural fill, periodic cover, final cover, and general fill. These excavation (cut) and structural fill (fill) volumes are shown in **Table 2**.

4.2 Periodic Cover

Assuming the previously mentioned periodic cover ratios, the required in-place volume for use as periodic cover during operations of the landfill is shown in **Table 2**.

4.3 Compacted Soil Barrier

On the basis of the 1.5-foot thick compacted soil barrier required for the landfill final cover, the in-place volume required is shown in **Table 2**.

4.4 Vegetative Soil Layer

On the basis of the 1.5-foot thick vegetative soil layer required for the landfill final cover, the in-place volume required for each landfill unit is shown in **Table 2**.

4.5 Soil Summary

The above soil quantities are summarized in **Table 2**. On-site borrow sources are anticipated to have an adequate supply of soil to meet these needs.

5.0 FACILITY DESIGN CRITERIA

Existing and proposed C&D landfill units were and will be constructed in accordance with Section .0540 of the North Carolina Administrative Code, Title 15A, Chapter 13, Subchapter 13B including the following requirements:

5.1 Horizontal Separation Requirements

The horizontal separation requirement between the disposal boundary (edge of waste) and the property lines is a minimum of 200 feet; the minimum buffer between private residences and wells and the disposal boundary is 500 feet; and the minimum buffer between any surface water (stream, river, creek) and the disposal boundary is 50 feet. The proposed design satisfies all buffer requirements.

5.2 Vertical Separation Requirements

The post-settlement bottom elevation of the landfill subgrade will meet the minimum requirement of four (4) feet above the seasonal high groundwater table and bedrock.

6.0 CONTAINMENT AND ENVIRONMENTAL CONTROL SYSTEMS

The following systems and elements are the basic containment and environmental controls for the C&D landfill unit. Technical specifications and construction quality assurance requirements can be found in **Attachments C and D**, respectively.

6.1 Landfill Subgrade and Perimeter Berms

The landfill subgrade elevations will be achieved by excavation or placement of compacted structural fill (embankment). During excavation, a determination of unsuitable soils (i.e. soils which are too soft, wet, or organic) will be made. Where unsuitable soils are found, the soils will be undercut and backfilled with structural fill.

In addition to providing the liner foundation in fill areas, structural fill will be used for berm and roadway construction. Structural fill will consist of on site soils removed during excavation of the landfill units or imported borrow soils, except that no CH, OL, or OH soils will be allowed.

Per State rules, the upper 2 feet of the landfill subgrade must consist of SC, SM, ML, CL, MH, or CH soils (per Unified Soil Classification System). Verification of this requirement will be performed during construction.

6.2 Final Cover System

The final cover system for Phases I and II will consist of the following components (top-down):

Regulatory Final Cover System (.0543 (c) (2)):

- an 18-inch thick vegetative soil layer; and
- an 18-inch thick soil liner with a hydraulic conductivity (k) of no more than 1×10^{-5} cm/sec ("compacted soil barrier").

6.3 Erosion and Sedimentation Control

Erosion and sedimentation control devices/measures are/will be designed and maintained to manage the run-off generated by the 25-year 24-hour storm event and conform to the requirements of the North Carolina Sedimentation Pollution Control Law (15A, NCAC, 4).

6.4 Landfill Gas Control

The landfill gas (LFG) control system for Phases I & II will consist of wells and/or vents placed within the waste to capture the gas and passively vent the gas. Wells and/or vents will be placed in conjunction with the final cover system.

6.5 Access and Roadways

The facility is accessed from Poplar Drive. A scale and a scale house are located near this entrance. **Drawing S2** (Existing Conditions) shows this infrastructure.

All-weather access to active areas as well as areas under intermediate cover will be provided. Access roads into the landfill units will be provided where necessary.

7.0 **SLOPE STABILITY AND SETTLEMENT**

An evaluation of the slope stability of the overall waste mass as well as an evaluation of foundation settlement is addressed in **Appendix A**. These analyses indicate that the proposed landfill configuration will satisfy applicable regulatory criteria.

Table 1 Total Operating Capacity and Life Expectancy

Unit	Area (Ac.)	Capacity (See Note 1)		Life Expectancy (Years)
		Gross (CY)	Net (CY/Tons)	
Phases I & II (Filled) (as of July 16, 2013)	7.0	461,978	392,681 CY 161,032 Tons	-----
Phases I & II – Extension	0.4	72,687	33,184 CY 16,592 Tons	1.1 (See Note 2)
Totals:	7.4	534,665	425,865 CY 177,624 Tons	1.1

Notes:

1. The net capacity is based on an assumed 10% periodic cover soil ratio and waste density of 0.5 tons/CY.
2. Life expectancy is based on an assumed average disposal rate of 15,000 tons/year and is projected from July 16, 2013.

Table 2 Soil Summary - Phases I & II

Material	Quantity (CY) (See Note 1)
Excavation	1,349
Structural Fill	(2,324)
Periodic Cover	(3,687)
Compacted Soil Barrier	(17,908)
Vegetative Soil Layer	(17,908)
Total:	(40,478)

Notes:

1. Quantities estimated from July 16, 2013 and include 7.4 Acre footprint.

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Appendix A

Landfill Design Calculations

**Facility and Engineering Plan
Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

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Facility and Engineering Plan

Appendix A: Landfill Design Calculations

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- 1.0 Quantity Calculations
 - Capacity Evaluation (Density & Life Calcs.)
 - Earthwork Quantities
- 2.0 Slope Stability Evaluation
- 3.0 Settlement Evaluation

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ADDRESS

14 N. Boylan Avenue, Raleigh, NC 27603

TEL

919.828.0577

WEB

www.smithgardnerinc.com

PROJECT Harnett County AC C&DLF

SHEET 1 OF 5

DATE 11/12/2013

SUBJECT Capacity Evaluation (Density & Life)

JOB # HARNETT-AC-13-4

COMPUTED BY PKS

CHECKED BY _____

OBJECTIVE:

To determine the capacity of landfill units. Also, to estimate the expected life of the landfill unit(s) given the proposed contours and the anticipated waste loading rate(s). As part of the evaluation, an evaluation or estimate of waste density will be required based on the known or assumed percentage of periodic cover soil.

ANALYSIS:

The volume(s) will be calculated by using AutoCAD. Alternatively, the volume(s) will be calculated by taking cross sections of the landfill, using a planimeter to measure the area of the cross sections, and using the average end area method.

PROJECT Harnett County AC C&D Landfill - Phases I & II

SUBJECT Capacity Evaluation - Filling Rate & Density Calculations

SHEET 2/5

JOB # HARNETT-AC-13-4

DATE 11/12/2013

COMPUTED BY PKS

CHECKED BY _____

Density and Filling Rate Calculations:

Start Date	Period of Interest		Volume Filled (CY)	Quantity of Waste Disposed (Tons)		Waste Filling Rate* (PCY)	Periodic Cover		Waste Volume (CY)	Waste Density** (PCY)
	End Date	Total Time (Years)		Assumed %	Volume (CY)					
4/1/1997	7/16/2013	16.30	461,978	161,032	697	15	69,297	392,681	820	
Totals:		16.30	461,978	161,032			69,297	392,681	820	
Avg. Waste Density (PCY) =									820	

Notes:

*Waste Filling Rate = (Tons of Waste Disposed)/(Volume Filled).

**Waste Density = (Tons of Waste Disposed)/(Volume Filled - Volume of Periodic Cover).



PROJECT Harnett County AC C&D Landfill - Phases I & II
 SUBJECT Capacity Evaluation - Phases I & II Expansion

SHEET 3/5
 JOB # HARNETT-AC-13-4
 DATE 11/12/2013
 COMPUTED BY PKS
 CHECKED BY _____

Waste & Periodic Cover Parameters:

Waste Density (PCY) = 1,000 (Assumed)
 Waste Density (TCY) = 0.50
 Percentage of Periodic Cover = 10

Volume Calculations:

Volume From AutoCAD (CY) = 36,871 [7/16/13 Topo. to Top of Intermediate Cover]
 (= Expansion Volume)

Gross Capacity Remaining (Expansion Volume Plus Final Cover):

Adjustment For Other Layers:

Area of Waste Footprint (Acres) = 7.4

1.5 feet	Compacted Soil Barrier (CY) =	17,908
1.5 feet	Vegetative Soil Layer (CY) =	17,908

Sum (CY) = 35,816

Gross Capacity Remaining (CY) = 72,687

Net (Waste) Capacity:

Adjustment For Other Layers:

Area of Final Cover (Acres) = 7.4

1.5 feet	Compacted Soil Barrier (CY) =	(17,908)
1.5 feet	Vegetative Soil Layer (CY) =	(17,908)

Sum (CY) = (35,816)

Volume of Waste and Periodic Cover (CY) = 36,871

Volume of Periodic Cover (CY) = (3,687)

Net (Waste) Capacity (CY) = 33,184

Net (Waste) Capacity (Tons) = 16,592

Life Expectancy Calculations:

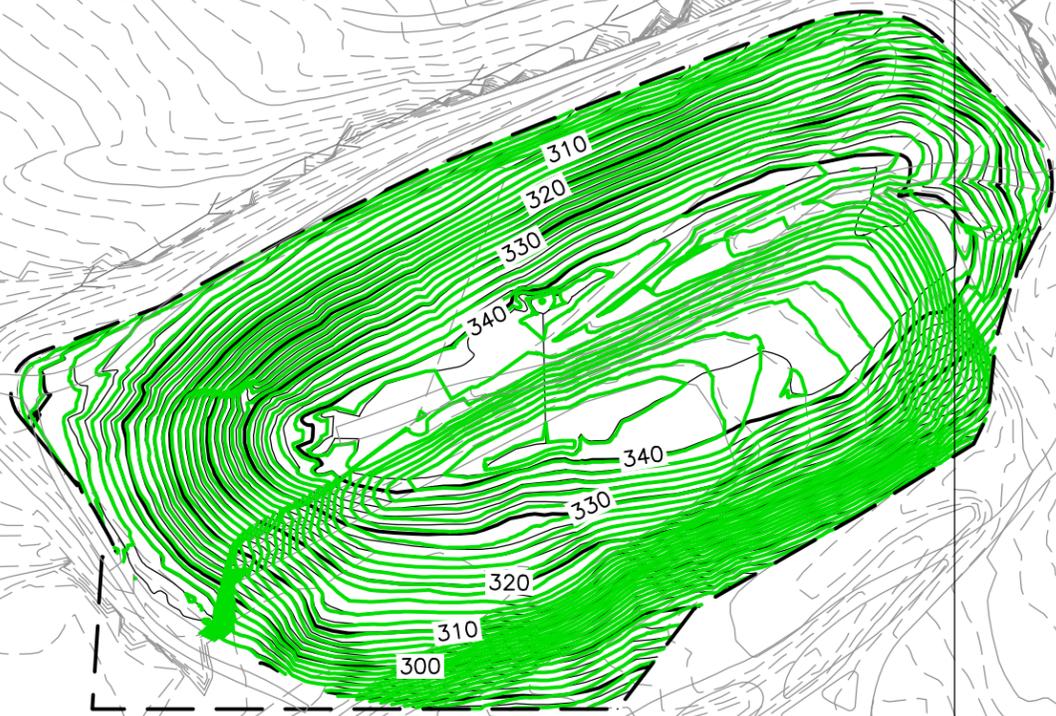
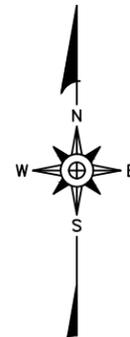
Start Time (Year)	End Time (Year)	Tons Disposed	Total Tons	Remainder
2013.54	2014	6,900	6,900	9,692
2014	2014.65	7,500	14,400	2,192

Based on 15,000 Tons per Year

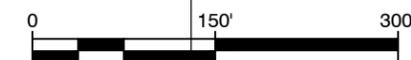
Landfill Life Expectancy (Years) = 1.1

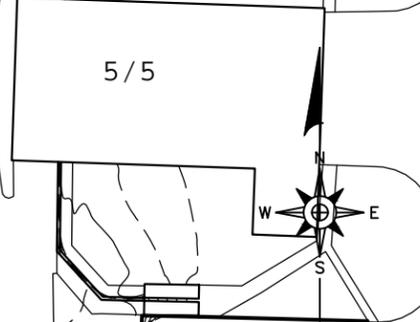
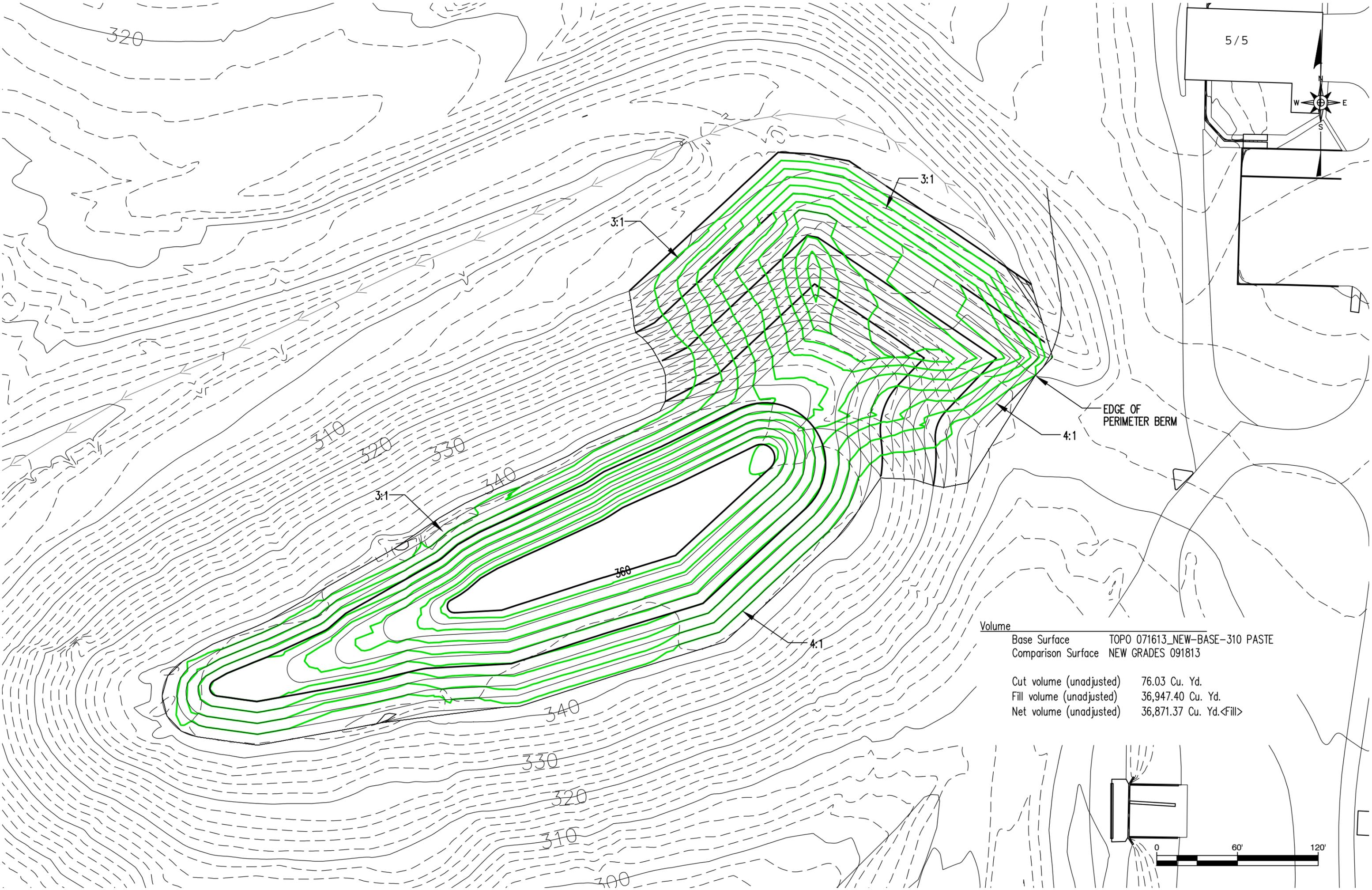
August 2014





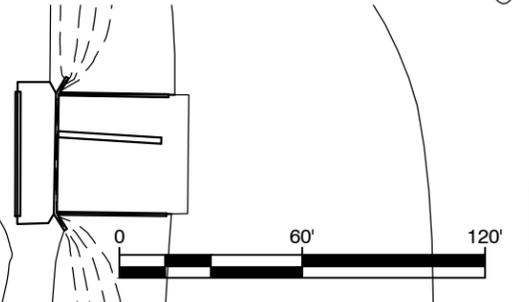
Volume	
Base Surface	PHASE I-II BASE COMPOSITE
Comparison Surface	TOPO 071613_PHASE I-II AREA
Cut volume (unadjusted)	0.94 Cu. Yd.
Fill volume (unadjusted)	461,979.15 Cu. Yd.
Net volume (unadjusted)	461,978.20 Cu. Yd.<Fill>





5/5

Volume	
Base Surface	TOPO 071613_NEW-BASE-310 PASTE
Comparison Surface	NEW GRADES 091813
Cut volume (unadjusted)	76.03 Cu. Yd.
Fill volume (unadjusted)	36,947.40 Cu. Yd.
Net volume (unadjusted)	36,871.37 Cu. Yd.<Fill>



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PROJECT Harnett County AC C&DLF - Ph. I & II

SHEET 1 OF 3

DATE 11/18/2013

SUBJECT Earthwork Quantities

JOB # HARNETT-AC-13-4

COMPUTED BY PKS

CHECKED BY _____

OBJECTIVE:

To determine the earthwork and related material quantities associated with the construction and operation of the landfill.

ANALYSIS:

The volumes of each material were calculated by taking design thicknesses and/or cross sections and multiplying by design areas and/or lengths. Areas and lengths were determined using AutoCAD, a planimeter, and/or direct measurement.

PROJECT Harnett County AC C&DLF - Phases I & II

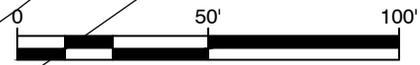
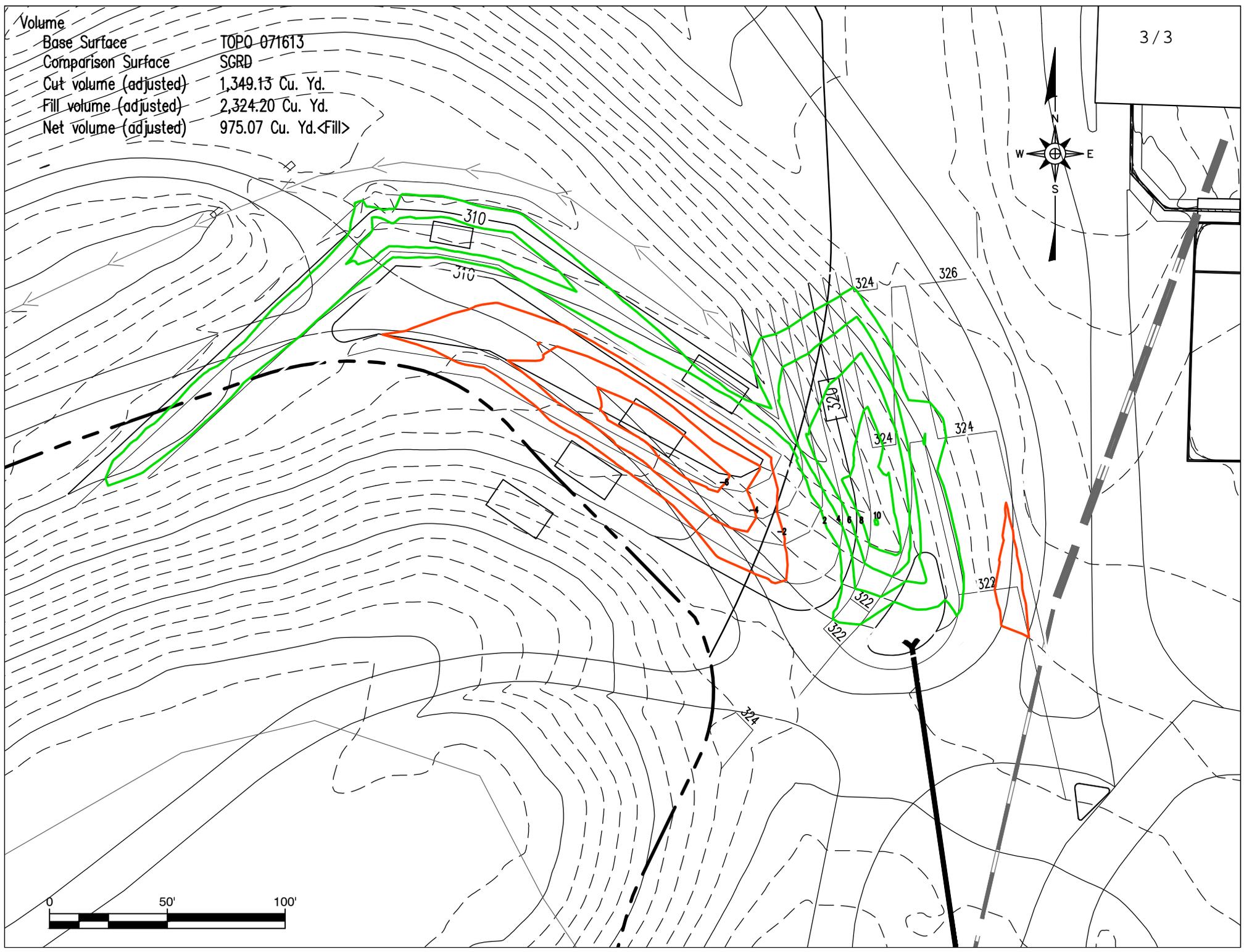
SUBJECT Earthwork Quantities - Summary

SHEET 2/3
 JOB # HARNETT-AC-13-4
 DATE 11/18/2013
 COMPUTED BY PKS
 CHECKED BY _____

Landfill Unit	Area (Acres)	General Earthwork			Periodic Cover (CY)	Compacted Soil Barrier (CY)	Vegetative Soil Layer (CY)	
		Cut (CY)	Fill (CY)					
Phases I & II	7.4	1,349	2,324		3,687	17,908	17,908	
Totals (CY) =	7.4	1,349	2,324		3,687	17,908	17,908	
Location (On-Site/Off-Site):		On-Site	On-Site		On-Site	On-Site	On-Site	
On-Site Soil Balance (CY) =							(40,478)	

SMITH+GARDNER

Volume
Base Surface TOPO 071613
Comparison Surface SGRD
Cut volume (adjusted) 1,349.13 Cu. Yd.
Fill volume (adjusted) 2,324.20 Cu. Yd.
Net volume (adjusted) 975.07 Cu. Yd.<Fill>



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PROJECT Harnett County AC C&DLF - Ph. I & IISHEET 1 OF 8DATE 11/18/2013SUBJECT Slope Stability EvaluationJOB # HARNETT-AC-13-4COMPUTED BY PKS

CHECKED BY _____

OBJECTIVE:

To perform a slope stability evaluation for the C&D landfill. Note that only static conditions were evaluated in that the landfill is not in a seismic impact zone ($a_{peak} = 0.098$). Based on EPA guidance for MSW landfills (EPA/600/R-95/051), landfills are required to have a minimum long-term static factor of safety of 1.5.

ANALYSIS:

The slope stability evaluations for the overall C&D landfill area were performed using the computer program STABL5M, a computer program developed by Purdue University.

The slope stability evaluation was performed on Cross Section A (reference Permit Drawings) which represents a worst case. The shear strength envelope assumed for the waste in this evaluation was cohesion = 500 psf and $\phi = 25$ degrees; which is believed to be conservative for C&D wastes. Also, the shear strength envelope assumed for the subgrade/berms in this evaluation was cohesion = 0 psf and $\phi = 20$ degrees; which is conservative as well. The result is as follows:

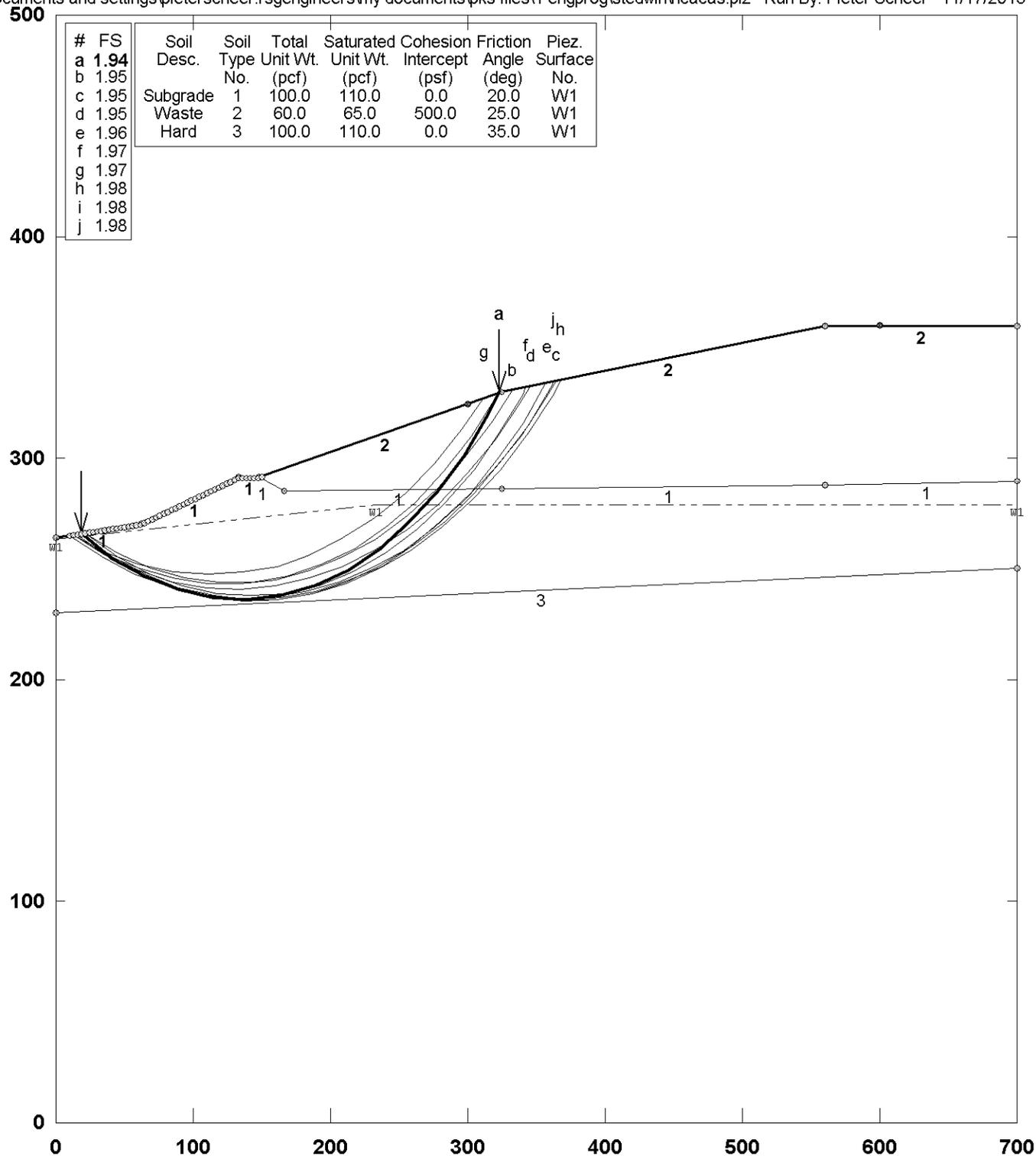
Circular Failure (Static): 1.94

RESULTS:

Based on the results of the evaluation (see attached), the minimum factor of safety satisfies EPA guidelines.

Harnett County AC C&DLF Section A Global Circular Static

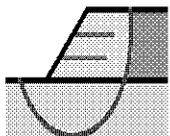
c:\documents and settings\pieterscheer.rsgengineers\my documents\pks files\1 engprog\stedwin\hcacas.pl2 Run By: Pieter Scheer 11/17/2013 11:56AM



#	FS	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
a	1.94							
b	1.95							
c	1.95	Subgrade	1	100.0	110.0	0.0	20.0	W1
d	1.95	Waste	2	60.0	65.0	500.0	25.0	W1
e	1.96	Hard	3	100.0	110.0	0.0	35.0	W1
f	1.97							
g	1.97							
h	1.98							
i	1.98							
j	1.98							

PCSTABL5M/si FSmin=1.94
 Safety Factors Are Calculated By The Modified Bishop Method

STED



**** PCSTABLE5M ****

by

Purdue University

--Slope Stability Analysis--

Simplified Janbu, Simplified Bishop

or Spencer`s Method of Slices

Run Date: 11/17/2013

Time of Run: 11:56AM

Run By: Pieter Scheer

Input Data Filename: C:HCACAS.

Output Filename: C:HCACAS.OUT
 Unit: ENGLISH
 Plotted Output Filename: C:HCACAS.PLT
 PROBLEM DESCRIPTION Harnett County AC C&DLF
 Section A Global Circular Static

BOUNDARY COORDINATES

6 Top Boundaries
 11 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	264.00	62.00	270.00	1
2	62.00	270.00	133.00	291.00	1
3	133.00	291.00	148.00	291.00	1
4	148.00	291.00	325.00	330.00	2
5	325.00	330.00	560.00	360.00	2
6	560.00	360.00	700.00	360.00	2
7	148.00	291.00	166.00	285.00	1
8	166.00	285.00	325.00	286.00	1
9	325.00	286.00	560.00	288.00	1
10	560.00	288.00	700.00	290.00	1
11	.00	230.00	700.00	250.00	3

ISOTROPIC SOIL PARAMETERS

3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	100.0	110.0	.0	20.0	.00	.0	1
2	60.0	65.0	500.0	25.0	.00	.0	1
3	100.0	110.0	.0	35.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 3 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	263.00
2	233.00	279.00
3	700.00	279.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
 2500 Trial Surfaces Have Been Generated.

50 Surfaces Initiate From Each Of 50 Points Equally Spaced
 Along The Ground Surface Between X = 10.00 ft.
 and X = 150.00 ft.

Each Surface Terminates Between X = 300.00 ft.
 and X = 600.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is Y = 200.00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
 Failure Surfaces Examined. They Are Ordered - Most Critical
 First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	18.57	265.80
2	41.09	254.93
3	64.61	246.48
4	88.90	240.53
5	113.67	237.15
6	138.65	236.37
7	163.59	238.21
8	188.19	242.64
9	212.20	249.62

10	235.34	259.07
11	257.38	270.89
12	278.05	284.94
13	297.15	301.07
14	314.46	319.11
15	322.48	329.44

Circle Center At X = 133.6 ; Y = 475.3 and Radius, 239.0

*** 1.935 ***

Slice No.	Width (ft)	Weight (lbs)	Individual data on the		22 slices		Earthquake		Surcharge Load (lbs)
			Water Force Top	Water Force Bot	Tie Force Norm	Tie Force Tan	Force Hor	Force Ver	
			(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	
1	2.8	220.8	.0	.0	.0	.0	.0	.0	.0
2	19.8	15536.7	.0	7434.4	.0	.0	.0	.0	.0
3	20.9	40456.2	.0	21254.2	.0	.0	.0	.0	.0
4	2.6	6661.1	.0	3528.5	.0	.0	.0	.0	.0
5	24.3	80934.3	.0	38545.8	.0	.0	.0	.0	.0
6	24.8	113657.5	.0	48428.0	.0	.0	.0	.0	.0
7	19.3	105842.9	.0	41688.7	.0	.0	.0	.0	.0
8	5.7	32865.0	.0	12632.5	.0	.0	.0	.0	.0
9	9.3	54095.9	.0	21073.4	.0	.0	.0	.0	.0
10	15.6	88772.0	.0	35087.5	.0	.0	.0	.0	.0
11	2.4	13543.9	.0	5477.4	.0	.0	.0	.0	.0
12	22.2	122653.9	.0	48449.6	.0	.0	.0	.0	.0
13	24.0	126046.2	.0	47643.8	.0	.0	.0	.0	.0
14	20.8	98128.6	.0	34152.9	.0	.0	.0	.0	.0
15	2.3	10217.3	.0	3222.2	.0	.0	.0	.0	.0
16	22.0	84225.6	.0	21872.1	.0	.0	.0	.0	.0
17	11.9	35290.1	.0	3654.3	.0	.0	.0	.0	.0
18	8.7	20549.6	.0	.0	.0	.0	.0	.0	.0
19	.9	1904.2	.0	.0	.0	.0	.0	.0	.0
20	18.2	31058.1	.0	.0	.0	.0	.0	.0	.0
21	17.3	16281.2	.0	.0	.0	.0	.0	.0	.0
22	8.0	2060.5	.0	.0	.0	.0	.0	.0	.0

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	12.86	265.24
2	36.34	256.66
3	60.47	250.12
4	85.07	245.67
5	109.96	243.35
6	134.96	243.18
7	159.88	245.16
8	184.54	249.26
9	208.76	255.47
10	232.35	263.74
11	255.15	274.00
12	276.98	286.18
13	297.69	300.18
14	317.12	315.92
15	332.77	330.99

Circle Center At X = 124.5 ; Y = 534.0 and Radius, 291.0

*** 1.949 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	10.00	264.97
2	33.10	255.40
3	56.89	247.73
4	81.23	242.03
5	105.96	238.33
6	130.90	236.65

7	155.90	237.00
8	180.78	239.38
9	205.39	243.78
10	229.57	250.17
11	253.14	258.50
12	275.95	268.72
13	297.86	280.76
14	318.72	294.54
15	338.39	309.97
16	356.74	326.95
17	364.13	334.99

Circle Center At X = 139.1 ; Y = 543.8 and Radius, 307.2
 *** 1.949 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	12.86	265.24
2	36.20	256.29
3	60.21	249.33
4	84.72	244.40
5	109.56	241.56
6	134.55	240.80
7	159.51	242.15
8	184.27	245.59
9	208.66	251.09
10	232.50	258.62
11	255.62	268.12
12	277.86	279.54
13	299.07	292.77
14	319.09	307.75
15	337.79	324.35
16	345.68	332.64

Circle Center At X = 130.9 ; Y = 537.6 and Radius, 296.9
 *** 1.951 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	15.71	265.52
2	38.56	255.36
3	62.21	247.25
4	86.48	241.25
5	111.18	237.41
6	136.12	235.75
7	161.12	236.30
8	185.97	239.03
9	210.48	243.94
10	234.47	250.99
11	257.74	260.12
12	280.12	271.26
13	301.44	284.32
14	321.52	299.21
15	340.22	315.80
16	357.39	333.97
17	357.54	334.15

Circle Center At X = 142.5 ; Y = 519.8 and Radius, 284.1
 *** 1.958 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.43	266.07
2	44.24	255.84
3	67.92	247.81
4	92.25	242.07
5	117.01	238.67

6	141.99	237.63
7	166.96	238.97
8	191.68	242.67
9	215.94	248.70
10	239.52	257.00
11	262.21	267.51
12	283.79	280.12
13	304.09	294.73
14	322.90	311.19
15	340.06	329.37
16	342.28	332.21

Circle Center At X = 140.4 ; Y = 500.4 and Radius, 262.8
 *** 1.968 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	12.86	265.24
2	36.66	257.61
3	61.04	252.06
4	85.81	248.65
5	110.77	247.40
6	135.76	248.32
7	160.57	251.40
8	185.02	256.61
9	208.92	263.93
10	232.10	273.29
11	254.39	284.63
12	275.60	297.85
13	295.59	312.87
14	311.34	326.99

Circle Center At X = 112.7 ; Y = 535.1 and Radius, 287.7
 *** 1.970 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	15.71	265.52
2	38.70	255.69
3	62.43	247.81
4	86.73	241.93
5	111.43	238.09
6	136.37	236.32
7	161.36	236.63
8	186.25	239.02
9	210.85	243.47
10	235.00	249.95
11	258.52	258.41
12	281.26	268.80
13	303.05	281.05
14	323.75	295.07
15	343.21	310.76
16	361.30	328.02
17	367.93	335.48

Circle Center At X = 145.2 ; Y = 536.5 and Radius, 300.3
 *** 1.975 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.43	266.07
2	44.77	257.13
3	68.86	250.42
4	93.47	246.02
5	118.38	243.96
6	143.38	244.26
7	168.24	246.92

8	192.73	251.91
9	216.65	259.19
10	239.77	268.70
11	261.90	280.34
12	282.82	294.02
13	302.36	309.62
14	320.34	326.99
15	322.44	329.44

Circle Center At X = 127.7 ; Y = 508.4 and Radius, 264.6
 *** 1.975 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	18.57	265.80
2	41.49	255.80
3	65.18	247.83
4	89.48	241.93
5	114.19	238.16
6	139.14	236.53
7	164.13	237.07
8	188.99	239.77
9	213.51	244.60
10	237.53	251.54
11	260.86	260.53
12	283.32	271.50
13	304.76	284.37
14	325.00	299.04
15	343.89	315.41
16	361.30	333.35
17	362.47	334.78

Circle Center At X = 145.4 ; Y = 525.4 and Radius, 288.9
 *** 1.978 ***

PROJECT Harnett County AC C&DLF - Ph. I & II

SHEET 1 OF 8

DATE 11/14/2013

SUBJECT Foundation Settlement Evaluation

JOB # HARNETT-AC-13-4

COMPUTED BY PKS

CHECKED BY _____

OBJECTIVE: To estimate the total foundation settlement due to the weight of the planned waste loads. A worst-case point (maximum waste load) was assumed.

REFERENCES: Holtz, R.D., & Kovacs, W.D. (1981), An Introduction To Geotechnical Engineering, Prentice-Hall, Englewood Cliffs, NJ, Chapters 8 and 9.

Ohio EPA - Geotechnical Resource Group (2004), "Geotechnical and Stability Analyses for Ohio Waste Containment Facilities", Ohio EPA, Columbus, Ohio, Chapter 6.

Quian, X., Koerner, R.M., & Gray, D.H. (2001), Geotechnical Aspects of Landfill Design and Construction, Prentice Hall, Upper Saddle River, N.J., pp. 310, 469-473.

ASSUMPTIONS:

1. Vertical stresses acting on the liner are assumed to be one-dimensional (1-D).
2. Assumptions for soil properties are listed in the attached spreadsheet.

ANALYSIS: The following approach is used to perform the evaluation:

1. Identify the critical cross section(s) to be evaluated (maximum waste fill, minimum liner slopes, etc.).
2. Select points along each cross section to perform calculations (points of grade breaks in final cover and/or liner system).
3. For each calculation point, determine the subsurface profile beneath the liner system and separate into distinct layers (thickness and material properties) (Include structural fill where applicable).
4. For each calculation point, determine the stresses acting on the midpoint of each layer both before and after liner construction.
5. For each calculation point, determine the stress change at the liner. Take into account the stress decrease due to excavation (where applicable) and the stress increase due to waste loads.
6. Calculate elastic settlements for each granular soil layer using the equations below.
7. Calculate consolidation (primary and secondary) settlements for each clay/silt soil layer using the equations below.
8. Calculate total settlements at each calculation point and resulting post-settlement slopes and liner strain between each point. Verify that slopes meet or exceed the minimum allowable slope. Verify that tensile strains do not exceed allowable values.

CALCULATIONS:

- Elastic Settlement Equation:

$$S_e = \frac{\Delta p}{M_s} H$$

where: S_e = elastic settlement (ft)
 Δp = net stress change acting on middle of soil layer (psf)
 M_s = constrained modulus of soil (psf)

$$M_s = \frac{E_s(1 - \nu_s)}{(1 + \nu_s)(1 - 2\nu_s)}$$

E_s = elastic modulus of soil (psf)
 ν_s = Poisson's ratio of soil
 H = initial thickness of soil layer (ft)

- Primary Consolidation Settlement Equations:for $p'_o + \Delta p \geq p'_{mp}$

$$S_c = H \left(C_{re} \log \frac{p'_{mp}}{p'_o} + C_{ce} \log \frac{p'_o + \Delta p}{p'_{mp}} \right)$$

for $p'_o + \Delta p < p'_{mp}$

$$S_c = H \left(C_{re} \log \frac{p'_o + \Delta p}{p'_o} \right)$$

where:

- S_c = primary consolidation settlement (ft)
- H = initial thickness of soil layer (ft)
- p'_{mm} = maximum past consolidation pressure (psf)
- p'_o = effective vertical stress in middle of soil layer after excavation, but before loading (psf)
- Δp = net stress change acting on middle of soil layer (psf).
- C_{re} = modified recompression index

$$C_{re} = \frac{C_r}{1 + e_o}$$

C_{ce} = modified primary compression index

$$C_{ce} = \frac{C_c}{1 + e_o}$$

- C_r = recompression index
- C_c = primary compression index
- e_o = initial void ratio

- Secondary Consolidation Settlement Equation:

$$S_s = C_{se} H \log \frac{t_s}{t_{pf}}$$

where:

- S_s = secondary consolidation settlement (ft)
- C_{se} = modified secondary compression index
- H = initial thickness of soil layer (ft)
- t_s = time over which secondary settlement is to be calculated (typ. this is a max. of 100 years plus the max. time to complete primary consolidation) (years)
- t_{pf} = time to complete primary consolidation (years)

$$t_{pf} = \frac{T_v * H_t^2}{C_v}$$

T_v = dimensionless time factor associated with the time it takes for primary consolidation settlement to be completed

$$\text{For } U < 60\%: T_v = \frac{\pi}{4} \left(\frac{U\%}{100} \right)^2$$

$$\text{For } U \geq 60\%: T_v = 1.781 - 0.933 \log(100 - U\%)$$

H_t = maximum length of drainage in the consolidating layer (= H for single-drained; = 0.5H for double-drained)

C_v = coefficient of consolidation (ft²/year)

U = percent of primary consolidation (%) (typ. max. is 99.999; results in $T_v = 4.58$)

PROJECT Harnett County AC C&DLF - Ph. I & II

SHEET 3 OF 8

DATE 11/14/2013

SUBJECT Foundation Settlement Evaluation

JOB # HARNETT-AC-13-4

COMPUTED BY PKS

CHECKED BY 0

- Total Settlement Equation:

$$S_{Total} = S_e + S_c + S_s$$

where: S_{Total} = total settlement (ft)
 S_e = elastic settlement (ft)
 S_c = primary consolidation settlement (ft)
 S_s = secondary consolidation settlement (ft)

- Liner Strain Equation:

$$E_T = \frac{L_f - L_o}{L_o} \times 100$$

where: E_T = total strain (%) ["+" = tension; "-" = compression]
 L_o = original distance separating two adjacent calculation points (ft)
 L_f = final distance separating two adjacent calculation points after settlement is complete (ft)

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PROJECT Harnett County AC C&DLF - Phases I & II
 SUBJECT Settlement Analysis - Worst Case Point

SHEET 4/8
 JOB # HARNETT-AC-13-4
 DATE 11/14/2013
 COMPUTED BY PKS
 CHECKED BY _____

Soils Information: (Note: When elastic or consolidation settlement is not applicable to a particular layer, enter "NA" for requested parameters.)

Soil Layer	Description	Dry Unit Wt. (pcf)	Natural Moisture Content (%)	Wet Unit Wt. (pcf)	Elastic Settlement Parameters			Consolidation Settlement Parameters			
					E _s (psf)	n _s	M _s (psf)	OCR	C _{ce}	C _{re}	C _{se}
1	Clayey Sand w/ Interbedded Clay V. Stiff Clay (V. Low Compressibility)	110.0	15.0	126.5	200,000	0.00	200,000	NA	NA	NA	NA
2											

Waste Information:

Average Unit Weight, γ_{Waste} (pcf) = 50 Waste and Soil Cover

Assumptions:

Es (Silty Sand): E_s (kPa) = 320 (N₅₅ + 15) (Bowles Table 5-5)* where N₇₀ = 12 bpf and N₅₅ = 70/55 x N₇₀ = 15; 1 kPa = 20.89 psf
 Poisson's Ratio (Silty Sand): 0.3

* Bowles, J.E. (1988), *Foundation Analysis and Design*, McGraw-Hill, Inc., page 266.



Stress Change, Δp , at Liner:

Parameter	Point											
	1	2	3	4	5	6	7	8	9	10	11	12
Stress Decrease From Excavation (psf) =	1,200											
Stress Increase From Waste Load (psf) =	3,750											
Net Stress Increase/Decrease, Δp (psf) =	2,550											

Elastic Settlement:

Parameter	Point											
	1	2	3	4	5	6	7	8	9	10	11	12
Elastic Settlement (ft):												
Layer 1: $S_e =$	0.26											
Total Elastic Settlement (ft) =	0.26											

Elastic Settlement Equation:

$$S_e = \frac{\Delta p}{M_s} H$$

Primary Consolidation Settlement:

Parameter	Point											
	1	2	3	4	5	6	7	8	9	10	11	12
Primary Consolidation Settlement (ft):												
Layer 1: $S_c =$	NA ---											
Total Primary Consol. Settlement (ft) =	0.00											

Primary Consolidation Settlement Equations:

For primary recompression and compression (designated C):

$$S_c = H \left(C_{re} \log \frac{p'_{mp}}{p'_o} + C_{ce} \log \frac{p'_o + \Delta p}{p'_{mp}} \right)$$

For primary recompression only (designated R):

$$S_c = H \left(C_{re} \log \frac{p'_o + \Delta p}{p'_o} \right)$$

PROJECT Harnett County AC C&DLF - Phases I & II
 SUBJECT Settlement Analysis - Worst Case Point

SHEET 8/8
 JOB # HARNETT-AC-13-4
 DATE 11/14/2013
 COMPUTED BY PKS
 CHECKED BY _____

Total Settlement:

Parameter	Point												
	1	2	3	4	5	6	7	8	9	10	11	12	
Total Settlement (ft):													
Layer 1: $S_{Total} =$	0.26												
Total Settlement (ft) =	0.26												

Total Settlement Equation:

$$S_{Total} = S_e + S_c + S_s$$

Liner Slopes & Liner Strain:

Parameter	Point												
	1	2	3	4	5	6	7	8	9	10	11	12	
Before Settlement:													
Top of Subgrade Elevation (ft) =	285.0												
After Settlement:													
Top of Subgrade Elevation (ft) =	284.7												
Comments:													

Liner Strain Equation:

$$E_r = \frac{L_f - L_o}{L_o} \times 100$$



Technical Specifications

Harnett County Anderson Creek Landfill Facility Harnett County, North Carolina

Prepared for:

Harnett County Solid Waste Department
Lillington, North Carolina

January 2014

NC LIC. NO. C-0828 (ENGINEERING)

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**Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

Technical Specifications

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SECTION 02110

SITE PREPARATION

Site Preparation: Site Preparation includes clearing, grubbing, and stripping operations which precede the proposed construction.

A. Description

1. General:

- a. The Contractor shall furnish all labor, material, and equipment to complete Site Preparation in accordance with the Contract Drawings and these Specifications.
- b. Principal items of work include:
 1. Notifying all authorities owning utility lines running to or on the property. Protect and maintain all utility lines to remain and cap those that are not required in accordance with instructions of the Utility Companies, and all other authorities having jurisdiction.
 2. Clearing the site within the clearing limits, including removal of grass, brush, shrubs, trees, loose debris, and other encumbrances except for trees to remain.
 3. Boxing and protecting all areas to be preserved.
 4. Removing all topsoil from designated areas and stockpiling on site where directed by the Engineer for future use.
 5. Disposing from the site all debris resulting from work under this Section.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Excavation	02222
Embankment	02223

B. Materials Not Used.

C. Submittals Not Used.

D. Construction

1. Clearing of the Site:

- a. Clearing limits, as shown on the Contract Drawings, shall be established by the Contractor's Surveyor. Once established, the clearing limits shall be inspected and approved by the Engineer prior to clearing the affected areas.
- b. Before removal of topsoil, and start of excavation and grading operations, the areas within the clearing limits shown on the Contract Drawings shall be cleared and grubbed.
- c. Clearing shall consist of cutting, removal, and satisfactory disposal of all trees, fallen timber, brush, bushes, rubbish, fencing, and other perishable and objectionable material.

Should it become necessary to remove a tree, bush, brush, or other plants outside the clearing limits, the Contractor shall do so only after permission has been granted by the Engineer.

- d. Excavation resulting from the removal of trees, roots, and the like shall be filled with suitable material, as approved by the Engineer, and thoroughly compacted per the requirements contained in Section 02223, Embankment, of these Specifications.
- e. In temporary construction easement locations, only those trees and shrubs shall be removed which are in actual interference with excavation or grading work under this Contract, and removal shall be subject to approval by the Engineer. However, the Engineer reserves the right to order additional trees and shrubs removed at no additional cost to the Owner, if such, in his opinion, they are too close to the work to be maintained or have become damaged due to the Contractor's operations.

2. Stripping and Stockpiling Existing Topsoil:

- a. Existing topsoil and sod on the site within areas designated on the Contract Drawings shall be stripped to whatever depth it may occur, and stored in locations directed by the Engineer.
- b. The topsoil shall be free of stones, roots, brush, rubbish, or other unsuitable materials before stockpiling.
- c. Care shall be taken not to contaminate the stockpiled topsoil with any unsuitable materials.

3. Grubbing:

- a. Grubbing shall consist of the removal and disposal of all stumps, roots, logs, sticks, and other perishable materials to a depth of at least 6 inches below ground surfaces.

- b. Large stumps located in areas to be excavated may be removed during grading operations, subject to the approval of the Engineer.

4. Disposal of Cleared and Grubbed Material:

No open burning of clearing debris will be allowed on this project. Air curtain burning will be allowed only by permit if permitted or approved by State Solid Waste and Air Quality regulators and the local Fire Department and in accordance with 15A NCAC 02D.1904 (Air Curtain Burners). Any material other than plant growth shall not be burned. Otherwise, all trees, stumps, roots, bushes, etc. shall be removed from the site and disposed of by the Contractor.

END OF SECTION

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SECTION 02222

EXCAVATION

Excavation: Excavation includes excavating, sealing, hauling, scraping, undercutting, removal of accumulated surface water or ground water, stockpiling, and all necessary and incidental items as required for bringing the landfill and related structures to the specified lines and grades.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment required to complete Excavation of the project area in accordance with the Contract Drawings and these Specifications, except as noted below:

- a. Clearing and grubbing and removal of topsoil is addressed in Section 02110, Site Preparation, of these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Site Preparation	02110
Embankment	02223
Erosion and Sedimentation Control	02270
CQA Manual	Attached

3. Quality Assurance:

Quality Assurance during Excavation will be provided by the Owner as described in the accompanying Project CQA Manual.

4. Definitions:

- a. Excavation: shall consist of the removal and satisfactory disposal and/or stockpiling of all materials (borrow and/or unsuitable materials included) located within the limits of construction including widening cuts and shaping of slopes necessary for the preparation of roadbeds, slope areas, cutting of any ditches, channels, waterways, entrances, and other work incidental thereto.
- b. Borrow: shall consist of approved on-site material required for the construction of embankments/fills or for other portions of the work.
- c. Select Borrow (Where Applicable): shall consist of approved off-site material required for the construction of embankments/fills, roadway subgrade, backfilling, or for other portions of the work as shown on Contract Drawings or in

these Specifications. The Contractor shall make his own arrangements for obtaining select borrow and pay all costs involved.

- d. Unsuitable Material: is any in-place or excavated material which contains undesirable materials or is in a state which is not appropriate, in the opinion of the CQA Engineer, for the intended use or support of planned structures, embankment, or excavation. This may include but not be limited to organic material, waste/refuse, soft, or wet material not meeting required specifications, etc.
- e. Unsuitable Material Overexcavation: shall consist of the removal and satisfactory disposal of all unsuitable material located within the limits of construction and below subgrade elevations shown or indicated on the Contract Drawings. Where excavation to the subgrade elevations results in a subgrade or slopes of unsuitable material, the Contractor shall overexcavate such material to below the grades shown or indicated on the Contract Drawings or as otherwise directed by the Engineer and CQA Engineer.

B. Materials

Excavation shall include the removal of all soil, weathered rock, boulders, conduits, pipe, unsuitable material, and all other obstacles encountered and shown or indicated on the Contract Drawings and/or specified herein.

