

Permit Amendment Application

Wilson County Westside C&D Landfill (Permit 98-09) Continued Operations Wilson County, North Carolina



*County of Wilson
North Carolina*

Prepared For:

**Wilson County Solid Waste Management Department
113 E. Nash Street
Wilson, North Carolina 27894**

Permit No.	Date	Document ID No.
98-09	January 28, 2010	9498

RECEIVED

January 28, 2010 via Hand delivery

Solid Waste Section
Raleigh Central Office

Prepared By:



BlackRock Engineers, Inc.
PO Box 58
Wilmington, NC 28402
NC LIC. NO. C-2919 (ENGINEERING)


RICHARDSON SMITH GARDNER
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14 N. BOYLAN AVENUE
RALEIGH, NC 27603
NC LIC. NO. C-0828
(ENGINEERING)

January 2010

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PERMIT AMENDMENT APPLICATION

**Wilson County
Westside C&D Landfill
Wilson, North Carolina**

Prepared for:
**Wilson County Solid Waste Management Department
Wilson, North Carolina**

RSG Project No. WESTSIDE-08-1

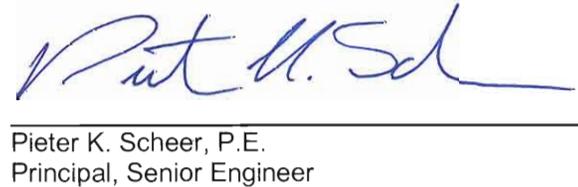
Statement of Compliance with Engineering Plan Requirements:

The engineering elements of this Permit Application have been prepared by the undersigned Professional Engineer licensed to practice engineering in accordance with NCGS 89C and the Administrative Rules developed thereunder. It is my opinion that the design described in the application meets the intent of the 15A NCAC 13B.0531 et seq. of the Solid Waste Management Rules.



Gary W. Ahlberg, P.E.
Consulting Engineer





Pieter K. Scheer, P.E.
Principal, Senior Engineer



January 2010


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WILSON COUNTY WESTSIDE C&D LANDFILL

PERMIT AMENDMENT APPLICATION

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ATTACHMENT B	TECHNICAL SPECIFICATIONS <i>(15A NCAC 13B.0539)</i>
ATTACHMENT C	CONSTRUCTION QUALITY ASSURANCE MANUAL <i>(15A NCAC 13B.0541)</i>
ATTACHMENT D	OPERATION PLAN <i>(15A NCAC 13B.0542)</i>
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ATTACHMENT G	PERMIT AMENDMENT DRAWINGS <i>(15A NCAC 13B.0537, .0539, .0540, .0542, and .0543, and 15A NCAC 4)</i>
ATTACHMENT H	WATER QUALITY MONITORING PLAN <i>(15A NCAC 13B.0538)</i>

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EXECUTIVE SUMMARY

GENERAL

The following is a Permit Amendment Application submitted on behalf of Wilson County for continued operations of the County's Westside construction and demolition debris (C&D) Landfill. This submittal follows the Construction Plan Application prepared by Gary W. Ahlberg, P.E.¹.

The Westside C&D Landfill, which has 3 contiguous cells over approximately 10.5 acres, has already been built to its maximum extent laterally. At the projected gate rate of 25,700 tons/year (current average disposal rate), the landfill has approximately 6.4 years of remaining volume (from the 8/26/2008 survey) to designed contours.

The components of the final cover system will consist of the following components (top-down):

Regulatory Final Cover System (.0543 (c) (1)):

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

REGULATORY REFERENCES

This submittal has been prepared in accordance with the requirements of the North Carolina Solid Waste Management Rules (15A NCAC 13B.500 et. seq.) and the North Carolina Sedimentation Control Rules (15A NCAC 4) which are enforced by the Division of Waste Management (DWM) and the Division of Land Quality, respectively, of the North Carolina Department of Environment and Natural Resources. Included in this document are the following attachments:

Facility and Engineering Plan;
Technical Specifications;
Construction Quality Assurance (CQA) Manual;
Operation Plan*;
Closure and Post-Closure Plan;
Erosion and Sedimentation Control Plan*;
Permit Amendment Drawings; and
Water Quality Monitoring Plan*.

** No changes are proposed for these documents from the approved 2004 submittal.*

¹ Gary W. Ahlberg, P.E. (2004), "Construction Plan Application for Wilson County Westside C&D Landfill Facility, Wilson, North Carolina", dated August 2004 (revised September 2004), approved by NC DWM in September 2004.