C. Submittals Not Used.

D. Construction

- 1. The Contractor shall conduct Excavation activities in such a manner that erosion of disturbed areas and off site sedimentation is absolutely minimized as outlined in Section 02270, Erosion and Sedimentation Control, of these Specifications.
- 2. The Contractor shall excavate to the lines and grades shown on the Contract Drawings and stockpile all suitable excavated materials. As the excavation is made, the materials will be examined and identified to the CQA Engineer.

The Contractor will perform all surveys necessary to establish and verify lines and grades for all Excavation, including pipe excavations, soil overexcavation, and anchor trenches.

3. Stockpiling:

The Contractor shall stockpile the materials in appropriate stockpiles as approved by the CQA Engineer. The Contractor shall use equipment and methods as necessary to maintain the moisture content of soils stockpiled (excluding topsoil) at or near their optimum moisture content.

Stockpiles shall be properly sloped and the surfaces sealed by the Contractor at the end of each working day, or during the day in the event of heavy rain, to the satisfaction of the Engineer.

4. The Contractor shall protect all existing facilities and structures including, but not limited to, existing utilities, monitoring wells, signs, grade stakes, etc. during the grading and stockpiling operations.
5. All excavations shall be made in the dry and in such a manner and to such widths as will give ample room for properly constructing and inspecting the structures and/or piping they are to contain and for such sheeting, timbering, pumping, and drainage as may be required.
6. The Contractor shall be responsible for the control of surface and subsurface water when necessary. Except for certain erosion and sedimentation control measures and other areas designated to impound water, all areas shall be graded to drain.
7. Excavation slopes shall be flat enough to avoid sloughs and slides that will cause disturbance of the subgrade or damage of adjacent areas. Slides and overbreaks which occur due to negligence, carelessness, or improper construction techniques on the part of the Contractor shall be removed and disposed of by the Contractor as directed by the Engineer at no additional cost to the Owner.
8. The intersection of slopes with natural ground surfaces, including the beginning and ending of cut slopes, shall be uniformly rounded. All protruding roots and other vegetation shall be removed from slopes.
9. The bottom of all excavations for structures and pipes shall be examined by the CQA Engineer for bearing value and the presence of unsuitable material. If, in the opinion of the CQA Engineer, additional Excavation is required due to the low bearing value of the subgrade material, or if the in-place materials are soft, yielding, pumping and wet, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted structural fill, or material directed by the CQA Engineer. No payment will be made for subgrade disturbance caused by inadequate Dewatering or improper construction methods.
10. Any areas excavated below design subgrade elevations by the Contractor, unless directed by the CQA Engineer, shall be brought back to design elevations at no cost to the Owner. The Contractor shall place and compact such material in accordance with Section 02223, Embankment, of these Specifications.
11. The Contractor shall dispose of excess or unsuitable excavation materials on-site at location(s) approved by the Owner.
12. The Contractor shall properly level-off bottoms of all excavations. Proof-rolling shall be conducted with appropriate equipment.
13. Upon reaching subgrade elevations shown in excavation areas, the Contractor shall scarify subgrade soils to a minimum depth of 6" and obtain the CQA Engineer's approval

of quality. If unsuitable materials are encountered at the subgrade elevation, perform additional excavations as approved by the CQA Engineer to remove unsuitable materials.

14. Overexcavation and Backfill:

- a. Where subgrade materials are determined to be unsuitable, such materials shall be removed by the Contractor to the lengths, widths, and depths approved by the Engineer and CQA Engineer in advance and backfilled with compacted Embankment in accordance with Section 02223, Embankment, of these Specifications.
- b. No additional payment will be made for such overexcavation and backfill 1 foot or less than the finished subgrade as this is considered superficial.
- c. Where overexcavation of unsuitable material is greater than 1 foot beneath the finished subgrade, payment shall be made on a unit price basis for overexcavation and backfill and the measured quantity shall include the entire excavation quantity below the finished subgrade elevations. The unit price for overexcavation and backfill shall include disposal of unsuitable materials.

15. All cuts shall be brought to the grade and cross section shown or indicated on the Contract Drawings, or established by the Engineer, prior to final inspection.

16. The Contractor shall protect finished lines and grades of completed excavation against excessive erosion, damage from trafficking, or other causes and shall repair any damage at no additional cost to the Owner.

17. Trench Excavation:

- a. All pipe Excavation and trenching shall be done in strict accordance with these Specifications, all applicable parts of the OSHA Regulations, 29 CFR 1926, Subpart P, and other applicable regulations. In the event of any conflicts in this information, safe working conditions as established by the appropriate OSHA guidelines shall govern.
- b. The minimum trench widths shall be as indicated on the Contract Drawings. Enlargements of the trench shall be made as needed to give ample space for operations at pipe joints. The width of the trench shall be limited to the maximum dimensions shown on the Contract Drawings, except where a wider trench is needed for the installation of and work within sheeting and bracing.
- c. Except where otherwise specified, excavation slopes shall be flat enough to avoid slides which will cause disturbance of the subgrade, damage to adjacent areas, or endanger the lives or safety of persons in the vicinity.
- d. Hand excavation shall be employed wherever, in the opinion of the Engineer, it is necessary for the protection of existing utilities, poles, trees, pavements, obstructions, or structures.

- e. No greater length of trench in any location shall be left open, in advance of pipe laying, than shall be authorized or directed by the Engineer and, in general, such length shall be limited to approximately one hundred (100) feet.
 - f. Pipe Bedding: All pipe bedding shall be as shown on the Contract Drawings, unless otherwise specified herein.
18. Sheeting and Bracing:
- a. The Contractor shall furnish, place, and maintain such sheeting and bracing which may be required to support sides of Excavation or to protect pipes and structures from possible damage and to provide safe working conditions in accordance with current OSHA requirements. If the Engineer is of the opinion that at any point sufficient or proper supports have not been provided, he may order additional supports put in at the sole expense of the Contractor. The Contractor shall be responsible for the adequacy of all sheeting and bracing used and for all damage resulting from sheeting and bracing failure or from placing, maintaining, and removing it.
 - b. The Contractor shall exercise caution in the installation and removal of sheeting to insure that excessive or unusual loadings are not transmitted to any new or existing structure. The Contractor shall promptly repair at his expense any and all damage that can be reasonably attributed to sheeting installation or removal.
 - c. All sheeting and bracing shall be removed upon completion of the work.
19. If grading operations are suspended for any reason whatsoever, partially completed cut and fill slopes shall be brought to the required slope and the work of seeding and mulching or other required erosion and sedimentation control operations shall be performed at the Contractor's sole expense.

END OF SECTION

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SECTION 02223

EMBANKMENT

Embankment: Embankment is the on-site compacted fill that provides the foundation and the berms for the containment area, the subgrade for some access roadways and structures, and backfill around structures and piping.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete Embankment including borrowing, hauling, screening, discing, drying, compaction, control of surface and subsurface water, final grading, sealing, and all necessary and incidental items as detailed or required to complete the Embankment, all in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Excavation	02222
Erosion and Sedimentation Control	02270
CQA Manual	Attached

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these Specifications.

ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³).
ASTM D 1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
ASTM D 2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
ASTM D 2216	Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
ASTM D 2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

ASTM D 2488	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
ASTM D 2937	Standard Test Method for Density of Soil in Place by the Drive Cylinder Method.
ASTM D 2974	Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
ASTM D 4643	Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.
ASTM D 4959	Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method.
ASTM D 6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

4. Quality Assurance:

Quality Assurance during placement of Embankment will be provided by the Owner as described in the accompanying Project CQA Manual.

5. Definitions:

- a. Embankment: Shall include construction of all site earthwork including roadways, subgrade, perimeter berm embankments, including preparation of the areas upon which materials are to be placed. Embankment may also be referred to as structural and/or controlled fill. All Embankment materials may be either (off-site) Select Borrow or (on-site) Borrow unless otherwise noted on Contract Drawings or specified by the Engineer.
- b. Prepared Subgrade: The ground surface after clearing, grubbing, stripping, excavation, scarification, and/or compaction, and/or proof rolling to the satisfaction of the CQA Engineer.
- c. Well-Graded: A mixture of particle sizes that has no specific concentration or lack thereof of one or more sizes. Well-graded does not define any numerical value that must be placed on the coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters. Well-graded is used to define a material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.
- d. Unclassified Fill: The nature of materials to be used is not identified or described herein but must be approved by the Engineer prior to use.

B. Materials

1. Embankment materials shall consist of clean well-graded natural soil classified as SP, SW, SM, SC, ML, or CL (ASTM D 2487) containing no topsoil or other deleterious material. Soils within two (2) feet of the landfill subgrade shall be SM, SC, ML, MH, CL, or CH.

Other material classifications may be approved by the Engineer.

2. Stones or rock fragments shall not exceed one half the maximum lift thickness as compacted in any dimension. Isolated rocks shall be a maximum of 24-inches in any dimension.

C. Submittals Not Used.

D. Construction

1. The Contractor shall conduct Embankment activities in such a manner that erosion of disturbed areas and off-site sedimentation is absolutely minimized as outlined in Section 02270, Erosion and Sedimentation Control, of these Specifications.
2. All placement and compaction of Embankment shall be performed only when the CQA Engineer is informed by the Contractor of intent to perform such work.
3. Embankment shall be placed and compacted to the lines and grades shown on the Contract Drawings. Placement of Embankment outside the construction limits shall occur only as directed and approved by the Engineer.

The Contractor will perform all surveys necessary to establish and verify lines and grades for all Embankment.

4. The Contractor shall protect all existing facilities including, but not limited to, utilities and monitoring wells.
5. Subgrade Preparation:
 - a. The CQA Engineer shall inspect the exposed subgrade prior to placement of Embankment to assure that all rocks, topsoil, vegetation, roots, debris, or other deleterious materials have been removed.
 - b. Prior to placement of Embankment, the exposed subgrade shall be proofrolled using a static smooth-drum roller, loaded tandem axle dump truck, or other suitable equipment in the presence of the CQA Engineer. Any soft or unsuitable materials revealed before or during the in-place compaction shall be removed as directed by the CQA Engineer and replaced with suitable Embankment.
6. Surfaces on which Embankment is to be placed, shall be scarified or stepped in a manner which will permit bonding of the Embankment with the existing surface.

7. The Contractor shall be responsible for preparing the materials for the Embankment, including but not limited to, in-place drying or wetting of the soil necessary to achieve the compaction criteria of these Specifications.
8. The Contractor shall be responsible for the control of surface and subsurface water when necessary. Except for certain erosion and sedimentation control measures and other areas designated to impound water, all areas shall be graded to drain.
9. Embankment materials shall be placed in a manner permitting drainage and in continuous, approximately horizontal layers.
10. Compaction Requirements:
 - a. The Contractor shall compact Embankment in accordance with the requirements shown in Table 1 of this section. If Embankment does not meet the specified requirements, the Contractor shall rework the material, as may be necessary and continue compaction to achieve these requirements, or remove and replace the material to achieve the specified requirements, at Contractor's expense.
 - b. Each lift shall be compacted prior to placement of succeeding lifts. In confined areas, mechanical equipment, suitable for small areas and capable of achieving the density requirements, shall be required.
 - c. Lift compaction shall be performed with an appropriately heavy, properly ballasted, penetrating-foot or smooth-drum vibratory compactor depending on soil type. Compaction equipment shall be subject to approval by the CQA Engineer.
11. Embankment that becomes excessively eroded, soft, or otherwise unsuitable shall be removed or repaired by the Contractor as directed by the CQA Engineer, at no cost to the Owner.
12. The exposed surface of Embankment shall be rolled with a smooth-drum roller at the end of each work day to protect from adverse weather conditions.
13. Where Embankment is to be placed and compacted on slopes that are steeper than 3H:1V, the subgrade shall be benched to a minimum depth of 6 inches and the Embankment shall be placed in horizontal lifts.
14. Backfilling for Structures and Piping:
 - a. All structures, including manholes and pipes shall be backfilled with Embankment as shown in the Contract Drawings and as described in these Specifications.
 - b. Where sheeting is used, the Contractor shall take all reasonable measures to prevent loss of support beneath and adjacent to pipes and existing structures when sheeting is removed. If significant volumes of soil cannot be prevented from clinging to the extracted sheets, the voids shall be continuously backfilled as rapidly as possible. The Contractor shall thereafter limit the depth below

subgrade that sheeting will be driven in similar soil conditions or employ other appropriate means to prevent loss of support.

- c. When backfilling around structures, do not backfill until concrete has sufficiently cured (as determined by the CQA Engineer) and is properly supported. Place backfill in a manner to avoid displacement or damage of structures.

Table 1: Required Embankment Properties

Item	Required % Standard Proctor (ASTM D698) ²	Required Moisture Content ³	Maximum Lift Thickness (Compacted) (inches)
Embankment Beneath Structures and Roads ¹	100	+/- 2% of Optimum (std. Proctor)	8
Embankment	95	As Required for Compaction	8
Backfill Around Structures	95		8
Backfill in Pipe Trenches	95		6
Unclassified Fill	N/A	N/A	N/A

Notes:

1. Embankment beneath structures shall be considered to include a zone 10 feet out from the foundation of the structure extending down to the natural ground on a 45° slope. Embankment beneath roads shall be considered to include all embankment placed within 2 vertical feet of the final wearing surface and shall also include shoulders.
2. Determine field density using ASTM D 6938, ASTM D 1556, ASTM D 2167, or ASTM D 2937.
3. Determine field moisture content using ASTM D 6938, ASTM D 2216, ASTM D 4643, or ASTM D 4959.
4. The Engineer may allow exceptions to the above criteria for areas outside of the containment area which are not subject to significant long-term loads.

END OF SECTION

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SECTION 02240

GEOTEXTILES

Geotextiles: For the proposed construction, a Type GT-S (Separator/Filter) Geotextile is specified. The Type GT-S Geotextile will be placed between soil subgrade and aggregate in access roads, in the landfill gas system, and in some erosion control and drainage applications.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of Geotextiles including all necessary and incidental items as detailed or required for the Contractor to complete the installation in accordance with the Contract Drawings and these Specifications, except as noted below:

- a. Geotextiles used as a Silt Fence is covered under Section 02270, Erosion and Sedimentation Control, of these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Erosion and Sedimentation Control CQA Manual	02270 Attached

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) and the American Association of State Highway and Transportation Officials (AASHTO) are hereby made a part of these specifications.

ASTM D 4355	Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon-Arc Type Apparatus.
ASTM D 4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
ASTM D 4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
ASTM D 4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

ASTM D 4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile.
ASTM D 5261	Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
ASTM D 6241	Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile Related Products Using a 50 mm Probe.
AASHTO M 288	Standard Specification for Geotextiles.

B. Materials

1. General:

The materials supplied under these Specifications shall consist of new, first-quality products designed and manufactured specifically for the purpose of this work, which shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes.

Labels on each roll of Geotextile shall identify the length, width, lot and roll numbers, and name of Manufacturer.

2. The Type GT-S Geotextile shall be a nonwoven spunbonded or nonwoven needlepunched synthetic fabric consisting of polyester or polypropylene manufactured in a manner approved by the Engineer. Woven fabrics may be used in certain applications if approved in advance by the Engineer.
3. All Geotextiles shall conform to the properties listed in Table 1 of this section.

C. Submittals

Prior to the installation of Geotextiles, the Contractor shall submit the following to the CQA Engineer:

1. Mill Certificate and Sample: Prior to shipping to the site, the Contractor shall submit a mill certificate or affidavit signed by a legally authorized official of the Manufacturer for each type of Geotextile attesting that the Geotextiles meet the physical and manufacturing requirements stated in these Specifications. The Contractor shall also submit a sample of each Geotextile to be used. The samples shall be labeled with the product name and be accompanied by the Manufacturer's specifications.
2. Shipping, Handling, and Storage Instructions: The Manufacturer's plan for shipping, handling, and storage shall be submitted for review.
3. Seaming Procedures: Submit proposed seaming procedures including proposed method and equipment.

4. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into the construction.

D. Construction

1. Shipping, Handling, and Storage:

All Geotextiles shall be shipped, handled, and stored in strict accordance with the Manufacturer's recommendations.

2. Failing CQA Material Control Tests:

Geotextiles that are rejected upon testing shall be removed from the project site and replaced at Contractor's cost. Sampling and CQA testing of Geotextiles supplied as replacement for rejected material shall be performed by the CQA Engineer at Contractor's cost.

3. Installation:

- a. The surface receiving the Geotextiles shall be prepared to a relatively smooth condition, free of obstructions, standing water, excessive depressions, debris, and very soft, excessively wet, and/or loose pockets of soil. This surface shall be approved by the CQA Engineer prior to Geotextile placement.
- b. Geotextiles shall be placed to the lines and grades shown on the Contract Drawings. At the time of installation, Geotextiles shall be rejected by the CQA Engineer if they have defects, rips, holes, flaws, evidence of deterioration, or other damage.
- c. The Geotextiles shall be placed smooth and free of excessive wrinkles.
- d. On slopes, Geotextiles shall be anchored at the top and unrolled down the slope. In the presence of wind, all Geotextiles shall be weighted with sandbags or other material as appropriate. Geotextiles uplifted by wind may be reused upon approval by the CQA Engineer.

4. Seams:

- a. All Geotextile seams shall be continuously sewn or heat bonded with methods approved by the Engineer. Overlapping of seams may also be allowed if approved in advance by the Engineer. All seams must be approved by the CQA Engineer.
- b. On slopes of 6H:1V or steeper, all seams shall be oriented parallel to (in the direction of) the slope unless otherwise approved by the Engineer.
- c. Seams to be sewn shall be sewn using a Type 401 stitch. One or two rows of stitching may be used. Each row of stitching shall consist of 4 to 7 stitches per inch. The minimum distance from the geotextile edge to the stitch line nearest to that edge (seam allowance) shall be 1.5 inches if a Type SSa (prayer or flat) seam

is used. The minimum seam allowance for all other seam types shall be 1.0 inches.

- d. Seams to be heat bonded shall be bonded using hot plate, hot knife, ultrasonic, or other approved devices.

5. Repair Procedures:

Any Geotextile that is torn, punctured, or otherwise damaged shall be repaired or replaced, as directed by the CQA Engineer, by the Contractor at no additional cost to the Owner. The repair shall consist of a patch of the same type of Geotextile placed over the failed areas and shall overlap the existing Geotextile a minimum of 18 inches from any point of the rupture. Patches shall be spot sewn or heat bonded so as not to shift during cover placement.

6. Cover Placement:

- a. Except when designed to remain exposed, Geotextiles shall be covered in a timely manner to limit potential UV damage. Unless otherwise approved by the Engineer, covering shall occur within 30 days of installation. Extension of this time may be considered by the Engineer based on weather conditions (i.e. prolonged cloud cover during 30 day period) or technical information provided by the Manufacturer that would justify an extension.

(1) The Engineer may conduct sampling and testing of any Geotextiles exposed for a period longer than allowed to verify the material properties. The cost associated with this testing and the subsequent repair(s) shall be borne solely by the Contractor regardless of the test results. In no case will the maximum length of exposure be greater than 60 days without verification of material properties.

- b. Placement of cover over Geotextiles shall be performed in a manner as to ensure that the Geotextiles or underlying materials are not damaged. Cover material shall be placed such that excess tensile stress is not mobilized in the Geotextile.

Table 1: Required Geotextile Properties

Property	Test Method	Units	Value ¹
			Type GT-S
Geotextile Construction (NW = Nonwoven) (W = Woven)	-----	-----	NW ² or W ³
Mass per Unit Area (Unit Weight)	ASTM D 5261	oz/yd ²	N/A
Ultraviolet Resistance (500 hrs)	ASTM D 4355	%	70
Strength Class ⁴	AASHTO M 288	Class	2
Tensile Properties:	ASTM D 4632		
Grab Strength		lbs	160 (NW) 250 (W)
Grab Elongation		%	≥ 50 (NW) < 50 (W)
Puncture Resistance	ASTM D 6241	lbs	410 (NW) 950 (W)
Trapezoidal Tear Strength	ASTM D 4533	lbs	55 (NW) 90 (W)
Apparent Opening Size (AOS)	ASTM D 4751	U.S. Sieve	70+
Permittivity	ASTM D 4491	sec ⁻¹	1.0

Notes:

1. Minimum Average Roll Value (MARV).
2. Nonwoven geotextiles that have been heat calendered are not acceptable, unless approved by the Engineer in advance.
3. Woven geotextiles shall be approved in advance by the Engineer. Woven geotextiles formed exclusively with slit film fibers are not acceptable.
4. AASHTO M 288 criteria include the above listed requirements for: Tensile Properties, Puncture Resistance, Trapezoidal Tear Strength, and Burst Strength.

END OF SECTION

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SECTION 02250

SOIL LINER

Soil Liner: The Soil Liner(s) serves as a hydraulic containment barrier in the final cover system.

A. Description

1. General:

- a. The Contractor shall furnish all labor, material, and equipment to complete installation of the Soil Liner including borrowing, hauling, screening, mixing, stockpiling, discing, compacting, drying or wetting, removal of surface water, removal of all previously placed material affected by adverse weather conditions or construction disturbance, final grading and sealing, and all necessary and incidental items as detailed or required to complete the Soil Liner, all in accordance with the Contract Drawings and these Specifications.
- b. The Contractor shall provide suitable soil from an on-site or off-site borrow site that meets all requirements outlined in these Specifications for Soil Liner.

Off-site borrow sources shall be approved in advance by the Engineer. The Contractor shall be responsible for all submittals required for Engineer approval of off-site borrow sources.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Excavation	02222
Embankment	02223
CQA Manual	Attached

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these Specifications.

ASTM D 422	Standard Test Method for Particle Size Analysis of Soils.
ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³).
ASTM D 1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

ASTM D 2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
ASTM D 2216	Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
ASTM D 2488	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
ASTM D 2937	Standard Test Method for Density of Soil in Place by the Drive Cylinder Method.
ASTM D 4318	Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
ASTM D 4643	Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.
ASTM D 4959	Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method.
ASTM D 5084	Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
ASTM D 6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

4. Quality Assurance:

Quality Assurance during placement of Soil Liner will be provided by the Owner as described in the accompanying Project CQA Manual.

B. Materials

All material for Soil Liner shall conform to the requirements shown in Table 1 of this section.

C. Submittals

The Contractor shall submit the following to the CQA Engineer:

1. Before approval is given to proceed with test fill construction, the Contractor shall submit descriptive information on compaction equipment to be used for construction of the Soil Liner.

2. Off-Site Borrow Sources (If Applicable):

a. For each off-site borrow source for Soil Liner soils, the Contractor shall provide the following information at least four weeks prior to placement of the Soil Liner:

- (1) The name, location, and owner of proposed borrow site, including a topographic map and location map of the site.
- (2) A certification submitted by an independent Registered Professional Engineer that the proposed borrow site contains a minimum of double the in-place volume of Soil Liner required to complete the work.
- (3) A certification submitted by an independent Registered Professional Engineer that the proposed borrow soils meet the requirements for Soil Liner outlined in these Specifications. Certification shall include the following minimum testing and test frequency:

Test (Test Method)	Quantity (Min.)
Atterberg Limits (ASTM D 4318)	10
Grain Size (with Hydrometer) (ASTM D 422)	10
Standard Proctor (ASTM D 698)	5
Natural Moisture Content (ASTM D 2216)	10
Hydraulic Conductivity (Lab Remolded) (ASTM D 5084)	5

Testing samples for certification shall be obtained from well distributed locations within the proposed borrow area. All test data shall be submitted with the soil certification.

- b. The Contractor shall be responsible for maintaining quality of the Soil Liner borrow source throughout construction and shall ensure that the borrow soil meets the project criteria outlined in these Specifications. The Contractor shall cooperate with the CQA Engineer so that the CQA Engineer has unlimited access to the borrow area during construction for the purposes of sampling and testing borrow soil.
- c. If the borrow source does not meet the requirements outlined in these Specifications, the Contractor shall be responsible for providing an alternative borrow source at no cost to the Owner.

4. Survey Results:

Survey results for Soil Liner subgrade shall be submitted for review prior to placement of Soil Liner. After completion of a segment of Soil Liner, survey results shall be submitted for review prior to placement of overlying layers.

D. Construction

1. General:

- a. All placement and compaction of Soil Liner shall be performed only when the CQA Engineer is informed by the Contractor of intent to perform such work.
- b. The Contractor shall place and compact the Soil Liner to the lines and grades shown on the Contract Drawings with the exception that a 0.15 foot overbuild at the Contractor's expense is allowed. Thickness requirements are minimum values. The Contractor will perform all surveys necessary to establish and verify lines and grades for all Soil Liner.

3. Borrow Soils:

- a. The Contractor may haul borrow soil to an on-site stockpile area. Unless otherwise allowed by the Engineer, borrow soil cannot be hauled directly to the containment area for placement and compaction unless each load is monitored and approved by the CQA Engineer prior to loading at the borrow site.
- b. Any borrow soil not meeting the requirements for Soil Liner shall be rejected and removed from the project site by the Contractor at no cost to the Owner.

4. Test Fill Construction:

The Contractor shall construct a test fill prior to construction of Soil Liner. The test fill shall be at least 20 feet wide by 50 feet long and shall be compacted in lifts to the full design thickness. The Contractor shall use materials and equipment for test fill construction that the Contractor intends to use during construction.

No Soil Liner construction may be performed until the test fill construction is confirmed to be adequate in accordance with the Project CQA Manual.

The Contractor shall amend construction techniques or equipment in order to meet all criteria outlined for Soil Liner in these Specifications at no cost to the Owner.

5. Subgrade Preparation:

- a. The CQA Engineer shall inspect the exposed subgrade prior to placement of Soil Liner to assure that all rocks, topsoil, vegetation, roots, debris, or other deleterious materials have been removed.
- b. Prior to placement of Soil Liner, the exposed subgrade shall be proofrolled using a static smooth-drum roller, loaded tandem axle dump truck, or other suitable equipment in the presence of the CQA Engineer. Any soft or unsuitable subgrade materials revealed before or during the in-place compaction shall be removed as directed by the CQA Engineer and replaced with suitable materials.

6. Placement and Compaction:

- a. All Soil Liner shall be placed in loose lifts no greater than the height of the feet on compaction equipment to be used. The loose Soil Liner shall be free from clods or rocks which exceed the sizes in Table 1. Where excessive sized clods do occur, the Contractor shall break up the clods using methods approved by the CQA Engineer.
- b. Lift compaction shall be performed with an appropriately heavy, properly ballasted, penetrating-foot compactor. Compaction equipment shall be the same as used in the test fill, unless otherwise approved by the Engineer.

Each lift shall be compacted prior to placement of succeeding lifts. The maximum lift thickness shall be as shown in Table 2. In confined areas, mechanical equipment, suitable for small areas and capable of achieving the density requirements, shall be required.

- c. The exposed surface of Soil Liner shall be protected from adverse weather conditions or desiccation of the soil. This is commonly done by rolling the surface of the Soil Liner with a smooth-drum roller at the end of each work day. Alternative means of protecting the Soil Liner may be employed by the Contractor.
- d. The in-place Soil Liner shall conform to the requirements shown in Table 2 of this section. If Soil Liner does not meet the specified requirements, the Contractor shall rework the material, as may be necessary and continue compaction to achieve these requirements, or remove and replace the material to achieve the specified requirements, at Contractor's expense.
- e. Any Soil Liner surface which is smooth, has a moisture content outside of the specified moisture content range, as defined by ASTM D 698, or exhibits evidence of desiccation cracking ½ inch deep or greater, shall be scarified to a depth of 1 to 3 inches and brought to a proper moisture content prior to placement of a subsequent lift. This includes any Soil Liner surface that was previously seal rolled for protection.
- f. No Soil Liner shall be placed or compacted when soil temperatures are so low as to produce ice lenses in the Soil Liner borrow soil.
- g. Soil Liner placed on side slopes shall be placed and compacted in lifts which are parallel to the slope. Lift criteria shall be as described herein.
- k. Surfaces not properly maintained shall be repaired by the Contractor at no cost to the Owner. A suitable surface for geosynthetics construction shall be a surface maintained at the specified compaction and moisture content criteria provided in these Specifications.

- l. Locations of control stakes, in-place density tests, or other samples in the Soil Liner shall be patched with compacted Soil Liner or sodium bentonite compacted and hydrated in the holes.

7. Surveying:

- a. Before placement of a segment of Soil Liner, the Soil Liner subgrade shall be surveyed on 100 foot centers and at slope breaks (including all tops and toes of slope, points of grade change, etc.) to ensure the top of the Soil Liner subgrade slopes at grades specified on the Contract Drawings.
- b. After completion of a segment of Soil Liner, but before installation of subsequent layers, the Soil Liner shall be surveyed on 100 foot centers and at slope breaks to ensure:
 - (1) The specified thickness has been achieved.
 - (2) The top of the Soil Liner slopes at grades specified on the Contract Drawings; and
 - (3) Soil Liner placed more than 0.15 feet beyond the limits of the lines and grades as shown on the Contract Drawings will not be accepted and must be removed at the Contractor's expense if required by the Engineer.

This work shall be performed at the Contractor's cost by a registered surveyor.

Table 1: Soil Liner Material Requirements

Property	Test Method	Value
Visual Classification	ASTM D 2488	Clean natural fine-grained soil free from organics, debris, or other detrimental material. Soil type as required to achieve the hydraulic conductivity criteria.
Clod Size	-----	Maximum = ¾ inch (or less if required to achieve hydraulic conductivity criteria)
Gradation	ASTM D 422	Max. = ½ inch
Atterberg Limits	ASTM D 4318	As required based on soil type.
Hydraulic Conductivity (Lab Remolded) (Compacted Soil Barrier)	ASTM D 5084 ³	≤ 1 x 10 ⁻⁵ cm/s at a density of ≥ 95% maximum standard dry density and a moisture content ≥ optimum moisture content ⁴

Table 2: In-Place Soil Liner Requirements

Property	Test Method	Value
Density	ASTM D 6938 ¹	≥ 95% maximum standard dry density ⁴
Moisture Content	ASTM D 6938 ²	≥ optimum moisture content ⁴
Maximum Lift Thickness (Compacted): (Compacted Soil Barrier)	-----	9 inches
Hydraulic Conductivity (Shelby Tube): (Compacted Soil Barrier)	ASTM D 5084 ³	≤ 1 x 10 ⁻⁵ cm/s
Completed Thickness: (Compacted Soil Barrier)	Survey	18 inches minimum

Notes:

1. Optionally use ASTM D 1556, ASTM D 2167, or ASTM D 2937.
2. Optionally use ASTM D 2216, ASTM D 4643, or ASTM D 4959.
3. Maximum effective confining pressure and maximum hydraulic gradient as follows.
Backpressure as recommended by ASTM D 5084. Modifications of the maximum hydraulic gradient may be allowed by the Engineer depending on actual hydraulic conductivity values.

Material	Maximum Effective Confining Pressure (psi)	Maximum Hydraulic Gradient
Compacted Soil Barrier (k ≤ 1 x 10 ⁻⁵ cm/s)	5	15

4. Or as otherwise determined by remolded samples to achieve hydraulic conductivity criteria.

END OF SECTION

SECTION 02258

VEGETATIVE SOIL LAYER

Vegetative Soil Layer (VSL): The Vegetative Soil Layer (VSL) is placed in the final cover system in order to support permanent vegetative cover.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of the VSL (including topsoil) for the landfill cover, including borrowing, hauling, spreading, and final grading and all necessary and incidental items as detailed or required to complete the VSL, all in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Revegetation	02930
CQA Manual	Attached

3. Quality Assurance:

Quality Assurance during placement of Vegetative Soil Layer will be provided by the Owner as described in the accompanying Project CQA Manual.

B. Materials

Soil that meets all of the following requirements shall be classified as select soil fill for use in construction of the VSL.

1. Select soil fill materials shall be reasonably free of gypsum, ferrous, and/or calcareous concretions and nodules, refuse, roots, or other deleterious substances.
2. Continuous and repeated visual inspection of the materials being used will be performed by the Contractor to ensure proper soils are being used. In addition, the CQA Engineer shall make frequent inspections of the placement operations and materials, and will consult with the Engineer.
3. The VSL shall be uniform, smooth, and free of debris, rock, plant materials, and other foreign material larger than 3 inches in diameter. The material should contain no sharp edges. This material must be capable of supporting growth of vegetative cover.
4. Topsoil: The upper 6 inches of VSL shall be natural or blended soil material capable of supporting the growth of vegetative cover.

C. Submittals

The Contractor shall submit the following to the CQA Engineer:

1. Before approval is given to proceed, the Contractor shall submit descriptive information on placement equipment to be used in construction of the VSL.

2. Survey Results:

After completion of a segment of VSL, survey results shall be submitted for review prior to VSL acceptance.

D. Construction

1. All placement and compaction of VSL shall be performed only when the CQA Engineer is informed by the Contractor of intent to perform such work.

2. VSL shall be placed as specified below:

- a. The VSL, including topsoil, shall be placed and spread using tracked equipment. The CQA Engineer shall approve the equipment used to place the VSL.

- d. VSL shall be placed and compacted to the lines and grades shown on the Contract Drawings with the exception that a 0.15 foot overbuild at Contractor's expense is allowed. The Contractor will perform all surveys necessary to establish and verify lines and grades for all VSL.

- e. VSL shall be compacted by tracking the final lift with tracked equipment.

3. After the specified thickness has been achieved and verified, the Contractor shall proceed immediately with seeding.

4. Surveying:

After completion of a segment of VSL, the VSL shall be surveyed on 100 foot centers and at slope breaks (including all tops and toes of slope, points of grade change, etc.) (using the same grid as for the underlying Compacted Soil Barrier) to ensure:

- a. The specified thickness has been achieved. A hand auger or similar method may be used to check for thickness at each location.
- b. The top of the VSL slopes at grades specified on the Contract Drawings; and
- c. VSL placed more than 0.15 feet beyond the limits of the lines and grades as shown on the Contract Drawings will not be accepted and must be removed at the Contractor's sole expense if required by the Engineer.

This work shall be performed at the Contractor's cost by a registered surveyor.

END OF SECTION

SECTION 02270

EROSION AND SEDIMENTATION CONTROL

Erosion and Sedimentation Control: Erosion and Sedimentation Control is a system of construction and engineered measures (devices, structures, practices, etc.) which act to minimize surface water induced erosion of disturbed areas and the resulting off-site sedimentation.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of and maintain Erosion and Sedimentation Control measures and related work in accordance with the Contract Drawings and these Specifications.

All Erosion and Sedimentation Control work shall be in accordance with the latest edition of the North Carolina Erosion and Sediment Control Planning and Design Manual as well as applicable regulations.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Geotextiles	02240
Rip Rap	02271
Rolled Erosion Control Products	02275
Revegetation	02930

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these specifications.

ASTM D 3786	Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method.
ASTM D 4355	Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
ASTM D 4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

ASTM D 4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
ASTM D 4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
ASTM D 4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile.
ASTM D 4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

B. Materials

1. Permanent Sediment or Detention Basins:

Permanent sediment or detention basins shall be constructed as shown on the Contract Drawings.

2. Permanent Drainage Channels, Diversions, Swales, and Ditches:

Permanent drainage channels, diversions, swales, and ditches shall be constructed as shown on the Contract Drawings.

3. Silt Fence:

Silt fences shall be constructed as shown on the Contract Drawings and as needed, based on the Contractor's discretion and Engineer's approval. The silt fence is a permeable barrier erected within and downgradient of small disturbed areas to capture sediment from sheet flow. It is made of filter fabric buried at the bottom, stretched, and supported by posts and wire mesh backing. Silt fence shall conform to the following properties:

- a. Posts: Posts shall be 1.33 lb/linear foot steel (preferred) or wood with a minimum length of 5 feet. Steel posts shall be "U" or "T"-type. Wood posts shall have a minimum diameter of 4-inches.
- b. Filter Fabric: Filter fabric shall be a woven geotextile made specifically for sediment control. Filter fabric shall conform to the properties listed in Table 1 of this section.

4. Geotextiles:

Geotextiles shall conform to the requirements of Section 02240, Geotextiles, of these Specifications.

5. Temporary Sediment Traps:

Temporary sediment traps shall be constructed as shown on the Contract Drawings.

6. Filter Berms:

Filter berms shall be constructed as shown on the Contract Drawings.

7. Down Chutes and Pipes:

Down chutes and pipes shall be constructed as shown on the Contract Drawings.

8. Rip Rap:

Rip Rap shall conform to the requirements of Section 02271, Rip Rap, of these Specifications.

9. Rolled Erosion Control Products (RECPs):

Rolled Erosion Control Products (RECPs) shall conform to the requirements of Section 02275, Rolled Erosion Control Products, of these Specifications.

10. Other Work:

In addition to the Erosion and Sedimentation Control measures shown on the Contract Drawings, the Contractor shall provide adequate means to prevent any sediment from entering any storm drains, drop inlets, ditches, streams, or bodies of water downstream of any area disturbed by construction. Excavation materials shall be placed upstream of any trench or other excavation to prevent sedimentation of off-site areas. In areas where a natural buffer area exists between the work area and the closest stream or water course, this area shall not be disturbed. All paved areas shall be scraped and swept as necessary to prevent the accumulation of dirt and debris. Work associated with this provision shall be considered incidental to the project and no separate payment will be made.

11. Temporary and Permanent Ground Cover:

The Contractor shall provide temporary or permanent ground cover (or other acceptable measure(s)) adequate to restrain erosion on erodible slopes or other areas within 21 calendar days following completion of any phase of grading. The Contractor shall provide permanent ground cover for all disturbed areas within 15 working days or 90 calendar days (whichever is shorter) following the completion of construction.

C. Submittals

The Contractor shall submit the following to the Engineer:

1. Submit a certification and summary of all required test results, prior to installation, that all Erosion and Sedimentation Control materials manufactured for the project have been produced in accordance with these Specifications.
2. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.

D. Construction

1. Establishment of Erosion and Sedimentation Control Measures:
 - a. All Erosion and Sedimentation Control measures will be constructed according to the Contract Drawings and these Specifications.
 - b. Due to the nature of the work required by this Contract, it is anticipated that the location and nature of the Erosion and Sedimentation Control measures may need to be adjusted on several occasions to reflect the current phase of construction.
 - c. Erosion and Sedimentation Control measures shall be established prior to the work in a given area. Where such practice is not feasible, the Erosion and Sedimentation Control measure(s) shall be established immediately following completion of the clearing operation.
 - d. The construction schedule adopted by the Contractor will impact the placement and need for specific measures required for the control of erosion. The Contractor shall develop and implement such additional techniques as may be required to minimize erosion and prevent or correct the discharge of sediment outside the limits of construction (unless controlled by other on-site measure(s)).
 - e. The location and extent of Erosion and Sedimentation Control measures shall be revised at each phase of construction that results in a change in either the quantity or direction of surface runoff from construction areas. All deviations from the control provisions shown on the Contract Drawings shall have the prior approval of the Engineer.

2. Inspection and Maintenance of Erosion and Sedimentation Control Measures:
 - a. The Contractor shall furnish the labor, material, and equipment required for the inspection and maintenance of all Erosion and Sedimentation Control measures. Maintenance shall be scheduled as required for a particular measure to maintain the removal efficiency and intent of the measure.
 - b. All Erosion and Sedimentation Control measures shall be inspected at least once every seven calendar days and within 24 hours after any storm event of greater than 0.5 inches of rain per 24 hour period and appropriate maintenance conducted. A rain gauge shall be maintained on the site and a record of the rainfall amounts and dates shall be kept properly.
 - c. Maintenance shall include, but not be limited to:
 - (1) The removal and satisfactory disposal of trapped or deposited sediments from basins, traps, barriers, filters, and/or drainage features/devices;
 - (2) Replacement of filter fabrics used for silt fences upon loss of efficiency; and

(3) Replacement of any other components which are damaged or cannot serve the intended use.

- d. The Contractor shall accept and maintain any existing sediments that are included in existing sediment traps or basins that accept or will accept stormwater flow and or sediment accumulation from all areas within the Contractor's limits of construction.
- e. Sediments removed from Erosion and Sedimentation Control measures shall be disposed of in locations that will not result in off-site sedimentation as approved by the Engineer.
- f. All Erosion and Sedimentation Control measures shall be maintained to the satisfaction of the Engineer until the site has been stabilized.

3. Graded Slopes and Fills:

The angle for graded slopes and fills shall be no greater than the angle that can be retained by vegetated cover or other adequate measures.

4. Finish Grading:

All disturbed areas shall be uniformly graded to the lines, grades, and elevations shown on the Contract Drawings. Except for certain erosion and sedimentation control measures and other areas designated to impound water, all areas shall be graded to drain. Finished surfaces shall be reasonably smooth, compacted, and free from irregular surface changes. Unless otherwise specified, the degree of finish shall be that ordinarily obtainable from either blade or scraper operations. Areas shall be finished to a smoothness suitable for application of topsoil.

5. Revegetation:

Revegetation shall conform to the requirements of Section 02930, Revegetation, of these Specifications.

6. Cleanup:

- a. The Contractor shall remove from the site all subsoil excavated from his work and all other debris including, but not limited to, branches, paper, and rubbish in all landscape areas, and remove temporary barricades as the work proceeds.
- b. All areas shall be kept in a neat, orderly condition at all times. Prior to final acceptance, the Contractor shall clean up the entire landscaped area to the satisfaction of the Engineer.

Table 1: Required Silt Fence Filter Fabric Properties

Property	Test Method	Units	Value ¹
Grab Tensile Strength ²	ASTM D 4632	lbs	90 x 90
Grab Elongation	ASTM D 4632	%	20 (Max.)
Ultraviolet Resistance (500 hrs)	ASTM D 4355	%	80
Apparent Opening Size (AOS)	ASTM D 4751	U.S. Sieve	30+
Permittivity	ASTM D 4491	sec ⁻¹	0.05

Notes:

1. Minimum Average Roll Value (MARV).
2. Values for machine and cross machine direction (MD x XD), respectively.

END OF SECTION

SECTION 02271

RIP RAP

Rip Rap: This section includes all rip rap aprons and channel protection.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of Rip Rap for protection of earthen slopes against erosion as indicated, including all necessary and incidental items, in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Geotextiles	02240
Erosion and Sedimentation Control	02270

3. Reference Standards:

The latest revision of the following standards of the North Carolina Department of Transportation (NCDOT) are hereby made a part of these Specifications.

NCDOT Standard Specifications for Roads and Structures (2006).

B. Materials

1. Rip Rap: Rip Rap shall be of the size indicated on the Contract Drawings and shall conform to NCDOT Section 1042, Rip Rap Materials.

2. Geotextiles: Geotextiles shall conform to the requirements outlined in Section 02240, Geotextiles, of these Specifications.

C. Submittals

The Contractor shall submit the following to the Engineer:

1. Submit a certification and summary of all required test results prior to installation, that all Rip Rap has been produced in accordance with these Specifications.

2. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.

D. Construction

1. Surface Preparation:

- a. Trim and dress all areas to conform to the Contract Drawings as indicated with tolerance of 2 inches from theoretical slope lines and grades.
- b. Bring areas that are below allowable minimum tolerance limit to grade by filling with compacted Embankment material similar to adjacent material.
- c. Geotextiles shall be placed as shown on the Contract Drawings and in accordance with Section 02240, Geotextiles, of these Specifications.
- d. Do not place any stone material on the prepared surface prior to inspection and approval to proceed from the Engineer.

2. Placing Rip Rap:

Rip Rap shall be placed in accordance with NCDOT Section 876, Rip Rap.

END OF SECTION

SECTION 02275

ROLLED EROSION CONTROL PRODUCTS

Rolled Erosion Control Products: Rolled Erosion Control Products (RECPs) include erosion control blankets (ECB) and turf reinforcement mats (TRM) placed in channels and on slopes.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of all RECPs in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Erosion and Sedimentation Control	02270
Revegetation	02930

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these specifications.

ASTM D 4355	Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
ASTM D 6475	Standard Test Method for Measuring Mass per Unit Area of Erosion Control Blankets.
ASTM D 6524	Standard Test Method for Measuring the Resiliency of Turf Reinforcement Mats.
ASTM D 6525	Standard Test Method for Measuring Nominal Thickness of Permanent Erosion Control Products.
ASTM D 6566	Standard Test Method for Measuring Mass per Unit Area of Turf Reinforcement Mats.
ASTM D 6818	Standard Test Method for Ultimate Tensile Properties of Turf Reinforcement Mats.

B. Materials

1. General:

The materials supplied under these Specifications shall consist of new, first-quality products designed and manufactured specifically for the purpose of this work, which shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes.

Labels on each RECP shall identify the length, width, product name, and name of Manufacturer.

2. Erosion Control Blanket (ECB):

ECB (double net) shall consist of a machine-produced mat of straw or wood excelsior fiber covered on the top and bottom sides with photodegradable extruded plastic or woven biodegradable nettings and sewn together with degradable thread. ECB (double net) shall also conform to the properties listed in Table 1 of this section. ECB (double net) shall be S150, as manufactured by North American Green, CURLEX II, as manufactured by American Excelsior Company, LANDLOK S2, as manufactured by Propex Fabrics, or approved equal.

3. Turf Reinforcement Mat (TRM):

TRM shall consist of a dense web of crimped and interlocking polypropylene fibers positioned between two biaxially oriented nets and mechanically bound together by parallel stitching with polypropylene thread. TRM shall be designed to accelerate seedling emergence, exhibit high resiliency, and possess strength and elongation properties to limit stretching in a saturated condition. TRM shall be stabilized against chemical and UV degradation which are normally found in a natural soil environment and shall have no biodegradable components. TRM shall also conform to the properties listed in Table 1 of this section. TRM shall be LANDLOK TRM 435, as manufactured by Propex Fabrics, or approved equal.

4. Anchors: Anchors for RECPs shall consist of machine made staples of No. 8 gauge new steel wire formed into a "U" shape. The size when formed shall be not less than 8 inches in length with a throat of not less than 1 inch in width. Longer anchors may be required for loose soils. Other anchors, such as metal pins or plastic pegs, may also be used if approved in advance by the Engineer.

C. Submittals

The Contractor shall submit the following to the Engineer:

1. Mill Certificate and Sample: Prior to shipping to the site, the Contractor shall submit a mill certificate or affidavit signed by a legally authorized official of the Manufacturer for each RECP attesting that each RECP meets the physical and manufacturing requirements stated in these Specifications. The Contractor shall also submit a sample of each RECP to be used. The sample shall be labeled with the product name and be accompanied by the Manufacturer's specifications.

2. Installation Guidelines/Instructions: The Manufacturer's guidelines/instructions for installation shall be submitted for review.
3. Furnish copies of delivery tickets or other approved receipts as evidence for materials received that will be incorporated into the construction.

D. Construction

1. Shipping, Handling, and Storage:

All RECPs shall be shipped, handled, and stored in strict accordance with the Manufacturer's recommendations.

2. Installation - General:

- a. Placing of RECPs shall be done immediately following seeding. Seeding shall be performed in accordance with Section 02930, Revegetation, of these Specifications.
- b. RECPs shall be placed to the lines and grades shown on the Contract Drawings. The earth surface shall be smooth and free from stones, clods, or debris which will prevent the contact of the RECP with the soil. Care shall be taken to preserve the required line, grade, and cross section of the area.
- c. RECPs shall be unrolled in the direction of the flow of water and shall be applied without stretching so that it will lie smoothly but loosely on the soil surface.
- d. At the time of installation, RECPs shall be rejected, if they have defects, rips, holes, flaws, evidence of deterioration, or other damage.
- e. The Engineer may require adjustments in the installation requirements to fit individual conditions.

3. Installation - Channels:

RECPs installed in channels shall be unrolled parallel to the direction of water flow. The first roll shall be centered longitudinally in the channel and anchored with staples. Subsequent rolls shall be installed outward to the edges of the channel and be lapped to allow installation of a common row of anchors. RECP ends shall be overlapped with the upstream ends on top ("shingled"). Refer to the Contract Drawings and/or the Manufacturer's installation guidelines/instructions for installation details.

4. Installation - Slopes:

RECPs installed on slopes shall be oriented in vertical strips and anchored. Subsequent rolls shall be installed outward to the edge(s) of the original roll and be lapped to allow installation of a common row of anchors. RECP ends shall be shingled. Refer to the Contract Drawings and/or the Manufacturer's installation guidelines/instructions for installation details.

5. Maintenance:

Maintenance of RECPs shall be in accordance with Section 02270, Erosion and Sedimentation Control, of these Specifications.

Table 1: Required Rolled Erosion Control Product Properties

Property	Test Method	Units	Value ¹
Erosion Control Blanket (ECB)			
Mass per Unit Area	ASTM D 6475	lbs/yd ²	0.5 ± 10% (Straw) 0.7 ± 10% (Excelsior)
Tensile Strength ²	ASTM D 6818	lbs/ft	75 x 75
Tensile Elongation	ASTM D 6818	%	25
Maximum Permissible Shear Stress (Un-Vegetated)	-----	lb/ft ²	1.75
Functional Longevity	-----	months	12
Turf Reinforcement Mat (TRM)			
Mass per Unit Area	ASTM D 6566	oz/yd ²	8
Thickness	ASTM D 6525	inches	0.35
Tensile Strength ²	ASTM D 6818	lbs/ft	225 x 175
Tensile Elongation	ASTM D 6818	%	50 (max.)
Resiliency	ASTM D 6524	%	80
UV Resistance (1,000 Hours)	ASTM D 4355	%	80
Maximum Permissible Shear Stress (Long-Term Vegetated)	Large Scale	lb/ft ²	5

Notes:

1. Typical for ECB; Minimum Average Roll Value (MARV) for TRM and HPTRM.
2. Values for machine and cross machine direction (MD x XD), respectively.

END OF SECTION

SECTION 02930

REVEGETATION

Revegetation: Revegetation includes permanent Revegetation of all site areas disturbed by the Contractor whether inside the Contract Limits or not.

A. Description

1. General:

The Contractor shall furnish all labor, material, and equipment to complete Revegetation in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

<u>Work</u>	<u>Section</u>
Excavation	02222
Embankment	02223
Vegetative Soil Layer	02258
Erosion and Sedimentation Control	02270
Rolled Erosion Control Products	02275

3. Warranty:

The Contractor shall be responsible for the satisfactory establishment and growth of a permanent stand of vegetation for a period of one year following the final seeding as judged by the Engineer. During this period, the Contractor shall be responsible for the maintenance items described in Paragraph D.4 (Maintenance) of this Specification.

B. Materials

1. Limestone: Unless otherwise defined by specific soil tests, supply agricultural grade ground limestone conforming to the current "Rules, Regulations, and Standards of the Fertilizer Board of Control."

2. Fertilizer: Unless otherwise defined by specific soil tests, supply commercial fertilizer meeting applicable requirements of State and Federal law. Do not use cyanamic compounds of hydrated lime. Deliver fertilizer in original containers labeled with content analysis.

3. Grass Seed: Supply fresh, clean, new-crop seed. Do not use seed which is wet, moldy, or otherwise damaged. Deliver seed in standard sealed containers labeled with producer's name and seed analysis, and in accord with US Department of Agriculture Rules and Regulations under Federal Seed Act.

4. Mulch: Supply clean, seed-free, threshed straw of oats, wheat, barley, rye, beans, or other locally available mulch material.
 - a. Do not use mulch containing a quantity of matured, noxious weed seeds or other species that will be detrimental to seeding, or provide a menace to surrounding land.
 - b. Do not use mulch material which is fresh or excessively brittle, or which is decomposed and will smother or retard growth of grass.
5. Binder: Supply emulsified asphalt or synthetic binder.
6. Water: Supply potable, free of substances harmful to growth.
7. Application rates, seed types, and other requirements shall be in accordance with Table 1 of this section.

C. Submittals

The Contractor shall submit the following to the Engineer:

1. Results of soil tests performed and proposed modifications, if any, to the specified requirements.
2. Certificates for each grass seed mixture, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed. Certify that each container of seed delivered is fully labeled in accordance with Federal Seed Act and equals or exceeds specification requirements.
3. Copies of invoices for fertilizer, showing grade furnished and total quantity applied.

D. Construction

1. The Contractor shall establish a smooth, healthy, uniform, close stand of grass from the specified seed. Prior to Revegetation, the Contractor shall adequately test the soils to be revegetated to ensure the adequacy of the specified requirements. Any modifications to these requirements deemed necessary after the review of soil test results, shall be at the Contractor's sole expense. The Engineer will perform the observations to determine when successful Revegetation is achieved.
2. Soil Preparation:
 - a. Limit preparation to areas which will be planted soon after preparation.
 - b. Loosen surface to minimum depth of four (4) inches.
 - c. Remove stones, sticks, roots, rubbish and other extraneous matter over three (3) inches in any dimension.

- d. Spread lime uniformly over designated areas at the rate specified in Table 1 of this section.
- e. After application of lime, prior to applying fertilizer, loosen areas to be seeded with double disc or other suitable device if soil has become hard or compacted. Correct any surface irregularities in order to prevent pocket or low areas which will allow water to stand.
- f. Distribute fertilizer uniformly over areas to be seeded at the rate specified in Table 1 of this section.
 - (1) Use suitable distributor.
 - (2) Incorporate fertilizer into soil to depth of at least two (2) inches.
 - (3) Remove stones or other substances which will interfere with turf development or subsequent mowing.
- g. Grade seeded areas to smooth, even surface with loose, uniformly fine texture.
 - (1) Roll and rake, remove ridges and fill depressions, as required to meet finish grades.
 - (2) Fine grade just prior to planting.

3. Seeding:

- a. Use approved mechanical power driven drills or seeders, mechanical hand seeders, or other approved equipment.
- b. Distribute seed evenly over entire area at the rate specified in Table 1 of this section.
- c. Stop work when work extends beyond most favorable planting season for species designated, or when satisfactory results cannot be obtained because of drought, high winds, excessive moisture, or other factors.
- d. Resume work only when favorable condition develops, or as directed by the Engineer.
- e. Lightly rake seed into soil followed by light rolling or cultipacking.
- f. Immediately protect seeded areas against erosion by mulching or placing Rolled Erosion Control Products in accordance with Section 02275 of these Specifications, where applicable.
 - (1) Spread mulch in a continuous blanket at the rate specified in Table 1 of this section.

- (2) Immediately following spreading mulch, secure with evenly distributed binder at the rate specified in Table 1 of this section.
- (3) For slopes not steeper than 3H:1V and as an option to using binder to secure mulch, use a mulch anchoring tool operated along the contour of the slope.

4. Maintenance:

The Contractor shall be responsible for maintaining all seeded areas through the end of his warranty period. The Contractor shall provide, at his expense, protection of all seeded areas against damage at all times until acceptance of the work. Maintenance shall include, but not be limited to, the following items:

- a. Regrade and revegetate all eroded areas until adequately stabilized by grass.
- b. Remulch with new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose. Anchor as required to prevent displacement.
- c. Replant bare areas using same materials specified.

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Construction Quality Assurance Manual

**Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

Prepared for:

**Harnett County Solid Waste Department
Lillington, North Carolina**

January 2014

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Harnett County Anderson Creek Landfill Facility Harnett County, North Carolina

Construction Quality Assurance Manual

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APPENDIX

Appendix A Reference List of Test Methods

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1.0 GENERAL

This Construction Quality Assurance (CQA) Manual has been prepared to provide the Owner, (Design) Engineer, and CQA Engineer the means to govern the construction quality and to satisfy landfill certification requirements under current solid waste management regulations.

More specifically, this CQA Manual addresses the soils and other components of the landfill subgrade and final cover system. The landfill subgrade, as referenced herein, consists of two (2) feet of specific soil types (SM, SC, ML, CL, MH, and/or CH). The final cover system consists of a passive landfill gas (LFG) system, compacted soil barrier, and overlying vegetative soil layer.

The CQA Manual is divided into the following sections:

- Section 1.0 General
- Section 2.0 CQA Documentation
- Section 3.0 Earthwork CQA
- Section 4.0 Soil Liner CQA
- Section 5.0 Final Cover System CQA

1.1 Definitions Relating to Construction Quality

1.1.1 Construction Quality Assurance (CQA)

In the context of this Manual, Construction Quality Assurance is defined as a planned and systematic program employed by the Owner to assure conformity of the landfill subgrade and final cover system installation with the project drawings and the project specifications. CQA is provided by the CQA Engineer as a representative of the Owner and is independent from the Contractor and all manufacturers. The CQA program is designed to provide adequate confidence that items or services meet contractual and regulatory requirements and will perform satisfactorily in service.

1.1.2 Construction Quality Control (CQC)

Construction Quality Control refers to actions taken by manufacturers, fabricators, installers, and/or the Contractor to ensure that the materials and the workmanship meet the requirements of the project drawings and the project specifications. The manufacturer's specifications and quality control (QC) requirements are included in this CQA Manual by reference only.

1.1.3 CQA Certification Document

At the completion of construction, a certification document will be prepared by the CQA Engineer and submitted to State Solid Waste Regulators. The

certification report will include documentation of all CQA testing performed by the CQA Engineer.

1.1.4 Discrepancies Between Documents

The Contractor is instructed to bring discrepancies to the attention of the CQA Engineer who shall then notify the Engineer for resolution. The Engineer has the sole authority to determine resolution of discrepancies existing within the Contract Documents (this may also require the approval of State Solid Waste Regulators). Unless otherwise determined by the Engineer, the more stringent requirement shall be the controlling resolution.

1.2 **Parties to Construction Quality Assurance**

1.2.1 Description of the Parties

The parties to Construction Quality Assurance and Quality Control include the Owner, Engineer, Contractor, CQA Engineer, and Soils CQA Laboratory.

1.2.1.1 Owner

The Owner is Harnett County, North Carolina, who owns and/or is responsible for the facility.

1.2.1.2 Engineer

The Engineer is responsible for the engineering design, drawings, and project specifications for the landfill subgrade and final cover system. The Engineer is an official representative of the Owner. The Engineer serves as communications coordinator for the project, initiating the meetings outlined in **Section 1.6**. The Engineer will also be responsible for proper resolution of all quality issues that arise during construction. The Engineer is Smith Gardner, Inc.

1.2.1.3 Contractor

The Contractor is responsible for the construction of the subgrade, earthwork, and for placement of the final cover system. The Contractor is responsible for the overall CQC on the project and coordination of submittals to the CQA Engineer. Additional responsibilities of the Contractor are defined by the project specifications.

1.2.1.4 CQA Engineer

The CQA Engineer is a representative of the Owner, is independent from the Contractor, and is responsible for observing, testing, and documenting activities related to the CQA of the earthworks at the site, and the installation of the components of the landfill subgrade and final cover system. The CQA Engineer may make field observations and review submittals for the Engineer and is responsible for notifying the Owner and Engineer of all quality issues that arise during construction. The CQA Engineer is also responsible for issuing a facility certification report, sealed by a Professional Engineer registered in The State of North Carolina.

1.2.1.5 Soils CQA Laboratory

The Soils CQA Laboratory is a party, independent from the Owner, that is responsible for conducting geotechnical tests on conformance samples of soils and aggregates used in structural fills and the landfill subgrade and final cover system. The services of the Soils CQA Laboratory are coordinated by the CQA Engineer and are paid for by the Owner.

1.2.2 Qualifications of the Parties

The following qualifications are required of all parties involved with the manufacture, fabrication, installation, transportation, and CQA of all materials for the landfill subgrade and final cover system. Where applicable, these qualifications must be submitted by the Contractor to the Owner and Engineer for review and approval.

1.2.2.1 Contractor

Qualifications of the Contractor are specific to the construction contract and independent of this CQA Manual.

1.2.2.2 CQA Engineer

The CQA Engineer will act as the Owner's Quality Assurance Representative. The CQA Engineer will perform CQA testing to satisfy the requirements of this CQA Manual and will prepare the CQA certification document. The CQA Engineer will have experience in the CQA aspects of the construction and testing of landfill components, and be familiar with ASTM and other related industry standards. The activities of the CQA Engineer will be performed under the supervision of a Registered Professional Engineer.

1.2.2.3 Soils CQA Laboratory

The Soils CQA Laboratory will have experience in testing structural fills, soil liners, and aggregates, and be familiar with ASTM and other applicable test standards. The Soils CQA Laboratory will be capable of providing test results within 24 hours or a reasonable time after receipt of samples depending on the test(s) to be conducted, as agreed to at the outset of the project by affected parties, and will maintain that standard throughout the installation.

1.3 Scope of Construction Quality Assurance Manual

The scope of this CQA Manual includes the CQA of the components of the landfill subgrade and final cover system for the subject facility. The CQA for the selection, evaluation, and placement of the soils is included in the scope.

1.4 Units

In this CQA Manual, all properties and dimensions are expressed in U.S. units.

1.5 References

The CQA Manual includes references to the most recent version of the test procedures of the American Society of Testing and Materials (ASTM). **Appendix A** contains a list of these procedures.

1.6 CQA Meetings

To facilitate the specified degree of quality during installation, clear, open channels of communication are essential. To that end, meetings are critical.

1.6.1 Landfill Subgrade CQA Meeting

A CQA meeting will be held prior to the construction and verification of the landfill subgrade. This meeting will include all parties then involved, including the Engineer, the CQA Engineer, and the Contractor.

The purpose of this meeting is to begin planning for coordination of tasks, anticipate any problems which might cause difficulties and delays in construction, and, above all, review the CQA Manual to all of the parties involved. It is very important that the rules regarding testing, repair, etc., be known and accepted by all.

This meeting should include all of the activities referenced in the project specifications.

The meeting will be documented by the Engineer and minutes will be transmitted to all parties.

1.6.2 Final Cover System CQA Meeting

Prior to the start of final cover system construction, a CQA Meeting will be held. This meeting will include all parties then involved, including the Engineer, the CQA Engineer, and the Contractor.

The purpose of this meeting is to begin planning for coordination of tasks, anticipate any problems which might cause difficulties and delays in construction, and, above all, review the CQA Manual to all of the parties involved. It is very important that the rules regarding testing, repair, etc., be known and accepted by all.

This meeting should include all of the activities referenced in the project specifications.

The meeting will be documented by the Engineer and minutes will be transmitted to all parties.

1.6.3 CQA Progress Meetings

Progress meetings will be held between the Engineer, the CQA Engineer, the Contractor, and representatives from any other involved parties at the frequency dictated in the project specifications or, at a minimum, once per month during active construction. These meetings will discuss current progress, planned activities for the next week, and any new business or revisions to the work. The CQA Engineer will log any problems, decisions, or questions arising at this meeting in his daily or periodic reports. Any matter requiring action which is raised in this meeting will be reported to the appropriate parties. These meetings will be documented by the Engineer and minutes will be transmitted to affected parties.

1.6.4 Problem or Work Deficiency Meetings

A special meeting will be held when and if a problem or deficiency is present or likely to occur. At a minimum, the meeting will be attended by the Engineer, the CQA Engineer, the Contractor, and representatives from any other involved parties. 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 will be documented by the Engineer and minutes will be transmitted to affected parties.

1.7 Control Versus Record Testing

1.7.1 Control Testing

In the context of this CQA Manual, Control Tests are those tests performed on a material prior to its actual use in construction to demonstrate that it can meet the requirements of the project plans and specifications. Control Test data may be used by the Engineer as the basis for approving alternative material sources.

1.7.2 Record Testing

Record Tests are those tests performed during the actual placement of a material to demonstrate that its in-place properties meet or exceed the requirements of the project drawings and specifications.

2.0 CQA DOCUMENTATION

An effective CQA plan depends largely on recognition of 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 Engineer will document that quality assurance requirements have been addressed and satisfied.

The CQA Engineer will provide the Owner and Engineer with his daily and progress reports including signed descriptive remarks, data sheets, and logs to verify that required CQA activities have been carried out. These reports will also identify potential quality assurance problems. The CQA Engineer will also maintain at the job site a complete file of project drawings, reports, project specifications, a CQA Manual, checklists, test procedures, daily logs, and other pertinent documents.

2.1 Daily CQA Report

The CQA Engineer's reporting procedures will include preparation of a daily report which, at a minimum, will include the following information, where applicable:

- a unique identifying sheet number for cross referencing and document control;
- date, project name, location, and other identification;
- data on weather conditions;
- a reduced scale Site Plan showing all proposed work areas and test locations;
- descriptions and location of ongoing construction;
- descriptions and specific locations of areas, or units, of work being tested and/or observed and documented;
- locations where tests and samples were taken;
- a summary of test results;
- calibrations or recalibrations of test equipment, and actions taken as a result of recalibration;
- 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;

- summaries of pertinent discussions with the Contractor; and
- the CQA Engineer's signature.

The daily report must be completed at the end of each day. This information will be submitted to the Engineer for review on a routine basis and to the Owner upon request.

2.2 CQA Progress Reports

The CQA Engineer will prepare summary progress reports at time intervals as requested by the Engineer or Owner or upon a total project shutdown. As a minimum, this report will include the following information for the reporting period, where applicable:

- a summary of work activities performed;
- a summary of construction situations, deficiencies, and/or defects;
- a summary of all test results, failures, and retests;
- a compilation of daily CQA reports; and
- the CQA Engineer's signature.

Critical problems that occur will be communicated verbally to the Engineer immediately as well as being included in the progress reports.

2.3 CQA Photographic Reporting

Photographs will be taken by the CQA Engineer at regular intervals during the construction process and in all areas deemed critical by the CQA Engineer. These photographs will serve as a pictorial record of work progress, problems, and mitigation activities. Videotaping may be used to supplement photographs in the documentation of work progress, problems, and/or mitigation activities. These records will be presented to the Engineer upon completion of the project.

2.4 Deficiencies

The Owner and Engineer will be made aware of any significant recurring non-conformance with the project specifications. The Engineer will then determine the cause of the non-conformance and recommend appropriate changes in procedures or specification. When this type of evaluation is made, the results will be documented, and any revision to procedures or project specifications will be approved by the Owner and Engineer.

2.5 Design and/or Project Technical Specification Changes

Design and/or project specification changes may be required during construction. In such cases, the CQA Engineer will notify the Engineer. The Engineer will then notify the appropriate agency, if necessary.

Design and/or project specification changes will be made only with the written agreement of the Engineer, and will take the form of an addendum to the project specifications. All design changes will include a detail (if necessary) and state which detail it replaces in the plans.

2.6 Final CQA Report

At the completion of each major construction activity, the CQA Engineer will certify all required forms, observation logs, field and laboratory testing data sheets including sample location plans, etc. The CQA Engineer will also provide a final report which will certify that the work has been performed in compliance with the plans and project technical specifications, and that the supporting documents provide the necessary information.

The CQA Engineer will also provide summaries of all the data listed above with the report. The Record Drawings will include scale drawings depicting the location of the construction and details pertaining to the extent of construction (e.g., depths, plan dimensions, elevations, soil component thicknesses, etc.). All surveying and base maps required for development of the Record Drawings will be done by the Contractor's Construction Surveyor. These documents will be certified by the Contractor and delivered to the CQA Engineer and included as part of the final CQA (Certification) report.

It may be necessary to prepare interim certifications, as allowed by the regulatory agency, to expedite completion and review.

At a minimum, the items shown in **Table 2.1** will be included in the Final CQA Report. Note that some items may not be applicable to all projects.

2.7 Storage of Records

All handwritten data sheet originals, especially those containing signatures, will be stored by the CQA Engineer in a safe repository on site. Other reports may be stored by any standard method which will allow for easy access. All written documents will become property of the Owner.

Table 2.1A Final CQA Report General Outline (Landfill Subgrade)

1. Introduction
2. Project Description
3. CQA Program
 - a. Scope of Services
 - b. Personnel
4. Earthwork CQA
5. Summary and Conclusions
6. Project Certification

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| Appendix A | Design Clarifications and Modifications |
| Appendix B | Piezometer Abandonment (if applicable) |
| Appendix C | Photographic Documentation |
| Appendix D | CQA Reporting |
| D1. | CQA Reports |
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| Appendix E | Earthwork CQA Data |
| E1. | CQA Test Results - Control Tests |
| E2. | CQA Test Results - Record Tests |
| Appendix F | Record Drawings |
| F1. | Subgrade As-Built |

Table 2.1B Final CQA Report General Outline (Final Cover System)

1. Introduction
2. Project Description
3. CQA Program
 - a. Scope of Services
 - b. Personnel
4. Earthwork CQA
5. Soil Liner CQA
6. Final Cover System CQA
7. Summary and Conclusions
8. Project Certification

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| C1. | CQA Reports |
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3.0 EARTHWORK CQA

This section of the CQA Manual addresses earthwork (excavation and embankment) and outlines the soils CQA program to be implemented with regard to material approval, subgrade approval, field control and record tests, and resolution of problems.

3.1 Embankment Material Approval

All material to be used as compacted embankment shall be approved in advance by the CQA Engineer. Approval is based upon successful completion of CQA control testing outlined below. Such testing can be performed either during excavation and stockpiling or from existing stockpiles prior to use.

3.1.1 Control Tests

The procedure for CQA testing during excavation and stockpiling (including existing stockpiles) is outlined below.

Each load of soil will be examined either at the borrow source or the stockpile area. Any unsuitable material will be rejected or routed to separate stockpiles consistent with its end use. Appropriate entries will be made in the daily log.

During stockpiling operations, control tests, as shown on **Table 3.1**, will be performed by the CQA Engineer prior to placement of any compacted embankment.

3.2 Subgrade Approval

The CQA Engineer will verify that the compacted embankment subgrade is constructed in accordance with the project specifications.

3.3 Earthwork Construction

3.3.1 Construction Monitoring

- A. Earthwork shall be performed as described in the project specifications.
- B. Only soil previously approved by the CQA Engineer (see **Section 3.1**) shall be used in construction of the compacted embankment. Unsuitable material will be removed prior to acceptance by the CQA Engineer.
- C. All required field density and moisture content tests shall be completed before the overlying lift of soil is placed. The surface preparation (e.g.

wetting, drying, scarification, etc.) shall be completed before the CQA Engineer will allow placement of subsequent lifts.

- D. The CQA Engineer will monitor protection of the earthwork during and after construction.

3.3.2 Control Tests

The control tests, as shown on **Table 3.2**, will be performed by the CQA Engineer prior to placement of compacted embankment.

3.3.3 Record Tests

The record tests, as shown on **Table 3.2**, will be performed by the CQA Engineer during placement of compacted embankment.

3.3.3.1 Record Test Failure

Recompaction of the failed area shall be performed and retested until the area meets or exceeds requirements outlined in the specifications.

3.3.4 Judgmental Testing

During construction, the frequency of control and/or record testing may be increased at the discretion of the CQA Engineer when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when:

- the rollers slip during rolling operation;
- the lift thickness is greater than specified;
- the fill material is at an improper moisture content;
- fewer than the specified number of roller passes are made;
- dirt-clogged rollers are used to compact the material;
- the rollers may not have used optimum ballast;
- the fill materials differ substantially from those specified; or
- the degree of compaction is doubtful.

3.4 Deficiencies

The CQA Engineer will immediately determine the extent and nature of all defects and deficiencies and report them to the Owner and Engineer. All defects and deficiencies will be documented by the CQA Engineer. The Contractor shall correct defects and deficiencies to the satisfaction of the CQA Engineer. The CQA Engineer will observe all retests on repaired defects.

Table 3.1 CQA Testing Program for Embankment Material Approval

Property	Test Method	Minimum Test Frequency
Control Tests:		
Visual Classification	ASTM D 2488	Each Soil
Moisture-Density Relationship	ASTM D 698	5,000 CY per Each Soil

Table 3.2 CQA Testing Program for Compacted Embankment

Property	Test Method	Minimum Test Frequency
Control Tests: (See Table 3.1)		
Record Tests:		
Lift Thickness	-----	Each Lift
In-Place Density	ASTM D 6938 ¹	20,000 ft ² per lift & 1 per 500 LF/lift of Berms (< 200 ft. base width)
Moisture Content	ASTM D 6938 ²	20,000 ft ² per lift & 1 per 500 LF/lift of Berms (< 200 ft. base width)
Verification of Subgrade Soil Type (Soil within 2 Vertical Feet of Finished Subgrade Elevations) (See Note 3):		
Visual Classification	ASTM D 2488	5,000 ft ²
Atterberg Limits	ASTM D 4318	10,000 ft ²
Grain Size Analysis	ASTM D 422	10,000 ft ²

Notes:

1. Optionally use ASTM D 1556, ASTM D 2167, or ASTM D 2937. For every 10 nuclear density tests perform at least 1 density test by ASTM D 1556, ASTM D 2167, or ASTM D 2937 as a verification of the accuracy of the nuclear testing device.
2. Optionally use ASTM D 2216, ASTM D 4643, or ASTM D 4959. For every 10 nuclear moisture tests perform at least 1 moisture test by ASTM D 2216, ASTM D 4643, or ASTM D 4959 as a verification of the accuracy of the nuclear testing device.
3. Conduct subgrade verification using hand augered boring or test pit.

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4.0 SOIL LINER CQA

This section of the CQA Manual addresses the soil liner component of the final cover system and outlines the soils CQA program to be implemented with regard to material approval, subgrade approval, test fill construction, field and laboratory control and record tests, and resolution of problems.

4.1 Soil Liner Material Approval

All material to be used as soil liner shall be approved in advance by the CQA Engineer. Approval is based upon successful completion of CQA control testing outlined below. Such testing can be performed either during excavation and stockpiling or from existing stockpiles prior to use.

4.1.1 Control Tests

The procedure for CQA testing during excavation and stockpiling (including existing stockpiles) is outlined below.

Each load of soil will be examined either at the borrow source or the stockpile area. Any unsuitable material will be rejected or routed to separate stockpiles consistent with its end use. Appropriate entries will be made in the daily log.

During stockpiling operations, control tests, as shown on **Table 4.1**, will be performed by the CQA Engineer prior to placement of any soil liner material.

4.2 Subgrade Approval

The CQA Engineer will verify that the soil liner subgrade is constructed in accordance with the project specifications.

4.3 Test Fill Construction

A test fill meeting the requirements of the project specifications will be constructed using the same construction methods, equipment, and material to be used for the soil liner component. The test fill construction will be conducted prior to or coincide with the beginning of construction of the soil liner component.

Construction equipment and methods will be reviewed by the CQA Engineer prior to test fill placement.

4.3.1 Control Tests

The control tests, as shown on **Table 4.2**, will be performed by the CQA Engineer prior to placement of soil liner material in the test fill.

4.3.2 Record Tests

The record tests, as shown on **Table 4.2**, will be performed by the CQA Engineer during placement of soil liner material in the test fill.

4.3.3 Test Fill Completion

The test fill program is completed when the Contractor has shown that the soil liner constructed using the same construction methods, equipment, and material to be used in construction of the soil liner will satisfy project specifications. No soil liner can be placed until the test fill program is completed.

4.4 **Soil Liner Construction**

4.4.1 Construction Monitoring

- A. Soil liner shall be placed as described in the applicable section(s) of the project specifications using the construction methods, equipment, and material demonstrated in the test fill construction.
- B. Only soil previously approved by the CQA Engineer (see **Section 4.1**) shall be used in construction of the soil liner. Unsuitable material will be removed prior to acceptance by the CQA Engineer.
- C. All required field density and moisture content tests shall be completed before the overlying lift of soil is placed. The surface preparation (e.g. wetting, drying, scarification, etc.) shall be completed before the CQA Engineer will allow placement of subsequent lifts.
- D. The CQA Engineer will monitor protection of the soil liner during and after construction.
- E. The liner surface shall be sprinkled with water as needed to prevent desiccation. Should desiccation occur, the last lift shall be reconstructed in accordance with the project specifications. Standing water should not be present on the soil liner.
- F. Frost heave or other damage due to freezing shall require lift reconstruction in accordance with the project specifications.

- G. The CQA Engineer will inspect the soil liner and certify that it is in accordance with the project specifications and approved plans prior to the Contractor beginning installation of overlying components.
- H. The finished soil liner shall be free of all rock protrusions. All cracks and voids shall be filled and the surface made uniform. This shall be accomplished by final dressing of the soil liner with smooth-drum rollers and hand raking. No rubber tired vehicles are permitted on the final dressed surface unless authorized by the CQA Engineer.

4.4.2 Control Tests

The control tests, as shown on **Table 4.3**, will be performed by the CQA Engineer prior to placement of soil liner material.

4.4.3 Record Tests

The record tests, as shown on **Table 4.3** and as described below, will be performed by the CQA Engineer during placement of soil liner material.

- A. Each lift will be checked visually for soil clods, rocks, debris, plant materials and other foreign material. Any such material which does not meet specified requirements shall be identified and removed prior to and during the compaction process.
- B. The thickness of the loose lift will be measured at random locations after spreading and leveling is completed. Loose lift thickness should not exceed the depth of penetration of the compaction feet.
- C. Moisture content will be monitored by the CQA Engineer prior to compaction. If the soil is drier than the specified minimum moisture content, water will be added and the lift will be disced to distribute the moisture evenly.

Results of testing will be certified within 7 days of soil liner placement.

4.4.3.1 Record Test Failure

The following procedures shall be used in the event of density or hydraulic conductivity test failure:

- A. Failed Density Test: Recomposition of the failed area shall be performed and retested until the area meets or exceeds requirements outlined in the specifications.

- B. Failed Hydraulic Conductivity Test: The area of failure shall be localized and reconstructed in accordance with the project specifications. This area will be retested as outlined within the plan by the CQA Engineer. Optionally, at least five replicate samples shall be obtained and tested by the Contractor in the immediate vicinity of the failed test. If all five samples pass, then the initial failing test will be discounted. However, should the replicate samples confirm the failure of the soil liner to meet specifications, the area of failure shall be localized, reconstructed, and retested as described above.

4.4.4 Judgmental Testing

During construction, the frequency of control and/or record testing may be increased at the discretion of the CQA Engineer when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when:

- the rollers slip during rolling operation;
- the lift thickness is greater than specified;
- the fill material is at an improper moisture content;
- fewer than the specified number of roller passes are made;
- dirt-clogged rollers are used to compact the material;
- the rollers may not have used optimum ballast;
- the fill materials differ substantially from those specified; or
- the degree of compaction is doubtful.

4.4.5 Perforations In Soil Liner

All holes shall be patched with compacted soil liner (if allowed by the project specifications) or sodium bentonite compacted and hydrated in the holes.

4.5 Deficiencies

The CQA Engineer will immediately determine the extent and nature of all defects and deficiencies and report them to the Owner and Engineer. All defects and deficiencies will be documented by the CQA Engineer. The Contractor shall correct defects and deficiencies to the satisfaction of the CQA Engineer. The CQA Engineer will observe all retests on repaired defects.

Table 4.1 CQA Testing Program for Soil Liner Material Approval

Property	Test Method	Minimum Test Frequency
Control Tests:		
Visual Classification	ASTM D 2488	Each Soil
Moisture Content	ASTM D 2216	2,000 CY per Each Soil
Grain Size Analysis	ASTM D 422	2,000 CY per Each Soil
Atterberg Limits	ASTM D 4318	2,000 CY per Each Soil
Moisture-Density Relationship	ASTM D 698	5,000 CY per Each Soil
Hydraulic Conductivity - Lab Remolded	ASTM D 5084 ³	10,000 CY per Each Soil

Table 4.2 CQA Testing Program for Soil Liner Test Fill

Property	Test Method	Minimum Test Frequency
Control Tests: (See Table 4.1)		
Moisture-Density Relationship	ASTM D 698 ⁴	1 per lift
Hydraulic Conductivity - Lab Remolded	ASTM D 5084 ^{3,4}	1 per lift
Record Tests:		
Lift Thickness	-----	Each Lift
Atterberg Limits	ASTM D 4318	1 per lift
Grain Size Analysis	ASTM D 422	1 per lift
In-Place Density	ASTM D 2922 ¹	3 per lift
Moisture Content	ASTM D 6938 ²	3 per lift
Hydraulic Conductivity - Undisturbed (Shelby Tube)	ASTM D 5084 ³	1 per lift

Table 4.3 CQA Testing Program for Soil Liner

Property	Test Method	Minimum Test Frequency
Control Tests: (See Table 4.1)		
Record Tests:		
Lift Thickness	-----	Each Lift
In-Place Density	ASTM D 6938 ¹	10,000 ft ² per lift
Moisture Content	ASTM D 6938 ²	10,000 ft ² per lift
Hydraulic Conductivity - Undisturbed (Shelby Tube)	ASTM D 5084 ³	80,000 ft ² per lift

Notes:

1. Optionally use ASTM D 1556, ASTM D 2167, or ASTM D 2937. For every 10 nuclear density tests perform at least 1 density test by ASTM D 1556, ASTM D 2167, or ASTM D 2937 as a verification of the accuracy of the nuclear testing device.
2. Optionally use ASTM D 2216, ASTM D 4643, or ASTM D 4959. For every 10 nuclear moisture tests, perform at least 1 moisture test by ASTM D 2216, ASTM D 4643, or ASTM D 4959 as a verification of the accuracy of the nuclear testing device.
3. Maximum effective confining pressure and hydraulic gradient as required by the project specifications. Backpressure as recommended by ASTM D 5084.
4. These tests performed on the test fill may count toward the minimum frequencies established in **Table 4.1**.

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5.0 FINAL COVER SYSTEM CQA

This section of the CQA Manual addresses the drainage piping, landfill gas (LFG) system, and the vegetative soil layer of the final cover system. By reference to **Section 4.0** of this CQA Manual, this section also addresses the soil liner that is included in the final cover system. This section outlines the CQA program to be implemented with regard to material approval, construction monitoring, and resolution of problems.

5.1 Final Cover System Material Approval

The CQA Engineer shall verify that the following are provided and installed in accordance with the project drawings, specifications, and this CQA Manual.

5.1.1 Corrugated Polyethylene (CPE) Pipe

- A. Receipt of Contractor's submittals on CPE pipe.
- B. Review of submittals for CPE pipe for conformity to the project specifications.

5.1.2 LFG System Components

- A. Receipt of Contractor's submittals on LFG system components.
- B. Review of submittals for LFG system components for conformity to the project specifications.

5.1.3 Soil Liner

The CQA program for Soil Liner is presented in **Section 4.0** of this CQA Manual.

5.1.4 Vegetative Soil Layer

- A. Review the proposed source of vegetative soil layer for conformance with the project specifications.

5.2 Final Cover System Installation

The CQA Engineer will monitor and document the construction of all final cover system components for compliance with the project specifications. Monitoring the construction work for the components of the final cover system includes the following:

- verify location and depth of LFG wells/vents;

- verify location of all piping;
- monitoring the minimum vertical buffer maintained between field equipment and piping; and
- monitoring the placement of the soil components of the final cover system.

5.3 Deficiencies

The CQA Engineer will immediately determine the extent and nature of all defects and deficiencies and report them to the Owner and Engineer. All defects and deficiencies will be documented by the CQA Engineer. The Contractor shall correct defects and deficiencies to the satisfaction of the CQA Engineer. The CQA Engineer will observe all retests on repaired defects.

Appendix A

Reference List of Test Methods

**Construction Quality Assurance Manual
Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

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Construction Quality Assurance Manual

Appendix A: Reference List of Test Methods

American Society American Society of Testing and Materials (ASTM):

ASTM C 136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM D 422	Standard Test Method for Particle Size Analysis of Soils.
ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³).
ASTM D 1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
ASTM D 2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
ASTM D 2216	Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
ASTM D 2488	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
ASTM D 2937	Standard Test Method for Density of Soil in Place by the Drive Cylinder Method.
ASTM D 4318	Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
ASTM D 4643	Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.
ASTM D 4959	Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method.
ASTM D 5084	Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
ASTM D 6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

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Operations Manual

Harnett County Anderson Creek Landfill Facility Harnett County, North Carolina

Prepared for:

**Harnett County Solid Waste Department
Lillington, North Carolina**

January 2014

NC LIC. NO. C-0828 (ENGINEERING)

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**Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

Operations Manual

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1.0 GENERAL FACILITY OPERATIONS

This Operations Manual was prepared for operations of the Harnett County Anderson Creek Landfill facility located at 1086 Poplar Drive in Spring Lake. Harnett County (County) owns and operates the facility under Solid Waste Permit Nos. 43-03 (C&D Landfill) and 43-09T (Transfer Station). This document discusses the operation of the following landfill units and other solid waste management activities:

- Municipal Solid Waste (MSW) Transfer Station;
- Construction and Demolition Debris (C&D) Landfill;
- Convenience Center;
 - Small MSW Loads
 - Recyclables
 - White Goods and Scrap Metal
 - Consumer Electronics
 - Used Tires
 - Used Vehicle Oil Filters
 - Automotive Batteries
 - Pallets
 - Asphalt Shingles
- Yard Waste Processing Area; and
- Material Recovery.

Refer to **Figure 1** for the location of existing and proposed landfill units, the transfer station, and other solid waste management activities.

The information contained herein was prepared to provide facility personnel with a clear understanding of how the Design Engineer assumed that the completed facility would be operated and how regulatory operations criteria will be met. While deviations from the operations procedures outlined herein may be acceptable, they must be reviewed and approved by the NC Department of Environment and Natural Resources (DENR) Division of Waste Management (DWM) prior to implementation. Additionally, the Design Engineer should be consulted regarding any changes which may affect the design of the facility. Please refer to the appropriate permit application for a detailed discussion and calculations for the individual components of each landfill unit, including phasing plans.

1.1 Contact Information

All correspondence and questions concerning the operation of the Harnett County Anderson Creek Landfill facility should be directed to the appropriate County and State personnel listed below. For fire or police emergencies dial 911.

1.1.1 Harnett County (County)

Harnett County Solid Waste Department
103 E. Ivey Street
Lillington, NC 27546
Phone: (910) 814-6156
Fax: (910) 814-8263

Anderson Creek Landfill Facility
1086 Poplar Drive
Spring Lake, NC 28390
Phone: (910) 893-5626

County Engineer:	Amanda Bader, P.E.
Solid Waste Operations Manager:	Randy Smith
Solid Waste Operations Crew Leader:	Andrew Holland

1.1.2 North Carolina Department of Environment and Natural Resources

North Carolina DENR - Raleigh Central Office (RCO)
217 W. Jones Street
Raleigh, NC 27603
1646 Mail Service Center
Raleigh, NC 27699-1646
Phone/Fax: (919) 707-8200

North Carolina DENR - Fayetteville Regional Office (FRO)
225 Green Street, Suite 714
Fayetteville, NC 28301
Phone: (910) 486-1541
Fax: (910) 486-0707

Division of Waste Management (DWM) - Solid Waste Section:

Field Operations Branch Head:	Mark Poindexter (RCO)
Eastern District Supervisor:	Dennis Shackelford (FRO)
Environmental Senior Specialist:	Robert Hearn (RCO)

Division of Land Resources - Land Quality Section:

Regional Engineer:	Brad Cole, P.E. (FRO)
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1.2 Facility Operating Hours

Normal hours of operation will be 7:30 A.M. to 4:30 P.M. Monday, Tuesday, Thursday, Friday, and Saturday and 7:30 A.M. to 12:00 P.M. on Wednesday. The facility will be closed on Sunday and on holidays as designated by the County.

The County may elect to modify these hours from time to time.

1.3 Site Access

The site will be accessed by the existing entrance on Poplar Drive. A scale and a scale house are provided near the entrance. All waste will have been weighed prior to being placed in the landfill or transfer station.

1.3.1 Physical Restraints

Limiting access to the landfill facility is important for the following reasons:

- Unauthorized and illegal dumping of waste materials is prevented.
- Trespassing, and injury resulting therefrom, is discouraged.
- The risk of vandalism is greatly reduced.

Access to active areas of the landfill will be controlled by a combination of fences and natural barriers, and strictly enforced operating hours. A landfill attendant will be on duty at all times when the facility is open for public use to enforce access restrictions (see also **Section 1.2**). The entrance has a gate which will be securely locked during non-operating hours.

1.3.2 Security

Frequent inspections of gates and fences will be performed by landfill personnel. The County will arrange for a random security patrol of the landfill entrance to further discourage trespassing. Evidence of trespassing, vandalism, or illegal operation will be reported to the County Engineer or Solid Waste Operations Manager.

1.4 Signage

A prominent sign(s) containing the information required by the DWM will be placed at the main landfill entrance. This sign(s) will provide information on operating hours, operating procedures, and acceptable wastes. Additional signage will be provided as necessary within the landfill complex to distinctly distinguish the roadway to the active landfill unit(s). Service and maintenance roads for use by facility staff will be clearly marked and barriers (e.g., traffic cones, barrels, etc.) will be provided as required.

1.4.1 Waste Limit Markers

During construction or closure of landfill units, waste limit markers will be used to identify the permitted limits of waste. The waste markers will be constructed of non-degradable material and will state "Waste Limits" in bold lettering. Offsets are acceptable such that all wording is clear to the DWM and operational staff. The waste markers will be maintained and replaced when damaged.

1.5 Communications

Two-way radio communication will be maintained between the active landfill unit, transfer station, and the landfill scale house. The scale house has a telephone in case of emergency and for the conduct of day-to-day business. Emergency telephone numbers are displayed in this location.

1.6 Fire Control

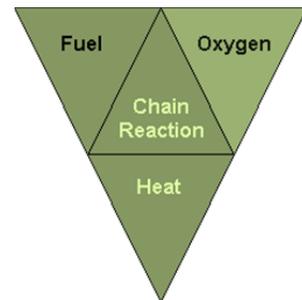
The possibility of fire within the landfill, transfer station, or a piece of equipment must be anticipated in the daily operation of the facility. Potential fire hazards include both surface conditions and subsurface conditions. Surface conditions include equipment operations and newly placed waste. Subsurface conditions include existing waste previously landfilled.

1.6.1 Open Burning

With the exception of the controlled burning of land clearing debris generated on-site or from emergency clean-up operations, no opening burning is allowed at the facility. Controlled burning will occur only if permitted or approved by the DWM, the Division of Air Quality (DAQ), and the local fire department.

1.6.2 Fire Tetrahedron¹

To better understand the properties of fire, the fundamental methods to extinguish it must be understood. The fire "tetrahedron" illustrates the rule that in order to ignite and burn, each component of the tetrahedron (fuel, oxygen, heat, and chemical chain reaction) represents a property of flaming fire. A fire is prevented or extinguished by "removing" any one of them. A fire naturally occurs when the elements are combined in the right mixture (e.g., more heat needed for igniting some fuels, unless there is concentrated oxygen). The fire tetrahedron is a more modern adaptation of the traditional fire "triangle"



¹ National Fire Protection Association (www.nfpa.org).

recognizing the chemical reactions that may occur as a component - “the uninhibited chain reaction”. This chain reaction is the feedback of heat to the fuel to produce the gaseous fuel used in the flame. In other words, the chain reaction provides the heat necessary to maintain the fire. These principles are integral in the prevention and management of potential fire situations. *Please note this information is considered as a basis of understanding which may be superseded by the direction and skill of the local Fire Marshal.*

1.6.3 Equipment

A combination of factory installed fire suppression systems and/or portable fire extinguishers will be operational on all pieces of heavy equipment at all times. Potential fire hazards are created from the build-up of fine, dry dust particles on and around operational motors and control panels. The presence of these build-ups can cause overheating and potential fire if periodic equipment cleaning and maintenance are not practiced. Portable fire extinguishers should be maintained in a state of readiness on each piece of moving equipment and equipment should be cleaned periodically.

1.6.4 General Fire Management Strategies

Each fire situation is site specific; however, general strategies for active fire management include the following (in no particular order):

- Accelerated high temperature combustion (displacing fuel);
- Covering of burning material with soil (reduce oxygen);
- Covering of burning material with foams (reduce oxygen);
- Flooding of burning material with water (reduce heat);
- Injecting an inert gas such as CO₂ (reduce oxygen);
- Excavating the burning material (displacing fuel) and then extinguishing it in small controlled areas; and
- Applying extinguishing agents that will interfere with and inhibit the combustion process at the molecular level (break the chemical reaction).

1.6.5 Fires Within Disposal Areas

Fires within the landfill disposal areas will be limited by the use of cover soil as a fire break and control of “hot” loads entering the landfill. Landfill personnel at the scale house will turn away all trucks containing waste that is suspected to be hot. If a hot load is placed on the working face, then the load will be spread as thin as possible and daily cover soil will be immediately placed on the waste to extinguish the fire.

In general, fires that break out close to the surface of the disposal area should be excavated and smothered with cover material. Deep fires should be smothered

out by placing moist soil on the surface and by constructing soil barriers around the fire. Where the smothering technique fails, the burning material must be excavated and smothered or quenched with water once the burning material is brought to the surface. Water is usually not effective unless it can be directly applied to the burning material.

1.6.6 Fires within the Transfer Station or in Transfer Trailers

Fires within the transfer station or in transfer trailers will be limited by the control of “hot” loads entering the facility. Facility personnel at the scale house will turn away all vehicles containing waste that is suspected to be hot. If smoldering or burning waste is discovered on the tipping floor, then the waste will be segregated, spread as thin as possible, and the fire will be extinguished. No “hot” material will be loaded onto transfer trailers.

Transfer trailer fires are uncommon, but may occur when open trailers are loosely loaded with combustible waste materials. If smoke or fire are observed in a loaded waste transfer trailer, the fire must be immediately reported to the Solid Waste Operations Manager. If possible, the load should be immediately doused with water from the tipping floor. If possible, the transfer trailer should be slowly moved from the loading bay, moved at least 100 feet away from the building, and disconnected from the truck cab. The Solid Waste Operations Manager will evaluate the situation and response, and, if necessary, call 911.

1.6.7 Notification

The County will verbally notify the DWM (see **Section 1.1.2**) within 24 hours of discovery of a fire within any landfill disposal area or in the transfer station. In addition, 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 15 days following any such occurrence using the DWM’s Fire Occurrence Notification Form (see **Appendix A**).

1.6.8 Coordination With Local Fire Department

A copy of this Operations Manual will be filed with the local fire department including all contact information for the facility.

1.7 **Severe Weather Conditions**

Unusual weather conditions can directly affect the operation of the landfill facility. Some of these weather conditions and recommended operational responses are as follows.

1.7.1 Ice Storms

An ice storm can make access to the facility dangerous, prevent movement or placement of cover soil, and, thus, may require closure of the facility until the ice is removed or has melted.

1.7.2 Heavy Rains

Exposed soil surfaces can create a muddy situation in some portions of the facility during rainy periods. The control of drainage and use of crushed stone on unpaved roads should provide all-weather access for the site and promote drainage away from critical areas. In areas where the aggregate surface is washed away or otherwise damaged, new aggregate should be used for repair.

Intense rains can affect newly constructed drainage structures such as swales, diversions, cover soils, and vegetation. After such a rain event, inspection by facility personnel will be initiated and corrective measures taken to repair any damage found before the next rainfall.

1.7.3 Electrical Storms

The open area of the facility is susceptible to the hazards of an electrical storm. If necessary, activities will be temporarily suspended during such an event. Refuge will be taken as necessary in the on-site buildings or in rubber-tired vehicles.

1.7.4 Windy Conditions

Facility operations during a particularly windy period may require that the working face be temporarily shifted to a more sheltered area. When this is done, the previously exposed face will be immediately covered with cover soil.

1.7.5 Violent Storms

In the event of hurricane, tornado, or severe winter storm warning issued by the National Weather Service, facility operations may be temporarily suspended until the warning is lifted. Cover soil will be placed on exposed waste and buildings and equipment will be properly secured to the extent deemed safe.

1.8 Equipment Requirements

The County will maintain on-site equipment required to perform the necessary site activities. Periodic maintenance of all equipment and minor and major repair work will be performed at designated maintenance zones.

The anticipated major equipment requirements for operation and maintenance of the site are listed in the following table. These may vary based upon incoming tonnages and equipment replacement schedules.

Table 1 Equipment Requirements

Description	Primary Function (Allocation)
1) Compactor	Waste placement and compaction
2) Dozers (2)	Stripping and grading of borrow areas, fine grading, slope work, and site cleanup
3) Rubber-Tired Front End Loader	Moving waste on tipping floor of transfer station
4) Rubber-Tired Backhoe	General site operations; backup for front end loader
5) Yard Tractor	Moving transfer trailers
6) Transfer Trailers (Multiple)	Waste transportation (Contractor-Owned)
7) Excavator	Loading and placement of cover soils; general site operations
8) Farm Tractor w/ Pavement Brush	General site operations; road cleaning
9) Pans (2)	Loading and hauling of cover soil
10) Leachate Truck	Hauling of leachate

1.9 Personnel Requirements

1.9.1 C&D Landfill

At least one member of the facility supervisory staff will be certified as a Manager of Landfill Operations (MOLO) by the Solid Waste Association of North America (SWANA) (or other DWM-approved program) and operations staff will go through appropriate training. At least one certified (SWANA Landfill Operations Specialist or other DWM-approved program) operator will be present on-site during times when the landfill is receiving or disposing of waste. As part of this training, personnel learn to recognize loads which may contain prohibited wastes.

1.9.2 Transfer Station

At least one member of the facility supervisory staff will be trained in the management of transfer station operations and operations staff will go through appropriate training. As part of this training, personnel learn to recognize loads which may contain prohibited wastes.

1.10 Health and Safety

All aspects of the facility operations were developed with the health and safety of the operating staff, customers, and neighbors in mind. Prior to commencement of operations of the facility, a member of the operating staff will be designated site safety

officer. This individual, together with the facility's management will modify the site safety and emergency response program to remain consistent with SWANA and Occupational Safety and Health Administration (OSHA) guidance.

Safety equipment provided includes equipment rollover protective cabs, seat belts, audible reverse warning devices, hard hats, safety shoes, and first aid kits. Facility personnel will be encouraged to complete the American Red Cross Basic First Aid Course. Other safety requirements as designated by the County will also be implemented.

Facility employees will be routinely trained in health and safety by supervisory staff. All training will be documented. The following are some general recommendations for the health and safety of workers:

1.10.1 Personal Hygiene

The following items are recommended as a minimum of practice:

- Wash hands before eating, drinking, or smoking.
- Wear personal protective equipment as described in **Section 1.10.2**.
- Wash, disinfect, and bandage ANY cut, no matter how small it is. Any break in the skin can become a source of infection.
- Keep fingernails closely trimmed and clean (dirty nails can harbor pathogens).

1.10.2 Personal Protective Equipment

Personal Protective Equipment (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 the PPE typically used and/or required in a solid waste management facility workplace.

- Safety shoes with steel toes.
- Noise reduction protection should be used in areas where extended exposure to continuous high decibel levels are expected.
- Disposable rubber latex or chemical resistant gloves for handling and/or sampling of waste materials.
- Dust filter masks (voluntary).
- Hard hats (in designated areas).

Following use, PPE's should be disposed of or adequately cleaned, dried, or readied for reuse.

1.10.3 Mechanical Equipment Hazard Prevention

All equipment should be operated with care and caution. All safety equipment such as horns, backup alarms, and lights should be functional. A Lockout-Tagout program will be used to identify equipment in need or under repair and insure that operation is “off-limits” prior to maintenance or repair. All operators will be trained in the proper operation of equipment.

1.10.4 Employee Health and Safety

Some general safety rules are:

- Consider safety first when planning and conducting activities.
- Review the equipment O&M manual(s) prior to attempting repairs/changes.
- Remember the buddy system for repair of mechanical equipment.
- Post emergency contact phone numbers.
- Provide easy and visible access to the Right to Know materials.
- Provide easy and visible access to first aid kits and fire extinguishers.

1.10.5 Physical Exposure

Facility personnel may come in contact with the fluids, solids, and airborne constituents found at the facility. Routine training should be conducted regarding the individual and collective materials used at the facility and their associated hazards. Training concerning safe work practices around these potential exposures should cover the use of equipment and proper disposal procedures.

1.10.6 Safety Data Sheets

Safety Data Sheets (SDS) will be made available for all chemicals stored on site for use at the facility. SDS will be stored in a location with all other Right to Know information for the site.

1.11 Utilities

Electrical power, water, telephone, and restrooms will be provided at the scale house and transfer station.

1.12 Record Keeping Program

The County will maintain the following records in an operating record at the facility:

- A. Current permit(s) (Permit to Construct, Permit to Operate, etc.);
- B. Current operations manual/plan(s) and engineering plan for each landfill unit;
- C. Inspection reports;
- D. Audit and compliance records;
- E. Annual reports (including survey and other documentation related to airspace usage in landfill units);
- F. Waste inspection records (see **Section 2.3.1**);
- G. Daily tonnage records - including source of generation;
- H. Waste determination records (if applicable);
- I. Quantity, location of disposal, generator, and special handling procedures for all special wastes disposed of at the site;
- J. List of generators and haulers that have attempted to dispose of restricted wastes;
- K. Employee training procedures and records of training completed;
- L. All ground water monitoring and surface water quality information (See the current **Water Quality Monitoring Plan**) including:
 - 1. Monitoring well construction records;
 - 2. Sampling dates and results;
 - 3. Statistical analyses (if applicable); and
 - 4. Results of inspections, repairs, etc.
- M. LFG monitoring results and remedial measures as required (see the current **LFG Monitoring Plan**);
- N. All closure and post-closure information, where applicable, including:
 - 1. Notification of intent to close;
 - 2. Testing;
 - 3. Certification; and
 - 4. Recording.
- O. Cost estimates or financial assurance documentation;
- P. A notation of the date of cover placement;
- Q. Documentation of approval for controlled burning (Date of Approval/Name of Approving DWM personnel) (see **Section 1.6.1**);
- R. Documentation of Asphalt Shingle Recycling (see **Section 2.6** and **Appendix E**);
- S. NPDES records (see **Section 3.1.4**); and
- T. Leachate records (see **Sections 3.2 and 3.3**).

The operating record will be kept up to date by the Solid Waste Operations Manager or his designee. It will be presented upon request to the DWM for inspection. A copy of this Operations Manual will be kept at the landfill and will be available for use at all times.

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2.0 WASTE HANDLING OPERATIONS

This section describes the required waste handling operations for the Harnett County Anderson Creek Landfill facility. In addition to the MSW and C&D waste disposed of at or transferred from this facility, the County also collects/processes yard waste and recyclables including used tires, white goods, and scrap metal. These materials are stored at the landfill facility until there are sufficient quantities for pick up by various recycling contractors.

2.1 Acceptable Wastes

2.1.1 Approved Service Area

The Anderson Creek Landfill facility is currently approved to serve Harnett County.

2.1.2 Transfer Station

Non-hazardous solid waste as defined by NCGS 130A-290(a)(35) generated within the approved service area may be accepted at the transfer station. In addition, animal carcasses from the NC Department of Transportation and from local animal control departments within the approved service area are accepted and handled as described in **Section 2.4.3.2**. Carcasses are bagged prior to arrival.

Acceptable wastes must meet the requirements of the receiving disposal facility.

2.1.3 C&D Landfill Unit

Only the following wastes generated within the approved service area may be disposed of in the C&D landfill unit:

- Construction and Demolition (C&D) Solid Waste: as defined in 15A NCAC 13B.0532(8) means solid waste resulting solely from construction, remodeling, repair, or demolition operations on pavement and buildings or structures. C&D waste does not include municipal and industrial wastes that may be generated by the on-going operations at buildings or structures.
- Inert Debris: as defined in 15A NCAC 13B.0101(22) means concrete, brick, concrete block, uncontaminated soil, gravel and rock, and untreated and unpainted wood.
- Land Clearing Waste: as defined in 15A NCAC 13B.0101(23) means solid waste which is generated solely from land-clearing activities, limited to stumps, trees, limbs, brush, grass, and other naturally occurring vegetative material.
- Asphalt: in accordance with NCGS 130A-294(m).
- Industrial solid waste that is generated by mobile or modular home

manufacturers and asphalt shingle manufacturers. The waste must be separated at the manufacturing site to exclude municipal solid waste, hazardous waste, and other waste prohibited from disposal in a Construction and Demolition Landfill.

- Other Wastes as Approved by the Solid Waste Section of the Division of Waste Management.

In addition, asbestos as described in **Section 2.4.3** may also be disposed of in the C&D landfill unit.

2.2 Prohibited Wastes

2.2.1 Transfer Station

The following wastes are prohibited from acceptance at the transfer station:

- Used Oil and Motor Vehicle Oil Filters;
- Yard Waste;
- White Goods;
- Antifreeze (ethylene glycol);
- Aluminum Cans;
- Whole Scrap Tires;
- Lead Acid Batteries;
- Certain Recyclable Rigid Plastic Containers (per NCGS 130A-309.10(f)(11));
- Wooden Pallets;
- Oyster Shells;
- Discarded Computer Equipment and Televisions;
- Construction and Demolition Debris (C&D) (Except when allowed by the County).