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Facility and Engineering Plan

**Wilson County Westside C&D Landfill
Wilson County, North Carolina**

Prepared for:

**Wilson County Solid Waste Management Dept.
Wilson, North Carolina**

January 2010



14 N. BOYLAN AVENUE
RALEIGH, NORTH CAROLINA 27603
NC LIC. NO. C-0828 (ENGINEERING)

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WILSON COUNTY WESTSIDE C&D LANDFILL

FACILITY AND ENGINEERING PLAN

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WILSON COUNTY WESTSIDE C&D LANDFILL

FACILITY AND ENGINEERING PLAN

1.0 OVERVIEW

Wilson County, North Carolina currently owns and operates a solid waste management facility located between US Highway 264 and NC Highway 42 near Wilson. The facility can be accessed both from the south (off of Landfill Road) and from the north (NC Highway 42). The main access to the facility is from NC Highway 42, where the County recently constructed a new scale house and convenience center. As a component of the Wilson County facility, the active Westside landfill site is permitted under NC Permit 98-09 for the disposal of construction and demolition debris (C&D) waste. The County also conducts several other solid waste management activities at the facility. Refer to **Section 2.1**, which describes facility services.

The County has operated the Westside C&D Landfill under the current permit since October 4, 2004. This plan presents information describing the continued operations of the Westside C&D Landfill.

2.0 FACILITY SERVICES AND WASTE STREAM

2.1 Facility Services

Currently, the following activities or services are provided at the Wilson County Landfill facility:

- Scales and office/scale house building
- Convenience Center
- Maintenance building
- C&D landfill
- Used tire storage area
- White goods and scrap metal handling area
- Yard waste processing area.

2.2 Types of Waste

C&D waste and inert debris are accepted at the Wilson County Westside Landfill facility. Wastes are routed to the landfill or other areas as appropriate.

2.3 Disposal Rate and Anticipated Variances

Based on actual waste disposed from the start of operations (10/4/2004) through the most recent fiscal year (6/30/2009), an average of approximately 25,700 tons per year of C&D waste (average of approximately 92 tons per day based on 280 days of operation per year) is currently accepted for disposal at the Wilson County facility. Actual annual and daily

amounts of C&D waste are expected to vary.

2.4 Service Area

The landfill facility currently serves Wilson County.

2.5 Procedures for Waste Segregation

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

Wastes are segregated at the scales. Operators at the scalehouse are trained to classify and segregate the waste stream. C&D wastes are directed to the landfill. Inert debris is segregated in a stockpile for reclamation. Yard wastes are directed toward the yard waste storage and processing area.

Employees at the landfill are trained in the safety procedures for the handling and detection of illegal waste. The screening of unacceptable waste is 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 is rejected and not permitted into the facility. If hazardous waste is found at the tipping area, identification of the truck or persons is made (if possible) and documented, then the hazardous waste is identified and placed in a hazardous waste container and taken to a designated hazardous waste staging area for proper disposal. If this occurs, the event is reported to the appropriate authorities.

2.6 Equipment Requirements

The County will maintain on-site equipment required to perform the necessary landfill activities. The County currently uses a Terex 375E compactor, Komatsu D39 bulldozer, Komatsu WA200-5 loader, and Bobcat T-300 in their day to day operation of the C&D landfill unit. Periodic maintenance of all landfilling equipment, and minor and major repair work will be performed in the landfill's maintenance building.

3.0 LANDFILL CAPACITY

3.1 Total Operating Capacity and Life Expectancy

Figure 1 (Attachment G), identifies the final configurations for the C&D landfill. The exterior side slopes will be at a 4H to 1V slope and the top elevation will be at approximately 150 feet.

The estimated total gross operating capacity, net capacity (accounts for periodic and final cover), disposal area, and life expectancy for the landfill are shown in **Table 1**.

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

The capacities obtained above were based on an assumed 8:1 waste to soil ratio (11 percent) and a waste filling rate of 1,450 pounds per cubic yard (0.725 tons/cy) (waste density of 1,631 pounds per cubic yard (0.82 tons/cy) after removing the assumed soil volume). These values were based on an evaluation of a survey of the landfill performed on August 26, 2008.

4.0 AVAILABLE SOIL RESOURCES AND REQUIRED SOIL QUANTITIES

The soils required to construct the proposed landfill will be removed from on-site borrow sources.

4.1 Periodic Cover

Assuming the previously mentioned waste to cover soil ratio of 8:1, the estimated quantity of soil that will be required for use as periodic cover during C&D landfill operations is shown in **Table 2**.

4.2 Final Cover Soil

On the basis of an average 3 foot thickness, the estimated in-place volumes of the compacted soil barrier (18-inch minimum thickness) and vegetative soil layer (18-inch minimum thickness) components of the final cover system are shown in **Table 2**.

4.3 Soil Summary

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

5.0 FACILITY DESIGN CRITERIA

The Wilson County C&D landfill is designed and operates in accordance with Section .0542 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 more than 50 feet (as required for existing facilities) (for this site, the minimum buffer exceeds 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.

5.2 Vertical Separation Requirements

The landfill subgrade elevations have been designed (and constructed) to meet the minimum requirement of four feet (post-settlement) above the seasonal high groundwater table and bedrock.

6.0 CONTAINMENT AND ENVIRONMENTAL CONTROL SYSTEMS

Technical specifications and a project construction quality assurance (CQA) manual for the following materials can be found in **Attachments B and C**, respectively.