In addition, operating criteria prohibit other materials from acceptance at the transfer station. These materials include:

- Hazardous waste as defined by NCGS 130A-290(a)(8), including hazardous waste from conditionally exempt small quantity generators.
- Polychlorinated biphenyls (PCB) wastes as defined in 40 CFR 761 with the exception of trace amounts found in materials such as consumer electronics.
- Bulk or non-containerized liquid wastes unless the waste is household waste other than septic waste and waste oil; or the waste is leachate or gas condensate derived from the MSW landfill unit. A liquid determination will be performed by the paint filter test (see **Appendix B** for apparatus and procedure).
- Containers holding liquid wastes unless the waste is household waste.

- Medical waste as defined in G.S. 130A-290(a){18}.
- Sludge as defined in G.S. 130A-290(a){34}.
- Septage as defined in G.S. 130A-290(a){32}.

2.2.2 C&D Landfill Unit

Only wastes as defined in **Section 2.1.2** above may be accepted for disposal in the C&D landfill unit. Prohibited wastes include waste exclusions listed in 15A NCAC 13B 0.0542 as follows:

- Wastewater treatment sludge. Wastewater treatment sludge may be accepted, with the approval of the DWM, for utilization as a soil conditioner and incorporated into or applied onto the vegetative soil layer component of the final cover system. In this case, the sludge will be applied at no greater than agronomic rates and to a maximum depth of six inches.
- 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;
- Garbage as defined in G.S. 130A-290(a){7};
- Hazardous waste as defined in G.S. 130A-290(a){8}, to also include hazardous waste from conditionally exempt small quantity generators;
- Industrial solid waste unless a demonstration has been made and approved by the DWM that the landfill meets the requirements of Rule .0503(2)(d)(iii)(A);
- Liquid wastes;
- Medical waste as defined in G.S. 130A-290(a){18};
- Municipal solid waste as defined in G.S. 130A-290(a){18a};
- Polychlorinated biphenyls (PCB) wastes as defined in 40 CFR 761;
- Radioactive waste as defined in G.S. 104E-5{14};
- Septage as defined in G.S. 130A-290(a){32};
- Sludge as defined in G.S. 130A-290(a){34};
- Special wastes as defined in G.S. 130A-290(a){40};
- White goods as defined in G.S. 130A-290(a){44}; and
- Yard trash as defined in G.S. 130A-290(a){45}.

The following wastes cannot be received if separate from C&D 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;
- Copper chrome arsenate (CCA) and creosote treated woods; and
- Pallets.

Waste accepted for disposal in the C&D landfill 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 as follows:

- 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. For this case, a waste screening plan and waste acceptance plan will be prepared and made available to the DWM upon request.

The County will not dispose of C&D waste that is known to be 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.

2.3 Waste Screening Programs

In order to assure that prohibited wastes are not entering the landfill facility, screening programs have been implemented. Waste received at both the scale house and waste taken to the transfer station or active landfill unit is inspected by trained personnel. These individuals have been trained to spot indications of suspicious wastes, including: hazardous placarding or markings, liquids, powders or dusts, sludges, bright or unusual colors, drums or commercial size containers, and "chemical" odors. Screening programs for visual and olfactory characteristics of prohibited wastes are an ongoing part of the facility operation.

Records of information gathered as part of the waste screening programs will be maintained at the facility during its active life and as long as required by the County and the DWM.

2.3.1 Waste Receiving and Inspection

All vehicles must stop at the scale house located near the entrance of the facility and visitors are required to sign-in. All waste transportation vehicles are weighed and the content of the load assessed. The scale attendant(s) requests from the driver of the vehicle a description of the waste it is carrying to ensure that unacceptable waste is not allowed into the facility. The attendant(s) 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 transfer station, C&D landfill unit, or other area (convenience center, etc.) as appropriate.

Vehicles are randomly selected for screening on a regular basis, depending on personnel available. ***At least two (2) vehicles per week will be randomly selected by inspection personnel.*** However, if something suspicious is spotted in any waste load, that load is inspected further.

Vehicles selected for inspection are directed to an area of intermediate cover adjacent to the working face or to an area of the tipping floor of the transfer station where the vehicle will be unloaded. Waste is carefully spread using suitable equipment. An attendant trained to identify wastes that are unacceptable inspects the waste discharged at the screening site. If unacceptable waste is found, including wastes generated from outside of the service area, the load will be isolated and secured by berming off the area. For unacceptable wastes that are non-hazardous, the Solid Waste Operations Manager will then notify officials of the DWM (see **Section 1.1.2**) within 24 hours of attempted disposal of any waste the landfill is not permitted to receive in order to determine the proper course of action. For unacceptable wastes that are thought to be hazardous, the Hazardous Waste Contingency Plan outlined in **Section 2.3.2** will be followed. The hauler is responsible for removing unacceptable waste from the facility property.

If no unacceptable waste is found, the load will be pushed to the working face and incorporated into the daily waste cell or loaded into a transfer trailer. All random waste inspections will be documented by facility staff using the waste screening form provided in **Appendix C**.

In addition to random waste screening described above, waste unloaded on the active face of the landfill or on the tipping floor of the transfer station will be inspected by the equipment operators, trained to spot unacceptable wastes, before and during spreading and compaction or loading onto transfer trailers. Any suspicious looking waste is reported immediately to the designated primary inspector for further evaluation.

2.3.2 Hazardous Waste Contingency Plan

In the event that identifiable hazardous waste or waste of questionable character is detected at the facility, appropriate equipment, protective gear, personnel, and materials as necessary will be employed to isolate the wastes. The DWM will be notified immediately (see **Section 1.1.2**) that an attempt was made to dispose of hazardous waste at the facility. If the vehicle attempting disposal of such waste is known, all attempts will be made to prevent that vehicle from leaving the site or, if the vehicle has left the site, immediate notice will be served on the owner of the vehicle that hazardous waste, for which they have responsibility, has been disposed of at the facility.

The County will assist the DWM as necessary and appropriate in the removal and disposition of the hazardous waste and in the prosecution of responsible parties. If needed, the hazardous waste will be covered with either on-site soils or other tarping material until such time when an appropriate method can be implemented to properly handle the waste. The cost of the removal and disposing of the hazardous waste will be charged to the owner of the vehicle involved. Any vehicle owner or operator who knowingly dumps hazardous waste in the facility may be barred from using the facility.

Should an incident where hazardous waste is found at the facility occur, the event will be documented by facility staff using the waste screening form provided in **Appendix C**.

2.4 Waste Disposal

2.4.1 Access

Traffic will be clearly directed to the appropriate active access road. The location of access roads during waste placement will be determined by facility staff in order to reflect waste placement strategy. Additionally, access will be maintained for site monitoring locations.

2.4.2 General Procedures

For each active landfill unit, waste transportation vehicles will arrive at the working face at random intervals. There may be a number of vehicles unloading waste at the same time, while other vehicles are waiting. In order to maintain control over the unloading of waste, a certain number of vehicles will be allowed on the working face at a time. The actual number will be determined by the spotter (the spotter is typically the compactor operator). This procedure will be used in order to minimize the potential of unloading un-acceptable waste and to control disposal activity. Operations at the working face will be conducted in a

manner which will encourage the efficient movement of transportation vehicles to and from the working face, and to expedite the unloading of waste.

The approach to the working face will be maintained such that two or more vehicles may safely unload side by side (A minimum separation distance of 10 feet is encouraged.). A vehicle turn-around area large enough to enable vehicles to arrive and turn around safely with reasonable speed will be provided adjacent to the unloading area. The vehicles will back to a vacant area near the working face to unload. Upon completion of the unloading operation, the transportation vehicles will immediately leave the working face area. Personnel will direct traffic as necessary to expedite safe movement of vehicles.

Waste unloading at the landfill will be controlled to prevent disposal in locations other than those specified by site management. Such control will also be used to confine the working face to a minimum width, yet allow safe and efficient operations. The width and length of the working face will be maintained as small as practical in order to maintain the appearance of the site, control windblown waste, and minimize the amount of cover required each day. Normally, only one working face will be active on any given day, with all deposited waste in other areas covered by either daily/periodic, intermediate, or final cover, as appropriate.

The procedures for placement and compaction of solid waste include: unloading of vehicles, spreading of waste into 2 foot lifts (thicker lifts may be necessary at the operators discretion depending on waste type and location of waste placement), and compaction on relatively flat slopes (i.e. 5H:1V max.) using a landfill compactor and a minimum number of three full passes.

Caution will be used in wet conditions such that no waste will be placed into ponded water. Likewise, surface water will not be allowed to be impounded over waste.

Wind screens adjacent to active areas may be used as practical to control windblown waste (refer also to **Section 3.8, Litter Control**).

The use of portable signs with directional arrows and portable traffic barricades will facilitate the unloading of wastes to the designated disposal locations. These signs and barricades will be placed along the access route to the working face of the landfill or other designated areas which may be established.

Except as described in **Section 2.9**, the removal of solid waste from any landfill unit is prohibited except upon notification of the DWM (see **Section 1.1.2**). Regardless, the general public is prohibited from any waste removal activities from any landfill unit.

2.4.3 Special Waste Management

2.4.3.1 Asbestos Management (C&D Landfill Unit)

The County may dispose of asbestos within the C&D landfill unit. Asbestos will only be accepted if it has been processed and packaged in accordance with State and Federal (40 CFR 61) regulations. Asbestos will arrive at the site in vehicles that contain only the asbestos waste and only after advance notification by the generator.

Once the hauler brings the asbestos to the landfill, the hauler will be directed to the designated asbestos disposal area by facility staff. The designated disposal area will be prepared by facility staff by leveling a small area using a dozer or loader. Prior to disposal, the landfill operators will stockpile cover soil near the designated asbestos disposal area. The volume of soil stockpiled will be sufficient to cover the waste and to provide any berms, etc. to maintain temporary separation from other landfill traffic.

Once placed in the prepared area, the asbestos waste will be covered with a minimum of 18 inches of cover soil placed in a single lift. The surface of the cover soil will be compacted and graded using a tracked dozer or loader. The landfill compactor will be prohibited from operating over asbestos disposal areas until at least 18 inches of cover is in-place.

The facility staff will record the approximate location and elevation of the asbestos waste once cover is in-place (typically using a GPS device). The Solid Waste Operations Manager will then review pertinent disposal and location information to assure compliance with regulatory requirements and enter the information into the Operating Record.

Once disposal and recording for asbestos waste is completed, the disposal area may be covered with waste. No excavation into designated asbestos disposal areas will be permitted.

2.4.3.2 Animal Carcasses (Transfer Station)

Animal carcasses will be handled at the transfer station as follows:

- Carcasses will have been bagged prior to arrival.
- Upon arrival the bagged carcasses will be immediately loaded into a transfer trailer.

2.4.4 Daily or Periodic Cover (C&D Landfill Unit)

At the completion of waste placement each week, or sooner if the area of exposed waste exceeds one-half acre in size, a 6-inch layer of earthen material or other material as approved by the DWM will be placed over the exposed waste. Cover must be placed at more frequent intervals if necessary to control disease vectors, fires, odors, blowing litter, and scavenging.

2.4.5 Alternate Daily Cover

Alternate daily cover (ADC) materials/methods may be used upon approval by the DWM. Materials and corresponding methods that have been approved for use at other facilities may be used upon notification of the DWM (see **Section 1.1.2**). Materials/methods which have not been approved for use at other facilities will require a demonstration period prior to approval.

2.4.6 Intermediate Cover

A 12 inch layer of soil cover should be placed on all waste surfaces that have not received waste in 30 days but are below final elevation. This intermediate cover should be seeded immediately and graded such that all precipitation run-off is channeled to the surface water systems.

2.4.7 Height Monitoring

Periodically the facility staff will monitor landfill top and side slope elevations with a level. When such elevations approach design grades, the final top-of-waste grades will be staked to limit over-placement of waste.

2.5 Transfer Station Operations

The transfer station is located at the north end of the facility (see **Figure 1**). The operation of the transfer station is as described below. See **Figures 2A, 2B, and 2C** for the site and utility plan, floor plan, and plumbing plan of the transfer station, respectively.

2.5.1 Waste Receipt

All wastes received for processing at the transfer station will have been weighed-in and visually inspected by scale house personnel (see **Section 2.3**). Vehicles to be unloaded on the tipping floor will be directed by the waste spotter to back into the transfer station building and unload onto the tipping floor.

The transfer station typically receives an average of approximately 60 to 80 tons per day based on annual waste acceptance records. Actual daily amounts may vary outside of this range but future average values are anticipated to be similar.

2.5.2 Tipping Floor Operations

Unloaded wastes will be visually inspected on the tipping floor (see **Section 2.3**). Acceptable waste will be loaded into an awaiting open-top transfer trailer in the loading bay (lower floor of the building). The building has push walls on either side of the tipping floor to aid operations staff in pushing waste through the loading chute located above the loading bay.

2.5.3 Container Loading and Transport

The waste loaded into each transfer trailer should be placed to eliminate excessive voids, irregularities, and protruding wastes to the extent possible. Each loaded trailer will be immediately covered with a tarp prior to leaving the loading bay. Any partially loaded trailer will be left in the loading bay. The movement of trailers on the site is the responsibility of the County. The movement of trailers to and from the site is the responsibility of either the County or a contracted transfer trucking firm.

Once loaded, trailers will be moved from the loading bay to await transport to a disposal facility (currently the Sampson County Disposal MSW Landfill in Roseboro, NC - NC Solid Waste Permit No. 82-02; backup is Johnston County MSW Landfill in Smithfield, NC - NC Solid Waste Permit No. 51-03). The disposal facility will be appropriately permitted to receive waste from the transfer station's service area. Waste can be stored in covered containers at the facility after hours, but no longer than 48 hours.

2.5.4 Equipment Operations Within the Transfer Station

Equipment operations will be carried out in a safe manner to avoid damage to the structure and transport vehicles.

2.5.5 Daily Cleaning

Daily cleaning will be used to control the potential for disease vectors, fire, odors, blowing litter, and scavenging. Any waste remaining on the tipping floor at the end of each day will be placed into a transfer trailer and the partially filled trailer will be covered overnight with a tarp. Additionally, the tipping floor will be swept clean and rinsed with water at the end of each working day. Wash-down water, which becomes leachate upon contact with waste or waste residue, will be directed toward the drains located in the mid-section of the tipping floor and in the loading bay. From the drains, the wash-down water flows to a concrete

storage tank located to the southwest of the building (see **Section 3.2** for management of leachate at the transfer station).

2.5.6 Weekly Cleaning

A thorough cleaning of the transfer station (tipping floor, push walls, and loading bay) and waste handling equipment using water will be performed on a weekly basis. Cleaning agents may be used but must not be harmful to the concrete flooring or other surfaces which will be contacted.

2.6 **Asphalt Shingle Recycling**

Asphalt shingles are collected for recycling in a dedicated container at the convenience center. An asphalt company picks up the container when full. A description of the process is provided in **Appendix E**.

2.7 **Convenience Center Operations**

The operation of the citizen's convenience center is as follows:

The convenience center is set up with roll-off containers and other facilities for the collection and temporary storage of MSW (small loads) and recyclables. The County currently typically collects the following materials for recycling in co-mingled containers:

- Fiber (Newspaper, Cardboard, Paperboard, Mixed Residential Paper, and Office Paper);
- Glass Beverage Containers (Clear, Brown, and Green);
- Aluminum and Steel Food and Beverage Containers; and
- Recyclable Rigid Plastic (#1 through #7).

The convenience center also includes collections facilities for:

- Used Tires;
- Used Vehicle Oil Filters;
- Automotive Batteries;
- Pallets; and
- White Goods, Scrap Metal, and Consumer Electronics (in concrete surfaced area adjacent to the transfer station).

The list of accepted materials may change from time to time at the discretion of the County and depending on available recycling markets.

Used tires are collected at the convenience center in a roll-off container. Once full, the used tires are taken to a tire recycler for recycling.

The operation of the white goods and scrap metal handling area is as follows:

- County personnel segregate materials suspected of containing chloroflourocarbon (CFC) refrigerants (i.e. refrigerators, freezers, and air conditioners containing Freon), and set aside to minimize the potential for damage prior to CFC removal. CFC refrigerants are removed prior to loading these materials in a roll-off container or truck.
- Other white goods and scrap metal are stockpiled or loaded directly in a roll-off container or truck.
- Periodically the County hauls the full roll-off containers or trucks to a local salvage yard, where the white goods and scrap metal can be recycled.

2.8 Yard Waste Processing Area Operations

A yard waste processing area is located at the north end of the facility (see **Figure 1**). The operation of the yard waste processing area is as follows:

- Acceptable wood and yard wastes are stockpiled in separate windrows with a target height of 10 feet (maximum height of 15 feet) and width of 50 feet. Sufficient space is provided between windrows to allow equipment access in case of fire and the windrows are kept a minimum of 75 feet from the property line.
- Once sufficient material is accumulated at the site, a contractor is brought in to grind the waste. This typically occurs 2 to 4 times per year (or as needed).
- Once the waste is ground and becomes mulch, it is used either around the site, primarily for surface stabilization, or placed in windrows (with similar maximum dimensions to pre-processed materials) to be otherwise used in the future at the site. Mulch may also be taken off-site for use as boiler fuel. Typically, approximately 1,000 tons of material is ground each year.

Unacceptable wastes found in this area, if not otherwise prohibited, will be routed to either the transfer station or C&D landfill unit as appropriate.

2.9 Material Recovery

The County may elect to perform some material recovery at the facility for purposes of recycling and reuse. It is anticipated that most of the materials to be recovered will arrive at the facility as C&D waste. Thus, MSW will not be processed.

General procedures for material recovery will be as follows:

1. Staff will separate materials to be recovered near the active face of the landfill.
2. Only the following materials may be recovered:
 - Non-treated, non-painted clean wood (lumber);
 - Pallets (damaged and un-damaged);
 - Cardboard;
 - Metal (ferrous and non-ferrous);
 - Brick and block (undamaged and un-painted); and
 - Concrete (non-asphaltic).
3. Materials to be recovered may be stockpiled within the current or future limits of the C&D landfill (current Phases I & II and borrow area located to the north of Phases I & II), placed with similar materials stockpiled elsewhere (i.e. scrap metal), or placed in containers. Brick and block and concrete may be stockpiled until a load is generated; it is used as on-site as beneficial fill; or it is removed from the site for sale as fill, aggregate, etc.

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3.0 ENVIRONMENTAL MANAGEMENT

This section reviews the overall environmental management tasks required for the successful operation of the facility.

3.1 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 waste.

Proper control of surface water at the facility will accomplish the following goals:

- Minimize the potential for the discharge of pollutants to waters of the United States, including wetlands (point or non-point sources);
- Prevent the run-on of surface water into the landfill unit(s), the active face(s), or the transfer station;
- Prevent the run-off of surface water that has come into contact with the waste (i.e. leachate);
- Limit the erosion caused by surface waters;
- Limit sediments carried off-site by surface waters; and
- Maximize the SEPARATION of SURFACE water from LEACHATE.

Separate erosion and sedimentation control plans have been provided for the various landfill units and other site activities. These plans describe both short and long term engineered features and practices for preventing erosion and controlling sedimentation at this site. The following is a brief discussion of some of these features and practices, focusing more on the landfill units.

3.1.1 Surface Water Run-On Control

The perimeter berms and/or perimeter channels around the landfill unit(s) are designed to prevent the run-on of surface water from adjacent land into the landfill. Additional structures such as diversion berms, channels, down pipes, etc. carry surface water away from the landfill.

Likewise for the transfer station, the potential for run-on of surface water is minimized by use of a roof over the tipping and loading bay floors and exterior grades which slope away from the transfer station building.

3.1.2 Erosion Control

The serviceability of the landfill relies heavily on soil berms, barrier layers, and agricultural layers that are readily eroded by flowing water. Erosion control provisions incorporated in the landfill include the following:

- The slope of the working face should typically be no steeper than 5H:1V where practical to limit erosion of the daily/periodic cover.
- Intermediate cover that has been exposed for more than 30 days must be seeded immediately and repaired when erosion features are identified.
- Drainage breaks (diversion berms, etc.) are provided on the final cover to limit the flow length of run-off.
- Water collected by each drainage break is routed to stormwater drainage channels or down pipes so that the run-off volume does not accumulate going down the slope.
- The vegetative soil layer placed over the final cover must be seeded immediately.

Additional erosion control measures have been taken within the drainage channels and at points of stormwater discharge. All final cover should be inspected regularly for erosion damage and promptly repaired. Revegetation should be performed in accordance with the requirements of the applicable erosion and sedimentation control plan and/or the NC Erosion and Sedimentation Control Planning and Design Manual².

3.1.3 Sedimentation Control

Stormwater run-off from the landfill unit(s) is conveyed to one of the on-site sediment basins and/or traps. These basins and/or traps should be inspected regularly for sediment build-up or erosion damage. The basins and/or traps should be cleaned out when sediment fills the lower half of the basin. Sediments removed may be stockpiled within an active borrow area to dry (if needed) prior to use at the site.

3.1.4 NPDES Requirements

The County will follow the requirements of applicable National Pollutant Discharge Elimination System (NPDES) permit requirements for the site. Requirements include periodic inspections, qualitative monitoring, and sampling of stormwater discharge points. The County will keep records of all inspections, monitoring, and sampling activities (including any test results) in the operating record.

3.2 Leachate Management - Transfer Station

All wash-down water which comes into contact with the waste, tipping floor, loading bay floor, or waste handling equipment will be treated as leachate. Wash-down water, which is collected in floor drains in the tipping floor and loading bay and flows to a

² NC Division of Land Resources (Current Update), North Carolina Erosion and Sediment Control Planning and Design Manual, NCDENR - Division of Land Resources - Land Quality Section, Raleigh, NC.

concrete storage tank located to the southwest of the building. The floor drains will be visually inspected during routine cleaning activities. If there is evidence that the drains are not working properly the County will initiate the necessary maintenance activities.

The leachate storage tank level will be checked at least once per week. The tank will be pumped out whenever the tank approaches full capacity (typically quarterly or more frequently if larger storms are forecast). The leachate will then be hauled to an approved wastewater treatment plant (currently the Harnett County WWTP in Lillington) for treatment and disposal. The tank will be routinely inspected during pumping activities. If there is evidence that the tank is not functioning properly, the County will initiate the necessary maintenance actions.

It is anticipated that any leachate getting outside of the building or leachate storage tank will be minor (i.e. no more than a few gallons - such as the case of a leaky fitting during loading of leachate that is quickly repaired). In the event of a larger spillage of leachate, the spill will be contained as much as practical by County staff (using excavation, soil berms, or other means) and the DWM will be verbally notified (see **Section 1.1.2**). Any impacted soils will be excavated and properly disposed of.

3.2.1 Record Keeping

Records of leachate hauled from the transfer station will be placed in the facility operating record as described in **Section 1.12**.

3.3 Leachate Management - Landfill Units

3.3.1 Leachate Seeps

Leachate seeps can occur due to a variety of circumstances. The goal in dealing with leachate seeps is to prevent seepage from leaving the limits of waste disposal areas and to minimize the potential for reoccurrence. If evidence of leachate seeps is observed, the County will take the following actions.

Depending on the circumstances, various combinations of actions may be appropriate.

1. If leachate is observed outside of the limits of waste disposal areas, notify the DWM (see **Section 1.1.2**).
2. Contain the flow of leachate using soil berms and/or excavation.
3. Excavate the area of seepage to attempt to allow flow into the underlying waste (i.e. break-up soil layers that may be causing the seep.).
4. For contained leachate that will not flow into underlying waste, a pump may be required to route the leachate to the existing leachate collection system (see **Section 3.3.2**) or to a tanker truck for hauling to an approved wastewater treatment plant (currently

the Harnett County WWTP in Lillington) for treatment and disposal.

5. The use of soil (particularly clay) to plug the seepage may also be successful in the case where flows are minor.
6. Remove and dispose of impacted cover soils accordingly.
7. Repair/regrade landfill cover as necessary.

3.3.2 Leachate Management and Operational Plan

There is an existing leachate collection system for the active C&D landfill and closed MSW and C&D landfill units at the site which consists of four (4) sumps (A-D), connecting French drains, and load out areas (for pump and haul operations). Collected leachate is pumped and hauled to a local wastewater treatment plant (WWTP). A copy of the approved leachate management and operational plan (prepared by C.T. Clayton Sr., P.E., Inc.) is provided in **Appendix D**. This plan includes monitoring, disposal, and spill response requirements.

The County currently plans to modify the existing leachate collection system by removing Sumps B, C, and D and the associated French drains. Thus, only Sump A (located at the southwest end of Phase I) will remain in service long-term.

3.3.3 Record Keeping

Records associated with leachate management at the site will be placed in the facility operating record as described in **Section 1.12**.

3.4 **Water Quality Monitoring**

The monitoring program and procedures outlined in the current water quality monitoring plan(s) will be followed for the monitoring of site groundwater monitoring wells and surface water monitoring locations. Documentation of the water quality monitoring program will be placed in the facility operating record as described in **Section 1.12**.

3.5 **Landfill Gas (LFG) Management**

Landfill gas (LFG) generated from the landfill units will be vented using passive vents placed at the time of closure. Refer to the appropriate permit application for details of these vents.

3.6 **Landfill Gas (LFG) Monitoring Plan**

The County will implement a routine landfill gas (LFG) monitoring program to ensure that methane concentrations do not exceed 25 percent of the lower explosive limit (LEL) (1.25% methane (CH₄)) in facility structures, or 100 percent of the LEL (5% CH₄) at

property boundaries. LFG monitoring activities and remedial actions for concentrations exceeding these requirements will be in accordance with the current landfill gas monitoring plan(s) for the facility.

3.6.1 Record Keeping

Results of LFG monitoring and description of any remedial measures will be placed in the facility operating record as described in **Section 1.12**.

3.7 Vector Control

3.7.1 Transfer Station

Control of insects, rodents, and birds will be accomplished by regular cleaning of the transfer station and the control of litter. If vector control becomes a problem, additional measures will be taken to ensure the protection of human health.

3.7.2 C&D Landfill Unit

Due to the nature of the waste disposed in this landfill unit, vector control is not anticipated to be of concern. Note that the use of periodic cover will discourage animals from nesting in the waste.

3.8 Litter Control

The vegetative trees/bushes act as a barrier to keep litter contained within the site and a litter control crew will pick up litter around the site and on access roads daily as necessary. Wind screens adjacent to active areas may be used as practical to control windblown waste. Additionally, facility staff will make operational changes as practical based on wind conditions that may spread litter.

3.9 Odor Control

3.9.1 Transfer Station

Odorous or potentially odorous materials will be pushed into a transfer trailer and covered as soon as possible to avoid odor problems. Additionally, regular cleaning of the transfer station will help minimize the potential for odor problems. If odor control becomes a problem, additional measures will be taken to ensure odor control.

3.9.2 C&D Landfill Unit

Due to the nature of the waste disposed in this landfill unit, odor control is not anticipated to be of concern. However, if odor control becomes a problem, additional measures (such as additional cover over wastes such as drywall) will be taken to ensure odor control.

3.10 Dust Control

Dust related to waste hauler traffic on the access roads will be minimized by using a water truck to limit dust on the gravel portions of site roads. Dust generated by excavation of cover soil will be limited by watering the cut soil areas if accessible to the water truck.

3.11 Air Quality

The County will follow all air quality requirements which are applicable to the landfill facility. This includes 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.

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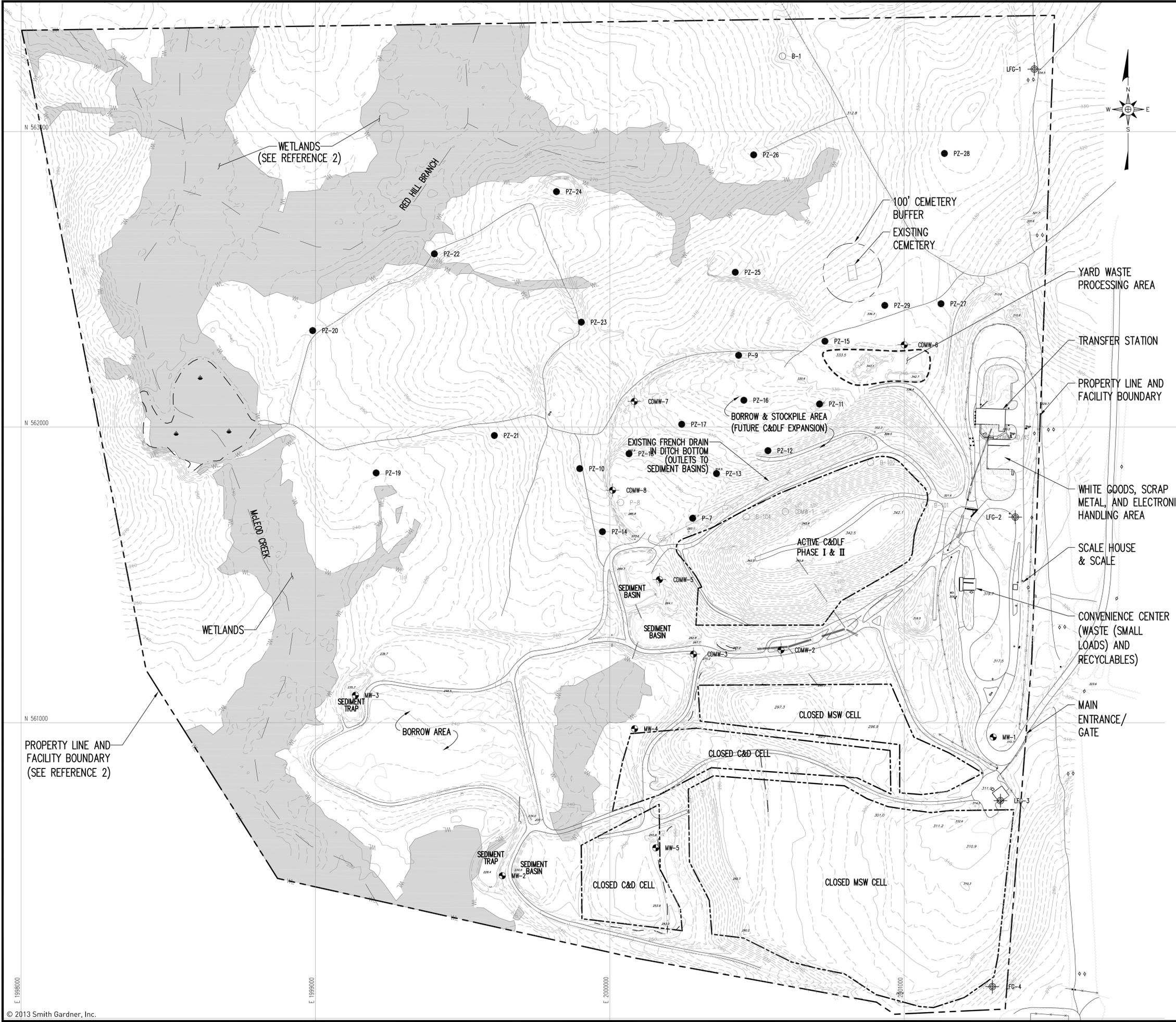
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PROJECT TITLE:
**ANDERSON CREEK
 LANDFILL FACILITY**

DRAWING TITLE:
**EXISTING AND PROPOSED
 LANDFILL UNITS
 AND SOLID WASTE
 MANAGEMENT ACTIVITIES**

DESIGNED:	P.K.S.	PROJECT NO.:	HARNETT-AC-13-4
DRAWN:	K.C.B.	SCALE:	AS SHOWN
APPROVED:		DATE:	SEPT 2013
FILENAME:	HARNETT-D0012		
SHEET NUMBER:		DRAWING NUMBER:	FIG. 1



LEGEND

- 10' --- EXISTING 10' CONTOUR (SEE REFERENCE 1)
- 2' --- EXISTING 2' CONTOUR
- - - - - APPROXIMATE PROPERTY LINE
- --- CELL LIMITS
- - - - - WETLAND BOUNDARY (SEE REFERENCE 2)
- - - - - STREAM (APPROXIMATE)
- PZ-14 PIEZOMETER (SEE REFERENCE 3)
- ⊕ CDW-2 C&D MONITORING WELL
- ⊕ MW-4 MONITORING WELL
- ⊕ LFG-1 LANDFILL GAS MONITORING WELL
- B-104 WELL/PIEZOMETER (REMOVED)

- REFERENCES**
- OVERALL SITE BASE TOPOGRAPHY BASED ON AERIAL SURVEY BY MAPPING RESOURCE GROUP, DATED 7/16/13.
 - OVERALL EXISTING SITE CONDITIONS PROVIDED BY C.T. CLAYTON, SR., P.E., INC., IN DRAWING TITLED "03001C ACLF Exp MAS-1", DATED 5/31/13.
 - WELL DATA AND LOCATIONS FROM C.T. CLAYTON, SR., P.E., INC., IN DRAWING TITLED "03001C ACLF Exp MAS-1", DATED 5/31/13.



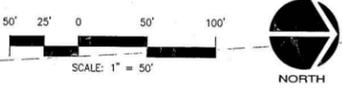
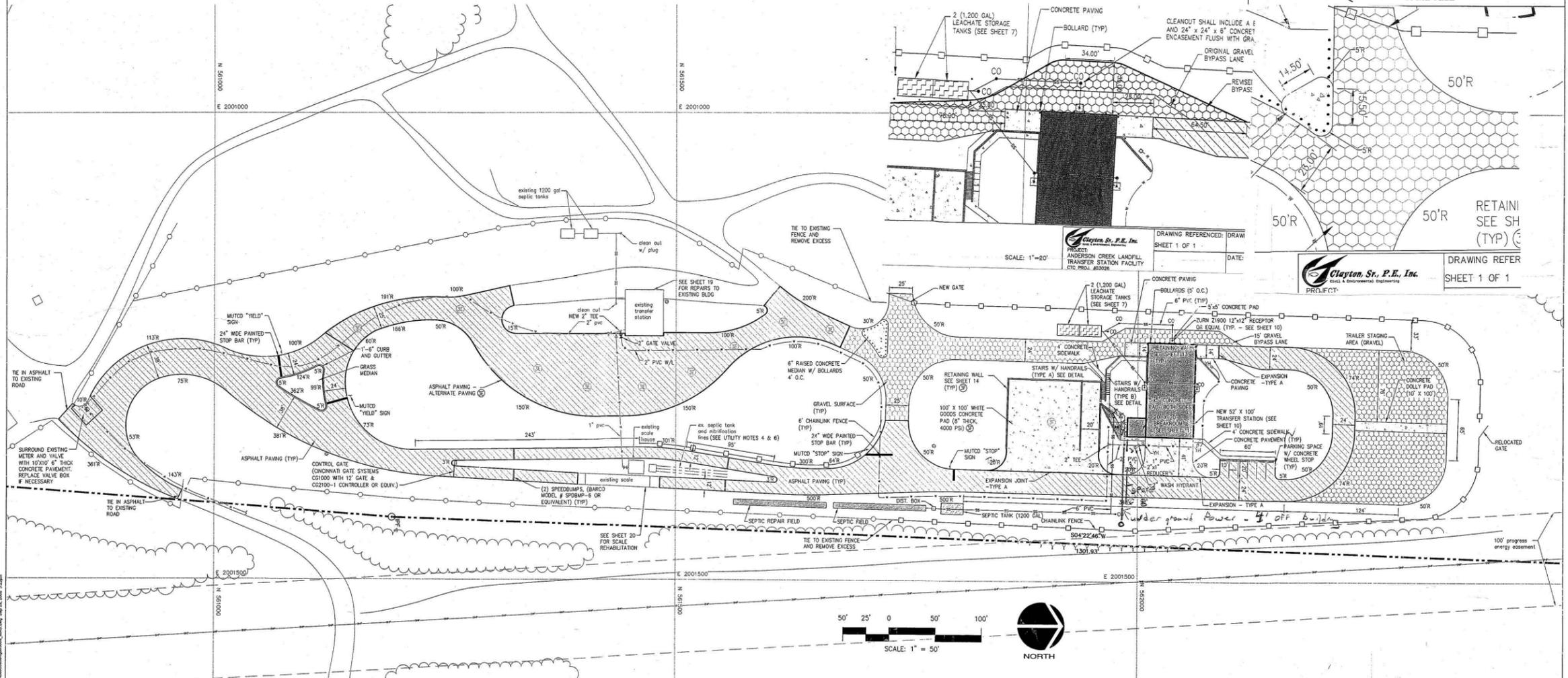
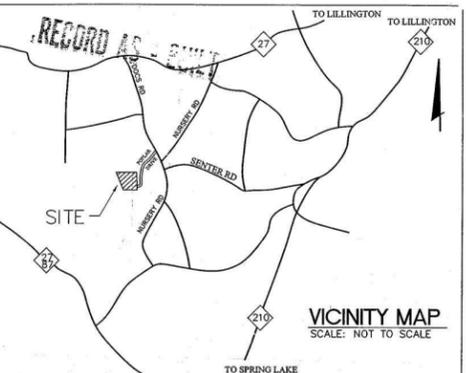
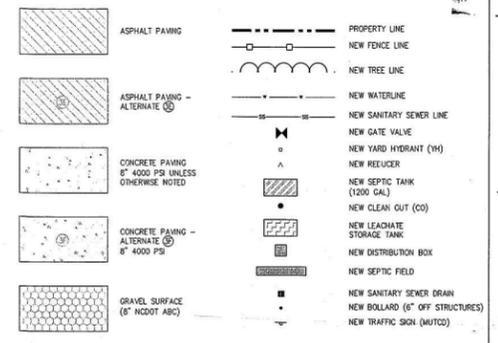
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GENERAL SITE NOTES:

- PRIOR TO BIDDING ON WORK AT THE SITE, THE CONTRACTOR SHALL VISIT THE SITE TO FIELD VERIFY THE EXISTING CONDITIONS.
- CONTRACTOR RESPONSIBLE FOR ADEQUATE EROSION AND SEDIMENT CONTROL PRACTICES AT ALL TIMES.
- ALL PAVEMENT MARKINGS, CONCRETE PAINT, LETTERING, ETC. SHALL BE PER NCDOT STANDARD SPECIFICATIONS SECTION 1087 AND SECTION 12. PAVEMENT MARKINGS SHALL BE EITHER PAINT COMPOSITION OR THERMOPLASTIC COMPOSITION AND SHALL CONTAIN THE SILICA GLASS BEADS AS SPECIFIED IN THE ABOVE REFERENCED SECTIONS.
- ALL DISTURBED AREAS SHALL BE PREPARED AND RESEDED PER THE TECHNICAL SPECIFICATIONS.
- GENERAL CONTRACTOR TO COORDINATE WITH UTILITY CONTRACTOR(S) PRIOR TO FINAL PAVEMENT COURSE INSTALLATION TO ASSURE ALL NECESSARY PAVEMENT UTILITY CUTS HAVE BEEN COMPLETED.
- DURING CONSTRUCTION, TRAFFIC CONTROL METHODS SHALL BE INCORPORATED DURING THESE ACTIVITIES WHEN IN A ROADWAY. REFER TO THE LATEST MANUAL OF "UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS" BY THE U.S. DEPT. OF TRANSPORTATION.
- CONTRACTOR STAGING AREA(S) SHALL BE RETURNED TO ORIGINAL CONDITION AT THE COMPLETION OF ALL WORK.
- ALTERNATE BID ITEMS ARE NOTED AS FOLLOWS:
ALTERNATE #3E
ALTERNATE #3F

UTILITY NOTES:

- PRIOR TO BIDDING ON WORK AT THE SITE, THE CONTRACTOR SHALL VISIT THE SITE TO FIELD VERIFY THE EXISTING CONDITIONS.
- NO WORK SHALL TAKE PLACE ON THE SITE UNTIL THE CONTRACTOR HAS CONTACTED NORTH CAROLINA ONE-CALL CENTER TO LOCATE ALL EXISTING UNDERGROUND UTILITIES.
- DURING TRENCHING AND BACK FILLING OF UTILITY DITCHES, TRAFFIC CONTROL METHODS SHALL BE INCORPORATED DURING THESE ACTIVITIES WHEN IN A ROADWAY. REFER TO THE LATEST MANUAL OF "UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS" BY THE U.S. DEPT. OF TRANSPORTATION.
- ANY INTERRUPTION OF UTILITY SERVICE SHALL BE APPROVED AT LEAST 48 HOURS PRIOR TO WORK IN THAT AREA.
- ANY SIGNIFICANT CHANGES IN THE ACTUAL SITE CONDITIONS FROM THOSE SHOWN ON THE PLANS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
- ALL EXISTING FACILITIES, WALKS, PAVEMENT, CURB, ETC. WHICH ARE DAMAGED BY CONSTRUCTION ACTIVITIES SHALL BE REPAIRED TO MATCH EXISTING CONDITIONS.
- ALL WATER AND SANITARY SEWER WORK SHALL CONFORM TO THE HARNETT COUNTY STANDARDS.
- CONTRACTOR TO MAINTAIN 5 FEET MINIMUM HORIZONTAL SEPARATION BETWEEN SANITARY SEWER AND WATER. WATER SHALL MAINTAIN 1.5 FOOT MINIMUM VERTICAL SEPARATION ABOVE SANITARY SEWER UNLESS OTHERWISE SHOWN. IF THE MINIMUM SEPARATION CAN NOT BE MAINTAINED, WATERLINE SHALL BE DUCTILE IRON UNTIL ADEQUATE SEPARATION IS GAINED.
- ALL WATERLINES TO BE INSTALLED 3 FEET MINIMUM BELOW PROPOSED GRADE UNLESS OTHERWISE NOTED.
- ADJUST ALL EXISTING AND NEW UTILITIES TO BE FLUSH WITH FINISHED GRADE PER APPLICABLE DETAILS SHOWN UNLESS OTHERWISE SPECIFIED.
- ALL EXTERNAL VALVES ARE TO BE GATE VALVES SUPPLIED WITH A STEM OPERATING NUT, ONE GATE VALVE OPERATING WRENCH OF SUFFICIENT LENGTH TO OPERATE ALL INSTALLED VALVES SHALL BE SUPPLIED TO THE OWNER PRIOR TO FINAL COMPLETION.
- ALL EXTERNAL VALVES ARE TO BE INSTALLED IN A VALVE BOX PER DETAILS.
- ALL SANITARY SEWER AND STORM SEWER CLEANOUTS ARE TO BE CONSTRUCTED PER THE DETAIL. THE TOP COVER OF THE CAST IRON VALVE BOX SHALL BE PAINTED WITH 2 COATS,
I. SANITARY SEWER: YELLOW
II. STORM SEWER: GREEN



OWNER:
Harnett County
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Lillington, NC 27548
Contact: Neil Emory
910-893-7596 Fax: 910-814-3967

SURVEYOR:
Streamline Land Surveying, Inc.
870 NC. Hwy 55 West
Coats, NC 27521
Contact: Robert E. Godwin, Jr.
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DATE	REVISION	BY

Clayton Sr. P.E., Inc.
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MOBILE: 252-671-8979 (C.T.) Email: cec@clayton.com

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COATS, NORTH CAROLINA, 27521
PHONE: 910-897-7070 FAX: 910-897-6767
MOBILE: 919-796-9200 (T.V.M.) Email: tv@clayton.com

DATE: 9/28/04

SITE AND UTILITY PLAN
OF
**ANDERSON CREEK LANDFILL
TRANSFER STATION
FACILITY**
HARNETT COUNTY NORTH CAROLINA

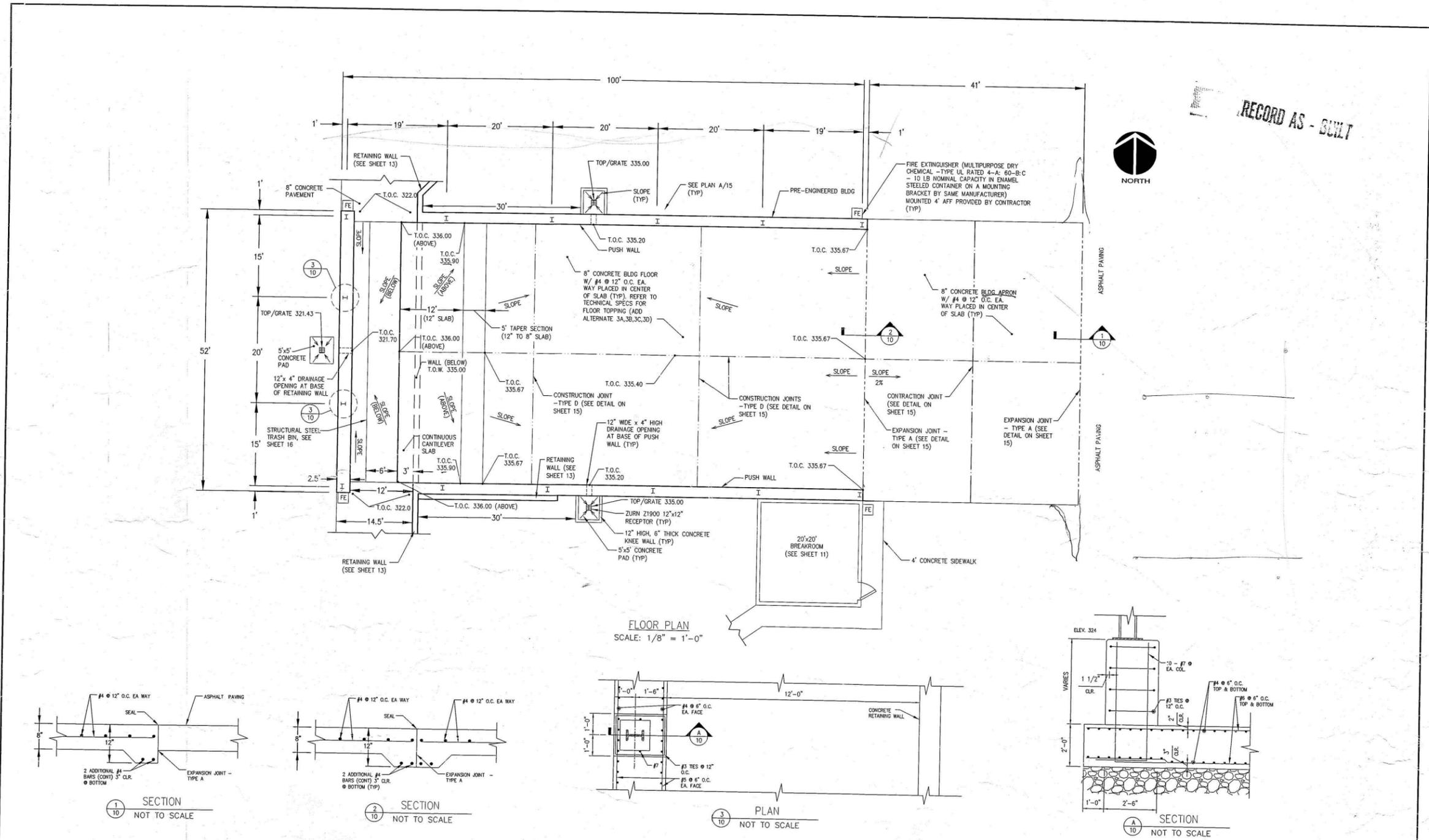
PROJECT # : 03006
PROJ. ENG. : CTC
DRAWN BY : LER
FIELD FILE :
CAD FILE : 03006_MAC.dwg
SCALE : 1" = 50'
DATE : AUGUST 14, 2008
SHEET # : 2 of 20

**TRANSFER STATION
SITE & UTILITY PLAN**

PREPARED BY: SMITH+GARDNER
FIGURE NO.: 2A
SCALE: N.T.S.
APPROVED: P.K.S.
DRAWN: K.C.B.
PROJECT NO.: HARNETT-AC-13-4
FILENAME: HARNETT-B0019
DATE: Jan 2014

SMITH+GARDNER
NC LIC. NO. C-9828 (ENGINEERING)
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

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RECORD AS - BUILT



OWNER:
Harnett County
900 South 9th Street
Lillington, NC 27548
Contact: Neil Emory
910-893-7596 Fax: 910-814-3967

SURVEYOR:
Streamline Land Surveying, Inc.
870 NC, Hwy 55 West
Coats, NC 27521
Contact: Robert E. Godwin, Jr.
910-897-7715 Fax: 910-897-7284

DATE	REVISION	BY



POST OFFICE BOX 12794
NEW BERN, NORTH CAROLINA 28561
PHONE: 252-872-0204 FAX: 252-872-8877
MOBILE: 252-871-8979 (C.T.) Email: cto@clayton.com

POST OFFICE BOX 518
COATS, NORTH CAROLINA 27521
PHONE: 910-892-7170 FAX: 910-897-8787
MOBILE: 910-755-8252 (TYP) Email: rto@clayton.com



TRANSFER STATION FLOORPLAN
of
**ANDERSON CREEK LANDFILL
TRANSFER STATION
FACILITY**

HARNETT COUNTY NORTH CAROLINA

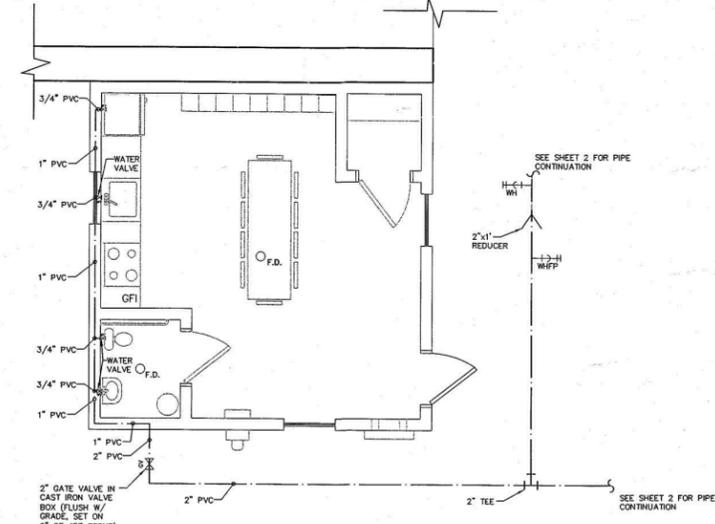
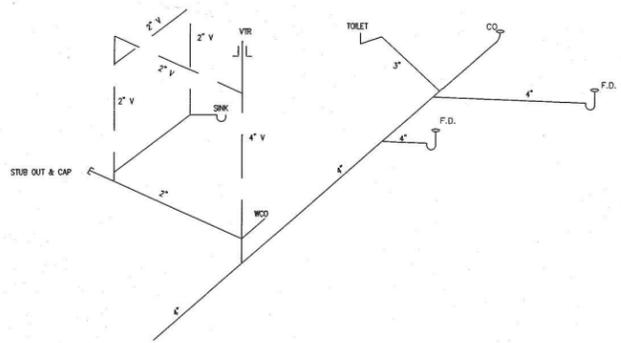
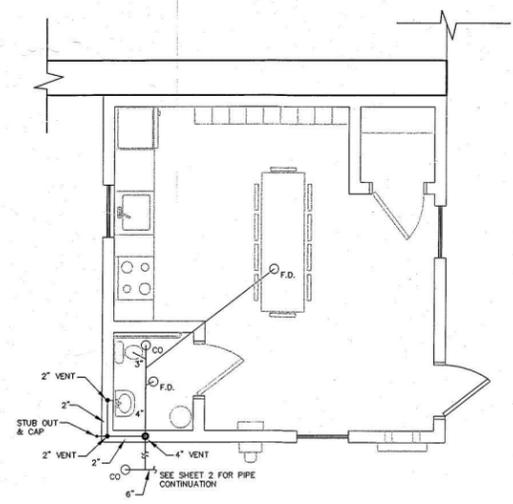
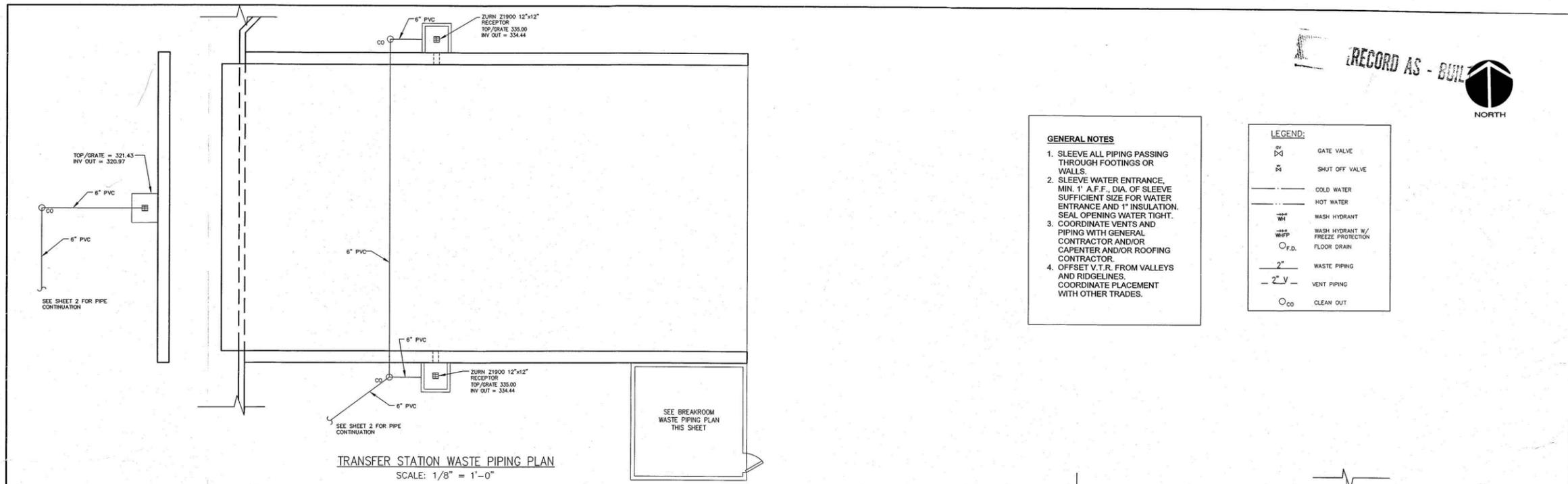
PROJECT # : 03006
PRJL. ENG. : CTD
DRAWN BY : LER
FIELD FILE :
CAD FILE : 03006_MAS.dwg
SCALE : AS SHOWN
DATE : AUGUST 14, 2006
SHEET # : 10 of 20

PREPARED BY: _____ NC LIC. NO. C-0828 (ENGINEERING)
FIGURE NO. 2B
SCALE: N.T.S.
APPROVED: P.K.S.
DRAWN: K.C.B.
PROJECT NO.: HARNETT-AC-13-4
DATE: Jan 2014
FILENAME: HARNETT-B0019

SMITH+GARDNER
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

**TRANSFER STATION
FLOOR PLAN**

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RECORD AS - BUILT

- GENERAL NOTES**
1. SLEEVE ALL PIPING PASSING THROUGH FOOTINGS OR WALLS.
 2. SLEEVE WATER ENTRANCE, MIN. 1" A.F.F., DIA. OF SLEEVE SUFFICIENT SIZE FOR WATER ENTRANCE AND 1" INSULATION. SEAL OPENING WATER TIGHT.
 3. COORDINATE VENTS AND PIPING WITH GENERAL CONTRACTOR AND/OR CARPENTER AND/OR ROOFING CONTRACTOR.
 4. OFFSET V.T.R. FROM VALLEYS AND RIDGELINES. COORDINATE PLACEMENT WITH OTHER TRADES.

LEGEND:

	GATE VALVE
	SHUT OFF VALVE
	COLD WATER
	HOT WATER
	WASH HYDRANT
	WASH HYDRANT W/ FREEZE PROTECTION
	FLOOR DRAIN
	WASTE PIPING
	VENT PIPING
	CLEAN OUT

OWNER:
Harnett County
900 South 9th Street
Lillington, NC 27548
Contact: Neil Emory
910-893-7596 Fax: 910-814-3967

SURVEYOR:
Streamline Land Surveying, Inc.
870 NC. Hwy 55 West
Coats, NC 27521
Contact: Robert E. Godwin, Jr.
910-897-7715 Fax: 910-897-7284

DATE	REVISION	BY

Clayton, Sr., P.E., Inc.
CIVIL & ENVIRONMENTAL ENGINEERING

POST OFFICE BOX 12784
NEW BERN, NORTH CAROLINA 28561
PHONE: 252-672-0264 FAX: 252-672-8577
MOBILE: 252-671-9979 (C.T.) Email: steve@clayton.com

POST OFFICE BOX 578
COATS, NORTH CAROLINA 27521
PHONE 910-897-7070 FAX: 910-897-6767
MOBILE: 919-795-9302 (Tyra) Email: tyra@clayton.com



PLUMBING PLAN
of
**ANDERSON CREEK LANDFILL
TRANSFER STATION
FACILITY**

HARNETT COUNTY NORTH CAROLINA

PROJECT # : 03006
PROJ. SNO. : CTC
DRAWN BY : LER
FIELD FILE :
CAD FILE : 03006_MAS.dwg
SCALE : AS SHOWN
DATE : AUGUST 14, 2006
SHEET # : 18 of 20

**TRANSFER STATION
PLUMBING PLAN**

PREPARED BY: _____ NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

APPROVED:	SCALE:	FIGURE NO.:	PREPARED BY:
K.C.B.	P.K.S.	N.T.S.	2C
DRAWN:	PROJECT NO.:	FILENAME:	
Jan 2014	HARNETT-AC-13-4	HARNETT-B0019	

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Appendix A

Fire Occurrence Notification Form

**Operations Manual
Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

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**SOLID WASTE MANAGEMENT FACILITY
 FIRE OCCURRENCE NOTIFICATION
 NC DENR Division of Waste Management
 Solid Waste Section**



Notify the Section verbally within 24 hours and submit written notification within 15 days of the occurrence.
(If additional space is needed, use back of this form.)

NAME OF FACILITY: _____ PERMIT # _____

DATE AND TIME OF FIRE: _____ @ _____

HOW WAS THE FIRE REPORTED AND BY WHOM:

LIST ACTIONS TAKEN:

WHAT WAS THE CAUSE OF THE FIRE:

DESCRIBE AREA, TYPE, AND AMOUNT OF WASTE INVOLVED:

WHAT COULD HAVE BEEN DONE TO PREVENT THIS FIRE:

DESCRIBE PLAN OF ACTIONS TO PREVENT FUTURE INCIDENTS:

NAME: _____ TITLE: _____ DATE: _____

 THIS SECTION TO BE COMPLETED BY SOLID WASTE SECTION REGIONAL STAFF
 DATE RECEIVED _____
 List any factors not listed that might have contributed to the fire or that might prevent occurrence of future fires:

FOLLOW-UP REQUIRED:
 NO PHONE CALL SUBMITTAL MEETING RETURN VISIT BY: _____ (DATE)

ACTIONS TAKEN OR REQUIRED:

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Appendix B

Paint Filter Liquids Test

**Operations Manual
Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

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METHOD 9095
PAINT FILTER LIQUIDS TEST
From EPA SW-846

1.0 Scope and Application

- 1.1 This method is used to determine the presence of free liquids in a representative sample of waste.
- 1.2 The method is used to determine compliance with 40 CFR 264.314 and 265.314.

2.0 Summary of Method

- 2.1 A predetermined amount of material is placed in a paint filter. If any portion of the material passes through and drops from the filter within the 5 minute test period, the material is deemed to contain free liquids.

3.0 Interferences

- 3.1 Filter media were observed to separate from the filter cone on exposure to alkaline materials. This development causes no problem if the sample is not disturbed.

4.0 Apparatus and Materials

- 4.1 Conical paint filter: Mesh number 60 (fine meshed size). Available at local paint stores such as Sherwin-Williams and Glidden for an approximate cost of \$0.07 each.
- 4.2 Glass funnel: If the paint filter, with the waste, cannot sustain its weight on the ring stand, then a fluted glass funnel or glass funnel with a mouth large enough to allow at least 1 inch of the filter mesh to protrude should be used to support the filter. The funnel is to be fluted or have a large open mouth in order to support the paint filter yet not interfere with the movement, to the graduated cylinder, of the liquid that passes through the filter mesh.
- 4.3 Ring stand and ring or tripod.
- 4.4 Graduated cylinder or beaker: 100-mL.

5.0 Reagents

- 5.1 None.

6.0 Sample Collection, Preservation, and Handling

- 6.1 All samples must be collected according to the directions in Chapter Nine of EPA SW-846.
- 6.2 A 100 mL or 100 g representative sample is required for the test. If it is not possible to obtain a sample of 100 mL or 100 g that is sufficiently representative of the waste, the analyst may use larger size samples in multiples of 100 mL or 100 g, i.e., 200, 300, 400 mL or g. However, when larger samples are used, analysts shall divide the sample into 100-mL or 100-g portions and test each portion separately. If any portion contains free liquids, the entire sample is considered to have free liquids.

7.0 Procedure

- 7.1 Assemble test apparatus as shown in **Figure 1**.
- 7.2 Place sample in the filter. A funnel may be used to provide support for the paint filter.
- 7.3 Allow sample to drain for 5 minutes into the graduated cylinder.
- 7.4 If any portion of the test material collects in the graduated cylinder in the 5-min. period, then the material is deemed to contain free liquids for purposes of 40 CFR 264.314 and 265.314.

8.0 Quality Control

- 8.1 Duplicate samples should be analyzed on a routine basis.

9.0 Method Performance

- 9.1 No data provided.

10.0 References

- 10.1 None required.

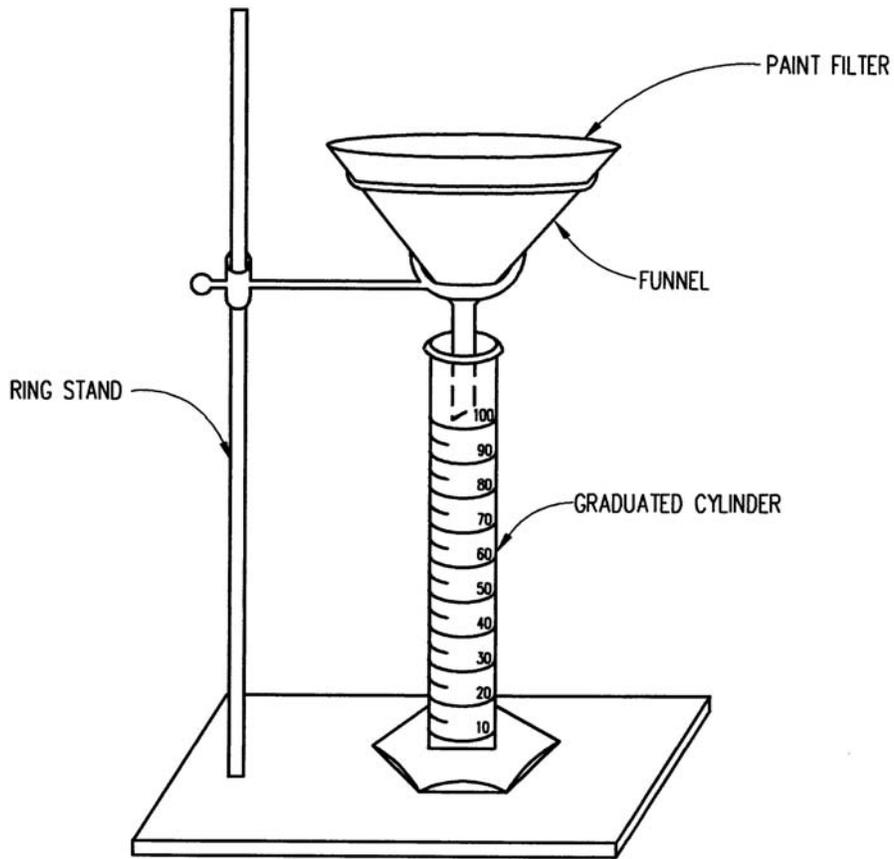
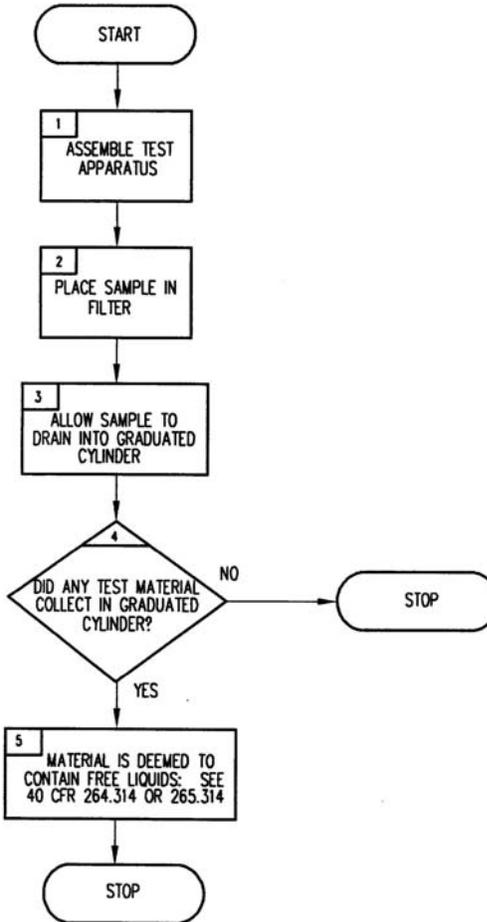


FIGURE 1. PAINT FILTER TEST APPARATUS.

METHOD 9095
PAINT FILTER LIQUIDS TEST



Appendix C

Waste Screening Form

**Operations Manual
Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

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Harnett County Solid Waste Department
Anderson Creek Landfill Facility
Permit Nos. 43-03 (Landfill) and 43-09T (Transfer Station)
(910) 893-5626

WASTE SCREENING FORM

Day / Date: _____ Time Weighed in: _____
Truck Owner: _____ Driver Name: _____
Truck Type: _____ Vehicle ID / Tag No: _____
Weight: _____ Tare: _____
Waste Generator / Source: _____

Reason Load Inspected: Random Inspection _____ Staff Initials _____
Detained at Scales _____ Staff Initials _____
Detained by Operating Staff _____ Staff Initials _____

Inspection Location: _____

Approved Waste Determination Form Present? Yes _____ No _____ N/A _____

Description of Load: _____

Load Accepted (signature) _____ Date _____
Load Not Accepted (signature) _____ Date _____

Reason Load Not Accepted (complete only if load not accepted)

Description of Suspicious Contents:

Color: _____ Hazardous Waste Markings: _____
Texture: _____
Drums Present: _____ Smell: _____
Est. Cubic Yards in Load: _____
Est. Tons in Load: _____

Harnett County Emergency Management Contacted? Yes _____ No _____

Company or Authority Contacted? _____

Hazardous Materials Present: _____

Hauler Notified (if waste not accepted) Phone: _____ Time Contacted: _____
Other Observations: _____

Final Disposition

Signed: _____ Date _____
Waste Screening Inspector or Solid Waste Operations Manager

Attach related correspondence to this form.
File completed form in Operating Record.

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Appendix D

Approved Leachate Management and Operational Plan

**Operations Manual
Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

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North Carolina Department of Environment and Natural Resources
Division of Waste Management

Beverly Eaves Perdue
Governor

Dexter R. Matthews
Director

Dee Freeman
Secretary

August 12, 2010

Jerry Blanchard
Harnett County General Services
103 E Ivey Street
P. O. Box 940
Lillington, NC 27546

Re: Leachate Management Plan [DIN 11314]
Anderson Creek Landfill
Harnett County, North Carolina
Permit No. 43-03
Doc ID No. 11322

Dear Mr. Blanchard:

The above referenced document is approved under the following conditions:

1. For pumping operations at the temporary loading stations, we recommend the overflow valve used to release storm water be closed prior to pumping leachate to ensure the valve is in working condition. The valve would then be closed after pumping leachate so that the valve is normally open for releasing storm water.
2. The pipes carrying leachate from the cells to the pumping tank or eventual pump station must be double lined (pipe within a pipe) to protect against leaks in the primary pipe. This design is consistent with the standard requirements for secondary containment at leachate collection facilities.
3. This authorization does not release the facility owner or operator from any liability for adverse impacts to human health or the environment in the operation of the leachate collection system. The owner and operator is responsible for obtaining and maintaining all other permits and licenses necessary for the construction, installation and operation of the facility.

Thank you for your efforts and cooperation in this matter. If you have questions about the permit conditions or questions arise during construction, please contact either me at 919.508.8495 or Drew Hammonds, Environmental Senior Specialist for the facility, at 910.433.3351.

Sincerely,

Geoffrey H. Little
Environmental Engineer II

Digitally signed by Geoffrey H. Little
Location: NC-DENR DWM Solid Waste Section
Date: 2010.08.12 10:53:14 -04'00'

c: Paul Crissman, DWM
Ed Mussler, DWM

Drew Hammonds, DWM
Ryan Sadler, CT Clayton

Zinith Barbee, DWM
Mark Poindexter, DWM

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Fac/Perm/Co ID #	Initials Trail	Date	Doc ID #
43-03	GL	07/09/2010	DIN 11314



July 7, 2010

PN: 03034

Mr. Geof Little
Solid Waste Section
Division of Waste Management
North Carolina Department of Environment and Natural Resources
Mail Service Center 1646
Raleigh, NC 27699-1646

**RE: Leachate Management System
Anderson Creek Landfill
Permit 43-03
Harnett County, North Carolina**

Dear Mr. Little:

On behalf of Harnett County, C. T. Clayton, Sr., P.E., Inc. (CTC) would like to inform you of our proposed leachate management system for the Anderson Creek C&D Landfill (ACLF) Permit 43-03.

Over the last year, routine landfill inspections have uncovered several leachate pop-outs on the active C&D cell that have required attention. The standard method of repair has been to dig back down and into the cell down-gradient of the pop-out and fill the area with stone. This directs the leachate back into the cell. The cap material and vegetative cover would then be replaced.

At the lower end of the landfill cells, several of these standard repairs have been attempted and in the last month, inspections have indicated that this method will not work any further. Therefore, the Owner has implemented a two-phased plan to manage the leachate. Phase 1, the temporary solution, is shown on the attached drawings and operational requirements described in the attached Leachate Management Plan. In summary, the system is as follows:

- Sumps will be dug into the side of the landfill where a perforated 36" corrugated plastic pipe (CPP) will be surrounded with rip-rap.
- A 4" PVC pipe will be inserted into the 24" CPP and exit out the top and down the slope to a truck loading area. The 4" PVC pipe will have a valve located at the discharge point. This pipe will act as a suction pipe.
- An all-weather road will be constructed to the leachate loading station(s).

PO Box 578 – 46 West Washington Street - Coats, North Carolina 27521

Phone: 910-897-7070 - Fax: 910-897-6767

Offices located in Coats and New Bern, North Carolina

License No. C-2570 - dba C. T. Clayton, Sr., P. E., Inc. - www.ctclayton.com

- The leachate loading station(s) will be graded on a 8:1 slope with a clay base and surrounded by a clay containment berm to hold any potential spills. A geosynthetic liner will be installed over the clay base and berm. A 4" PVC drain pipe will be installed on the lower end of the loading station to allow release of storm water. If the hauler has a spill, a plug valve is located on this line which the driver would immediately close to contain the spill within the berm. See the attached Operations Plan for more information.
- The permitted septic hauler will transport the leachate to the Harnett County WWTP in Lillington, NC which has a septic receiving station at the facility.

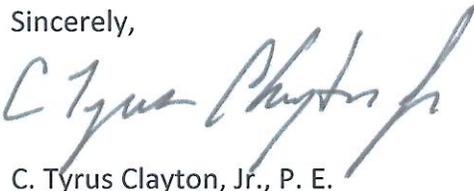
Phase 2 will be the permanent leachate management solution and will involve installing a pumping station on the ACLF facility and running a force main to the nearest gravity sewer that discharges to the Harnett county owned Lillington WWTP, building a constructed wetlands onsite for treatment, or taking over operation of the Carolina Lakes lagoon and spray fields adjacent to the ACLF parcel.

Discussions and planning are currently occurring within the Harnett County Departments of Solid Waste & Public Utilities to decide the most cost effective and otherwise advantageous alternative. Once the permanent solution is decided upon, NCDENR will be notified. It is anticipated that a permanent solution will not be utilized for at least 2-3 years.

In order to not incur any violations for leachate release, the County is proceeding with Phase 1 immediately as weather allows (The sump on the C&D cell has been constructed and is operational). If you have any problems or concerns with this plan, please contact CTC and Harnett County Solid Waste Department immediately. Also, please inform us of any permitting requirements that will be needed, and they will be addressed right away.

Should you have any questions or comments, please contact me or Ryan Sadler at the telephone numbers below or by e-mail at tyrus@ctclayton.com or ryan@ctclayton.com.

Sincerely,



C. Tyrus Clayton, Jr., P. E.

attachments: Leachate Extraction System Drawings (2 sheets)
Leachate Management Plan

cc: C. T. Clayton, Sr., P. E.
Jerry Blanchard
Drew Hammonds, NCDENR-SWS

LEACHATE MANAGEMENT AND
OPERATIONAL PLAN
FOR
TEMPORARY PUMP AND HAUL STATION(S)
ANDERSON CREEK
CONSTRUCTION AND DEMOLITION
LANDFILL
SWS PERMIT 43-03
HARNETT COUNTY, NORTH CAROLINA

Prepared by:



46 West Washington Street – PO Box 578 - Coats, NC 27521
910-897-7070 Phone – 910-897-6767 Fax
www.ctclayton.com – NCPE Firm C-2570



CTC PN#3034
JUNE 2010

LEACHATE MANAGEMENT PLAN
FOR
TEMPORARY PUMP AND HAUL STATION

ANDERSON CREEK
CONSTRUCTION AND DEMOLITION LANDFILL
HARNETT COUNTY, NORTH CAROLINA

Table of Contents

1.0	Temporary Loading Station Construction	1
2.0	Leachate Monitoring	1
3.0	Leachate Disposal	2
4.0	Loading Station Spill Response Plan	2

1.0 Temporary Loading Station(s) Construction

To control repeating leachate pop-outs, sumps will be dug into the side of the landfill cells where a perforated 36" corrugated plastic pipe (CPP) will be surrounded with rip-rap. A 4" PVC pipe will be inserted into the 36" CPP and exited out the top and down the slope to the temporary truck loading area. The 4" PVC pipe will have a valve located at the discharge point. This pipe acts as a suction pipe.

An all-weather road will be constructed to the temporary leachate loading station. The temporary leachate loading station will be graded on an 8:1 slope with a clay base and perimeter containment berm. A layer of HDPE geosynthetic liner will be installed over the clay base and berm. A cushion layer of sand will be placed next to protect the HDPE liner from puncture. Finally, an all-weather road material of mixed stone will be placed for vehicular traffic.

A liner penetration will be made for a 4" PVC drain pipe with plug valve which will be installed on the lower end of the loading station. During normal operation, the valve is to remain open to allow release of storm water. If the hauler has a spill, the driver will immediately close the plug valve to contain the spill within the lined berm.

2.0 Leachate Monitoring

The temporary loading station and leachate sump piping network are to be checked daily and immediately after any precipitation event. See attached landfill inspection checklist which is filled out by the landfill operator daily and kept on file. Any components found to be not properly functioning shall be promptly repaired or replaced.

The operator also, on a weekly basis, visually observes the landfill side slopes for leachate pop-outs which are to be documented and promptly repaired.

The leachate sump will be outfitted with a visual level indicator on a float system. When the leachate in the sump reaches a certain level, a visible colored rod will rise out of the sump which informs the landfill staff that it is time to pump the leachate. A rain gauge will also be installed at this location.

3.0 Leachate Disposal

A permitted septic hauler is contracted to pump from the temporary loading station into trucks and transport the leachate to the Harnett County Wastewater Treatment Plant (WWTP) in Lillington, NC which has a septic receiving station at the facility. There is no pre-treatment required at this time. If in the future Harnett County Public Utilities requires a pre-treatment process, this Leachate Management Plan will be updated to include those items.

4.0 Loading Station Spill Response Plan

In the event of a spill in the temporary loading station, the driver of the contracted hauler is instructed to immediately close the valve on the stormwater bypass pipe exiting the containment area. If this valve is properly closed and the leachate is contained within the temporary loading station, the contaminated soils on top of the geosynthetic liner shall be carefully removed and taken to the on-site Anderson Creek Transfer Station for disposal at a lined MSW landfill. The cushion layer and all-weather layer will be replaced with new materials.

If the driver of the contracted hauler is unable to close the valve on the stormwater bypass pipe in time to prevent a release beyond the liner limits, the following actions will occur:

- A) Should the leachate collect in a sediment pond or other surface waters:
 - 1. The County will notify SWS of the release within 24-hours.
 - 2. The County will analyze the contaminated water for Appendix I list of constituents and BOD₅, COD, phosphate, nitrate and sulfate. The sample results will be forwarded to SWS and used to determine whether the pond or surface waters are impacted by the release. At that time, the County will respond as the SWS deems necessary.

- B) If the leachate release is contained to a soil covered area and does not impact the sediment pond or other surface waters:
 - 1. The County will remove the contaminated soils within 24-hours of release and take the soils to the on-site Anderson Creek Transfer Station for disposal at a lined MSW landfill.
 - 2. Document the leachate release and cleanup activities.

HARNETT COUNTY LANDFILL DAILY/WEEKLY CHECK LIST

Inspector: _____
 Inspection Dates: / / 20 to / / 20

Facility: _____
 Landfill Cell: Active C&D Active LCID Closed MSW/C&D(Weekly)

ACLF

DAILY OPERATION REQUIREMENTS	Facility: _____						
	Mon	Tue	Wed	Thu	Fri	Sat	ACLF
Trucks using designated roads/approved parking areas per permit							
Operations conducted during permitted operating hours							
Access controlled per plan							
Access road(s) maintained (erosion, dust, litter, mud, etc) per plan							
Vehicles directed promptly to unloading area							
Vehicles promptly unloaded							
Inspection procedures implemented for prohibited wastes per plan							
No unapproved wastes							
Solid waste spread and compacted into layers per plan							
No waste <15 ft. from edge of liner, berm, edge marked, etc.							
Procedures followed for special handling and residual wastes							
No open burning							
Vectors minimized and controlled per plan							
Odors minimized and controlled per plan							
Other nuisances minimized and controlled per plan							
Litter minimized and controlled per plan							
Approved weekly cover placed							
Vegetation established and maintained per plan							
Surface and groundwater pollution discharges prevented/controlled							
Soil and erosion control BMPs are maintained per plan							
Leachate popouts detected							
Leachate popouts repaired							
Flow from leachate management system monitored daily							
Leachate management facilities operated and maintained							
Landfill gas controlled per plan/ LFG Flare Operational							
Daily operational records being made and maintained							
Salvaged materials are stored in an approved area							
Recyclable materials collection center maintained							
No immediate threats to public health and safety							

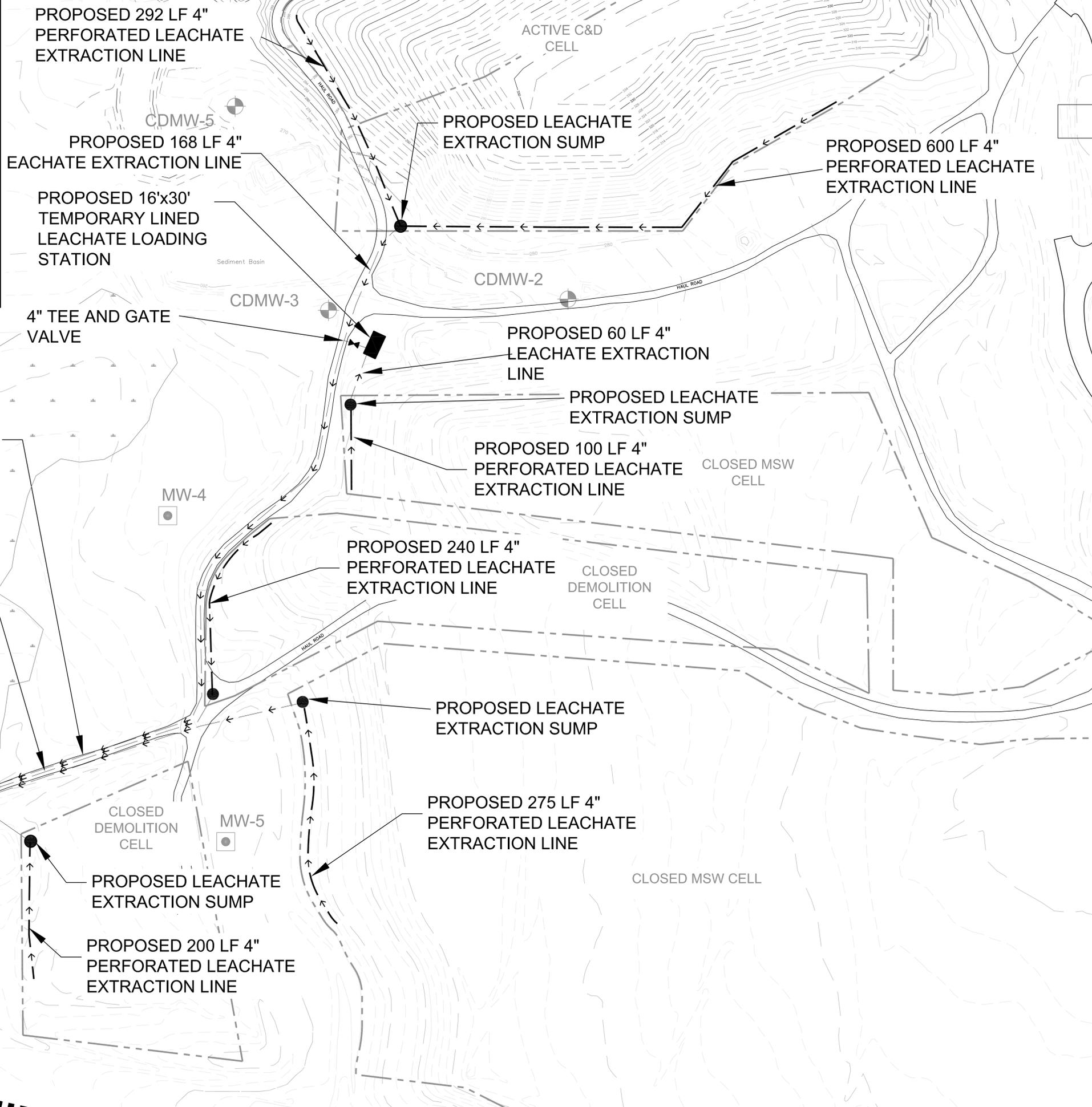
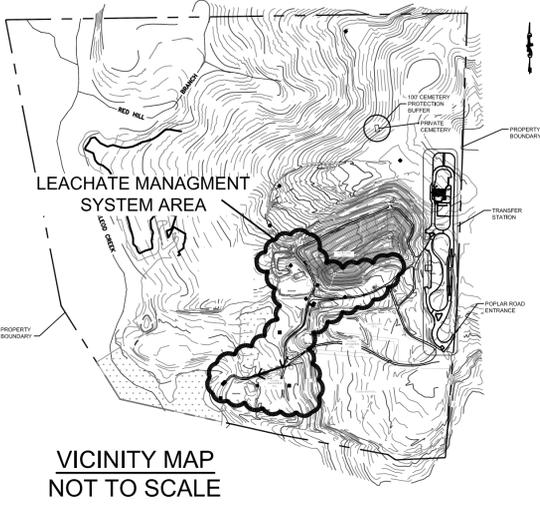
Daily Inspection Items for Active Cells

Daily & Weekly Inspection Items - All Cells

Inspector Signature: _____ Date: _____

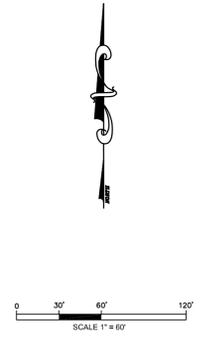
Key = Yes, No, NA (not applicable), ND (not determined)

(FRONT)



LEGEND

- LEACHATE EXTRACTION PUMP
- LINED LEACHATE LOADING STATION
- 4\"/>
- LEACHATE EXTRACTION LINE
- MW-4 existing monitoring well
- CDMW-2 existing monitoring well
- WETLANDS
- existing major contour
- existing minor contour
- existing limits of waste



No.	Revision/Issue	Date

THIS DOCUMENT ORIGINALLY ISSUED AND SEALED BY C. TYRUS CLAYTON, Jr., P.E. No. 03999 ON JULY 2, 2010. THIS ELECTRONIC MEDIUM IS NOT CONSIDERED A CERTIFIED DOCUMENT.

21-56.1103(4) BOARD RULES NORTH CAROLINA ADMINISTRATIVE CODE TITLE 21, CHAPTER 56 BOARD OF EXAMINERS FOR ENGINEERS AND SURVEYORS

Signature: _____
Date: _____

CLAYTON Engineering
Civil and Environmental
PO Box 578 - Coats, North Carolina 27521
Phone: 910-897-7070 - Fax: 910-897-6767
License No. C-2570 - www.ctclayton.com

ANDERSON CREEK LANDFILL
LEACHATE EXTRACTION SYSTEM

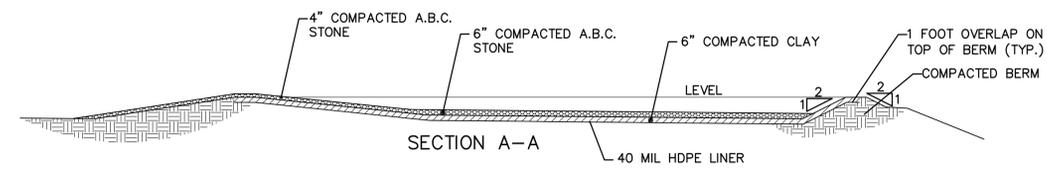
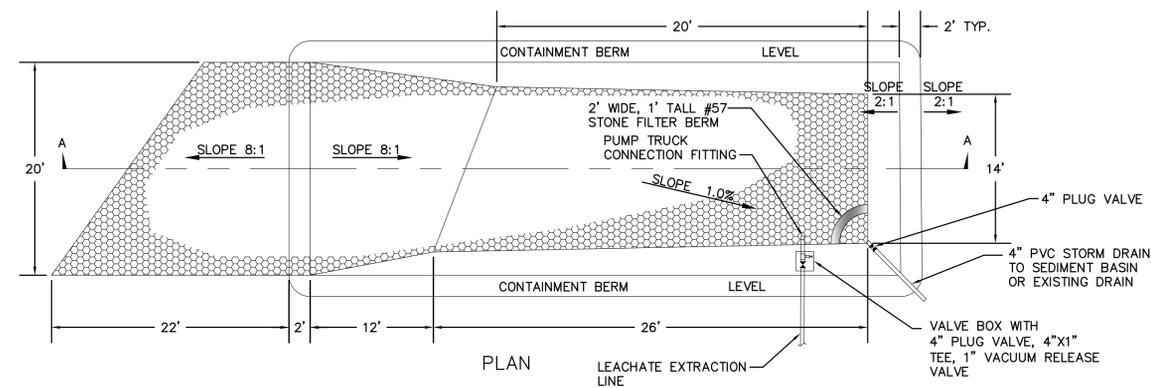
HARNETT COUNTY, NC

Project No:	3034	File Name:	3034MAS
Designed By:	CTC Sr.	Drawn By:	SBK
Checked By:	CTC Sr.	Proj. Eng.:	CTC Sr.

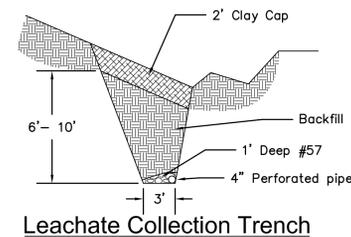
Sheet Title: LEACHATE EXTRACTION SYSTEM SITE PLAN

Date:	24 JUNE 2010	Sheet:	1
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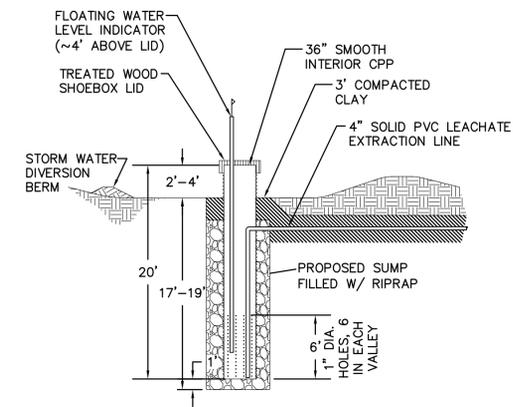
P:\03 Harnett_Coats\Anderson_Creek_Landfill_Leachate_Management\CDM\3034_ACLE_Leachate.dwg



TEMPORARY LEACHATE LOADING STATION DETAIL
NOT TO SCALE



Leachate Collection Trench



LEACHATE EXTRACTION SUMP DETAIL
NOT TO SCALE

No.	Revision/Issue	Date

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21-56.1103(4)
BOARD RULES
NORTH CAROLINA
ADMINISTRATIVE CODE
TITLE 21, CHAPTER 56
BOARD OF EXAMINERS FOR
ENGINEERS AND SURVEYORS

Signature _____
Date _____



**ANDERSON CREEK LANDFILL
LEACHATE EXTRACTION
SYSTEM**

HARNETT COUNTY, NC

Project No:	3034	File Name:	3034MAS
Designed By:	CTC Sr.	Drawn By:	SBK
Checked By:	CTC Sr.	Proj. Eng.:	CTC Sr.

Sheet Title: **LEACHATE EXTRACTION SYSTEM
DETAILS**

Date:	24 JUNE 2010	Sheet:	2
Scale:	NOT TO SCALE		2 OF 2

Appendix E

Asphalt Shingle Recycling

**Operations Manual
Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

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Operations Manual

Appendix E: Asphalt Shingle Recycling

Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina

Prepared for:

Harnett County Solid Waste Department
Lillington, North Carolina

January 2014

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577



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**Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

**Operations Manual
Appendix E: Asphalt Shingle Recycling**

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1.0 OVERVIEW

This portion of the Operations Manual was prepared to describe the plan for the recycling of asphalt shingles at the facility. Asphalt shingle recycling will occur in an area located at the convenience center. The Asphalt Shingle Recycling Area is strictly for the management of tear-off asphalt shingles in order to provide a “clean” material that can be used in the production of asphalt. This plan describes the criteria for waste acceptance, material receipt, inspection, and stockpiling, material transport, and record keeping.

2.0 WASTE ACCEPTANCE

Asphalt roofing shingles contain asphalt cement, mineral aggregate, and mineral filler which are raw materials used in asphalt production. Asbestos was used in shingle manufacture until the mid-1970's and in other roofing materials such as roof felt, roof putty, surface coating, and mastic until the mid 1980s. Due to the potential for the presence of asbestos, the following source separation and certification requirements will be followed. These practices help ensure that only recyclable tear-off shingles are sent for asphalt production while minimizing sorting at the facility.

2.1 Source Separation

Shingles will be accepted only when appropriately separated prior to delivery to the facility. Materials from flat and built-up roofing system are not acceptable and must be disposed of rather than accepted for recycling due to the higher use of asbestos roofing materials in those systems. Shingle suppliers are instructed to separate tear-off shingles into either a dedicated trailer or to layer their waste when loading so that the shingles can be easily separated from the unacceptable debris. A list of acceptable and unacceptable material is shown in **Appendix E1**.

2.2 Certification

Shingle suppliers are required to complete a supplier certification form (see **Appendix E2**). The handling and disposal of asbestos during demolition and renovation is regulated under the National Emissions Standards for Hazardous Air Pollution (NESHAP). NESHAP-regulated facilities are required to submit a notification of demolition and renovation prior to starting work. The notification includes an inspection by a North Carolina accredited asbestos inspector or roofing supervisor and analysis for asbestos. The supplier of shingles from a NESHAP-regulated facility must present documentation that the shingles do not contain greater than 1% asbestos. The documentation is a letter from the accredited asbestos inspector or roofing supervisor that sampled the shingles and the analytical test results. A copy of the documentation is kept with the supplier certification form. Shingles from a NESHAP-regulated facility that do not have the required documentation or that are documented to contain greater than 1% asbestos are disposed of.

Shingles from single family homes or residential buildings containing four or fewer dwelling units are generally not regulated under NESHAP. In this case, only the source of shingles is required on the certification form.

3.0 MATERIAL RECEIPT, INSPECTION, AND STOCKPILING

Shingles will be visually inspected when entering the facility to determine whether the shingles have been separated or if it is a mixed load. The supplier is then asked for a completed certification form including documentation when required (**Appendix E2**). Mixed loads, shingles from a NESHAP-regulated facility that contain greater than 1 percent asbestos, and shingles from a NESHAP-regulated facility without the proper documentation are directed to the C&D landfill unit (or alternately the transfer station) for disposal. Loads that were source-separated into dedicated containers are sent directly to the sorting area and unloaded. Loads that were separated into layers usually have the asphalt shingles on the bottom and other material on the top. These loads are first directed to the C&D landfill unit (or alternately the transfer station) to remove the non-shingle roofing waste and then to the sorting area for unloading the shingles. Shingles are not unloaded into an area with standing water and sorted and unsorted materials are kept separate.

Source-separation by the supplier eliminates most of the unacceptable materials that cannot be used in tear-off shingle recycling. The unloaded tear-off shingles are examined for unacceptable materials and any unacceptable materials are removed. The remaining sorted shingles are stockpiled in the recycling area until there is a sufficient amount to transport to a facility that will grind and use or sell the ground shingles for asphalt production.

4.0 MATERIAL TRANSPORT

Upon the transport of shingles to the receiving facility, the County will provide copies of all supplier certification forms and other documentation. When requested (and as agreed to prior to material transport), the County will follow any additional requirements of the receiving facility. Generally, at least 75% of the tear-off shingles that are sorted leave the facility during the same year.

5.0 RECORD KEEPING PROGRAM

The County will maintain the following records related to asphalt shingle recycling in an operating record at the landfill (see also **Section 1.12** of the Operations Manual):

- A. Supplier certification forms and any supporting documents;
- B. Disposition of waste and recyclables (quantity of materials disposed and location of disposal; quantity of recycled shingles and receiving facility information).

Appendix E1

List of Acceptable and Unacceptable Materials

**Operations Manual - Appendix E: Asphalt Shingle Recycling
Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

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TEAR-OFF ASPHALT SHINGLE RECYCLING

List of Acceptable and Unacceptable Materials

“YES”

Include these items:

- Shingles
- Felt attached to shingles

“NO”

Do NOT include these items:

- Wood
- Metal flashings, gutters, etc.
- Nails (best effort)
- Rolls of sheets of felt paper
- Plastic wrap, buckets
- Paper waste
- No garbage, trash, or other waste materials
- Built-up asphalt roofing
- Asbestos-containing materials
- Shingles containing mastics

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Appendix E2

Shingle Supplier Certification Form

**Operations Manual - Appendix E: Asphalt Shingle Recycling
Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

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SHINGLE SUPPLIER CERTIFICATION FORM

Supplier of Whole Tear-off Asphalt Shingles

Supplier Name: _____
Address: _____
Contact Name: _____
Phone: _____

We the undersigned certify that (check appropriate boxes):

The tear-off shingles are from a NESHAP regulated facility and documentation stating that the shingles do not contain >1% asbestos is attached. (Documentation is a letter from the North Carolina accredited asbestos inspector or roofing supervisor that collected the samples with the analytical results attached.)

The tear-off shingles are from a single family home or residential building having four or fewer dwelling units that is not regulated under NESHAP.

Tear-off shingles were removed from the following addresses:

(Please attach additional sheets as needed to record each building address.)

Shingle Supplier (signature)

Date

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Closure and Post-Closure Plan

Harnett County Anderson Creek Landfill Facility Harnett County, North Carolina

Prepared for:

**Harnett County Solid Waste Department
Lillington, North Carolina**

January 2014

NC LIC. NO. C-0828 (ENGINEERING)

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Harnett County Anderson Creek Landfill Facility Harnett County, North Carolina

Closure and Post-Closure Plan

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1.0 CLOSURE PLAN

This plan is intended to serve as a guide for the proposed closure. A formalized Closure Plan for each landfill unit (or incremental portion thereof) will be submitted to the Solid Waste Section of the North Carolina Department of Environment and Natural Resources Division of Waste Management (DWM) for approval prior to beginning closure construction.

1.1 Maximum Closure Area and Waste Capacity

The following are the estimated areas and capacity for each landfill unit to be closed under this plan.

Table 1.1 Closure Areas and Capacity Summary

Landfill Unit	Closure Area (Acres)	Gross Capacity (CY) ¹	Net (Waste) Capacity (CY/Tons) ¹
C&D Units			
Phases I & II	7.4	534,665	425,865 CY 177,624 Tons

Notes:

1. The volume and tonnage figures assumed for each landfill unit are based on the site's Facility Plan. Refer to Section 2.0 (Facility Report) of the Facility and Engineering Plan (**Attachment B**).

1.2 Final Cover System

The final cover system will consist of the following components (top-down):

C&D Landfill Units:

- an 18-inch thick vegetative soil layer; and
- an 18-inch thick soil liner with a hydraulic conductivity of no more than 1×10^{-5} cm/sec ("compacted soil barrier").

The final cover system will be placed on prepared intermediate cover at a maximum slope of 3H:1V. Surface water control devices and passive landfill gas (LFG) vents will also be incorporated into the final cover of each landfill unit. The final cover surface will be vegetated upon completion of the final cover installation according to the project seeding specifications.

Refer to the appropriate permit application for a detailed discussion and details related to the design of the final cover system for each landfill unit.

1.3 Landfill Gas System

For the C&D landfill units, a landfill gas system is provided in the final cover design. This system includes collection wells/vents placed within the waste to capture and passively vent the gas.

1.4 Surface Water Systems

Precipitation falling on the cover will infiltrate into the cover or run off of the cover. Short-term the run-off runs down the surface of the intermediate cover. Long-term the run-off is collected in a series of drainage breaks built into the areas covered by final cover. These drainage breaks are provided along side slopes (diversion berms). Water captured by diversion berms is routed toward one of the down pipes. Flow in the down pipes is routed to the base of the landfill and to one of the site sediment basins.

Refer to the appropriate permit application for a detailed discussion and details related to the design of surface water systems for each landfill unit.

1.4.1 Incremental Operation

During much of the life of the landfill, surface run-off will be handled by the intermediate cover system. Operations must strive to provide operational grading that encourages run-off from the intermediate cover to drain to the perimeter channels along the perimeter berms or to areas covered by final cover. Corrugated polyethylene (CPE) piping and temporary soil berms must be installed if required to accomplish this run-off routing.

1.4.2 Required Maintenance

The surface water systems must be inspected annually and immediately after every major storm. Sediment build-up in the drainage features/devices must be cleaned out on a regular basis to promote run-off. Sediments removed can be used as daily or intermediate cover.

1.5 Closure Schedule

In general, closure activities will occur on the following schedule:

C&D Landfill Units (15A NCAC 13B.0543(c)(5)):

- No later than 30 days after the date on which the C&DLF unit receives the known final receipt of wastes;
- No later than 30 days after the date that a 10 acre or greater area of waste, is within in 15 feet of final design grades; or
- No later than one year after the most recent receipt of wastes, if the C&DLF unit has remaining capacity.

Prior to beginning closure of any landfill unit, the County will notify the DWM that a notice of the intent to close the unit has been placed in the operating record.

All closure activities shall be completed within 180 days. Exemptions and extensions may be approved by the DWM.

1.6 Closure Verification

The following procedures will be implemented following closure:

- A Construction Quality Assurance (CQA) report will be submitted to the DWM. This report will describe the observations and tests used before, during, and upon completion of construction to ensure that the construction materials meet the final cover design specifications and the construction and certification requirements. The CQA report will contain as-built drawings.
- A signed certification from a registered Professional Engineer verifying that closure has been completed in accordance with the closure plan will be submitted to the DWM and placed in the operating record.
- At least one sign notifying all persons of the closing of the landfill (or incremental portions thereof) and that wastes are no longer accepted will be posted. Suitable barriers will be installed as necessary at former access points to prevent new waste from being deposited.
- Within 90 days, a survey plat, prepared by a registered Professional Land Surveyor, indicating the location and dimensions of landfill disposal areas, will be prepared.

- A notation will be recorded on the deed (through the County Register of Deed's Office) notifying any potential purchaser of the property that the land has been used as a landfill facility and that future use is restricted under the approved closure plan. A copy of the deed notation as recorded will be filed with the operating record and notification will be provided to the DWM.

2.0 POST-CLOSURE PLAN

This Post-Closure Plan has been developed to outline steps to be taken to ensure the integrity of the landfill during its post-closure care period. The post-closure care period will last at least 30 years after final closure and, at a minimum, will consist of the following:

- Maintaining the integrity and effectiveness of final cover system;
- Performing groundwater and surface water monitoring;
- Maintaining and operating a landfill gas monitoring system; and
- Maintaining run-on/run-off controls.

No wastes will remain exposed after closure of the landfill. Access to the closed site by the public will not pose a health hazard.

2.1 Post-Closure Contact

All correspondence and questions concerning the post-closure care of the landfill should be directed to:

Ms. Amanda Bader, P.E.
Harnett County Solid Waste Department
103 E. Ivey Street
Lillington, NC 27546
Phone: (910) 814-6156
Fax: (910) 814-8263

2.2 Post-Closure Use

After filling operations cease at the landfill and the landfill is officially closed in accordance with the Closure Plan, each landfill unit will be maintained as a grassy hill. Harnett County will maintain control of the property and prevent public access to it during the post-closure period.

There may be (an) access road(s) on the final cover to allow proper maintenance during post-closure. Precise location of the access road(s) will be determined as a part of operations. Low ground pressure and rubber tire vehicles will be used for maintenance. Additionally, the County will maintain access to all site monitoring locations through the post-closure period.

2.3 Maintenance

2.3.1 Repair of Security Control Devices

All security control devices will be inspected and maintained as necessary to ensure access to the site is controlled. Locks, vehicular gates, and fencing will be replaced if functioning improperly. Warning signs will be kept legible at all times and will be replaced if damaged by inclement weather or vandalism.

2.3.2 Erosion Damage Repair and Vegetation

If erosion of the final cover occurs during post-closure, the affected area will be repaired and revegetated as necessary. If necessary, rolled erosion control products (RECPs) will be used to expedite rapid revegetation of slopes and to secure topsoil in place. Revegetation (including fertilization and seeding) will be performed in accordance with the most recently approved erosion and sedimentation control plan and the North Carolina Erosion and Sediment Control Planning and Design Manual.

Mowing of the final cover surfaces will occur approximately once per year in order to help maintain a healthy stand of grasses and to cut down saplings and woody-stemmed plants.

2.3.3 Correction of Settlement, Subsidence, and Displacement

Minimum slopes of 5 percent will be maintained after settlement in order to prevent ponding and allow for proper drainage without infiltration. If vertical or horizontal displacement occurs due to differential settlement, cracks will be filled with appropriate material and final cover will be reestablished. Excessive vertical displacement is not anticipated.

2.3.4 Leachate Collection System

The County currently plans to modify the existing leachate collection system which consists of four (4) sumps (A-D), connecting French drains, and load out areas (for pump and haul operations). The County anticipates that Sumps B, C, and D and the associated French drains will be removed prior to closure of the C&D landfill at the site. Thus, only Sump A (located at the southwest end of Phase I) will remain in service. After closure, the flow in Sump A is expected to curtail. A flow of 5,000 gallons per week (one tanker load per week) is assumed during the post-closure period.

2.3.5 Leachate Seeps

If evidence of leachate seeps is observed, the County will take the following actions. Depending on the circumstances, various combinations of actions may be appropriate.

1. If leachate is observed outside of the limits of waste disposal areas, notify the DWM.
2. Contain the flow of leachate using soil berms and/or excavation.
3. Excavate the area of seepage to attempt to allow flow into the underlying waste (i.e. break-up soil layers that may be causing the seep.).
4. The use of soil (particularly clay) to plug the seepage may also be successful in the case where flows are minor.
5. For contained leachate that will not flow into underlying waste, a pump may be required to a tanker truck (only in the event that other options are not effective).
6. Remove and dispose of impacted cover soils accordingly.
7. Repair landfill cover as necessary.

2.3.6 Repair of Run-On/Run-Off Control Structures

All drainage swales, ditches, and perimeter channels will be repaired, cleaned, or realigned in order to maintain their original condition. Any culverts that are damaged will be repaired or replaced. Sediment basins/ponds will be cleaned out when sediment has reached design cleanout levels.