6.1 Landfill Subgrade

The subgrade for the landfill has previously been completed.

6.2 Final Cover System

The components of the final cover system will consist of the following components (top-down):

Regulatory Final Cover System (.0543 (c) (1)):

- a 6-inch thick vegetative soil layer; and
- an 18-inch thick soil liner with a permeability 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 4H:1V. Top slopes will be approximately 12.5%. A landfill gas (LFG) control system and surface water control devices will also be incorporated into the final cover. The final cover surface will be vegetated upon completion of the final cover installation according to the project seeding specifications.

6.3 Erosion and Sedimentation Control

The Erosion and Sedimentation Control measures have been designed and maintained to manage the run-off generated by the 24-hour, 25-year storm event, and conform to the requirements of the Sedimentation Pollution Control Law (15A, NCAC, 4) (see **Attachment F**).

6.4 Landfill Gas Control

Landfill gas control will consist of 10 passive wells/vents as shown on **Figure 1 (Attachment G)**. Due to a number of factors (the limited depth to groundwater, the distance to site structures, and the existence of wetlands around much of the property), no perimeter monitoring of gas from the C&D landfill is proposed.

6.5 Access and Roadways

Site operations will provide for all-weather access to active areas and site monitoring locations.

7.0 SLOPE STABILITY AND SETTLEMENT

Both the slope stability of the waste mass and settlement of the landfill subgrade were previously addressed in the 2004 Construction Plan Application. The results of these analyses indicate that the final C&D landfill configuration is stable and that the required vertical separation beneath the landfill will be maintained after settlement.

**TABLE 1
SUMMARY OF LANDFILL CAPACITY AND LIFE EXPECTANCY**

Unit	Area (Ac.)	Capacity (See Note 1)		Life Expectancy (Years) (See Note 2)
		Gross (CY)	Net (CY/Tons)	
Cells 1-3 (Filled Through August 26, 2008)	10.5	153,680	136,622 CY 111,418 Tons	-----
Cells 1-3 (Remaining)	-----	278,357	202,280 CY 164,960 Tons	6.4
Totals:	10.5	432,037	338,902 CY 276,378 Tons	6.4

Notes:

1. The net capacity is based on an assumed 8:1 waste to soil ratio and waste density of 0.82 tons/CY.
2. Life expectancy is based on an assumed average disposal rate of 25,700 tons/year and is projected from August 26, 2008 (date of most recent survey).

**TABLE 2
SOIL SUMMARY**

Material	Quantity (CY)
Periodic Cover	(25,257)
Final Cover Soil	
Compacted Soil Barrier	(25,410)
Vegetative Soil Layer	(25,410)
Total:	(76,077)

Notes:

1. Volumes estimated from August 26, 2008.

Appendix A

Landfill Design Calculations

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WILSON COUNTY WESTSIDE C&D LANDFILL
FACILITY AND ENGINEERING PLAN
APPENDIX A: LANDFILL DESIGN CALCULATIONS

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1.0 Capacity Evaluation

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PROJECT Wilson County - Westside C&D Landfill

SHEET 1 OF 7

JOB NO. WESTSIDE-08-1

DATE 12/22/09

SUBJECT Capacity Evaluation (Density & Life Calcs.)

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.

CAPACITY LF DENSITY & LIFE.WPD



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SHEET: WESTSIDE-08-1
 JOB #: 12/22/09
 DATE: PKS
 BY: PKS
 CHKD BY:

**Wilson County - Westside C&D Landfill
 Capacity Evaluation - Filling Rate & Density Calculations**

Density and Filling Rate Calculations:

Start Date	Period of Interest End Date	Total Time (years)	Volume Filled (cy)	Quantity of Waste Disposed (tons)	Waste Filling Rate* (lbs/cy)	Periodic Cover Assumed %	Periodic Cover Volume (cy)	Waste Volume (cy)	Waste Density** (lbs/cy)
10/4/2004	8/26/2008	3.90	153,680	111,418	1,450 0.725	11.1	17,058	136,622	1,631
		Totals:	153,680	111,418			17,058	136,622	1,631 *

* Overall Waste Density (lb/cy)

Notes:

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

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



RICHARDSON SMITH GARDNER & ASSOCIATES
 Engineering and Geological Services
 14 N. Boylan Avenue Tel: 919-828-0577
 Raleigh, NC 27603 Fax: 919-828-3899

SHEET: **317**
 JOB #: WESTSIDE-08-1
 DATE: 12/22/09
 BY: PKS
 CHKD BY:

**Wilson County - Westside C&D Landfill
 Capacity Evaluation - Cells 1-3 Remaining**

Waste & Periodic Cover Parameters:

Waste Density (pcy) = 1,631 (From Filling Rate and Density Calcs.)
 Waste Density (tcy) = 0.82
 Percentage of Periodic Cover = 11.1 (8:1 Waste to Soil Ratio)