2.3.7 Landfill Gas System

The landfill gas system will be maintained by the County and operated in accordance with any site air quality permits. Proper operation of the system is verified through testing at the landfill gas monitoring wells.

If gas wells/vents do not function as a result of irregular settlement, accumulation of liquids (condensate, leachate, and/or water), binding or corrosion, additional and/or replacement wells/vents can be installed if necessary in accordance with the current Landfill Gas Management Plan.

2.3.8 Groundwater Monitoring Wells

Procedures outlined in the current Water Quality Monitoring (WQM) Plan or subsequent revision will take precedence; however, a brief description follows. All groundwater monitoring wells have been installed with concrete pads and protective casings to prevent accidental damage by vehicles and equipment. The wells are also equipped with a locking cap to discourage vandalism. Groundwater wells will be inspected regularly (at the time of sampling) to ensure

integrity. Persons inspecting a well should look at the overall condition of the well, for signs of well tampering, and cracking or degradation of the concrete pad. Should a well require replacement, the defective well should be abandoned in accordance with specifications provided in the WQM Plan and a new well installed at a location that is approved by the DWM.

2.4 Monitoring Plan

The closed unit will be monitored for a minimum of 30 years. Inspections of the closed landfill will be scheduled to ensure the integrity and effectiveness of the final cover system, surface water systems, groundwater monitoring system, landfill gas system, and to protect human health and the environment.

2.4.1 Inspection Frequencies

Inspections to be conducted by the County during the post-closure care period will occur regularly as shown in **Table 2.1**.

2.4.2 Inspection Activities

Inspections will include examination of the security control devices for signs of deterioration or vandalism to ensure access to the site is limited to authorized persons. Each disposal area will be checked to ensure the integrity of the final cover system is maintained, erosion damage is repaired, vegetative cover persists, and that cover settlement, subsidence, and displacement are minimal. Additionally, the condition of the groundwater and gas monitoring systems and permanent benchmarks will be checked.

A report of findings will be made to the responsible party, including recommendations for actions deemed necessary to ensure the site continues to meet the closure performance standard.

2.4.3 Record Keeping

Records of inspections and repairs will be kept on file by the County throughout the post-closure period.

2.5 Engineering Certification

Following completion of the post-closure care period for each landfill unit, the County will notify the DWM that a certification, signed by a registered professional engineer, verifying that post-closure care has been completed in accordance with the post-closure plan, has been placed in the operating record.

Table 2.1 Post-Closure Inspection Frequencies

Inspection Activity	Year 1	Years 2-30
Security Control Devices	Quarterly	Quarterly
Vegetative Cover Condition	Quarterly ¹	Quarterly
Surface Water Systems	Quarterly ¹	Quarterly
Erosion Damage	Quarterly ¹	Quarterly
Cover Drainage System	Quarterly ¹	Semi-Annually
Cover Settlement, Subsidence, and Displacement	Quarterly ¹	Semi-Annually
Leachate Collection System	Quarterly	Semi-Annually
Landfill Gas System	Quarterly ²	Semi-Annually ²
Water Quality Monitoring	Semi-Annually ³	Semi-Annually ³
LFG Monitoring System	Quarterly ⁴	Quarterly ⁴
Benchmark Integrity	Annually	Annually

Notes:

1. These items will be inspected after each large storm event (i.e. ≥ 1 inch in any 24 hours).
2. Or in accordance with the current Landfill Gas Management Plan or air quality permit(s).
3. Or in accordance with groundwater monitoring schedule described in the current Water Quality Monitoring Plan.
4. Or in accordance with the current LFG Monitoring Plan.

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3.0 CLOSURE/POST-CLOSURE COST ANALYSIS

The purpose of this section is to provide a written estimate (in current year dollars) of costs associated with all activities specified in the written closure and post-closure plans which have been developed for the C&D landfill units of the Harnett County Anderson Creek Landfill facility.

3.1 Estimated Closure Costs

A cost estimate for complete closure of the Phases I and II C&D landfill units (the maximum area to be closed) is provided in **Appendix A** and is summarized in **Table 3.1**. The cost estimate is based on a third party providing the necessary services and includes labor in the unit prices given. The estimated closure costs will be reviewed and updated as required to reflect adjustments for inflation, increased costs in construction or materials, or any other adjustments to the Closure Plan.

3.2 Estimated Post-Closure Costs

A cost estimate for the post-closure care activities for the Phases I and II C&D landfill units is provided in **Appendix A** and summarized in **Table 3.1**. The cost estimate is based on a third party providing the necessary services and includes labor in the unit prices given. The estimated post-closure costs will be reviewed and updated as required to reflect adjustments for inflation, rising costs of anticipated post-closure care, or any other adjustments to the Post-Closure Plan.

3.3 Estimated Assessment and Corrective Action Costs

A cost estimate for current potential assessment and corrective (remedial) action at the landfill facility is provided in **Appendix A**. The total cost as shown in **Table 3.1** is equal to the required minimum amount (\$2,000,000) per NCGS 130A 295.2(h).

3.4 Financial Assurance Mechanism

Harnett County intends to continue to use the Local Government Financial Test (15A NCAC 13B.1628(e)(1)(f)) to demonstrate financial assurance for this facility.

Table 3.1 Summary of Cost Estimates

Activity	Total
C&D Phases I & II – Closure	\$388,829
C&D Phases I & II - Post-Closure (30 Year)	\$1,366,200
Assessment and Corrective Action	\$2,000,000
Total:	\$3,755,029

Appendix A

Closure, Post-Closure, and Assessment/Corrective Action Cost Estimates

**Closure and Post-Closure Plan
Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

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Harnett County Anderson Creek C&D Landfill - Financial Assurance
Table 1: Summary

Item No.	Description	Total
1.0	C&D Landfill - Phases I & II - Estimated Closure Cost (See Table 2)	\$388,829
2.0	C&D Landfill - Phases I & II - Estimated Post-Closure Cost (30-Year) (See Table 3)	\$1,366,200
3.0	Assessment & Corrective Action Cost	\$2,000,000
TOTAL =		\$3,755,029

Notes:

1. All cost projections are presented in 2014 dollars. Appropriate annual escalators should be applied.

Harnett County Anderson Creek Landfill - Financial Assurance
 Table 2: C&D Landfill - Phases I & II - Estimated Closure Cost

Item No.	Description	Estimated Quantity	Units	Unit Cost	Item Cost
1.0	Site Preparation	7.4	AC	\$2,000	\$14,800
2.0	Landfill Gas Wells/Vents	7.0	EA	\$2,500	\$17,500
3.0	Compacted Soil Barrier (18")	18,000	CY	\$6.00	\$108,000
4.0	Vegetative Soil Layer (18")	18,000	CY	\$4.00	\$72,000
5.0	Erosion Control (Diversion Berms, Down Pipes, Etc.)	7.4	AC	\$5,000	\$37,000
6.0	Revegetation	7.4	AC	\$1,500	\$11,100
7.0	Surveying	7.4	AC	\$2,000	\$14,800
Subtotal (Items 1 - 7) =					\$275,200
8.0	Bonds, Mobilization, & Insurance	4% of Subtotal (Items 1 - 7) =			\$11,008
Subtotal (Items 1 - 8) =					\$286,208
<i>Contingency (10%) =</i>					<i>\$28,621</i>
Construction Subtotal =					\$314,829
10.0	Engineering	7.4	AC	\$3,000.00	\$22,200
11.0	CQA	7.4	AC	\$7,000.00	\$51,800
TOTAL =					\$388,829

Notes:

1. All cost projections are presented in 2014 dollars. Appropriate annual escalators should be applied.
2. Unit costs include materials and anticipated labor/installation costs.

Harnett County Anderson Creek Landfill - Financial Assurance
 Table 3: C&D Landfill - Phases I & II - Estimated Post-Closure Cost (30-Year)

Item No.	Description	Estimated Quantity	Units	Unit Cost	Item Cost
1.0	Site Inspection & Record Keeping	80	HR	\$75	\$6,000
2.0	Revegetation	1	AC	\$1,500	\$1,500
3.0	Mowing (once per year)	8	AC	\$100	\$800
4.0	Erosion Control	1	LS	\$2,500	\$2,500
5.0	Gates/Fences/Access	1	LS	\$2,000	\$2,000
6.0	Water Quality Monitoring & Reporting (See Note 4)	1	LS	\$10,200	\$10,200
7.0	LFG Monitoring & Reporting (See Note 5)	1	LS	\$2,800	\$2,800
8.0	Leachate Pump & Haul & Disposal (See Note 6)	52	Trips	\$300	\$15,600
Subtotal (Items 1 - 8) =					\$41,400
<i>Contingency (10%) =</i>					<i>\$4,140</i>
Annual Total =					\$45,540
30-YEAR TOTAL =					\$1,366,200

Notes:

1. All cost projections are presented in 2014 dollars. Appropriate annual escalators should be applied.
2. Unit costs include materials and anticipated labor/installation costs.
3. Assumes total of 7.4 acres (Phases I & II).
4. The water quality monitoring and reporting cost assumes 13 long-term wells & 2 surface water locations sampled semi-annually @ \$5,100 per event (annual cost = \$10,200).
5. The LFG monitoring and reporting cost assumes quarterly monitoring @ \$700 per event (annual cost = \$2,800).
6. One trip per week and 5,000 gallons per load are assumed.

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August 12, 2013

Elizabeth Werner
Solid Waste Section
217 W Jones St
Raleigh, NC 27699



PN: 03001C

**RE: Anderson Creek Landfill
Groundwater Monitoring Plan – GWMP – (DIN 19383)**

Elizabeth,

On behalf of Harnett County, we are submitting a revised copy of the GWMP for the Anderson Creek C&D Landfill Phase III Expansion. The following items have been addressed per your correspondence with the County:

- *Section 6.2 Compliance (downgradient) Monitoring of the C&D Landfill Expansion - An additional monitoring well is needed in the vicinity of PZ-9 and PZ-25. According to the potentiometric surface contours, the northern portion of Phase III is not properly monitored.*

A new proposed groundwater monitoring well has been added in this location. The other proposed wells have been renumbered. Figures 1 and 3 have been revised accordingly.

- *Section 9.0 Groundwater Monitoring System Maintenance – Add verifying that each well is properly labeled to the list of maintenance items to be checked semi-annually.*

The statement has been added to Section 9.0.

- *Section 10.1 Overview – Tetrahydrofuran (THF) needs to be added to the list of constituents being analyzed as stated in Section 8.0 Combined Facility Monitoring.*

THF has been added to Section 10.1.

- *Section 10.4 Decontamination of Field Equipment – Phosphate free soap/detergent should be used to rinse the water level meter between wells instead of methanol.*

Section 10.4 has been revised to note the use of phosphate free soap/detergent.

- *Section 10.5 Sampling Protocol for Monitoring Wells and Piezometers #4 – Purged well water should be measured in gallon buckets to ensure an accurate measurement of water evacuated from each well.*

The sampling protocol in Section 10.5 has been revised to include this procedure.

- *Section 10.5 Sampling Protocol for Monitoring Wells and Piezometers #5 – The field parameter instrument probes should be rinsed with phosphate free soap/detergent instead of alcohol.*

Section 10.5 has been revised to note the use of phosphate free soap/detergent.

- *Section 10.7 QA/QC Procedures for Field Sampling and Collection #7 – Trip blanks are not collected in the field. Trip blanks are made in the lab and accompany the sampling containers to and from the lab. The trip blank should remain in the cooler at all times.*

The Trip Blank discussion in Section 10.7 has been revised accordingly.

- *Section 11.0 Conclusions – Add THF to the list of constituents being analyzed during each semi-annual sampling event (last bullet).*

THF has been added to the Conclusions, Section 11.0.

- **Sections 6.2, 8.0, & 11.0 have been revised to include the additional monitoring well requested.**

Attached you will find a digital copy of the revised GWMP & a hard copy will follow in the mail. If you require anything else feel free to call me at my office (910)-897-7070 and I will be happy to assist.

Sincerely,



Ryan Sadler
Project Manager

enclosures

cc: file
Amanda Bader, County of Harnett (email)

**GROUNDWATER MONITORING PLAN
FOR
CONSTRUCTION AND DEMOLITION LANDFILL
EXPANSION – (PHASE III)
ANDERSON CREEK LANDFILL
OPERATED UNDER NCDENR SWS PERMIT 43-03
HARNETT COUNTY, NORTH CAROLINA**

Submitted to:
**Solid Waste Section
Division of Waste Management
NCDENR
1646 Mail Service Center
Raleigh, NC 27699-1646**

Submitted on behalf of:
**Harnett County General Services
103 E Ivey Street
Lillington, NC 27546**

Prepared by:



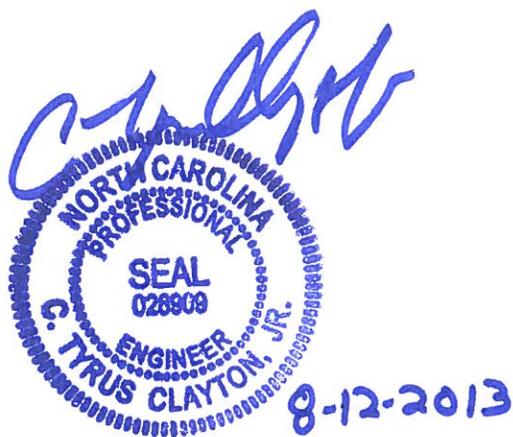
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License No. C 2570 · www.ctclayton.com

CTC Project No. 03001C

**Revised
August 2013**

CERTIFICATION PAGE

This report was prepared by C. T. Clayton, Sr., P. E., Inc., and is accordingly sealed below:



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FIGURES 1 THROUGH 4

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1.0 INTRODUCTION

The purpose of this report is the development of an effective groundwater monitoring plan (GWMP) which will be responsive to local conditions at Harnett County's Anderson Creek Construction and Demolition (C & D) Landfill. Harnett County proposes to expand the existing capacity of the C & D Landfill. The landfill is located off of Doc's Road (SR 1116) in western Harnett County. This GWMP was prepared in general accordance with the guidelines found in the North Carolina Administrative Code (NCAC), Title 15A, Chapter 13B. Relevant groundwater monitoring requirements in Section .1630 - .1633 are addressed in this GWMP which coherently includes both the C&D landfill and the closed MSW landfill.

The report provides a brief description of the geology and hydrogeology of the site and other relevant data used in developing the GWMP. The geological and hydrogeological data in this report is based on an extensive site study previously completed by Patterson Exploration Services and C.T. Clayton, Sr., P.E., Inc. for the proposed C&D expansion. Data were collected from sources including field observations of exposed sediment strata, site borings, soil maps, and a review of previous similar studies performed at this site. The relevant boring records and references to other sources can be found in the *Geologic and Hydrogeologic Report for the C&D Landfill Expansion* prepared by CTC and Patterson Exploration in March 2013.

2.0 PHYSIOGRAPHY

The landfill and the area permitted for expansion lies at the western edge of the Coastal Plain. The Coastal Plain in this site generally consists of unconsolidated sediments with gently sloping topography. USGS topographic maps for the Anderson Creek and Olivia quadrangles indicate that the site drains into tributaries of McLeod Creek and Red Hill Branch.

The Coastal Plain is located along the eastern third of the state and is characterized by gently rolling to subdued topography that was once generally covered by the Atlantic Ocean. The western half of the Coastal Plain is higher in elevation, exhibits rolling topography, and in general, is better drained. Southwestern Harnett County is located in the western half of the Coastal Plain. As would be anticipated, the location exhibits higher elevation and rolling topography.

Local Relief in the western Coastal Plain ranges from less than 20 feet to 100 feet. Elevations range from 70 to 150 feet above MSL. Relief is greatest where the larger streams have cut through the Tertiary and Cretaceous aged formations and exposed the underlying Raleigh Belt metamorphics, generally bedrock (basement rock).

This area of Harnett County is generally drained by streams flowing from northwest to southeast. Tributary stream valleys have parallel alignment except where topographic influence of terraces affect the stream courses. Streams in the Coastal Plain become shallower and wider, gradients flatten, and the streams meander within their floodplain. Harnett County is drained by the tributaries of the Cape Fear River Drainage Basin.

3.0 AREA GEOLOGY

The Anderson Creek C & D Landfill is located approximately fifteen (15) miles southwest of Lillington (Harnett County), North Carolina. The area, which lies at the western edge of the Coastal Plain, consists of formations of unconsolidated sediments of Cretaceous and Tertiary age. The sediments are generally described as clays, silts, sands, and gravels with mixtures of each. Depth to bedrock (basement rock) in the area is generally from eighty (80) feet to over two hundred (200) feet.

4.0 SITE GEOLOGY

Two formations, the Middendorf and the Cape Fear, are found on site. They are both of Cretaceous age. It is possible that Tertiary-aged Pinehurst Formation or terrace deposits and/or upland sediments overlie the above on certain parts of the landfill expansion area. The upland sediments generally consist of sands. Generally, the Middendorf consists of fine sandy clays grading into coarse clayey sand with depth. The Middendorf surficial aquifer appears to be perched atop the Cape Fear Formation sediments on site. The Cape Fear Formation generally consists of silty clays at this site. The Middendorf Formation sediments appear to be roughly thirty (30) to thirty-five (35) feet thick in places, generally higher elevations, and decrease at the lower elevations until they disappear.

The Cape Fear Formation consists generally of tan to gray silty clay with some lenses of clayey silts. This formation tends to dominate at lower elevations. Borings indicate that the thickness of the Cape Fear is in excess of fifty (50) feet at the site.

5.0 SITE HYDROGEOLOGY

As previously described, the two dominant formations found on site are the Middendorf and the Cape Fear. The Middendorf generally consists of sediments which range from silty clays to clayey sands and gravel. Clay lenses are common and may result in small pockets of perched groundwater. Zones containing more sand and gravel as opposed to silty clays will exhibit a higher hydraulic conductivity. The Cape Fear Formation is generally described as relatively impervious, tight, silty clay, and based on piezometer and boring data the it is found to be fairly consistent across the site. The Cape Fear appears to be a confining unit which would tend to resist vertical hydraulic connectivity and groundwater flow downwards from the uppermost aquifer in the overlying sediments to a confined, deeper aquifer.

Data from pre-existing and newly-constructed piezometers and monitoring wells on the site provided information on subsurface conditions, particularly soils and groundwater, at the facility. Based on these data, a potentiometric map was produced which indicates measured and predicted groundwater elevations of the uppermost aquifer across the face of the proposed landfill expansion area as shown in Figure 1. Based on rainfall data gathered from nearby observation stations, rainfall during the period when some of the groundwater elevation measurements were obtained were during or just after high periods of precipitation. Accordingly, it is assumed that seasonal variations in water table could have a bearing on elevation measurement readings. However, it appears that these potentiometric levels represent a consistent pattern at the site.

In general, groundwater flow is directed from areas of high potential to areas of low potential. Based on the findings of this and previous studies at the site, groundwater flow generally follows surface topography. This is typical of the Coastal Plain and Piedmont regions of North Carolina. Based on data obtained from this and previous site studies, groundwater flow direction in the Middendorf Formation sediments, the naturally-occurring overlying soils prior to excavations in the proposed expansion area, was almost due southwesterly.

Based on data compiled at the site from recent borings, piezometer installation, and monitoring wells, groundwater appears to be present in the region of the Cape Fear Formation sediments between the elevations of 275 and 285 feet in the proposed landfill expansion area. Data from a previous site investigation determined that the direction of groundwater flow in the Cape Fear Formation sediments is slightly west of due south, and at a very slow rate.

As shown in Figure 2, water/saturated zones were encountered at a level of seven (7) to twenty-seven (27) below ground level.

6.0 PROPOSED MONITORING SYSTEM

For the C&D landfill expansion and the existing, currently active C&D landfill, this GWMP plan utilizes a combination of existing monitoring wells and the installation of three new compliance wells. This GWMP is designed to incorporate the entire site covered by SWS Permit 43-03 also inclusive of the monitoring of the old, closed out MSW landfill.

6.1 Upgradient Monitoring for the C&D Landfill Expansion

The C&D landfill expansion is designed to accept waste for approximately 25 years. CDMW-6 is currently being utilized as the upgradient well for the existing, active C&D landfill. See Figure 3 for location. This well is positioned suitably for continued use as the upgradient well for the expansion.

6.2 Compliance (downgradient) Monitoring for the C&D Landfill Expansion

As shown in Figure 3, this GWMP includes the continued use of the existing monitoring wells CDMW-2, CDMW-3, & CDMW-5 located at the southwest corner of the existing active landfill.

Three new compliance (downgradient) wells, CDMW-7, CDMW-8, & CDMW-9 are proposed at roughly two hundred seventy (270) feet, four hundred ninety (490) feet, and seven hundred (700) feet respectively from the northwest corner of the existing C&D landfill cell, placing them roughly one hundred (100) feet downgradient from the center of the western waste boundary. Based on available subsurface data these wells will be approximately 20 feet deep.

CDMW-7, CDMW-8, & CDMW-9 in combination with the existing compliance monitoring wells already in place downgradient from the existing cell, will provide an effective compliance monitoring to intercept groundwater flow in the uppermost aquifer across the currently active and the proposed expansion of the C&D landfill.

7.0 NEW MONITORING WELL CONSTRUCTION

New monitoring well construction standards shall conform to requirements cited in 15A NCAC 2C "Well Construction Standards: Criteria and Standards Applicable to Water Supply and Certain Other Wells". A typical well construction for the uppermost aquifer is shown in Figure 4.

8.0 COMBINED FACILITY MONITORING

This new GWMP for Anderson Creek Landfill, NCDENR Permit 43-03, will include three groundwater monitoring sets, shown in Figure 3, as follows:

- **Set A:** Set A will include upgradient well CDMW-6 and compliance (downgradient) wells CDMW-2, CDMW-3, CDMW-5, CDMW-7, CDMW-8, & CDMW-9 to monitor the existing and expanded areas of the C&D landfill. According to Rule .1633, the C&D expansion permit would require that this monitoring set be sampled for VOC's per Appendix I, eight RCRA metals, tetrahydrofuran (THF), specific conductance, pH, and temperature.
- **Set B:** Set B will include the monitoring wells for the old, closed out MSW landfill cell including background (upgradient) well MW1 and compliance (downgradient) wells MW2, MW4, and MW5. This set can be separated from monitoring the new C&D expansion. Set B will be continued and sampled for Appendix I organics and eight RCRA metals, and THF.
- **Set C:** Set C will include surface water monitoring points SWPT-1 and SWPT-2 that will remain at the same locations to monitor surface water for the entire site. According to Rule .1633, these samples would also require VOC's per Appendix I, eight RCRA metals, THF, specific conductance, pH, and temperature.

In the future, if and when proposed new C&D rules are adopted, these monitoring parameters may be revised at the direction of NCDENR-SWS.

9.0 GROUNDWATER MONITORING SYSTEM MAINTENANCE

Because it is possible that accidental or natural events may influence the condition of the monitoring wells located on the landfill property, a maintenance plan will be put into place. At a minimum, landfill personnel and/or a person deemed by the Owner to complete the inspections, will inspect the groundwater monitoring system every 6 months, prior to the scheduled monitoring event. The following items will be verified during the inspection:

- Each monitoring well outer protective casing has a functional padlock and is locked.
- Each monitoring well casing has a secure cap and is properly labeled.

- The outer protective casing of each monitoring well is upright and undamaged by equipment or vehicles.
- Each monitoring well and surface water monitoring point has a clearly marked and unobstructed access path. The access path shall be free of dense vegetation.

If any issues arise from the inspection, they will be addressed and/or corrected immediately. The results of each inspection and any corrective measures will be documented and placed on file at the County Solid Waste Department office and in the facility onsite operational file.

10.0 SAMPLING AND ANALYSIS PLAN

10.1 Overview

Procedures to sample and analyze groundwater samples will be in accordance with 15 NCAC Chapter 13B, Sections .1632 and .1633.

Groundwater sampling will be conducted semi-annually. A certified commercial laboratory using qualified individuals for field sampling and handling will perform the sampling and analysis in accordance with the relevant guidelines in the most current version of "Groundwater Monitoring Guidance Document" of NCDENR-SWS. The samples are tested for Appendix I volatile organics using the most current USEPA SW-846 test method, currently USEPA Method 8260B, Tetrahydrofuran, and for the eight RCRA metals, using their respective current USEPA methods.

In accordance with 15 NCAC Chapter 13B, Section .1632, data from the monitoring plan would be evaluated to determine if there is significance increases/decreases in chemical constituents occurring during subsequent sampling events, as appropriate to this site.

10.2 Current Laboratory

At present Harnett County employs Environment One, Inc. (E1I), of Greenville, North Carolina, Drinking Water ID: 37715, Wastewater ID: 10. The following includes several pertinent notes regarding current practices of E1I in sampling at this landfill site.

10.3 Equipment used for sampling

A partial list of sampling equipment includes:

- 1) Non-disposable (1liter capacity) Teflon bailers. Laboratory cleaned as specified in the NCDENR-SWS guidance document.
- 2) Single use nylon rope for lowering bailers.
- 3) Single use latex gloves.
- 4) Water level indicators (Slope Indicator co., Model # 51453 and Sample Pro, Model #6000)
- 5) pH, Temperature, Conductivity Meter (Oakton, Series 10)

10.4 Decontamination of field equipment

The only equipment that is used from well to well is a water level meter. These meters are rinsed with phosphate-free soap/detergent & de-ionized water between wells.

10.5 Sampling protocol for Monitoring Wells and Piezometers

- 1) Upon arrival at the monitoring site, technicians make their presence known to site personnel and record the time of arrival in the Field Log. Keys for well cover locks are obtained and site locations of all monitoring wells and surface water locations are verified. Then, the following sequence is followed for all wells and piezometers while the technicians wear protective gloves at all times.
- 2) The protective cap is carefully removed from the outer casing followed by removal of the well cap. Care is taken to prevent particles adhered to the caps from falling into the wells. The water level indicator is lowered into the well to obtain a water level reading. The indicator is then lowered until it reaches the bottom of the well. Both numbers are recorded in the Field Log along with the well data, and water volume in the well is calculated. Probes and wiring are rinsed in methanol and de-ionized water before testing the next well. This process is repeated until all wells are recorded.
- 3) Based on the calculated water volume, each well is purged three to five (3 - 5) times of its respective volume using a laboratory prepared and cleaned Teflon bailer. Each bailer is dedicated to a specific well. To begin bailing, a new section of nylon rope, in the appropriate depth for the specific well is tied either to the lock ring on the outer casing or by a belt loop. The bailer is to be gradually lowered into the well until it is submerged (it is never dropped to prevent a splash). The bailer is then withdrawn while the technician coils the rope in his glove-protected hands.
- 4) The water is poured out far enough away from the casing to prevent equipment contamination. Purged well water should be measured in gallon buckets to ensure an accurate measurement of water evacuated from each well. The technician checks conductivity, pH, and temperature to assure proper purging. Then, the bailer is either wrapped with a protective covering or hung in well while the technician moves on to next well and repeat the above procedure.
- 5) The Technician then returns to the first bailed well and collects samples. The same technique used to bail the well is used to obtain samples. The first sample is poured in a disposable beaker and analyzed for pH, temperature, and conductivity. Prior to analysis, the equipment is field-calibrated as per manufacturer's specifications. Calibration information is recorded in the appropriate Field Log. Probes are cleaned with phosphate-free soap/detergent after each use and rinsed with de-ionized water. The rest of the samples are collected in the following order of volatilization sensitivity, e.g., volatile organics first followed by inorganics. Well caps are replaced and casing caps are locked. Samples are marked properly and placed in a cooler with ice. Then the technician proceeds to the next well. Occasionally, if a well does not recharge, it is necessary to collect samples on the following day.
- 6) After sample collection is completed the technician fills the required portion of the "Chain of Custody" document.

- 7) Finally, keys are to be returned to site personnel and the time noted in the Field Log. Any problems with well construction, site maintenance, etc., are reported to site personnel and also noted on the "Chain of Custody" documentation.

10.6 Sampling Protocol for Collecting Surface Water Samples

Samples are collected at the approved location as specified. The technician lowers sample bottles into the surface water location by hand, glove-protected. When lowering the containers, the container opening is positioned the mouth tilted down and towards the current at a depth not exceeding six (6) inches.

10.7 QA/QC Procedures for Field Sampling and Collection

- 1) Bailers are prepared using established procedures.
- 2) All sample containers are new and cleaned to EPA QC protocol.
- 3) Field measurement temperatures are read with a thermometer calibrated against a NBS certified thermometer.
- 4) Conductivity and pH meter is field calibrated on site each sampling day.
- 5) All well samples are collected the same day as purging if recharge rates allow.
- 6) Trip blanks are provided by the sampling laboratory and remain with the cooler at all times. These blanks are analyzed using the same methods as the actual samples and their results are included in the report.
- 7) All samples are placed on wet ice immediately upon collection and transported to the laboratory with "Chain of Custody" documentation included.

10.8 QA/QC Procedures for Laboratory Procedures

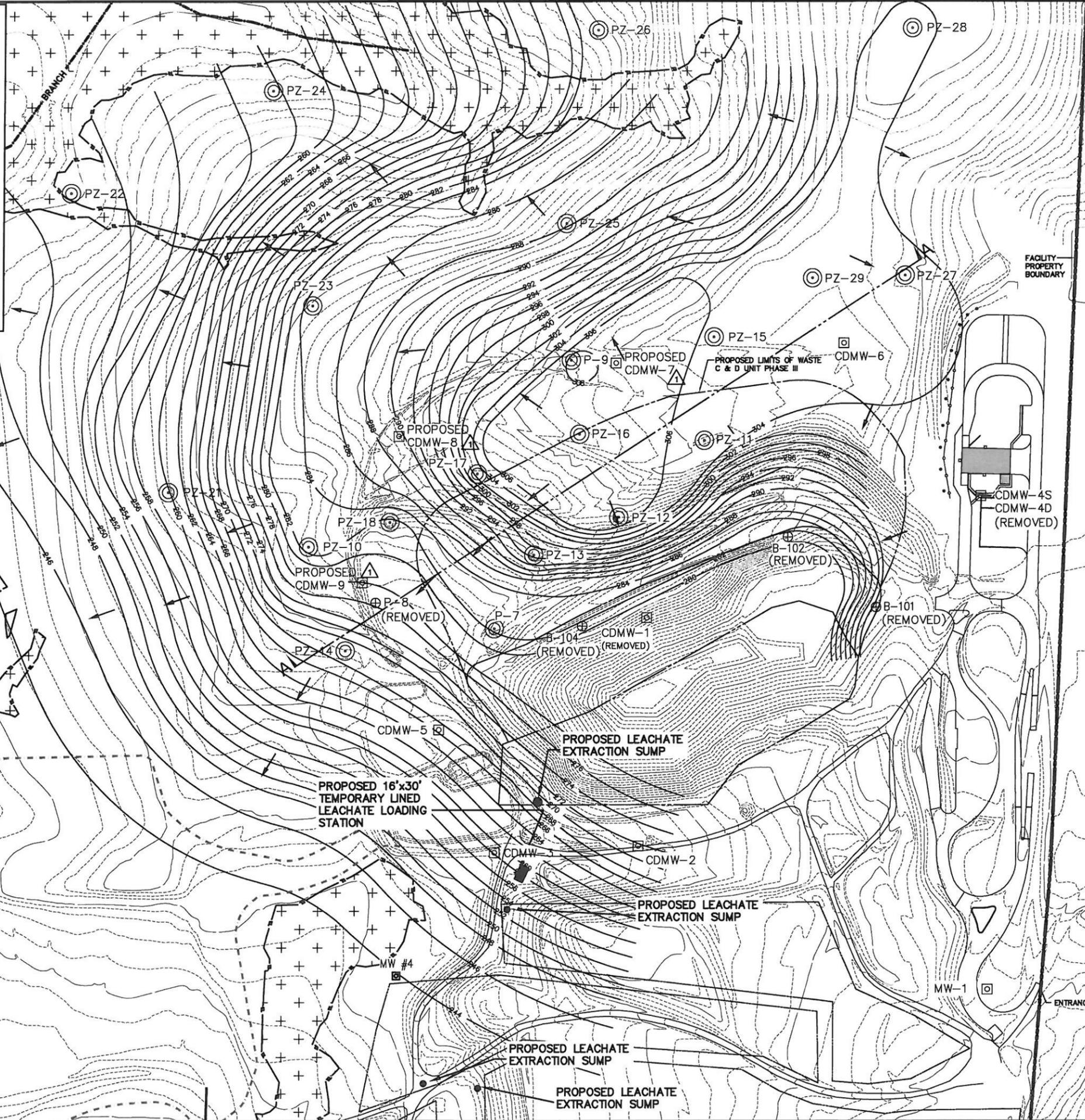
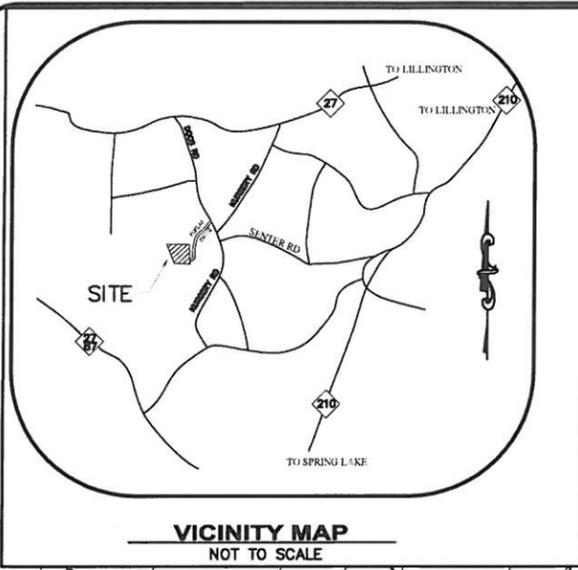
- 1) All samples are refrigerated during storage before analysis. Temperature records are kept on each refrigerator to assure holding temperatures of 4 °C.
- 2) E11 maintains certification for all analytical methods necessary to perform required NCDENR-SWS monitoring. Method numbers for specific inorganics as well as group organics appear on the report sheets.
- 3) Required analytical QA/QC is followed for both inorganics and organics.
- 4) Metals are analyzed using either flame AA, graphite furnace AA, ICP, or ICPMS as per requirements. Calibration curve samples, QC second source samples, method blanks, duplicates, and spikes are run with each sample set as required for a particular method.
- 5) Final reports are checked for the inclusion of all required data.

11.0 CONCLUSIONS

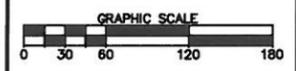
This GWMP addresses the complete groundwater monitoring needs for Permit 43-03 including the proposed C&D Landfill Phase III expansion, the existing C&D landfill and the old, closed-out MSW landfill, meeting the relevant NCDENR-SWS rules.

- The new monitoring wells to be installed under this GWMP and the existing monitoring wells and piezometers are shown in the general site layout in Figure 3.

- The existing piezometers located in what will be the working surface of the expanded C&D landfill area, will be abandoned in accordance with the requirements of 15 NCAC Chapter 2C, "Well Construction Standards," as appropriate. These include piezometers P-7, P-11, P-12, P-13, P-16, & P-17
- Groundwater sampling and analysis is to be performed semi-annually in accordance with the procedures described within this plan and will include monitoring Sets A, B, and C.
- Set A will include upgradient well CDMW-6 and compliance (downgradient) wells CDMW-2, CDMW-3, CDMW-5, CDMW-7, CDMW-8, & CDMW-9 to monitor the existing and expanded areas of the C&D landfill.
- Set B will include the monitoring wells for the old, closed out MSW landfill cell including background (upgradient) well MW1 and compliance (downgradient) wells MW2, MW4, and MW5.
- Set C will include surface water monitoring points SWPT-1 and SWPT-2 that will remain at the same locations to monitor surface water for the entire site.
- Groundwater and surface water samples will continue to be analyzed for the eight RCRA metals, Tetrahydrofuran, and Appendix I volatile organics.



- General Notes
- EXISTING MAJOR CONTOUR LINE
 - EXISTING MINOR CONTOUR LINE
 - WETLAND
 - PIEZOMETER LOCATION AND ID
 - C & D MONITORING WELL LOCATION AND ID
 - DIRECTION OF GROUND WATER FLOW
 - SEASONAL HIGH GROUND WATER CONTOURS



No.	ADDED CDMW-7, RENUMBERED	6/12/13
	Revision/Issue	Date

EXHIBIT ONLY

Signature _____
Date _____

Clayton, Sr., P.E., Inc.
 CIVIL & ENVIRONMENTAL ENGINEERING
 48 WEST WASHINGTON STREET
 COATS NORTH CAROLINA 27511
 PHONE: 919-897-9700 FAX: 919-897-0787
 LICENSE NO. C-2713 www.claytonpe.com

**ANDERSON CREEK LANDFILL
 PHASE III
 EXPANSION**

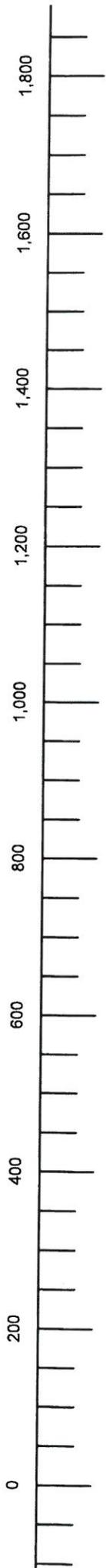
HARNETT COUNTY, NC

Project No.	03001C	File Name	03001C AGLF EXP MW-1
Designed By	SBK	Drawn By	SBK
Checked By	RS	Proj. Eng.	CTC Jr.
Sheet Title	GROUNDWATER CONTOUR MAP		
Date	5/29/13	DRAWING	

FIGURE 1

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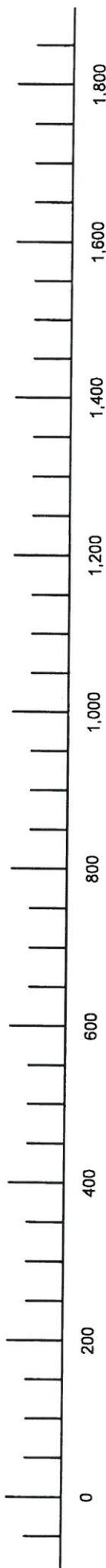
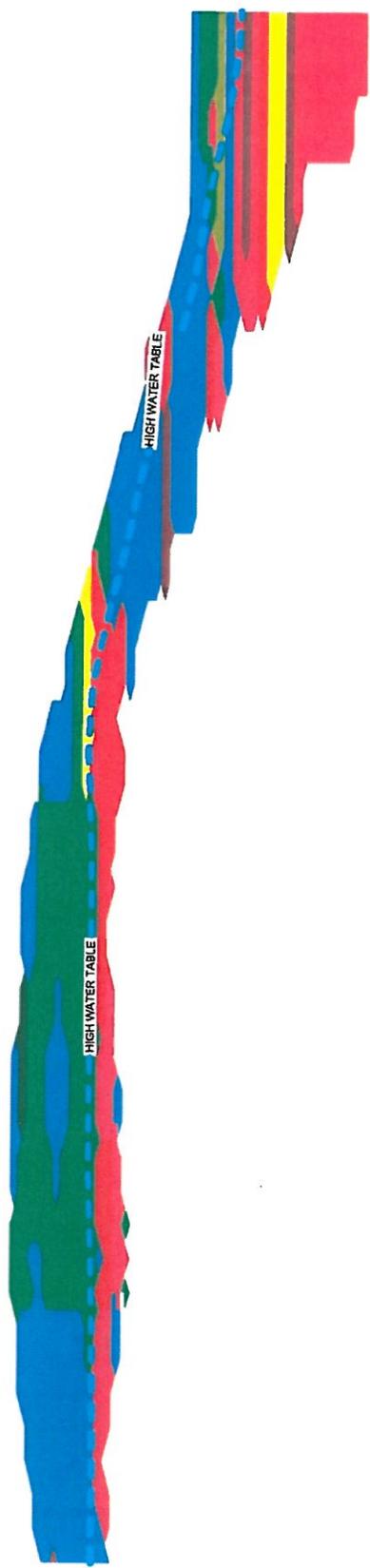


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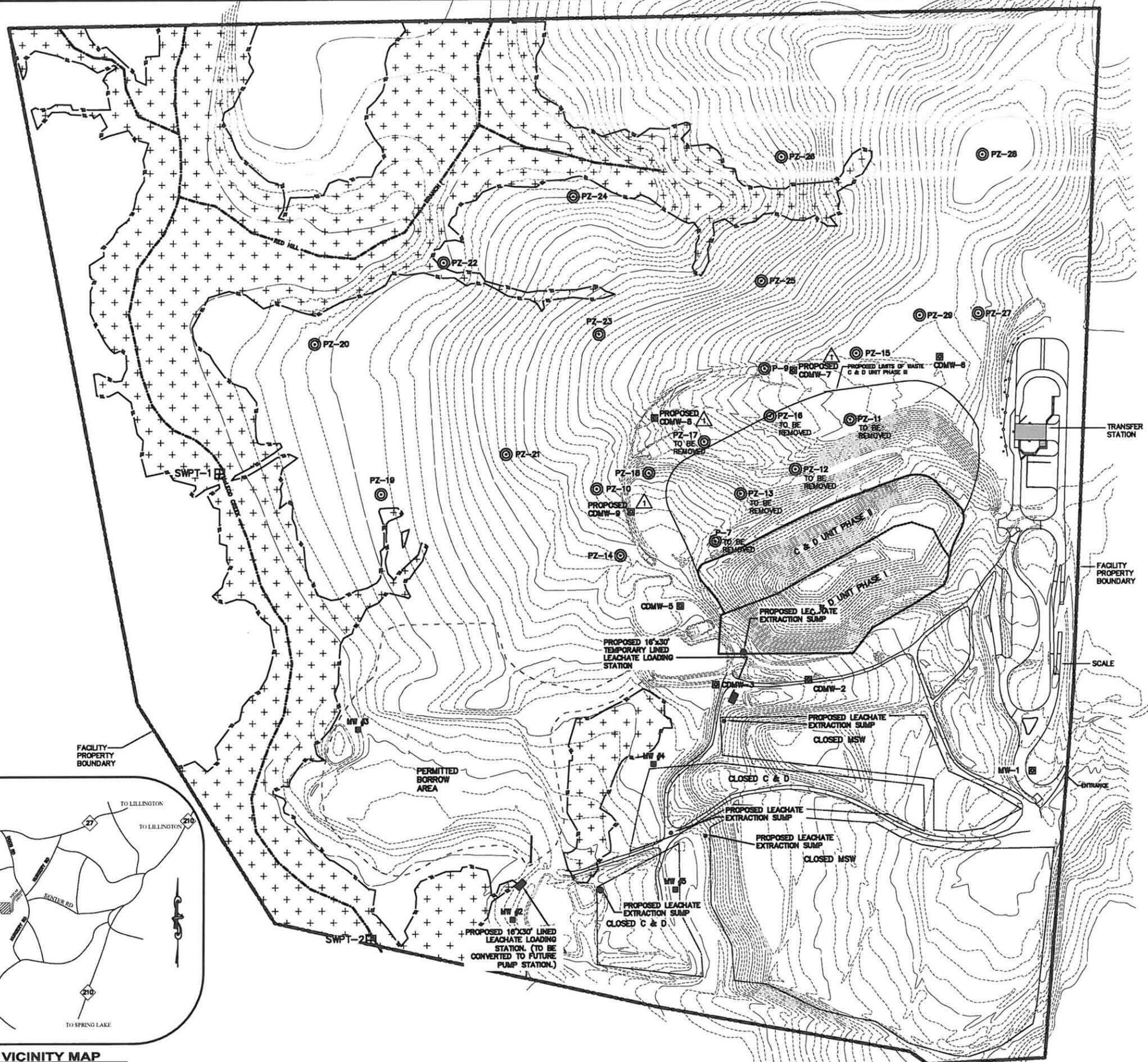
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 - SILT
 - SILTY CLAY
 - SILTY SAND
 - TOPSOIL



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General Notes

- EXISTING MAJOR CONTOUR LINE
- EXISTING MINOR CONTOUR LINE
- WETLAND
- ⊙ PZ-26 P-5 PIEZOMETER LOCATION AND ID
- ⊙ CDMW-3 C & D MONITORING WELL LOCATION AND ID
- ⊙ SWPT-1 SURFACE WATER MONITORING POINT LOCATION AND ID



▲	ADDED CDMW-7, RENUMBERED	6/12/13
No.	Revision/Issue	Date

EXHIBIT ONLY

Signature: _____
Title: _____

Clayton, Sr., P.E., Inc.
 CIVIL & ENVIRONMENTAL ENGINEERING
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**ANDERSON CREEK LANDFILL
 PHASE III
 EXPANSION**

HARNETT COUNTY, NC

Project No. 03001C File Name: 03001C ADLF EXP M3-1
 Designed By: SBK Drawn By: SBK
 Checked By: RS Proj. Eng: CTC Jr.

Sheet Title: **MONITORING WELL
 LOCATION PLAN**

Date: 5/29/13 DRAWING

FIGURE 3

VICINITY MAP
 NOT TO SCALE

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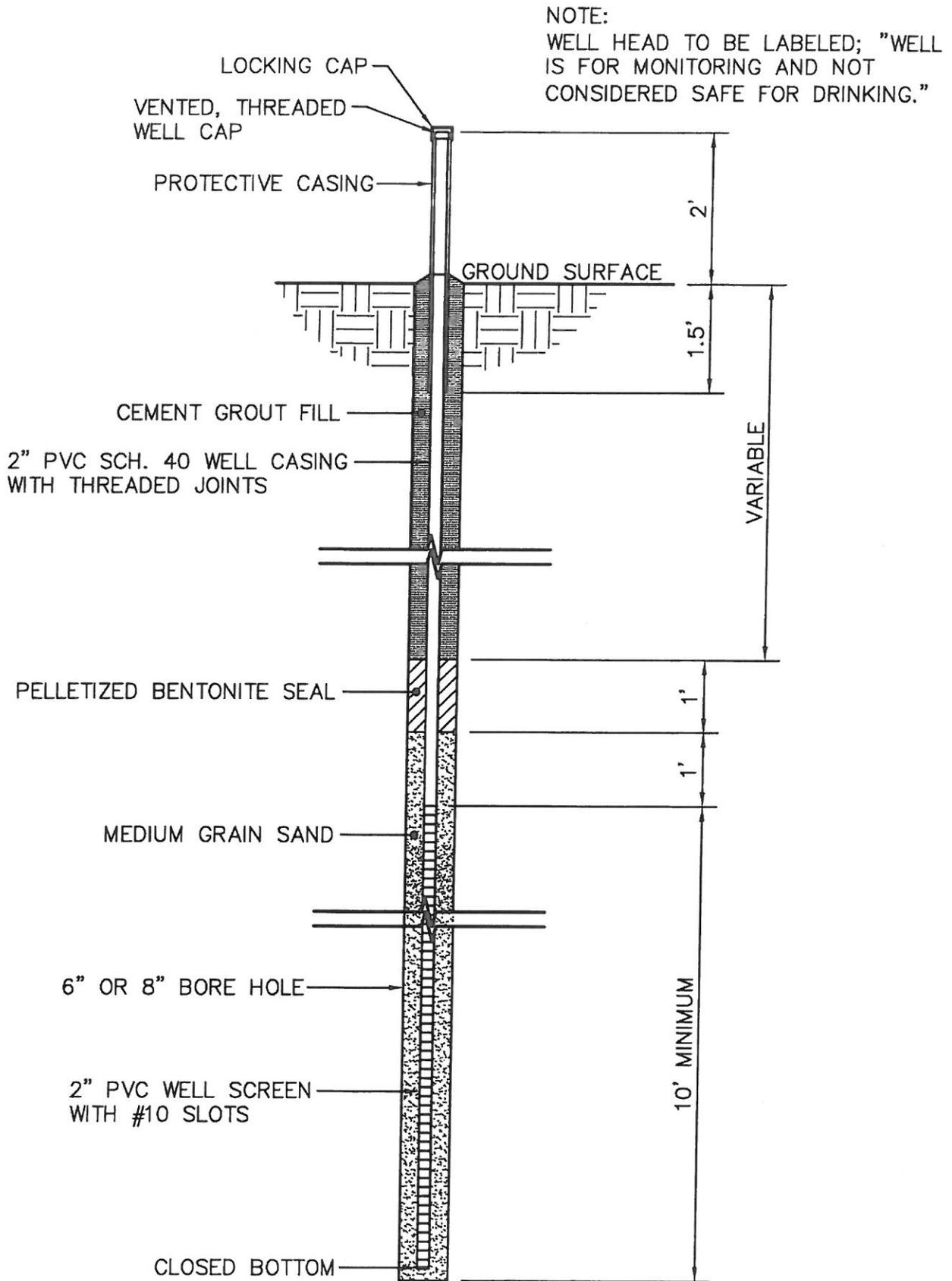


FIGURE 4

PROPOSED MONITORING WELL CONSTRUCTION

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Landfill Gas Monitoring Plan

**Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

Prepared for:

**Harnett County Solid Waste Department
Lillington, North Carolina**

January 2014

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577



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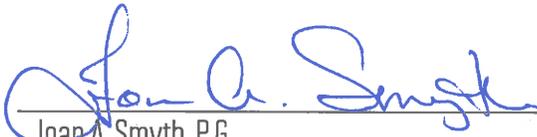
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Landfill Gas Monitoring Plan

Harnett County Anderson Creek Landfill Facility Harnett County, North Carolina

Prepared For:
Harnett County Solid Waste Department
Lillington, North Carolina

S+G Project No. HARNETT-AC-13-3



Joan A. Smyth, P.G.
Senior Hydrogeologist



Pieter K. Scheer, P.E.
Vice President, Senior Engineer



January 2014

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Harnett County Anderson Creek Landfill Facility Harnett County, North Carolina

Landfill Gas Monitoring Plan

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FIGURE

Figure 1	Site Vicinity Map
Figure 2	Site Plan
Figure 3	Flowchart of Methane Monitoring Requirements

APPENDIX

Appendix A	Reporting Form
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1.0 INTRODUCTION

This Landfill Gas (LFG) Monitoring Plan (plan) was prepared by Smith Gardner, Inc. to describe the LFG monitoring program at the Anderson Creek Landfill Facility (NC Solid Waste Permit 43-03), which is located on Poplar Drive Spring Lake, North Carolina. This landfill facility includes an active C&D landfill, a closed MSW landfill, and a closed C&D landfill. This plan describes the necessary procedures to satisfy applicable regulatory requirements (see **Section 1.1**) for landfill gas monitoring.

The Engineer has utilized the best available site data, practices, experience, and judgment to develop this plan. However, the plan may require modifications over time to accommodate changing landfill conditions, changing receptors in areas adjacent to and around the landfill, or other conditions that cannot be fully anticipated.

Uncontrolled migration of LFG (particularly methane (CH₄)) can result in, loss of life, injury, loss of property, vegetative damage, and intolerable odors. Landfill monitoring includes exposure to explosive gases. Monitoring personnel should be specifically trained in the management and response for situations such as fire or explosion and confined space entry and possess an awareness of changing conditions around the landfill.

Note that this plan does not address landfill gas collection and control, air quality, or other related landfill gas regulations or requirements which may be applicable to this site at present or in the future.

1.1 Regulatory Requirements – C&D Landfills

Rule 15A NCAC 13B.0544(d) of the North Carolina Solid Waste Management Rules requires the following for facilities having a C&D landfill:

- Owners or operators of MSW landfill units must ensure that:
 - the concentration of methane gas or other explosive gases generated by the facility does not exceed 25 percent of the lower explosive limit in on-site facility structures (excluding gas control or recovery system components);
 - the concentration of methane gas or other explosive gases does not exceed the lower explosive limit for methane or other explosive gases at the facility property boundary; and
 - the facility does not release methane gas or other explosive gases in any concentration that can be detected in offsite structures.
- Owners or operators of C&D landfill units must implement a routine methane monitoring program and perform monitoring on at least a quarterly basis.
- If regulatory limits for methane gas concentrations are exceeded, a contingency plan must be implemented for the protection of human health and safety.

1.2 Guidance Document

This plan was developed generally following the Landfill Gas Monitoring Guidance document prepared by the North Carolina Department of Environment and Natural Resources (NC DENR), Division of Waste Management (DWM)¹.