Volume Calculations:

Volume From AutoCAD (cy) = 278,357 (8/26 Survey to Top of Final Cover)
 (432,037 CY Gross - 153,680 CY Used) (= Gross Capacity Remaining)

Net (Waste) Capacity:

Adjustment For Other Layers:

	Area of Final Cover (Ac.) =	10.5
3 feet	<u>CSB & VSL =</u>	<u>(50,820) cy</u>
	Sum =	(50,820) cy

Volume of Waste and Periodic Cover (cy) = 227,537

Volume of Periodic Cover (cy) = (25,257)

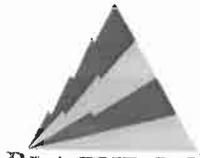
Net (Waste) Capacity (cy) = 202,280

Net (Waste) Capacity (tons) = 164,960

Life Expectancy Calculations:

Landfill Life Expectancy (years) = 6.4

From 8/26/08 based on average of
 25,700 Tons/Year (= January
 2015)



BLACKROCK ENGINEERS, INC.

4/7

P.O. Box 58
Wilmington, NC 28402
910.232.6696
blackrock42@earthlink.net

September 14, 2009

Mr. Andy Davis
Wilson County Solid Waste Management
Post Office Box 1728
Wilson, North Carolina 27894

RE: FY 2008-2009 LANDFILL CAPACITY REPORT
WESTSIDE CONSTRUCTION & DEMOLITION LANDFILL (CDLF)
WILSON COUNTY LANDFILL
WILSON, NORTH CAROLINA

Dear Mr. Davis:

The following report documents remaining capacity for the Westside C&D Landfill. The Westside Facility was initially in-service on October 4, 2004. According to the County's Material Analysis Report for 7/1/08 through 6/30/09, approximately 12,419 tons of waste were received for disposal at the permitted construction and demolition landfill. Due to increased recycling activities and economic recession, the average annual landfill disposal rate for the Westside CDLF is considerably lower than the average 29,000 tons/year.

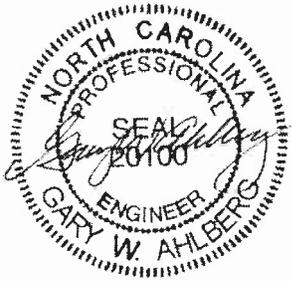
In August 2008, Taylor Wiseman and Taylor performed a survey of the landfill. From that survey BlackRock calculated the capacity used and remaining. The results of the survey indicate that the Airspace Utilization Factor is 0.725 tons/cubic yard in-place, an improvement of 7.5% over the facility average. Adjusted for end of year receipts, 121,828 tons in-place leaves a remaining capacity of 229,894 cubic yards (166,764 tons). Attached is Table 1 providing calculations for landfill capacity and remaining operating life.

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Based on the 29,000 tons/year disposal rate, the Westside CDLF is predicted to reach final capacity in 5.8 years, in 2015. This revises previous year's estimates for actual surveyed volumes. Future capacity plans continue to be evaluated for the County's long-term needs.

Please feel free to call me with any questions regarding this report.

Sincerely,
BlackRock Engineers, Inc.



7/7

NO.	DESCRIPTION	DATE



GENERAL NOTES:

1. THIS DRAWING SHOWS EXISTING TERRAIN AND THE 10-FOOT LAMBERT GRID FOR CAPACITY EVALUATION. SEE PLANS RECORD DRAWINGS FOR FUNDAMENTALS AND GRID GRADE AS-BUILT.

CAPACITY NOTES:

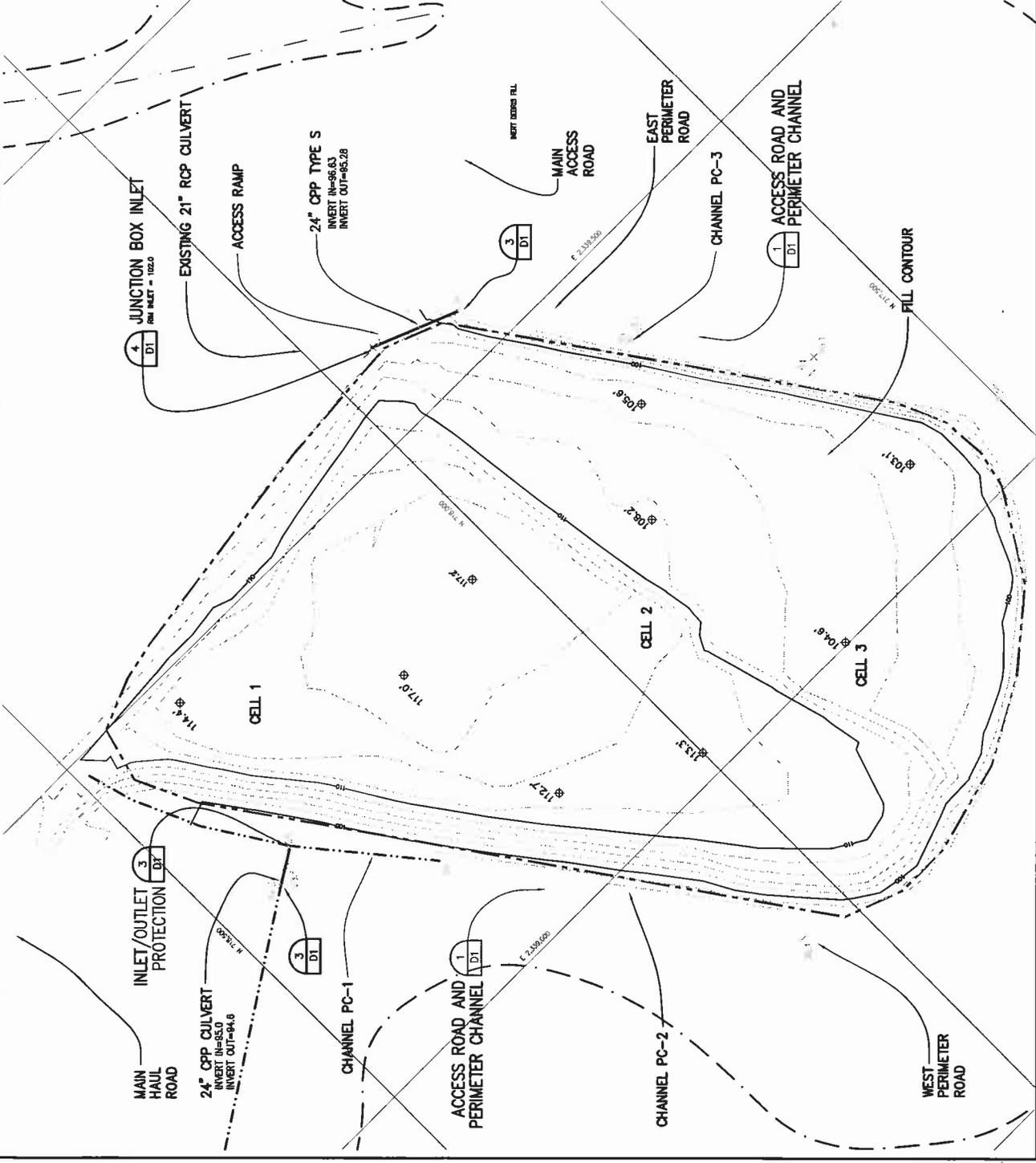
1. OPERATING SURVEY: THE OPERATING SURVEY WHEN THE FILL LAYER WAS DEPOSITED BY TAYLOR, WISBAMA, TAYLOR OF CARY, NORTH CAROLINA. SURVEY OF EXISTING CONDITIONS WAS PERFORMED ON AUGUST 24, 2008 AS A PERIODIC CHECK ON LANDFILL PROGRESS.
2. LANDFILL CAPACITY AND IN-PLACE WASTE DENSITY: EVALUATED FROM THE AS-BUILT GRADE VERTICES, EXISTING SOIL LOGS, TONNAGE, THE IN-PLACE WASTE DENSITY WAS INCREASED TO 0.74 TONS/CY (837 LB/CY).
3. F708-09 FINAL CAPACITY: FOR THE TOTAL RECORDED 10.48 TONS AN INCREMENTAL VOLUME OF 10.48 TONS WAS ADDED TO THE TOTAL TONNAGE OF 10.48 TONS.
4. ABOVE A GROSS VOLUME OF 10.48 TONS WAS USED FOR DISPOSAL AND OTHER USES.

LEGEND

- OPERATION GRADE 10-FOOT CONTOURS 06.26.08
- OPERATION GRADE 5-FOOT CONTOURS 06.26.08
- LANDFILL FOOTPRINT 10.5 ACRES
- DRAINAGE CHANNEL

HALF-SIZE PLOT - 1/21

RECORD DRAWING



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Technical Specifications

**Wilson County Westside C&D Landfill
Wilson County, North Carolina**

Prepared for:

Wilson County Solid Waste Management Dept.
Wilson, North Carolina

January 2010



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WILSON COUNTY WESTSIDE C&D LANDFILL

TECHNICAL SPECIFICATIONS

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<u>Section No.</u>	<u>Specification</u>
02222	Excavation
02223	Embankment
02250	Soil Liner
02258	Vegetative Soil Layer
02930	Revegetation

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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.

2. Related Work:

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

<u>Work</u>	<u>Section</u>
Embankment CQA Manual	02223 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 materials located within the limits of construction including widening cuts and shaping of slopes necessary for the preparation of roadbeds, landfill 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: 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 Materials Excavation (Overexcavation): shall consist of the removal and satisfactory disposal of all unsuitable material located within the limits of construction. Where excavation to the finished grade section shown results in a subgrade or slopes of unsuitable material, the Contractor shall overexcavate such material to below the grade shown on the Contract Drawings or as directed by the Engineer and CQA Engineer.