1.3 Contact Information

All correspondence and questions concerning this plan should be directed to the appropriate contact below:

1.3.1 Owner

Harnett County

Solid Waste Department

P.O. Box 940

Lillington, North Carolina 27546

Phone: (919) 814-6156

Contacts: Amanda Bader, P.E., County Engineer

abader@harnett.org

Randy Smith, Solid Waste Operations Manager

rsmith@harnett.org

1.3.2 Engineer

Smith Gardner, Inc.

14 N. Boylan Avenue

Raleigh, North Carolina 27603

Phone: (919) 828-0577

Contacts: Joan A. Smyth, P.G., Senior Hydrogeologist

joan@smithgardnerinc.com

Pieter K. Scheer, P.E., Project Manager

pieter@smithgardnerinc.com

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North Carolina DENR - Raleigh Central Office (RCO)

217 W Jones Street

Raleigh, North Carolina 27603

Phone: (919) 707-8200

Contact: Ms. Elizabeth Werner

elizabeth.werner@ncdenr.gov

¹ NC DENR DWM (2010), "Landfill Gas Monitoring Guidance", NC DENR DWM Solid Waste Section, November 2010.

1.4 Existing Site Conditions

The facility is located approximately 15 miles southwest of Lillington on Poplar Drive in Spring Lake, North Carolina. The surrounding area primarily undeveloped tracts of land with some residential development primarily to the northeast and east.

The facility is located on approximately 223 acres owned by Harnett County. The site location, with a 1-mile radius is provided as **Figure 1**. The site is bound to the north by undeveloped land and perennial streams with the exception of the northeast corner which is adjacent to a residential subdivision, to the east by undeveloped land, perennial streams and residential subdivisions, the south by undeveloped land and perennial streams with the exception of the southeast corner which appears to have a building on the adjacent property, and to the west by undeveloped property and perennial streams. As shown on the figure, there are perennial streams surrounding a significant portion of the site. These existing water features create a natural barrier to LFG migration.

1.4.1 Site Geology

The Anderson Creek Landfill facility is located in the Coastal Plain Physiographic Province of North Carolina. The Geologic Map of North Carolina (*USGS, 1985*) indicates that the site lies within the Middendorf Formation. The Middendorf formation consists of fine sandy clays grading to coarse clayey sands.

The Middendorf formation is located above the Cape Fear Formation at the site. The Cape Fear lithology at the site consists of gray silty clays with some clayey silt. The Cape Fear sediments extend at least 50 feet below the Middendorf Formation.

1.4.2 Local Groundwater Regime

The primary aquifer at the site is generally unconfined, surficial, unconsolidated sands and clays. McLeod Creek is located along the western property boundary. McLeod Creek flows southward into Jumping Run Creek and eventually into the Little River approximately 6 miles from the site. McLeod Creek and other unnamed tributaries serve as groundwater discharge features at the site. Groundwater occurs between elevations 307 and 242 ft msl.

2.0 MONITORING PROGRAM

This is the existing monitoring program for the site. The plan contained herein includes landfill gas monitoring wells to monitor for subsurface landfill gas migration as well as landfill gas monitoring in on-site structures.

2.1 Monitoring Wells

The monitoring wells and structures are shown on **Figure 1**.

2.1.1 LFG Monitoring Wells

The close location of streams to the north, west and south of the site limit the possibility of landfill gas migration in these directions. Therefore, landfill gas monitoring points are focused along the eastern property line where residential development is more predominant. The landfill gas monitoring network includes the wells summarized below:

LFG Monitoring Well	Screened Interval (ft bgs)	Total Depth (ft bgs)
LFG-1	20-10	20
LFG-2	15-5	15
LFG-3	15-5	15
LFG-4	15-5	15

The monitoring wells are shown on **Figure 2**.

2.1.2 LFG Monitoring Well Construction

The LFG monitoring wells were installed to groundwater in accordance with 15A NCAC 2C by Geologic Explorations, Inc. on October 17, 2013. Wells were advanced using HSA drilling technology and constructed of two-inch diameter, manufactured PVC well screens with 10-slot per inch intake spacing and solid PVC riser pipe. A sand filter pack was placed around the screened interval, to a height of up to two feet above the screen and a hydrated bentonite plug of two to five feet in thickness was positioned above the sand pack to seal each well. A protective steel casing and a cement pad for surface protection was also installed. Quick-connect fittings were installed in the cap as a monitoring port in accordance with SWS guidance.

2.2 Monitoring of Facility Structures

The following facility structures will be monitored:

- Scalehouse; and

- Transfer Station Building.

If desired by the County, a dedicated methane monitor may be installed within one or more of these structures. Otherwise, monitoring will be conducted quarterly with the landfill gas monitoring wells.

2.3 Monitoring and Reporting

Monitoring and reporting of LFG concentrations will be performed as outlined below.

2.3.1 Frequency

Routine LFG monitoring will be conducted on a quarterly basis.

2.3.2 Personnel

LFG monitoring will be performed by personnel who are familiar with the requirements of this plan and who are trained in LFG hazards and explosive gas meter use. As practical, a designated technician will be assigned to regular LFG monitoring duty.

2.3.3 Equipment

A Landtec™ GEM-2000 infrared portable gas analyzer (or equivalent) will be used to monitor probes and LFGCCS components. This analyzer, which is calibrated to methane (CH₄), operates using the infrared spectral property of methane to measure concentrations in air. Measurements of oxygen (O₂) and carbon dioxide (CO₂) will also be made with this meter. This meter may be used in oxygen deficient areas (less than 10% O₂) since oxygen is not required for a chemical combustion of flammable gases within the meter.

On the day of monitoring, prior to monitoring activities, this meter will be field calibrated. Additionally, all monitoring equipment should be regularly calibrated in accordance with manufacturer's specifications and operated only as instructed.

2.3.4 Procedures

Prior to each monitoring event, the portable gas analyzer will be calibrated with a known calibration standard in accordance with manufacturer's recommendations. General information related to the monitoring event, equipment used, calibration procedures, weather conditions, and results for each monitoring event will be recorded on the landfill gas monitoring data form (see **Appendix A**).

The following steps outline the procedure for the monitoring of LFG wells and facility structures:

- Check calibration date on the meter and calibrate according to manufacturers instructions; allowing equipment to warm up properly prior to use, per manufacturers direction.
- Purge sample tube for one minute before monitoring.

LFG Monitoring Wells:

- Connect instrument tubing to sample port on the monitoring well without removing the cap.
- Open the valve and record both the initial and stabilized methane concentrations. A stabilized concentration will not vary more than 0.5 percent by volume on the instrument's scale. Also record the oxygen concentration (at two percent per volume or less to indicate air is not being drawn into the system and providing false readings) and the carbon dioxide concentration.
- Close the valve and disconnect the tubing.
- Record monitoring data on the LFG monitoring data form provided in **Appendix A**.
- If any methane concentration is **greater than 50% of the LEL (2.5% CH₄)**, monitoring personnel should implement the Precautionary Action Plan (see **Section 2.3.5**).
- If both initial and stabilized methane concentrations are less than 50% of the LEL (2.5% CH₄), move to next LFG monitoring well.

Structures:

- Walk through the facility structure with a methane analyzer and monitor the perimeter wall interface of the structure, the floor to wall interface in hallways and rooms, and any floor penetrations in the structure. Record the initial and stabilized methane concentrations, oxygen concentration, and carbon dioxide concentration.
- Record monitoring data on the LFG monitoring data form provided in **Appendix A**.
- Notify the Landfill Superintendent and the Engineer for any methane concentration greater than 0% of the LEL.

IF A STABILIZED METHANE CONCENTRATION IS GREATER THAN 100% OF THE LEL IN A LFG MONITORING WELL OR GREATER THAN 25% OF THE LEL IN A FACILITY STRUCTURE, THE FOLLOWING ACTIONS WILL BE IMPLEMENTED:

- 1) Recalibrate monitoring equipment and confirm results.
- 2) If results are confirmed, **IMMEDIATELY** contact the Landfill Manager and the Engineer.

3) Implement the Compliance Action Plan located in **Section 3.1**.

A flowchart of actions to be taken if exceedances are noted is included as **Figure 3**.

2.3.5 Precautionary Action Plan

If an initial or stabilized methane concentration is equal to or greater than 50% of the LEL in a LFG monitoring well, monitoring personnel should perform the following additional steps at this location:

- Measure gas pressure in the well head (in inches of water) using magnehelic gauge or other appropriate metering device.
- Record at least one additional methane concentration measurement, inside the well just below the top of casing.
- Evaluate the surrounding area for potential receptors to or signs of LFG migration. LFG can stress vegetation and can kill trees and grass by root asphyxiation. Note stressed/dead vegetation areas on the monitoring form.
- Notify the Landfill Manager and the Engineer for further evaluation.

2.3.6 Record Keeping

Routine LFG monitoring events will be documented on the LFG monitoring data form provided in **Appendix A**. Completed forms will be placed in the landfill operating record located at 103 E. Ivey Street Lillington, North Carolina 27546. These forms will be available for review by DWM personnel on request.

Documentation of any contingency plan actions (see **Section 3.0**) will also be kept in the operating record.

2.4 Maintenance

Periodic maintenance and site observations will be conducted routinely to address monitoring program components (at a minimum):

- Maintain access to LFG monitoring locations.
- Perform LFG monitoring well maintenance (maintain well locks, steel casing, concrete pad, etc.).
- Observe landfill cover conditions, areas of dead vegetation, leachate seeps, odors, etc. as indications of potential LFG-related problems.

Note deficiencies on the monitoring forms and report to the Solid Waste Operations Manager for repair or replacement as necessary.

3.0 CONTINGENCY PLAN

If a stabilized methane concentration is **greater than 100% of the LEL in a LFG monitoring well or greater than 25% of the LEL in a facility structure**, the County will perform both an immediate action and plan and a remediation plan as described below.

3.1 Immediate Action Plan

The Solid Waste Operations Manager will perform the following actions for the protection of human health and safety:

- 1) Evacuate affected facility structures and the immediately surrounding area.
- 2) Determine nearby potential receptors (facility and off-site structures).
- 3) Perform monitoring in any other facility structure near the monitoring location having the high concentration.
- 4) Contact the County Fire Department (911). Coordinate evaluation of potentially affected off-site structures with the Fire Department.
- 5) Verbally notify the County Engineer, or their designee.
- 6) Verbally notify the NCDENR DWM (see **Section 1.1**) as soon as practical.
- 7) Investigate and identify the potential source(s) and conduit(s) for LFG migration that may have caused the high concentration (i.e. the path that the LFG may be taking to the monitoring location).
- 8) Identify the LFG extent using bar hole punch sampling methodology or other applicable alternative method as practical.
- 9) As appropriate, begin corrective action to control methane concentrations in structures surrounding the landfill site.

3.1.1 Reporting and Documentation

Within seven days of the detection of a high methane concentration, the County will prepare and submit an Environmental Monitoring Reporting Form (see **Appendix A**) with the results of the monitoring event to the DWM. The County will also place a description of the actions performed to protect human health in the operating record.

3.2 Remediation Plan

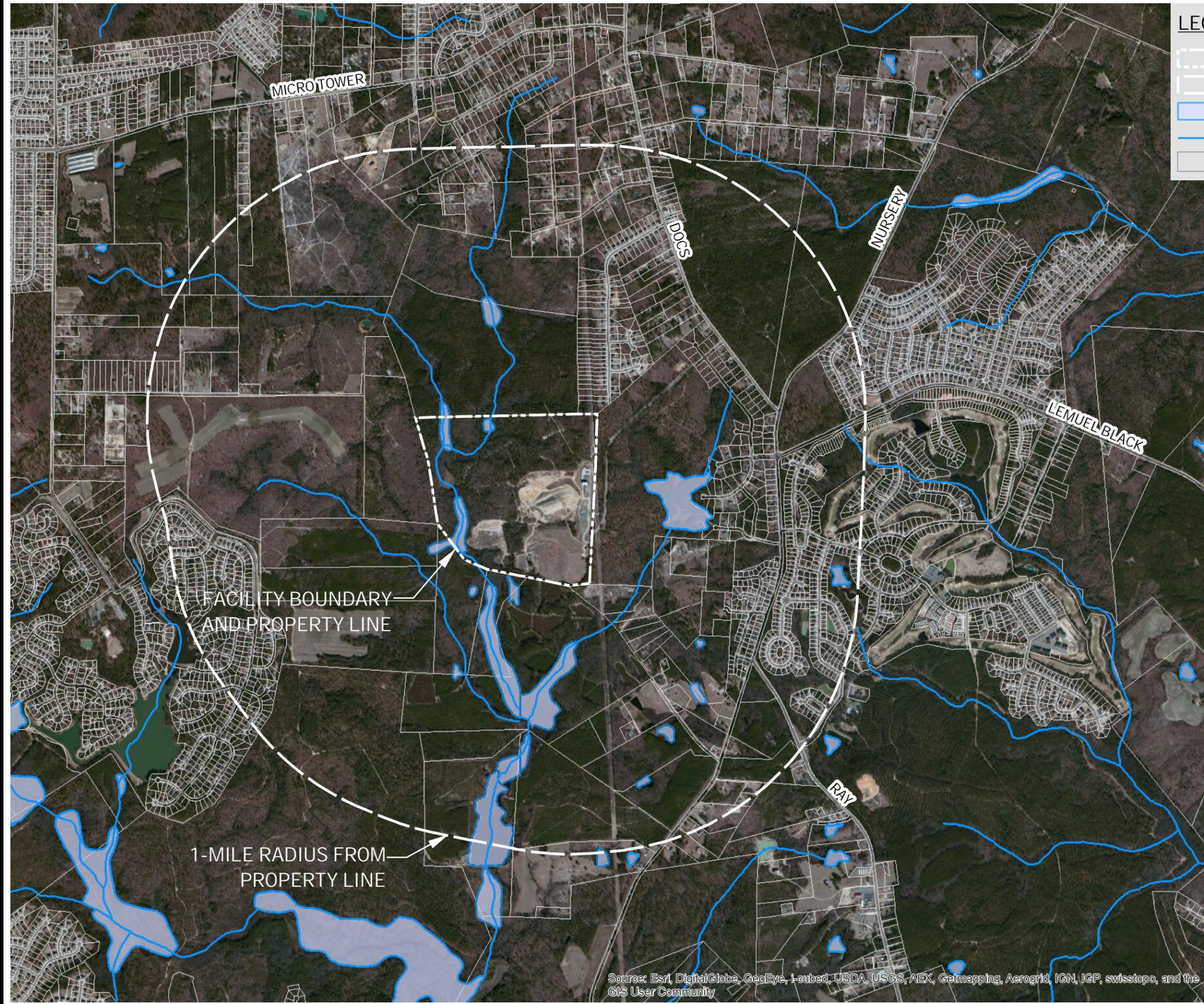
Within sixty days of the detection of a high methane concentration, a remediation plan describing the problem nature, extent, and proposed remedy will be submitted to NCDENR for approval. Upon approval the plan will be implemented and a copy will be placed in the operating record. The DWM will also be notified the plan has been implemented.

An extension may be granted by the DWM on written request and depending on severity of the situation.

Figures

**Landfill Gas Monitoring Plan
Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

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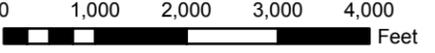


LEGEND

- FACILITY BOUNDARY & PROPERTY LINE
- 1-MILE RADIUS FROM PROPERTY LINE
- WATER FEATURE (SEE REFERENCE 2)
- STREAM LOCATION (SEE REFERENCE 2)
- PARCEL BOUNDARY (SEE REFERENCE 1)



- REFERENCES:**
1. PARCEL BOUNDARIES FROM HARNETT COUNTY GIS DEPARTMENT. PARCEL INFORMATION DATED JULY, 2013
 2. STREAM AND WATER FEATURES FROM U.S.G.S. 7.5 MIN. QUADRANGLES "ANDERSON CREEK" AND "OLIVIA".



Source: Esri, DigitalGlobe, GeoEye, Earthstar, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

NC LIC. NO. C-0828 (ENGINEERING)

SMITH + GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

DRAWN: C.T.J.	APPROVED: K.C.B.	SCALE: AS SHOWN	FIGURE NO.: 1
DATE: Aug. 2013	PROJECT NO.: HARNETT 13-2	FILENAME: HARNETT-B0002	

**HARNETT COUNTY
ANDERSON CREEK LANDFILL
SITE VICINITY MAP**

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MONITORING FREQUENCY IS QUARTERLY

METHANE CONCENTRATION MUST NOT EXCEED:
1. 25% OF THE LEL IN FACILITY STRUCTURES; AND
2. 100% OF THE LEL AT THE FACILITY PROPERTY BOUNDARY.

IF METHANE CONCENTRATION EXCEEDS EITHER OF THE ABOVE, THE OWNER MUST:

RECALIBRATE METER AND CONFIRM READINGS
(SEE SECTION 2.3.4 OF LFG MANAGEMENT PLAN)

IF CONFIRMED READINGS EXCEED LIMITS,
(SEE SECTION 3.0 OF THE LFG MANAGEMENT PLAN) AND:

1. IMMEDIATELY:
TAKE STEPS TO ENSURE PROTECTION OF HUMAN HEALTH AND SAFETY

2. WITHIN 7 DAYS:
PLACE THE METHANE READINGS AND STEPS TAKEN TO PROTECT HUMAN HEALTH IN THE OPERATING RECORD

3. WITHIN 60 DAYS:
PREPARE A REMEDIATION PLAN. SUBMIT PLAN TO NCDENR FOR APPROVAL. UPON APPROVAL, IMPLEMENT PLAN.

SMITH+GARDNER ENGINEERS
NOTIFY THE ENGINEER AND DIVISION WITHIN 24 HOURS
NCDENR

PLACE A COPY OF THE REMEDIATION PLAN IN THE OPERATING RECORD, AND

EVALUATE THE NEED FOR ADDITIONAL MONITORING

NOTIFY THE DIVISION THAT THE PLAN HAS BEEN IMPLEMENTED

PREPARED FOR:
**FLOWCHART OF METHANE MONITORING REQUIREMENTS
ANDERSON CREEK LANDFILL
HARNETT COUNTY, NC**

PREPARED BY: _____ NC LIC. NO. C-0828 [ENGINEERING]
SMITH+GARDNER
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

DRAWN: K.C.B.	APPROVED: J.A.S.	SCALE: N.T.S.	DATE: Aug 2013	PROJECT NO.: HARNETT 13-2	FIGURE NO.: 3	FILE NAME: HARNETT-A0004
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Appendix A

Reporting Forms

**Landfill Gas Monitoring Plan
Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

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Landfill Gas Monitoring Plan

**Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

Prepared for:

**Harnett County Solid Waste Department
Lillington, North Carolina**

January 2014

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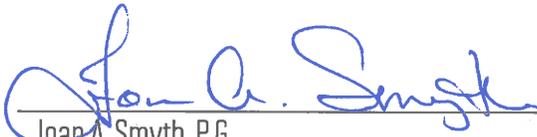
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Landfill Gas Monitoring Plan

Harnett County Anderson Creek Landfill Facility Harnett County, North Carolina

Prepared For:
Harnett County Solid Waste Department
Lillington, North Carolina

S+G Project No. HARNETT-AC-13-3



Joan A. Smyth, P.G.
Senior Hydrogeologist



Pieter K. Scheer, P.E.
Vice President, Senior Engineer



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**Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

Landfill Gas Monitoring Plan

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FIGURE

- Figure 1 Site Vicinity Map
- Figure 2 Site Plan
- Figure 3 Flowchart of Methane Monitoring Requirements

APPENDIX

- Appendix A Reporting Form

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1.0 INTRODUCTION

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Contact: Ms. Elizabeth Werner

elizabeth.werner@ncdenr.gov

¹ NC DENR DWM (2010), "Landfill Gas Monitoring Guidance", NC DENR DWM Solid Waste Section, November 2010.

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1.4.1 Site Geology

The Anderson Creek Landfill facility is located in the Coastal Plain Physiographic Province of North Carolina. The Geologic Map of North Carolina (*USGS, 1985*) indicates that the site lies within the Middendorf Formation. The Middendorf formation consists of fine sandy clays grading to coarse clayey sands.

The Middendorf formation is located above the Cape Fear Formation at the site. The Cape Fear lithology at the site consists of gray silty clays with some clayey silt. The Cape Fear sediments extend at least 50 feet below the Middendorf Formation.

1.4.2 Local Groundwater Regime

The primary aquifer at the site is generally unconfined, surficial, unconsolidated sands and clays. McLeod Creek is located along the western property boundary. McLeod Creek flows southward into Jumping Run Creek and eventually into the Little River approximately 6 miles from the site. McLeod Creek and other unnamed tributaries serve as groundwater discharge features at the site. Groundwater occurs between elevations 307 and 242 ft msl.

2.0 MONITORING PROGRAM

This is the existing monitoring program for the site. The plan contained herein includes landfill gas monitoring wells to monitor for subsurface landfill gas migration as well as landfill gas monitoring in on-site structures.

2.1 Monitoring Wells

The monitoring wells and structures are shown on **Figure 1**.

2.1.1 LFG Monitoring Wells

The close location of streams to the north, west and south of the site limit the possibility of landfill gas migration in these directions. Therefore, landfill gas monitoring points are focused along the eastern property line where residential development is more predominant. The landfill gas monitoring network includes the wells summarized below:

LFG Monitoring Well	Screened Interval (ft bgs)	Total Depth (ft bgs)
LFG-1	20-10	20
LFG-2	15-5	15
LFG-3	15-5	15
LFG-4	15-5	15

The monitoring wells are shown on **Figure 2**.

2.1.2 LFG Monitoring Well Construction

The LFG monitoring wells were installed to groundwater in accordance with 15A NCAC 2C by Geologic Explorations, Inc. on October 17, 2013. Wells were advanced using HSA drilling technology and constructed of two-inch diameter, manufactured PVC well screens with 10-slot per inch intake spacing and solid PVC riser pipe. A sand filter pack was placed around the screened interval, to a height of up to two feet above the screen and a hydrated bentonite plug of two to five feet in thickness was positioned above the sand pack to seal each well. A protective steel casing and a cement pad for surface protection was also installed. Quick-connect fittings were installed in the cap as a monitoring port in accordance with SWS guidance.

2.2 Monitoring of Facility Structures

The following facility structures will be monitored:

- Scalehouse; and

- Transfer Station Building.

If desired by the County, a dedicated methane monitor may be installed within one or more of these structures. Otherwise, monitoring will be conducted quarterly with the landfill gas monitoring wells.

2.3 Monitoring and Reporting

Monitoring and reporting of LFG concentrations will be performed as outlined below.

2.3.1 Frequency

Routine LFG monitoring will be conducted on a quarterly basis.

2.3.2 Personnel

LFG monitoring will be performed by personnel who are familiar with the requirements of this plan and who are trained in LFG hazards and explosive gas meter use. As practical, a designated technician will be assigned to regular LFG monitoring duty.

2.3.3 Equipment

A Landtec™ GEM-2000 infrared portable gas analyzer (or equivalent) will be used to monitor probes and LFGCCS components. This analyzer, which is calibrated to methane (CH₄), operates using the infrared spectral property of methane to measure concentrations in air. Measurements of oxygen (O₂) and carbon dioxide (CO₂) will also be made with this meter. This meter may be used in oxygen deficient areas (less than 10% O₂) since oxygen is not required for a chemical combustion of flammable gases within the meter.

On the day of monitoring, prior to monitoring activities, this meter will be field calibrated. Additionally, all monitoring equipment should be regularly calibrated in accordance with manufacturer's specifications and operated only as instructed.

2.3.4 Procedures

Prior to each monitoring event, the portable gas analyzer will be calibrated with a known calibration standard in accordance with manufacturer's recommendations. General information related to the monitoring event, equipment used, calibration procedures, weather conditions, and results for each monitoring event will be recorded on the landfill gas monitoring data form (see **Appendix A**).

The following steps outline the procedure for the monitoring of LFG wells and facility structures:

- Check calibration date on the meter and calibrate according to manufacturers instructions; allowing equipment to warm up properly prior to use, per manufacturers direction.
- Purge sample tube for one minute before monitoring.

LFG Monitoring Wells:

- Connect instrument tubing to sample port on the monitoring well without removing the cap.
- Open the valve and record both the initial and stabilized methane concentrations. A stabilized concentration will not vary more than 0.5 percent by volume on the instrument's scale. Also record the oxygen concentration (at two percent per volume or less to indicate air is not being drawn into the system and providing false readings) and the carbon dioxide concentration.
- Close the valve and disconnect the tubing.
- Record monitoring data on the LFG monitoring data form provided in **Appendix A**.
- If any methane concentration is **greater than 50% of the LEL (2.5% CH₄)**, monitoring personnel should implement the Precautionary Action Plan (see **Section 2.3.5**).
- If both initial and stabilized methane concentrations are less than 50% of the LEL (2.5% CH₄), move to next LFG monitoring well.

Structures:

- Walk through the facility structure with a methane analyzer and monitor the perimeter wall interface of the structure, the floor to wall interface in hallways and rooms, and any floor penetrations in the structure. Record the initial and stabilized methane concentrations, oxygen concentration, and carbon dioxide concentration.
- Record monitoring data on the LFG monitoring data form provided in **Appendix A**.
- Notify the Landfill Superintendent and the Engineer for any methane concentration greater than 0% of the LEL.

IF A STABILIZED METHANE CONCENTRATION IS GREATER THAN 100% OF THE LEL IN A LFG MONITORING WELL OR GREATER THAN 25% OF THE LEL IN A FACILITY STRUCTURE, THE FOLLOWING ACTIONS WILL BE IMPLEMENTED:

- 1) Recalibrate monitoring equipment and confirm results.
- 2) If results are confirmed, **IMMEDIATELY** contact the Landfill Manager and the Engineer.

3) Implement the Compliance Action Plan located in **Section 3.1**.

A flowchart of actions to be taken if exceedances are noted is included as **Figure 3**.

2.3.5 Precautionary Action Plan

If an initial or stabilized methane concentration is equal to or greater than 50% of the LEL in a LFG monitoring well, monitoring personnel should perform the following additional steps at this location:

- Measure gas pressure in the well head (in inches of water) using magnehelic gauge or other appropriate metering device.
- Record at least one additional methane concentration measurement, inside the well just below the top of casing.
- Evaluate the surrounding area for potential receptors to or signs of LFG migration. LFG can stress vegetation and can kill trees and grass by root asphyxiation. Note stressed/dead vegetation areas on the monitoring form.
- Notify the Landfill Manager and the Engineer for further evaluation.

2.3.6 Record Keeping

Routine LFG monitoring events will be documented on the LFG monitoring data form provided in **Appendix A**. Completed forms will be placed in the landfill operating record located at 103 E. Ivey Street Lillington, North Carolina 27546. These forms will be available for review by DWM personnel on request.

Documentation of any contingency plan actions (see **Section 3.0**) will also be kept in the operating record.

2.4 Maintenance

Periodic maintenance and site observations will be conducted routinely to address monitoring program components (at a minimum):

- Maintain access to LFG monitoring locations.
- Perform LFG monitoring well maintenance (maintain well locks, steel casing, concrete pad, etc.).
- Observe landfill cover conditions, areas of dead vegetation, leachate seeps, odors, etc. as indications of potential LFG-related problems.

Note deficiencies on the monitoring forms and report to the Solid Waste Operations Manager for repair or replacement as necessary.

3.0 CONTINGENCY PLAN

If a stabilized methane concentration is **greater than 100% of the LEL in a LFG monitoring well or greater than 25% of the LEL in a facility structure**, the County will perform both an immediate action and plan and a remediation plan as described below.

3.1 Immediate Action Plan

The Solid Waste Operations Manager will perform the following actions for the protection of human health and safety:

- 1) Evacuate affected facility structures and the immediately surrounding area.
- 2) Determine nearby potential receptors (facility and off-site structures).
- 3) Perform monitoring in any other facility structure near the monitoring location having the high concentration.
- 4) Contact the County Fire Department (911). Coordinate evaluation of potentially affected off-site structures with the Fire Department.
- 5) Verbally notify the County Engineer, or their designee.
- 6) Verbally notify the NCDENR DWM (see **Section 1.1**) as soon as practical.
- 7) Investigate and identify the potential source(s) and conduit(s) for LFG migration that may have caused the high concentration (i.e. the path that the LFG may be taking to the monitoring location).
- 8) Identify the LFG extent using bar hole punch sampling methodology or other applicable alternative method as practical.
- 9) As appropriate, begin corrective action to control methane concentrations in structures surrounding the landfill site.

3.1.1 Reporting and Documentation

Within seven days of the detection of a high methane concentration, the County will prepare and submit an Environmental Monitoring Reporting Form (see **Appendix A**) with the results of the monitoring event to the DWM. The County will also place a description of the actions performed to protect human health in the operating record.

3.2 Remediation Plan

Within sixty days of the detection of a high methane concentration, a remediation plan describing the problem nature, extent, and proposed remedy will be submitted to NCDENR for approval. Upon approval the plan will be implemented and a copy will be placed in the operating record. The DWM will also be notified the plan has been implemented.

An extension may be granted by the DWM on written request and depending on severity of the situation.

Figures

**Landfill Gas Monitoring Plan
Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

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LEGEND

- FACILITY BOUNDARY & PROPERTY LINE
- 1-MILE RADIUS FROM PROPERTY LINE
- WATER FEATURE (SEE REFERENCE 2)
- STREAM LOCATION (SEE REFERENCE 2)
- PARCEL BOUNDARY (SEE REFERENCE 1)

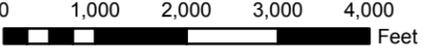


FACILITY BOUNDARY AND PROPERTY LINE

1-MILE RADIUS FROM PROPERTY LINE

Source: Esri, DigitalGlobe, GeoEye, Earthstar, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

- REFERENCES:**
1. PARCEL BOUNDARIES FROM HARNETT COUNTY GIS DEPARTMENT. PARCEL INFORMATION DATED JULY, 2013
 2. STREAM AND WATER FEATURES FROM U.S.G.S. 7.5 MIN. QUADRANGLES "ANDERSON CREEK" AND "OLIVIA".



NC LIC. NO. C-0828 (ENGINEERING)

SMITH + GARDNER
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

DRAWN: C.T.J.	APPROVED: K.C.B.	SCALE: AS SHOWN	FIGURE NO.: 1
DATE: Aug. 2013	PROJECT NO.: HARNETT 13-2	FILENAME: HARNETT-B0002	

**HARNETT COUNTY
ANDERSON CREEK LANDFILL
SITE VICINITY MAP**

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 SEAL

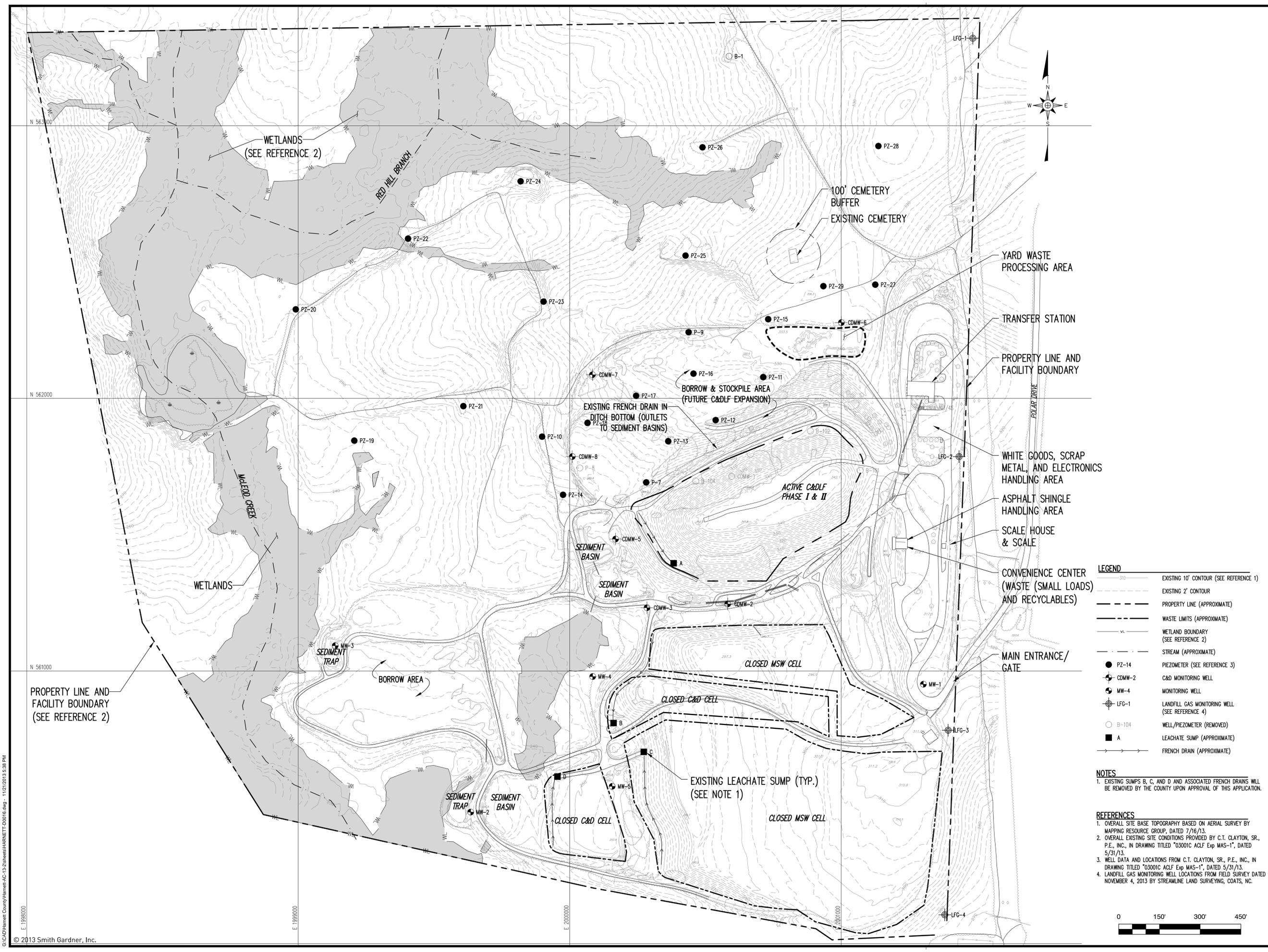
REV.	DATE	DESCRIPTION

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PROJECT TITLE:
**ANDERSON CREEK
 C&D LANDFILL
 PHASES I & II**

DRAWING TITLE:
EXISTING CONDITIONS

DESIGNED BY: J.A.S.	PROJECT NO: HARNETT-AC-13-4
DRAWN BY: C.T.J.	SCALE: AS SHOWN
APPROVED BY:	DATE: NOV. 2013
FILENAME: HARNETT-D0016	SHEET NUMBER: DRAWING NUMBER



- LEGEND**
- 10' --- EXISTING 10' CONTOUR (SEE REFERENCE 1)
 - 2' --- EXISTING 2' CONTOUR
 - - - - - PROPERTY LINE (APPROXIMATE)
 - - - - - WASTE LIMITS (APPROXIMATE)
 - - - - - WETLAND BOUNDARY (SEE REFERENCE 2)
 - - - - - STREAM (APPROXIMATE)
 - PZ-14 PIEZOMETER (SEE REFERENCE 3)
 - ⊕ CDMW-2 C&D MONITORING WELL
 - ⊕ MW-4 MONITORING WELL
 - ⊕ LFG-1 LANDFILL GAS MONITORING WELL (SEE REFERENCE 4)
 - B-104 WELL/PIEZOMETER (REMOVED)
 - A LEACHATE SUMP (APPROXIMATE)
 - - - - - FRENCH DRAIN (APPROXIMATE)

NOTES

1. EXISTING SUMPS B, C, AND D AND ASSOCIATED FRENCH DRAINS WILL BE REMOVED BY THE COUNTY UPON APPROVAL OF THIS APPLICATION.

- REFERENCES**
1. OVERALL SITE BASE TOPOGRAPHY BASED ON AERIAL SURVEY BY MAPPING RESOURCE GROUP, DATED 7/16/13.
 2. OVERALL EXISTING SITE CONDITIONS PROVIDED BY C.T. CLAYTON, SR., P.E., INC., IN DRAWING TITLED "03001C AGLF Exp MAS-1", DATED 5/31/13.
 3. WELL DATA AND LOCATIONS FROM C.T. CLAYTON, SR., P.E., INC., IN DRAWING TITLED "03001C AGLF Exp MAS-1", DATED 5/31/13.
 4. LANDFILL GAS MONITORING WELL LOCATIONS FROM FIELD SURVEY DATED NOVEMBER 4, 2013 BY STREAMLINE LAND SURVEYING, COATS, NC.

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MONITORING FREQUENCY IS QUARTERLY

METHANE CONCENTRATION MUST NOT EXCEED:
1. 25% OF THE LEL IN FACILITY STRUCTURES; AND
2. 100% OF THE LEL AT THE FACILITY PROPERTY BOUNDARY.

IF METHANE CONCENTRATION EXCEEDS EITHER OF THE ABOVE, THE OWNER MUST:

RECALIBRATE METER AND CONFIRM READINGS
(SEE SECTION 2.3.4 OF LFG MANAGEMENT PLAN)

IF CONFIRMED READINGS EXCEED LIMITS,
(SEE SECTION 3.0 OF THE LFG MANAGEMENT PLAN) AND:

1. IMMEDIATELY:
TAKE STEPS TO ENSURE PROTECTION OF HUMAN HEALTH AND SAFETY

2. WITHIN 7 DAYS:
PLACE THE METHANE READINGS AND STEPS TAKEN TO PROTECT HUMAN HEALTH IN THE OPERATING RECORD

3. WITHIN 60 DAYS:
PREPARE A REMEDIATION PLAN. SUBMIT PLAN TO NCDENR FOR APPROVAL. UPON APPROVAL, IMPLEMENT PLAN.

SMITH+GARDNER ENGINEERS
NOTIFY THE ENGINEER AND DIVISION WITHIN 24 HOURS
NCDENR

PLACE A COPY OF THE REMEDIATION PLAN IN THE OPERATING RECORD, AND

EVALUATE THE NEED FOR ADDITIONAL MONITORING

NOTIFY THE DIVISION THAT THE PLAN HAS BEEN IMPLEMENTED

PREPARED FOR:
**FLOWCHART OF METHANE MONITORING REQUIREMENTS
ANDERSON CREEK LANDFILL
HARNETT COUNTY, NC**

PREPARED BY: _____ NC LIC. NO. C-0828 [ENGINEERING]
SMITH+GARDNER
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

DRAWN: K.C.B.	APPROVED: J.A.S.	SCALE: N.T.S.	DATE: Aug 2013	PROJECT NO.: HARNETT 13-2	FIGURE NO.: 3	FILE NAME: HARNETT-A0004
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Appendix A

Reporting Forms

**Landfill Gas Monitoring Plan
Harnett County Anderson Creek Landfill Facility
Harnett County, North Carolina**

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NC Division of Waste Management - Solid Waste Section

Landfill Gas Monitoring Data Form

Notice: This form and any information attached to it are "Public Records" as defined in NC General Statute 132-1. As such, these documents are available for inspection and examination by any person upon request (NC General Statute 132-6).

Facility Name: _____ Permit Number: _____

Date of Sampling: _____ NC Landfill Rule (.0500 or .1600): _____

Name and Position of Sample Collector: _____

Type and Serial Number of Gas Meter: _____ Calibration Date of Gas Meter: _____

Date and Time of Field Calibration: _____

Type of Field Calibration Gas (15/15 or 35/50): _____ Expiration Date of Field Calibration Gas Canister: _____

Pump Rate of Gas Meter: _____

Ambient Air Temperature: _____ Barometric Pressure: _____ General Weather Conditions: _____

Instructions: Under "Location or LFG Well" identify the monitoring wells or describe the location for other tests (e.g., inside buildings). A drawing showing the location of test must be attached. Report methane readings in both % LEL and % methane by volume. A reading in percent methane by volume can be converted to % LEL as follows: % methane by volume = % LEL/20

Location or LFG Well ID	Sample Tube Purge	Time	Time Pumped (s)	Initial %LEL	Stabilized %LEL	%CH4 by Volume	%O2	%CO2	Notes

If your facility has more gas monitoring locations than there is room on this form, please attach additional sheets listing the same information as contained on this form.

Certification

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

SIGNATURE

TITLE

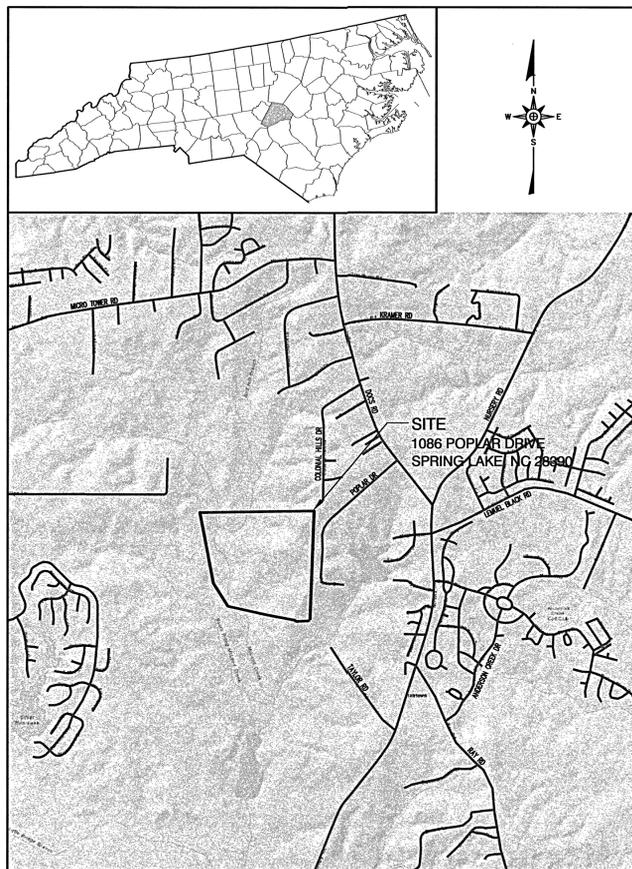
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HARNETT COUNTY ANDERSON CREEK C&D LANDFILL

PHASES I & II PERMIT DRAWINGS

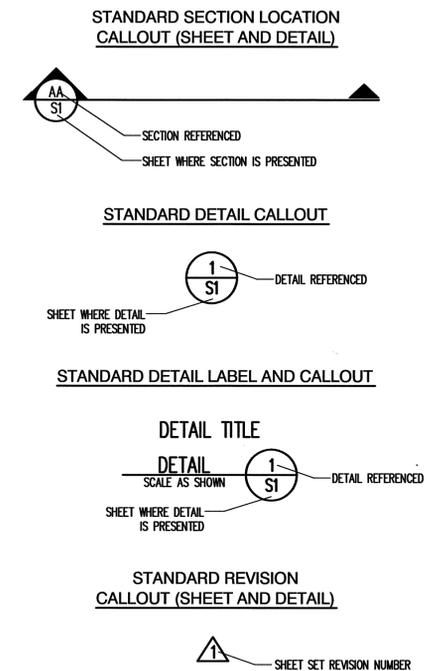
JANUARY 2014

HARNETT COUNTY SOLID WASTE DEPARTMENT LILLINGTON, NORTH CAROLINA

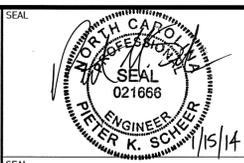


SITE LOCATION MAP
NOT TO SCALE
RIVER BASIN: CAPE FEAR

SHEET NO.	DRAWING NO.	DRAWING TITLE	REVISION NO.
1		TITLE - COVER SHEET	
2	S1	EXISTING CONDITIONS	
3	S2	SUBGRADE EXTENSION GRADING AND DRAINAGE PLAN	
4	S3	FINAL COVER GRADING AND DRAINAGE PLAN	
5	D1	DETAILS (SHEET 1 OF 3)	
6	D2	DETAILS (SHEET 2 OF 3)	
7	D3	DETAILS (SHEET 3 OF 3)	
8	EX1	ENGINEERING CROSS SECTIONS	



PERMIT ISSUE
NOT FOR CONSTRUCTION



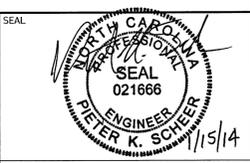
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NC LIC. NO. C-0828 (ENGINEERING)
SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577



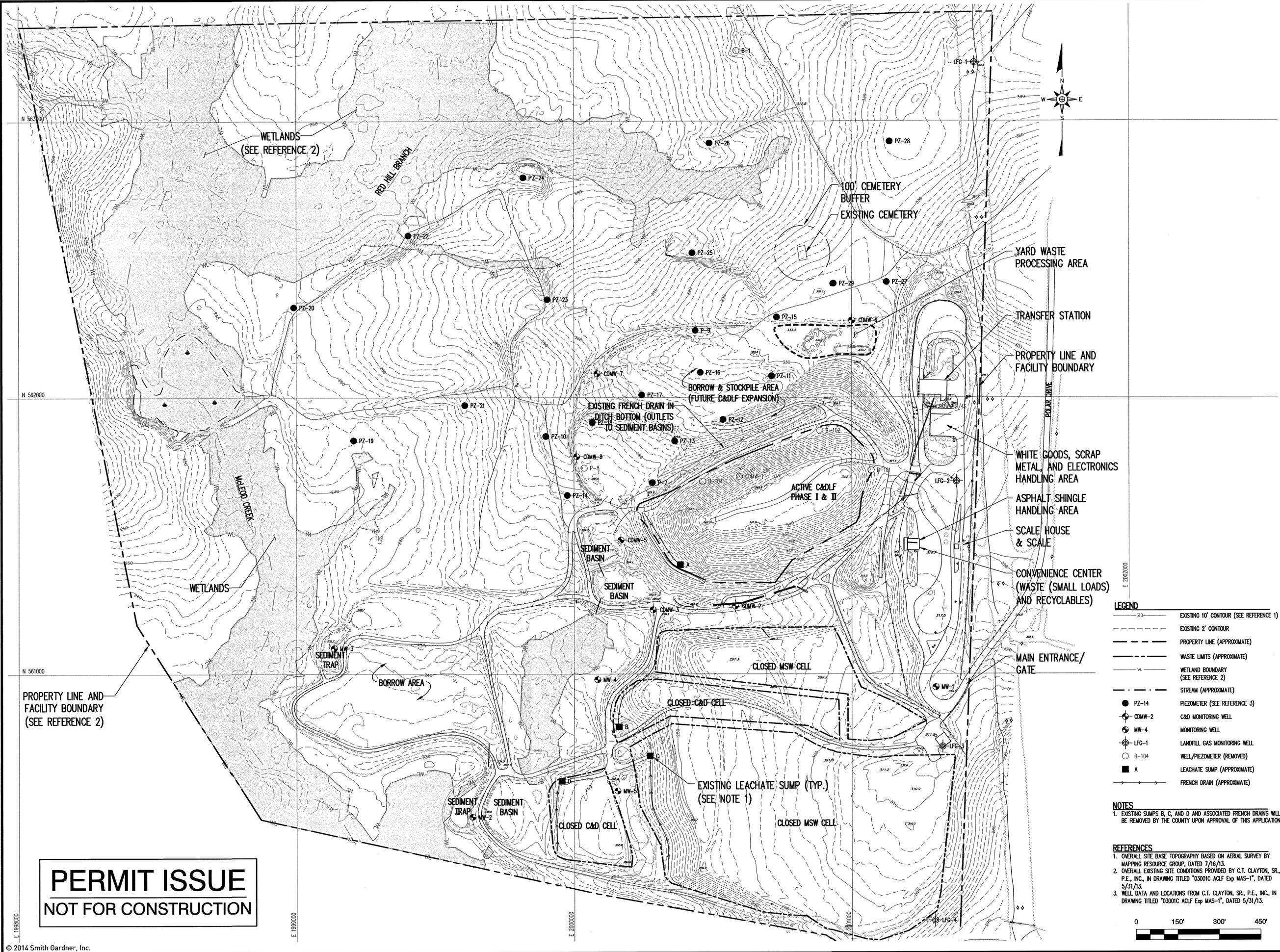
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PROJECT TITLE:
ANDERSON CREEK
C&D LANDFILL
PHASES I & II
PERMIT DRAWINGS

DRAWING TITLE:
EXISTING CONDITIONS

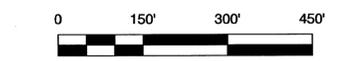
DESIGNED: P.K.S.	PROJECT NO: HARNETT-AC-13-4
DRAWN: K.C.B.	SCALE: AS SHOWN
APPROVED: P.K.S.	DATE: JAN. 2014
FILENAME: HARNETT-D0008	SHEET NUMBER: 2
SHEET NUMBER: 2	DRAWING NUMBER: S1



- LEGEND**
- 30' --- EXISTING 10' CONTOUR (SEE REFERENCE 1)
 - 2' --- EXISTING 2' CONTOUR
 - --- PROPERTY LINE (APPROXIMATE)
 - --- WASTE LIMITS (APPROXIMATE)
 - WL --- WETLAND BOUNDARY (SEE REFERENCE 2)
 - --- STREAM (APPROXIMATE)
 - PZ-14 PIEZOMETER (SEE REFERENCE 3)
 - ⊕ CMW-2 C&D MONITORING WELL
 - ⊕ MW-4 MONITORING WELL
 - ⊕ LFG-1 LANDFILL GAS MONITORING WELL
 - B-104 WELL/PIEZOMETER (REMOVED)
 - A LEACHATE SUMP (APPROXIMATE)
 - --- FRENCH DRAIN (APPROXIMATE)

- NOTES**
1. EXISTING SUMPS B, C, AND D AND ASSOCIATED FRENCH DRAINS WILL BE REMOVED BY THE COUNTY UPON APPROVAL OF THIS APPLICATION.

- REFERENCES**
1. OVERALL SITE BASE TOPOGRAPHY BASED ON AERIAL SURVEY BY MAPPING RESOURCE GROUP, DATED 7/16/13.
 2. OVERALL EXISTING SITE CONDITIONS PROVIDED BY C.T. CLAYTON, SR., P.E., INC., IN DRAWING TITLED "03001C ACFL Exp MAS-1", DATED 5/31/13.
 3. WELL DATA AND LOCATIONS FROM C.T. CLAYTON, SR., P.E., INC., IN DRAWING TITLED "03001C ACFL Exp MAS-1", DATED 5/31/13.



PERMIT ISSUE
NOT FOR CONSTRUCTION

CULVERT SCHEDULE							
NO.	NO. OF PIPES	SIZE/TYPE	LENGTH (FEET)	SLOPE (%)	INV. IN (FEET)	INV. OUT (FEET)	REMARKS
C-1	1	24" RCP (CLASS III) W/ FES (2)	143	2.1	318.0	315.0	-
C-2	1	24" RCP (CLASS III) W/ FES (2)	481	5.7	314.5	287.0	-

NOTES: 1. PROVIDE 1 FOOT MIN. COVER OVER ALL CULVERTS UNLESS OTHERWISE APPROVED BY THE ENGINEER.