B. MATERIALS

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

C. SUBMITTALS

The Contractor shall submit the following to the CQA Engineer before approval is given to proceed:

- 1. Descriptive information on Excavation equipment to be 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.
- 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.

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.
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:

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 CQA Engineer and backfilled with suitable material in accordance with Section 02223, Embankment, of these Specifications unless further excavation or earthwork is required. No additional payment will be made for such excavation and backfill 1 foot or less than the finished subgrade. Unsuitable material excavation greater than 1 foot beneath the finished subgrade shall be made on a unit price basis for excavation and backfill, only as approved by the Engineer and CQA Engineer prior to the work. Unit price for overexcavation and backfill greater than 1 foot in depth shall include disposal of unsuitable materials.

15. All cuts shall be brought to the grade and cross section shown 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
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 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 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 SW, SM, SM-SC, SC, ML, CL-ML, or CL (ASTM D 2488) containing no topsoil or other deleterious material. 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

The Contractor shall submit the following to the CQA Engineer before approval is given to proceed:

1. Descriptive information on compaction equipment to be used for construction of Embankment.
2. Descriptive information on the location and source of any off-site borrow material to be used for Embankment, where applicable. Information shall include Standard Proctor curves (ASTM D698) for each borrow material.

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.
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.

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 3:1, 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	95	As Required for Compaction	8
Embankment Beneath Structures and Roads ¹	98		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

SECTION 02250

SOIL LINER

Soil Liner: The Soil Liner 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>
Vegetative Soil Layer	02258

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.

B. MATERIALS

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

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.

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.

2. 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.

3. 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.

4. 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 Soil Liner.

5. 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 $\frac{1}{2}$ 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.
- h. Locations of control stakes, in-place density tests, thickness checks, or other samples in the Soil Liner shall be patched with compacted Soil Liner or sodium bentonite compacted and hydrated in the holes.

6. Surveying:

After completion of a segment of Soil Liner, but before installation of subsequent layers, the Soil Liner shall be surveyed (by test pit or hand auger) on a 100 foot grid to ensure the minimum specified thickness of Soil Liner has been achieved.

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. = 1½ inches
Atterberg Limits	ASTM D 4318	As required based on soil type.
Hydraulic Conductivity (Lab Remolded) (Compacted Soil Barrier)	ASTM D 5084 ³	$\leq 1 \times 10^{-5}$ cm/s at a density of $\geq 95\%$ maximum standard dry density and a moisture content \geq 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 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>
Soil Liner	02250

3. Quality Assurance:

Quality Assurance during placement of Vegetative Soil Layer will be provided by the Owner.

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. Soil materials used in the VSL shall be reasonably free of gypsum, ferrous, and/or calcareous concretions and nodules, refuse, roots, or other deleterious substances.
2. 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.

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.

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.
 - b. 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.
 - c. 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 (by test pit or hand auger) on a 100 foot grid to ensure the minimum specified thickness of VSL has been achieved.

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>
Vegetative Soil Layer	02258

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 of 10-10-10 analysis, 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 as specified in Table 1 of this section. 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.

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 a 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, 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.

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.

TABLE 1: SEEDING SCHEDULE

MATERIAL	SEED TYPE	APPLICATION RATE ¹
Lime	----	4,000 lbs/acre
Fertilizer	----	1,000 lbs/acre
Seed		
Permanent:	Tall Fescue	80 lbs/acre
	Pensacola Bahiagrass	50 lbs/acre
	Sericea Lespedeza ²	30 lbs/acre
	Kobe Lespedeza	10 lbs/acre
	Seasonal Nurse Crop	See Note 3
Temporary:	See Note 4	See Note 4
Mulch	----	4,000 - 5,000 lbs/acre
Binder	----	150 gallons/acre

Notes:

1. Application rates and/or chemical analysis shall be confirmed or established by a soil test(s).
2. From Sept. 1 - March 1, use unscarified Sericea seed.
3. 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	25 lbs/acre Rye (grain).
4. For temporary seeding, follow the guidelines of the NC Erosion and Sediment Control Planning and Design Manual.

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Construction Quality Assurance Manual

**Wilson County Westside C&D Landfill
Wilson County, North Carolina**

Prepared for:

**Wilson County Solid Waste Management Dept.
Wilson, North Carolina**

January 2010



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RALEIGH, NORTH CAROLINA 27603
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WILSON COUNTY WESTSIDE C&D LANDFILL
CONSTRUCTION QUALITY ASSURANCE MANUAL

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SECTION 1.0 GENERAL

1.1 INTRODUCTION

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 components of the final cover system. The final cover system consists of a 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

1.2 DEFINITIONS RELATING TO CONSTRUCTION QUALITY

1.2.1 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 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.

1.2.2 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.

1.2.3 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 all CQA testing performed by the CQA Engineer.

1.2.4 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.

1.3 PARTIES TO CONSTRUCTION QUALITY ASSURANCE

1.3.1 Description of the Parties

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

1.3.1.1 Owner

The Owner is Wilson County, who owns and/or is responsible for the facility.

1.3.1.2 Engineer

The Engineer is responsible for the engineering design, drawings, and project specifications for the 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 1.7**. The Engineer will also be responsible for proper resolution of all quality issues that arise during construction. The Engineers are BlackRock Engineers and Richardson Smith Gardner & Associates, Inc.

1.3.1.3 Contractor

The Contractor is responsible for the construction 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.

1.3.1.4 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 soil component of the 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.

1.3.1.5 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 final cover system. The services of the Soils CQA Laboratory are coordinated by the CQA Engineer and are paid for by the Owner.

1.3.2 **Qualifications of the Parties**

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

1.3.2.1 Contractor

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

1.3.2.2 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 final cover system, 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.

1.3.2.3 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.

1.4 SCOPE OF CONSTRUCTION QUALITY ASSURANCE MANUAL

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

1.5 UNITS

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

1.6 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.

1.7 CQA MEETINGS

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

1.7.1 Soil Liner CQA Meeting

Prior to the start of the soil liner 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.

1.7.2 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.

1.7.3 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.

1.8 CONTROL VERSUS RECORD TESTING

1.8.1 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.

1.8.2 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.

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SECTION 2.0 CQA DOCUMENTATION

2.1 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 weekly 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.

2.2 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 locations 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 CQA Engineer's shift, prior to leaving the site. This information will be submitted weekly to and reviewed by the Owner and Engineer.

2.3 CQA PROGRESS REPORTS

The CQA Engineer will prepare a summary progress report each week, or at time intervals established at the pre-construction meeting. As a minimum, this report will include the following information, where applicable:

- a unique identifying sheet number for cross-referencing and document control;
- the date, project name, location, and other information;
- a summary of work activities during the progress reporting period;
- a summary of construction situations, deficiencies, and/or defects occurring during the progress reporting period;
- summary of all test results, failures and retests, and
- signature of the CQA Engineer.

The CQA Engineer's progress reports must summarize the major events that occurred during that week. Critical problems that occur shall be communicated verbally to the Engineer immediately as well as being included in the weekly reports. The CQA Engineer's weekly report must be submitted to the Owner and Engineer no later than the Monday following the week reported.

2.4 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. These records will be presented to the Engineer upon completion of the project.

In lieu of photographic documentation, videotaping may be used to record work progress, problems, and mitigation activities. The Engineer may require that a portion of the

documentation be recorded by photographic means in conjunction with videotaping.

2.5 DEFICIENCIES

The Owner and Engineer will be made aware of any significant recurring nonconformance 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.

2.6 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.

2.7 FINAL CQA REPORT

At the completion of each major construction activity at the landfill unit, 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.

2.8 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 2.1: FINAL CQA REPORT GENERAL OUTLINE (FINAL COVER SYSTEM)

- 1.0 Introduction
- 2.0 Project Description
- 3.0 CQA Program
 - 3.1 Scope of Services
 - 3.2 Personnel
- 4.0 Earthwork CQA
- 5.0 Final Cover System CQA
- 6.0 Soil Liner CQA
- 7.0 Summary and Conclusions
- 8.0 Project Certification

Appendices

- Appendix A Design Clarifications/Modifications
- Appendix B Photographic Documentation
- Appendix C CQA Reporting
 - C1. CQA Reports
 - C2. CQA Meeting Minutes
- Appendix D Earthwork CQA Data
 - D1. CQA Test Results - Control Tests
 - D2. CQA Test Results - Record Tests
- Appendix E Final Cover System CQA Data
 - E1. CQA Test Results - Vegetative Soil Layer
- Appendix F Soil Liner CQA Data
 - F1. CQA Test Results - Control Tests
 - F2. CQA Test Results - Record Tests
- Appendix G Record Drawings
 - G1. Compacted Soil Liner As-Built
 - G2. Vegetative Soil Layer As-Built

SECTION 3.0 EARTHWORK CQA

3.1 INTRODUCTION

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.

3.2 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.

3.2.1 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.

3.3 SUBGRADE APPROVAL

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

3.4 EARTHWORK CONSTRUCTION

3.4.1 Construction Monitoring

- A. Earthwork shall be performed as described in the project specifications.
- B. Only soil previously approved by the CQA Engineer (see **Section 3.2**) 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.

3.4.2 Control Tests

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

3.4.3 Record Tests

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

3.4.3.1 Record Test Failure

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

3.4.4 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.

3.5 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 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)

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.

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SECTION 4.0 SOIL LINER CQA

4.1 INTRODUCTION

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.

4.2 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.

4.2.1 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.

4.3 SUBGRADE APPROVAL

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

4.4 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.

4.4.1 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.

4.4.2 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.

4.4.3 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.