PREPARED FOR:
**HARNETT COUNTY
NORTH CAROLINA
SOLID WASTE DEPARTMENT**

PREPARED BY:
NC LIC. NO. C-3828 (ENGINEERING)
**SMITH+
GARDNER
ENGINEERS**
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

SEAL
NORTH CAROLINA
PROFESSIONAL
ENGINEER
SEAL
021686
PIETER K. SCHIER
1/5/14

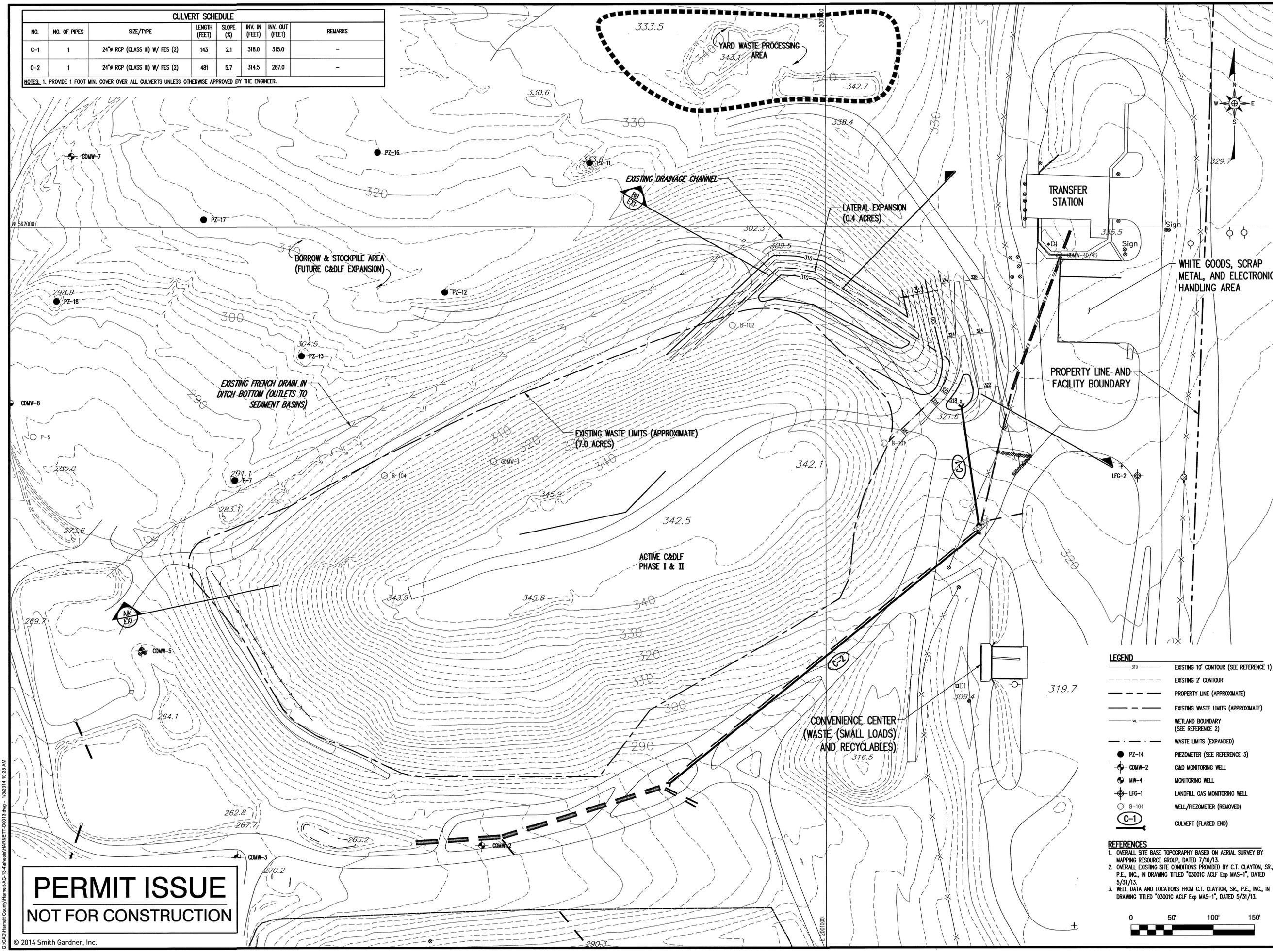
REV.	DATE	DESCRIPTION

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PROJECT TITLE:
**ANDERSON CREEK
C&DLF
PHASES I & II
PERMIT DRAWINGS**

DRAWING TITLE:
**SUBGRADE EXTENSION
GRADING AND DRAINAGE PLAN**

DESIGNED:	P.K.S.	PROJECT NO.:	HARNETT-AC-13-4
DRAWN:	K.C.B.	SCALE:	AS SHOWN
APPROVED:	PKS	DATE:	JAN. 2014
FILENAME:	HARNETT-0013		
SHEET NUMBER:	3	DRAWING NUMBER:	S2

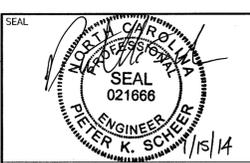


**PERMIT ISSUE
NOT FOR CONSTRUCTION**

- LEGEND**
- - - - - 310 - - - - - EXISTING 10' CONTOUR (SEE REFERENCE 1)
 - - - - - EXISTING 2' CONTOUR
 - - - - - PROPERTY LINE (APPROXIMATE)
 - - - - - EXISTING WASTE LIMITS (APPROXIMATE)
 - - - - - WETLAND BOUNDARY (SEE REFERENCE 2)
 - - - - - WASTE LIMITS (EXPANDED)
 - PZ-14
 - ⊕ CMW-2
 - ⊕ MW-4
 - ⊕ LFG-1
 - B-104
 - ⊕ (C-1)
- EXISTING 10' CONTOUR (SEE REFERENCE 1)
EXISTING 2' CONTOUR
PROPERTY LINE (APPROXIMATE)
EXISTING WASTE LIMITS (APPROXIMATE)
WETLAND BOUNDARY (SEE REFERENCE 2)
WASTE LIMITS (EXPANDED)
PIEZOMETER (SEE REFERENCE 3)
C&D MONITORING WELL
MONITORING WELL
LANDFILL GAS MONITORING WELL
WELL/PIEZOMETER (REMOVED)
CULVERT (FLARED END)

- REFERENCES**
- OVERALL SITE BASE TOPOGRAPHY BASED ON AERIAL SURVEY BY MAPPING RESOURCE GROUP, DATED 7/16/13.
 - OVERALL EXISTING SITE CONDITIONS PROVIDED BY C.T. CLAYTON, SR., P.E., INC., IN DRAWING TITLED "03001C ACFL Exp MAS-1", DATED 5/31/13.
 - WELL DATA AND LOCATIONS FROM C.T. CLAYTON, SR., P.E., INC., IN DRAWING TITLED "03001C ACFL Exp MAS-1", DATED 5/31/13.





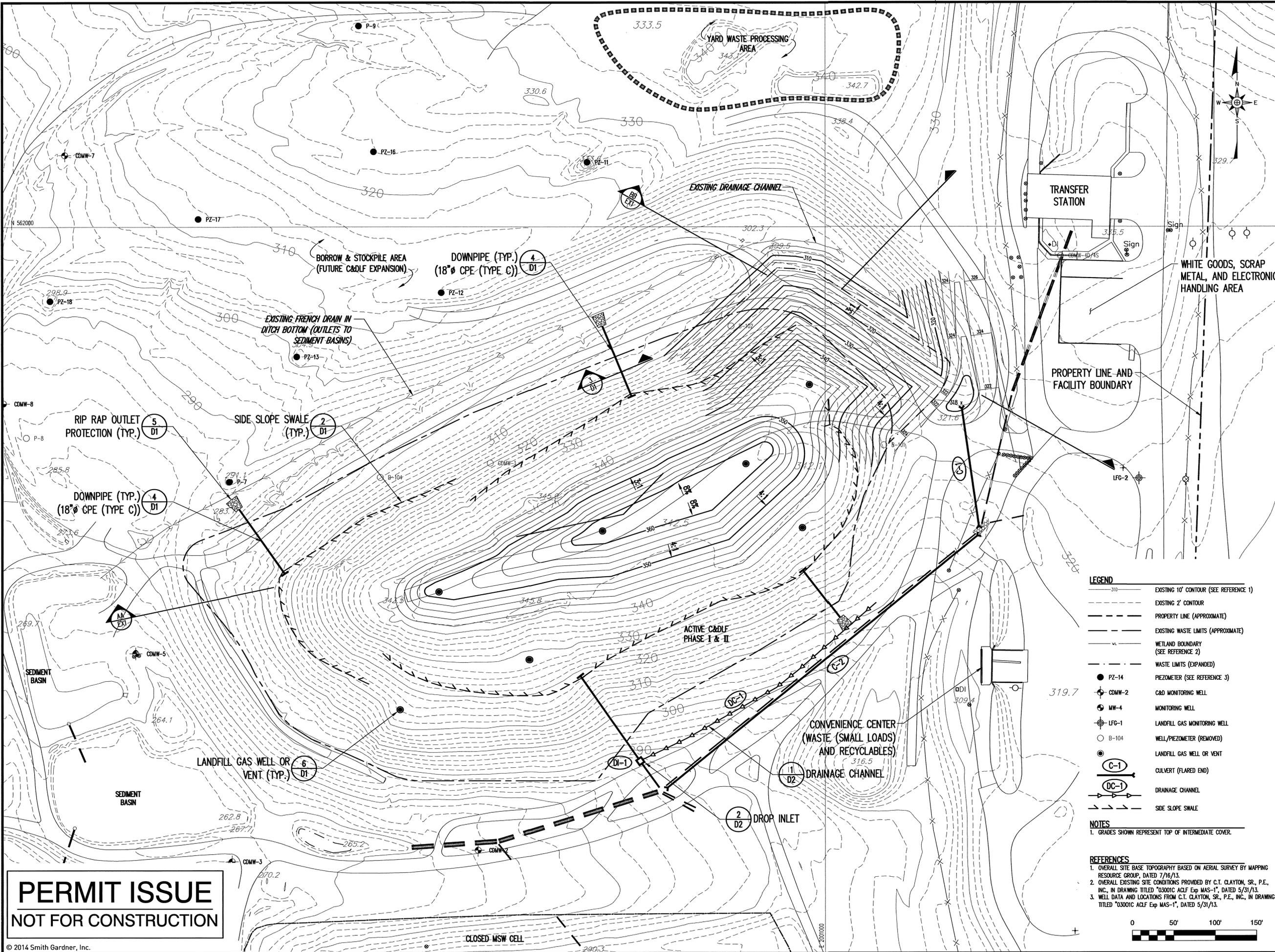
REV.	DATE	DESCRIPTION

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PROJECT TITLE:
**ANDERSON CREEK
 C&D LANDFILL
 PHASES I & II
 PERMIT DRAWINGS**

DRAWING TITLE:
**FINAL COVER
 GRADING AND
 DRAINAGE PLAN**

DESIGNED:	P.K.S.	PROJECT NO.:	HARNETT-AC-13-4
DRAWN:	K.C.B.	SCALE:	AS SHOWN
APPROVED:	PKS	DATE:	JAN. 2014
FILENAME:	HARNETT-D009?		
SHEET NUMBER:	4	DRAWING NUMBER:	S3

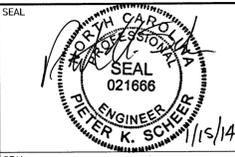


- LEGEND**
- EXISTING 10' CONTOUR (SEE REFERENCE 1)
 - EXISTING 2' CONTOUR
 - - - PROPERTY LINE (APPROXIMATE)
 - - - EXISTING WASTE LIMITS (APPROXIMATE)
 - - - WETLAND BOUNDARY (SEE REFERENCE 2)
 - - - WASTE LIMITS (EXPANDED)
 - PZ-14
 - ⊕ CDMW-2
 - ⊕ MW-4
 - ⊕ LFG-1
 - B-104
 - LANDFILL GAS WELL OR VENT
 - ⊕ (C-1) CULVERT (FLARED END)
 - ⊕ (DC-1) DRAINAGE CHANNEL
 - SIDE SLOPE SWALE
- NOTES**
- GRADES SHOWN REPRESENT TOP OF INTERMEDIATE COVER.

- REFERENCES**
- OVERALL SITE BASE TOPOGRAPHY BASED ON AERIAL SURVEY BY MAPPING RESOURCE GROUP, DATED 7/16/13.
 - OVERALL EXISTING SITE CONDITIONS PROVIDED BY C.T. CLAYTON, SR., P.E., INC. IN DRAWING TITLED "0300IC ACLF Exp MAS-1", DATED 5/31/13.
 - WELL DATA AND LOCATIONS FROM C.T. CLAYTON, SR., P.E., INC. IN DRAWING TITLED "0300IC ACLF Exp MAS-1", DATED 5/31/13.



**PERMIT ISSUE
 NOT FOR CONSTRUCTION**

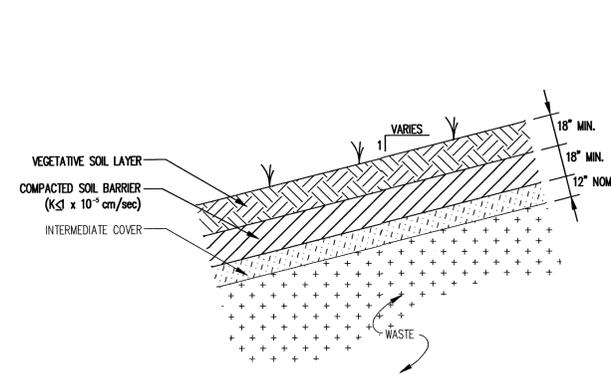


REV.	DATE	DESCRIPTION

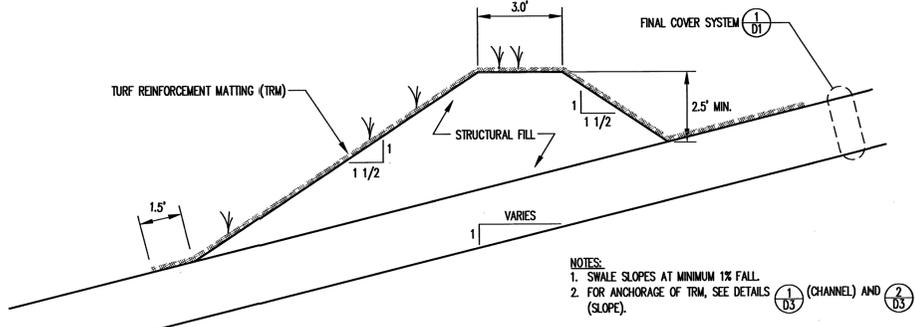
PROJECT TITLE:
ANDERSON CREEK
C&D LANDFILL
PHASES I & II
PERMIT DRAWINGS

DRAWING TITLE:
DETAILS
(SHEET 1 OF 3)

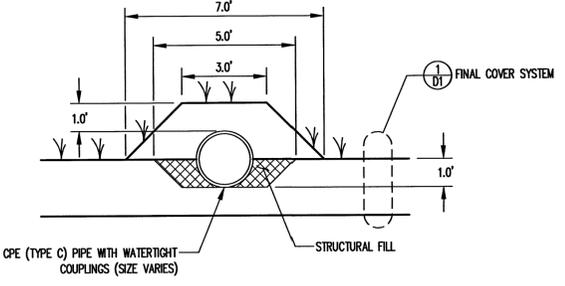
DESIGNED:	P.K.S.	PROJECT NO.:	HARNETT-AC-13-4
DRAWN:	K.C.B.	SCALE:	AS SHOWN
APPROVED:	PKS	DATE:	JAN. 2014
FILE NAME:	HARNETT-00010		
SHEET NUMBER:	5	DRAWING NUMBER:	D1



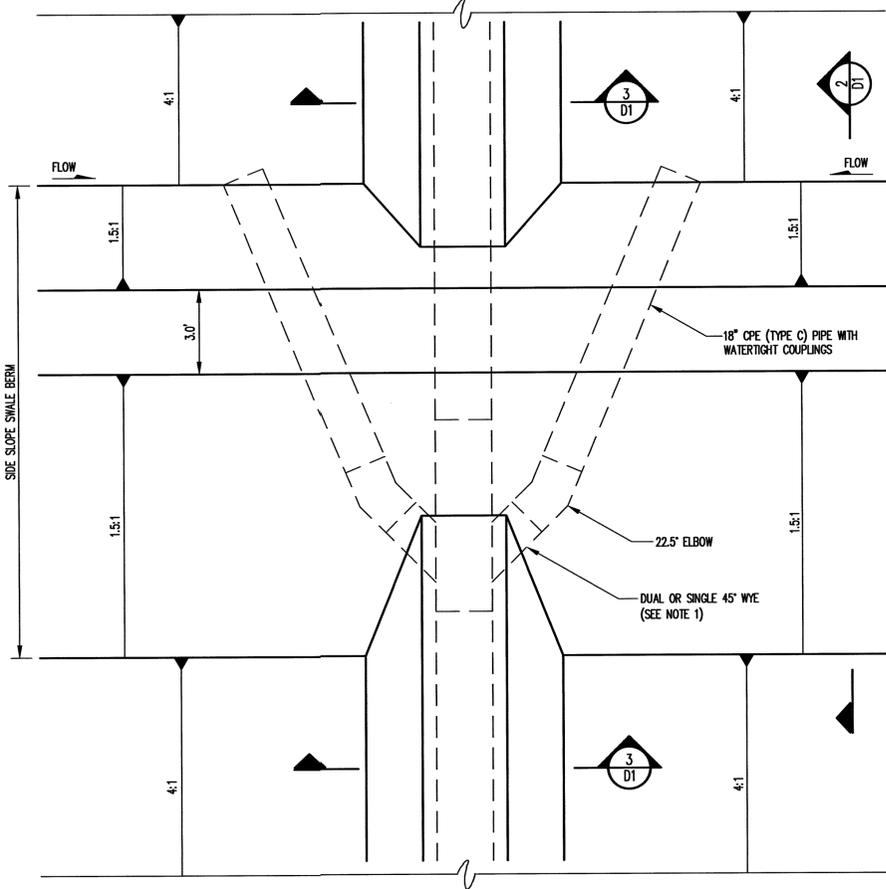
FINAL COVER SYSTEM
 DETAIL 1
 NOT TO SCALE



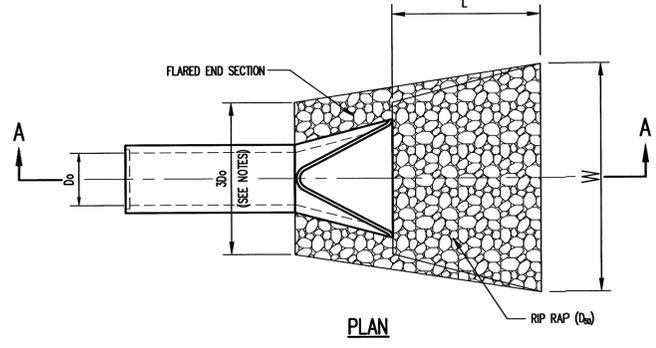
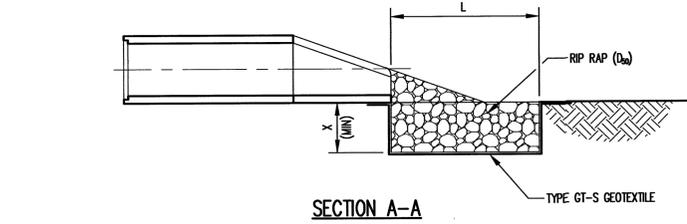
FINAL COVER SIDE SLOPE SWALE
 DETAIL 2
 NOT TO SCALE



DOWN PIPE ON SLOPE
 DETAIL 3
 NOT TO SCALE



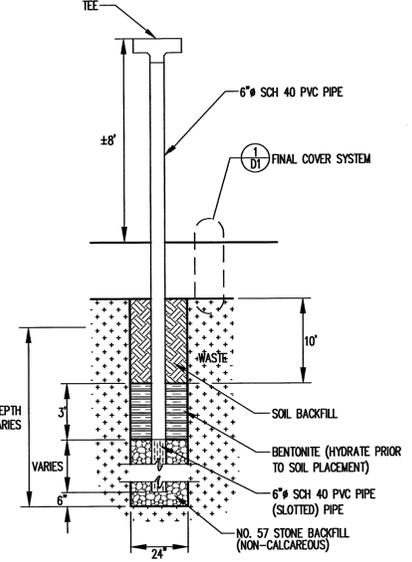
DOWN PIPE
 DETAIL 4
 NOT TO SCALE



RIP RAP OUTLET PROTECTION
 DETAIL 5
 NOT TO SCALE

PIPE	D ₆₀ (INCHES)	L (FEET)	W (FEET)	D ₃₀ (INCHES)	X (FEET)
DOWN PIPE OUTLETS	18	10	12	6	1.0

- NOTE:
 1. D₆₀ REFERS TO THE MINIMUM REQUIRED AVERAGE STONE SIZE.
 2. FOR MORE THAN ONE PIPE, EXTEND RIP RAP 1.0' MIN. BEYOND OUTSIDE EDGES OF PIPES.
 3. WHEN OUTLETING INTO DEFINED CHANNEL, CONTINUE RIP RAP TO TOP OF BANK.



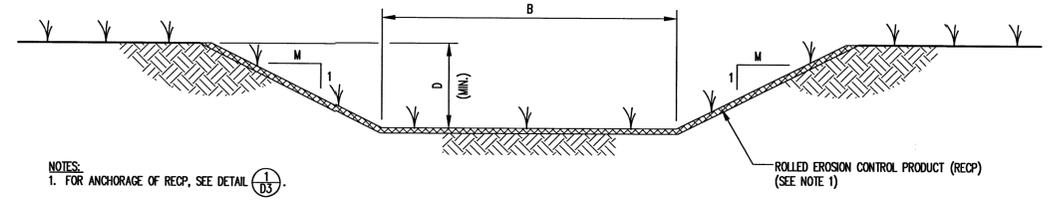
- NOTES:
 1. AS AN ALTERNATIVE TO WELLS, GAS COLLECTION TRENCHES MAY BE INSTALLED JUST BELOW THE FINAL COVER. TRENCHES SHALL CONSIST OF PERFORATED PIPE BEDDED IN NO. 57 STONE (NON-CALCAREOUS) AND WRAPPED IN A TYPE GT-S GEOTEXTILE. TRENCHES SHALL HAVE NOMINAL SIZE OF 6" WIDE x 20' LONG x 2' DEEP.

TYPICAL LANDFILL GAS WELL
 DETAIL 6
 NOT TO SCALE

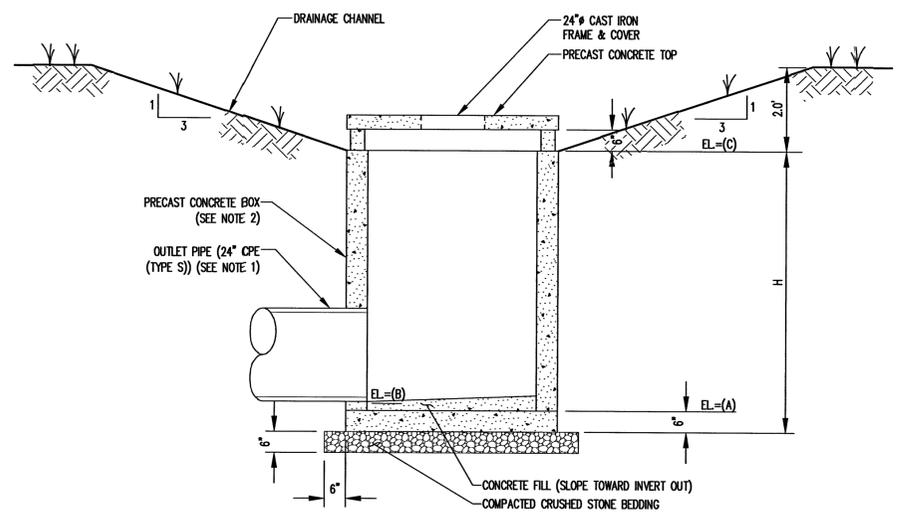
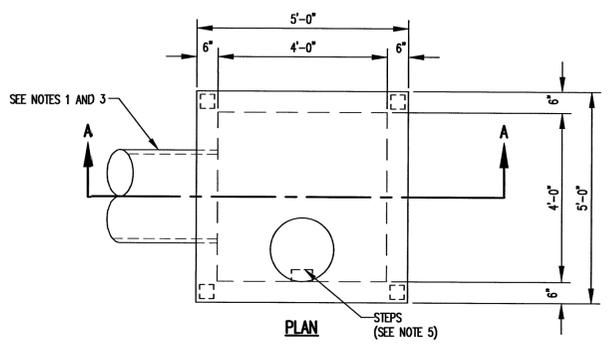
PERMIT ISSUE
NOT FOR CONSTRUCTION

DRAINAGE CHANNEL SCHEDULE				
DRAINAGE CHANNEL	LINING	B	D	M
DC-1	TRM*	4.0	2.0	3

*TRM = TURF REINFORCEMENT MATTING



RECP LINED CHANNELS
DRAINAGE CHANNEL
DETAIL 1 D2
NOT TO SCALE



- NOTES:
- PROVIDE WATERTIGHT JOINTS ON ALL PIPING.
 - PRECAST CONCRETE BOXES SHALL CONFORM TO THE FOLLOWING REQUIREMENTS:
 - CONCRETE: COMPRESSIVE STRENGTH 4000 PSI
 - REINFORCING: ASTM A-615, GRADE 60
 - MEETS H-20 LOADING.
 - PIPES MAY BE ORIENTED DIFFERENTLY WITH RESPECT TO THE CHANNEL THAN DISPLAYED HERE. SEE DRAWING S2 FOR PROPER ORIENTATION.
 - THE CONTRACTOR SHALL PROVIDE ADEQUATE PROTECTION FROM SEDIMENTATION FOR ALL DROP INLETS USING STONE FILTER FENCE OR OTHER METHOD AS APPROVED BY THE ENGINEER.
 - PROVIDE STEPS FOR DROP INLETS WITH H>4.5'. STEPS SHALL HAVE A 16" SPACING THE FULL HEIGHT OF THE DROP INLET. START FIRST STEP 6" BELOW TOP.

DROP INLET SCHEDULE				
DROP INLET	A (FEET)	B (FEET)	C (FEET)	H (FEET)
DI-1	282.5	283.0	286.0	4.0

SEEDING SCHEDULE		
MATERIAL	SEED TYPE	APPLICATION RATE (SEE NOTE 1)
LIME	-	4,000 LBS/ACRE
FERTILIZER (10-20-10)	-	1,000 LBS/ACRE
SEED		
PERMANENT	COMMON BERMUDA	30 LBS/ACRE (SEE NOTE 3)
	PENSACOLA BAHIAGRASS	50 LBS/ACRE
	KOBE LESPEDEZA	80 LBS/ACRE (SEE NOTE 4)
SEASONAL NURSE CROP		SEE NOTE 2
TEMPORARY	SEASONAL NURSE CROP	SEE NOTE 2
MULCH	-	4,000-5,000 LBS/ACRE
BINDER	-	400 GALLONS/ACRE

- NOTES:
- APPLICATION RATES AND/OR CHEMICAL ANALYSIS SHALL BE CONFIRMED OR ESTABLISHED BY A SOIL TEST.
 - USE SEASONAL NURSE CROP IN ACCORDANCE WITH SEEDING DATES AS STATED BELOW:

APRIL 15 - AUGUST 15	10 LBS/ACRE GERMAN MILLET OR 15 LBS/ACRE SUDANGRASS
AUGUST 16 - APRIL 14	40 LBS/ACRE RYE (GRAM)
 - HALF HULLED AND HALF UN-HULLED.
 - PLACE KOBE LESPEDEZA ON SLOPES STEEPER THAN OR EQUAL TO 4H:1V.

SPECIFICATIONS:

- GENERAL:

THE CONTRACTOR SHALL ESTABLISH A SMOOTH, HEALTHY, UNIFORM, CLOSE STAND OF GRASS FROM THE SPECIFIED SEED. PRIOR TO REVEGETATION, THE CONTRACTOR SHALL ADEQUATELY TEST THE SOILS TO BE REVEGETATED TO ENSURE THE ADEQUACY OF THE SPECIFIED REQUIREMENTS. ANY MODIFICATIONS TO THESE REQUIREMENTS DEEMED NECESSARY AFTER THE REVIEW OF SOIL TEST RESULTS, SHALL BE AT THE CONTRACTOR'S SOLE EXPENSE. THE ENGINEER WILL PERFORM THE OBSERVATIONS TO DETERMINE WHEN SUCCESSFUL REVEGETATION IS ACHIEVED.
- SOIL PREPARATION:
 - LIMIT PREPARATION TO AREAS WHICH WILL BE PLANTED SOON AFTER PREPARATION.
 - LOOSEN SURFACE TO MINIMUM DEPTH OF FOUR (4) INCHES.
 - REMOVE STONES, STICKS, ROOTS, RUBBISH AND OTHER EXTRANEIOUS MATTER OVER THREE (3) INCHES IN ANY DIMENSION.
 - SPREAD LIME UNIFORMLY OVER DESIGNATED AREAS AT THE RATE SPECIFIED IN THE SEEDING SCHEDULE.
 - AFTER APPLICATION OF LIME, PRIOR TO APPLYING FERTILIZER, LOOSEN AREAS TO BE SEEDDED WITH DOUBLE DISC OR OTHER SUITABLE DEVICE IF SOIL HAS BECOME HARD OR COMPACTED. CORRECT ANY SURFACE IRREGULARITIES IN ORDER TO PREVENT POCKET OR LOW AREAS WHICH WILL ALLOW WATER TO STAND.
 - DISTRIBUTE FERTILIZER UNIFORMLY OVER AREAS TO BE SEEDDED AT THE RATE SPECIFIED IN THE SEEDING SCHEDULE.
 - USE SUITABLE DISTRIBUTOR.
 - INCORPORATE FERTILIZER INTO SOIL TO DEPTH OF A LEAST TWO (2) INCHES.
 - REMOVE STONES OR OTHER SUBSTANCES WHICH WILL INTERFERE WITH TURF DEVELOPMENT OR SUBSEQUENT MOWING.
 - GRADE SEEDDED AREAS TO SMOOTH, EVEN SURFACE WITH LOOSE, UNIFORMLY FINE TEXTURE.
 - ROLL AND RAKE, REMOVE RIDGES AND FILL DEPRESSIONS, AS REQUIRED TO MEET FINISH GRADES.
 - FINE GRADE JUST PRIOR TO PLANTING.
- SEEDING:
 - USE APPROVED MECHANICAL POWER DRIVEN DRILLS OR SEEDERS, MECHANICAL HAND SEEDERS, OR OTHER APPROVED EQUIPMENT.
 - DISTRIBUTE SEED EVENLY OVER ENTIRE AREA AT THE RATE SPECIFIED IN THE SEEDING SCHEDULE.
 - STOP WORK WHEN WORK EXTENDS BEYOND MOST FAVORABLE PLANTING SEASON FOR SPECIES DESIGNATED, OR WHEN SATISFACTORY RESULTS CANNOT BE OBTAINED BECAUSE OF DROUGHT, HIGH WINDS, EXCESSIVE MOISTURE, OR OTHER FACTORS.
 - RESUME WORK ONLY WHEN FAVORABLE CONDITION DEVELOPS, OR AS DIRECTED BY THE ENGINEER.
 - LIGHTLY RAKE SEED INTO SOIL FOLLOWED BY LIGHT ROLLING OR CULTIPACKING.
 - IMMEDIATELY PROTECT SEEDDED AREAS AGAINST EROSION BY MULCHING OR PLACING ROLLED EROSION CONTROL PRODUCTS, WHERE APPLICABLE.
 - SPREAD MULCH IN A CONTINUOUS BLANKET AT THE RATE SPECIFIED IN THE SEEDING SCHEDULE.
 - IMMEDIATELY FOLLOWING SPREADING MULCH, SECURE WITH EVENLY DISTRIBUTED BINDER AT THE RATE SPECIFIED IN THE SEEDING SCHEDULE.
 - FOR SLOPES NOT STEEPER THAN 3H:1V AND AS AN OPTION TO USING BINDER TO SECURE MULCH, USE A MULCH ANCHORING TOOL OPERATED ALONG THE CONTOUR OF THE SLOPE.
- MAINTENANCE:

THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL SEEDDED AREAS THROUGH THE END OF HIS WARRANTY PERIOD. THE CONTRACTOR SHALL PROVIDE, AT HIS EXPENSE, PROTECTION OF ALL SEEDDED AREAS AGAINST DAMAGE AT ALL TIMES UNTIL ACCEPTANCE OF THE WORK. MAINTENANCE SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING ITEMS:

 - REGRADE AND REVEGETATE ALL ERODED AREAS UNTIL ADEQUATELY STABILIZED BY GRASS.
 - RE MULCH WITH NEW MULCH IN AREAS WHERE MULCH HAS BEEN DISTURBED BY WIND OR MAINTENANCE OPERATIONS SUFFICIENTLY TO NULLIFY ITS PURPOSE. ANCHOR AS REQUIRED TO PREVENT DISPLACEMENT.
 - REPLANT BARE AREAS USING SAME MATERIALS SPECIFIED.

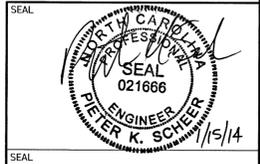
VEGETATIVE STABILIZATION

DETAIL 3 D2
NOT TO SCALE

PERMIT ISSUE
NOT FOR CONSTRUCTION

PREPARED FOR:
HARNETT COUNTY
NORTH CAROLINA
SOLID WASTE DEPARTMENT

PREPARED BY:
NC LIC. NO. C-0829 (ENGINEERING)
SMITH+GARDNER
ENGINEERS
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577



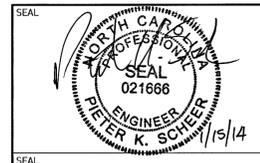
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PROJECT TITLE:
ANDERSON CREEK
C&D LANDFILL
PHASES I & II
PERMIT DRAWINGS

DRAWING TITLE:
DETAILS
(SHEET 2 OF 3)

DESIGNED: P.K.S. PROJECT NO: HARNETT-AC-13-4
DRAWN: K.C.B. SCALE: AS SHOWN
APPROVED: PKS DATE: JAN. 2014
FILENAME: HARNETT-D0010
SHEET NUMBER: 6 DRAWING NUMBER: D2



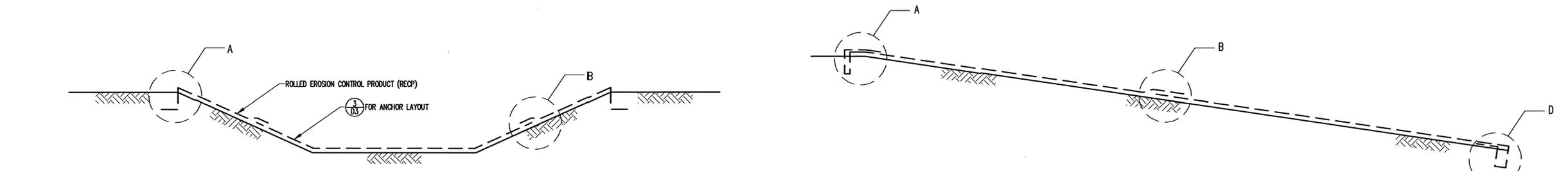
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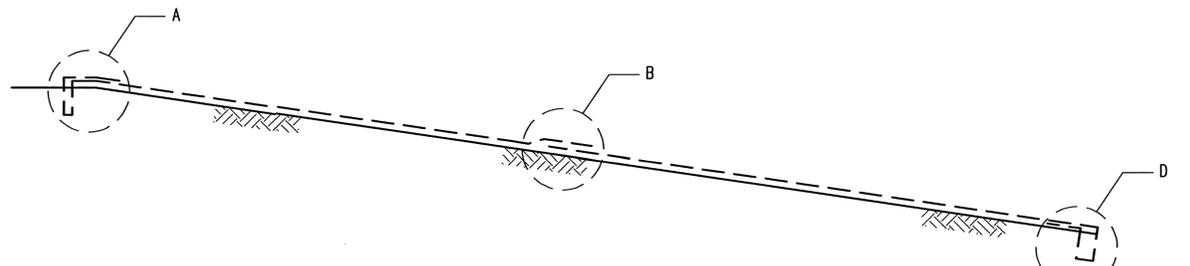
PROJECT TITLE:
**ANDERSON CREEK
 CSG LANDFILL
 PHASES I & II
 PERMIT DRAWINGS**

DRAWING TITLE:
**DETAILS
 (SHEET 3 OF 3)**

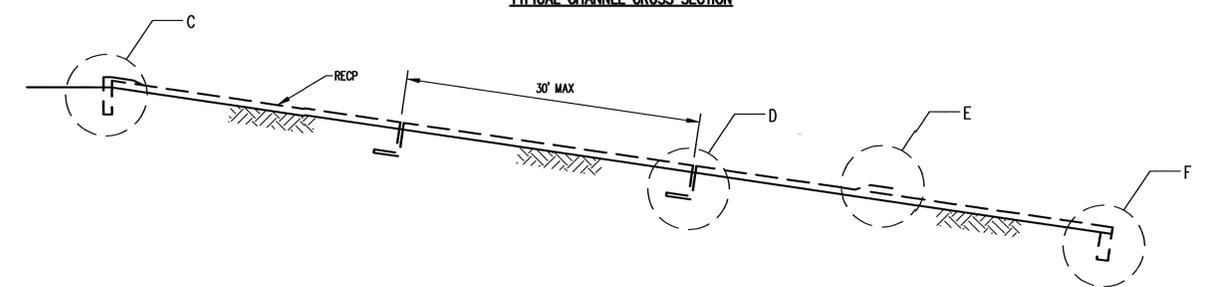
DESIGNED BY: P.K.S.	PROJECT NO: HARNETT-AC-13-4
DRAWN BY: K.C.B.	SCALE: AS SHOWN
APPROVED BY: PKS	DATE: JAN. 2014
FILE NAME: HARNETT-D0010	DRAWING NUMBER:
SHEET NUMBER: 7	DRAWING NUMBER: D3



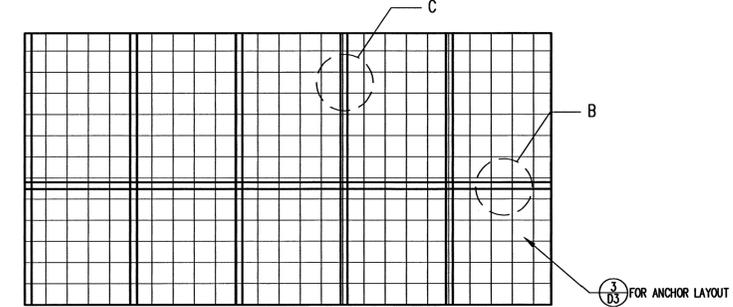
TYPICAL CHANNEL CROSS SECTION



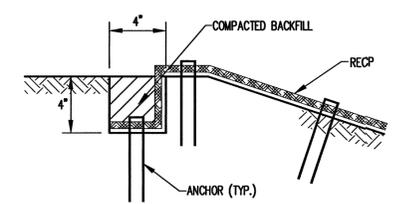
TYPICAL SLOPE PROFILE



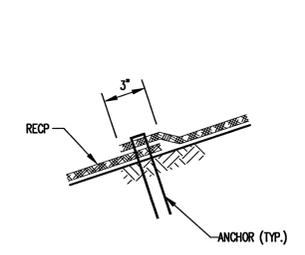
TYPICAL CHANNEL PROFILE



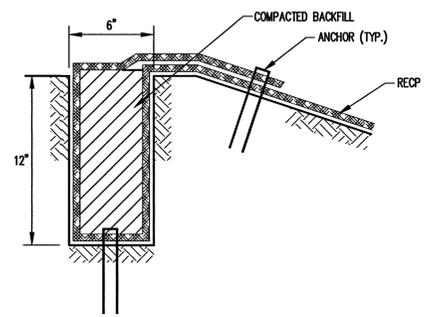
TYPICAL SLOPE PLAN VIEW



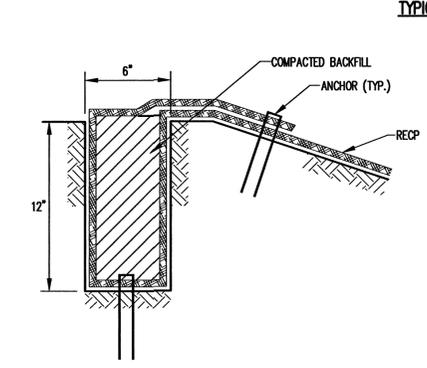
A. LONGITUDINAL ANCHOR TRENCH



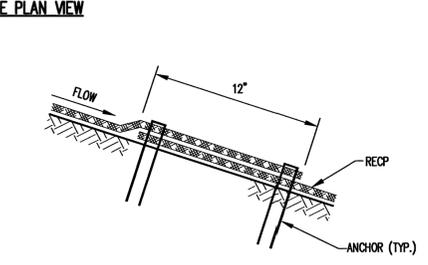
B. OVERLAP AT ADJACENT EDGES



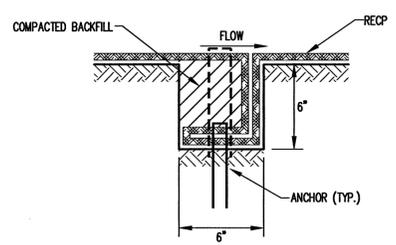
C. UPSTREAM TERMINAL ANCHOR TRENCH



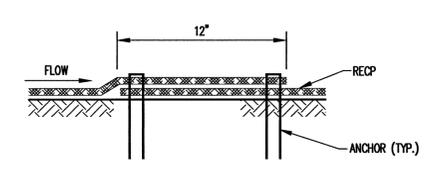
A. UPSLOPE TERMINAL ANCHOR TRENCH



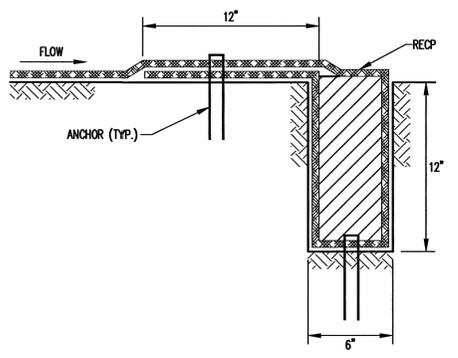
B. OVERLAP AT ROLL ENDS



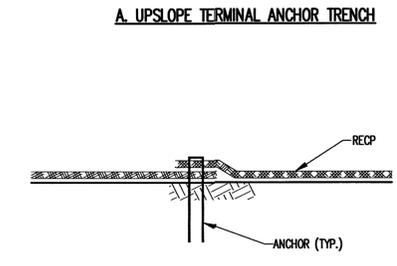
D. INTERMITTENT CHECK SLOT



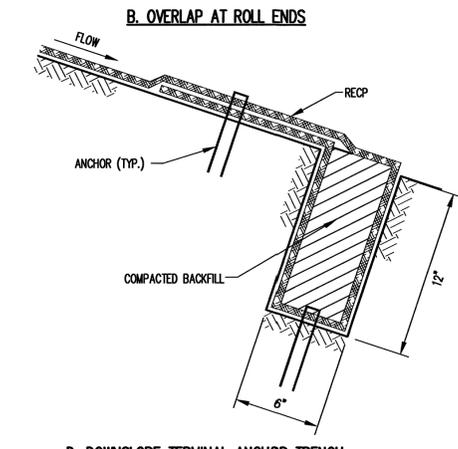
E. OVERLAP AT ROLL ENDS



C. DOWNSTREAM TERMINAL ANCHOR TRENCH



C. OVERLAP AT ADJACENT EDGES



D. DOWNSLOPE TERMINAL ANCHOR TRENCH

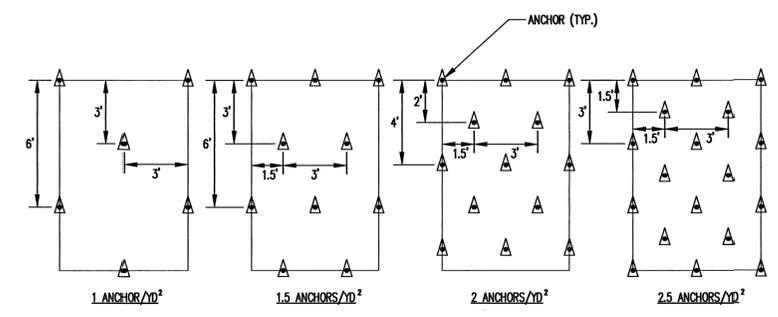
NOTES:
 1. PLACE ANCHORS AT ANCHOR TRENCHES, OVERLAPS, AND CHECK SLOTS ON 1 FOOT CENTERS.
 IF APPLICABLE, STAGGER ANCHOR SPACING BETWEEN MULTIPLE ROWS OF ANCHORS.

INSTALLATION OF ROLLED EROSION CONTROL PRODUCTS (CHANNELS)

DETAIL 1
 NOT TO SCALE
 D3

INSTALLATION OF ROLLED EROSION CONTROL PRODUCTS (SLOPES)

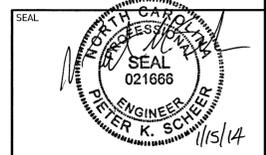
DETAIL 2
 NOT TO SCALE
 D3



ANCHOR LAYOUT

DETAIL 3
 NOT TO SCALE
 D3

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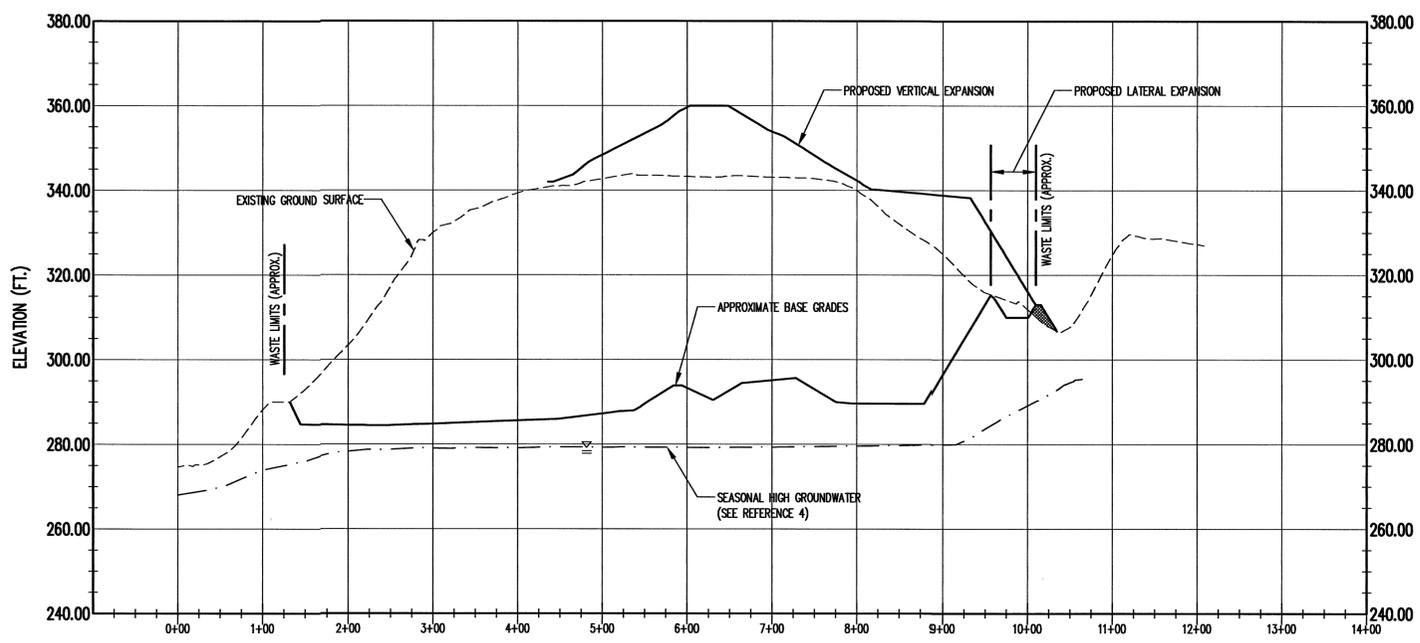
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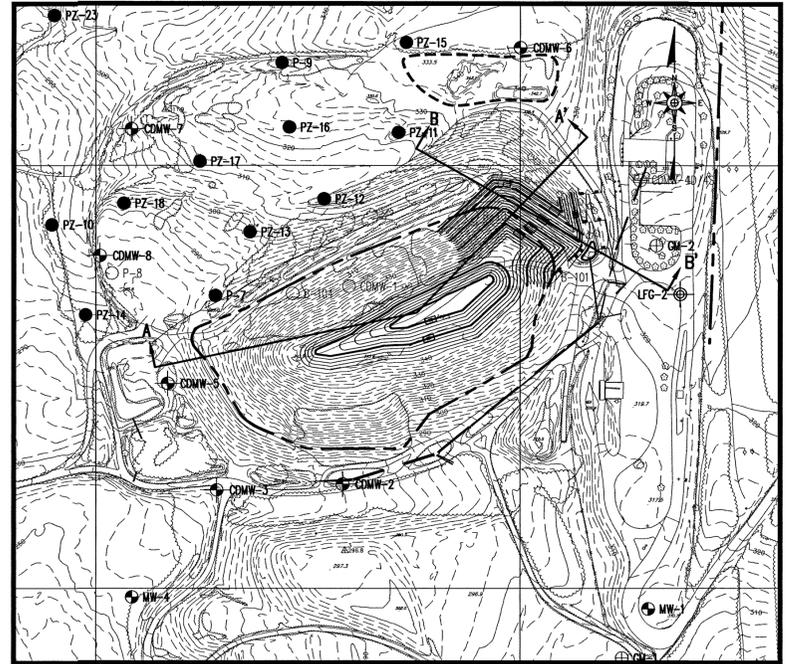
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**ANDERSON CREEK
 C&D LANDFILL
 PHASES I & II
 PERMIT DRAWINGS**

DRAWING TITLE:
**ENGINEERING
 CROSS SECTIONS**

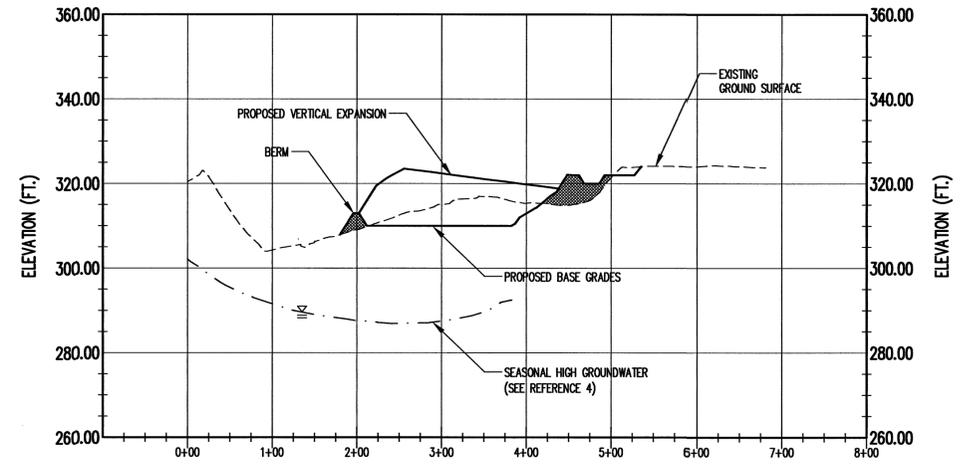
DESIGNED: P.K.S.	PROJECT NO: HARNETT-AC-13-4
DRAWN: K.C.B.	SCALE: AS SHOWN
APPROVED: PK	DATE: JAN. 2014
FILENAME: HARNETT-D0011	
SHEET NUMBER: 8	DRAWING NUMBER: EX1



SECTION **AA**
 NOT TO SCALE **EX1**



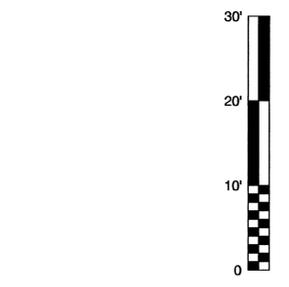
SECTION LOCATION MAP
 NOT TO SCALE



SECTION **BB**
 NOT TO SCALE **EX1**

- LEGEND**
- EXISTING GROUND SURFACE (SEE REFERENCE 1)
 - PROPOSED SURFACE
 - - - COMPOSITE HIGH GROUNDWATER SURFACE (SEE REFERENCE 4)

- REFERENCES**
1. OVERALL SITE BASE TOPOGRAPHY BASED ON AERIAL SURVEY BY MAPPING RESOURCE GROUP, DATED 7/16/13.
 2. OVERALL EXISTING SITE CONDITIONS PROVIDED BY C.T. CLAYTON, SR., P.E., INC., IN DRAWING TITLED "03001C ACLE Exp MAS-1", DATED 5/31/13.
 3. WELL DATA AND LOCATIONS FROM C.T. CLAYTON, SR., P.E., INC., IN DRAWING TITLED "03001C ACLE Exp MAS-1", DATED 5/31/13.
 4. SEASONAL HIGH GROUNDWATER SURFACE FROM DRAWING "GROUNDWATER CONTOUR MAP" PREPARED BY CT CLAYTON, DATED 5/29/13.



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