4.5 SOIL LINER CONSTRUCTION

4.5.1 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 4.2**) 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. 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.

4.5.2 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.

4.5.3 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.

4.5.3.1 Record Test Failure

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

- A. Failed Density Test: Recompaction 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.

4.5.4 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.

4.5.5 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.

4.6 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 6938 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	40,000 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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SECTION 5.0 FINAL COVER SYSTEM CQA

5.1 INTRODUCTION

This section of the CQA Manual addresses the 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 compacted soil barrier 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.

5.2 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.

5.2.1 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.

5.2.2 Compacted Soil Barrier

The CQA program for compacted soil barrier is presented in **Section 4.0** of this CQA Manual.

5.2.3 Vegetative Soil Layer

- A. Review the proposed source of vegetative soil layer for conformance with the project specifications.
- B. Conduct material control tests in accordance with **Table 5.1**.

5.3 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; and
- verify location of all piping.

5.4 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 5.1: CQA TESTING PROGRAM FOR FINAL COVER SYSTEM

COMPONENT	PROPERTY	TEST METHOD	MINIMUM TEST FREQUENCY
CONTROL TESTS:			
Vegetative Soil Layer:	Visual Classification	ASTM D 2488	Each Load
	Grain Size Analysis	ASTM D 422	5,000 CY
	Atterberg Limits	ASTM D 4318	5,000 CY

Appendix A

Reference List of Test Methods

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CQA MANUAL
APPENDIX A: REFERENCE LIST OF TEST METHODS

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

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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ATTACHMENT D

OPERATION PLAN

No changes to the Operation Plan approved as part of the 2004 Construction Plan Application are proposed. Attached is a copy of the approved plan.

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4.0 OPERATION PLAN

In Section 2.0 of this document, a general description of landfill capacity, disposal rates, and waste types is provided. This Section provides a detailed plan for operation of the CDLF. While similar to the operation plan for the MSWLF units, the limited waste types present a lesser concern for specific operational practices. Still, some of the MSWLF practices will be continued for C&D operations. All operations shall be in compliance with 15A NCAC 13B Rule .0505.

4.1 PHASES OF OPERATION

Drawing C2 illustrates the three cells of development for the CDLF. In general, the landfill will be constructed in 10-foot lifts, with the intermediate slopes following the current topography. At an annual disposal rate of 20,000 tons/year and a waste:soil ratio = 8:1, the peak intermediate fill elevation will be 122 msl under the initial 5-year operating phase.

4.2 BASE EMBANKMENT

In addition to the base soil layer, construction of the initial landfill lift shall include a perimeter embankment or toe dike. The peak elevation of the toe dike is approximately 5 feet. Waste placement shall be at least 3 feet below the top of the dike to allow for stormwater control during operations and final cover construction at closure.

4.3 ROUTINE OPERATIONS

Following completion of the base lift, routine waste placement and compaction operations shall be practiced. Lift progression shall establish a maximum side slope at 4:1, and the top grade should follow the planned 1-2% surface grade, sloped from the center to the perimeter. The waste shall be adequately compacted with a compactor.

4.4 WASTE ACCEPTANCE

4.4.1 *Approved Waste Types*

Wastes typically generated by construction and demolition activities shall be managed at the CDLF. Other waste types categorically approved by the Division, such as pallets, will also be accepted for disposal. Specific approval must be received from the Division for other waste types that Wilson County may want to accept for disposal; typically, this will require a demonstration to the Division that the waste type is "Inert Debris". The Inert Debris evaluation may require chemical analysis to document that potential leaching from the material will not exceed 15A NCAC 2L Groundwater Standards.

4.4.2 *Waste Screening*

In addition to C&D waste, the Wilson County Landfill receives other waste types at the facility entrance. The Weighmaster directs specific waste types, such as Land Clearing and Inert Debris, asbestos, and yard waste to specific management areas. The solid waste management areas are identified with signs. Signs will be posted for routing of C&D waste to the Westside facility.

A waste screening program similar to the current program shall be maintained for C&D operations. The facility shall only accept those solid wastes which it is permitted to receive. The operator shall monitor loads periodically to identify non-conforming wastes, including municipal solid waste, industrial waste, and hazardous waste. If a suspect load is identified, an inspection will be conducted in an area prepared near the working face. This staging area will be graded to contain and segregate the wastes if necessary.

Personnel Training and Preparation

The following facility personnel shall receive Awareness Level Training by a qualified consultant to identify non-conforming wastes: Weighmaster, Compactor Operators, and the Heavy Equipment Supervisor. The Supervisor will lead waste inspections and ensure that the staging area is properly prepared, inspectors are

outfitted with the appropriate Personal Protective Equipment, and records are properly maintained.

Identifying Excluded Wastes

When conducting waste inspections, personnel should look for municipal waste, and industrial containers with hazard labels, liquids, powders and dusts, sludges, bright or unusual colors, and be aware of chemical odors. No liquids will be allowed in the landfill. Suspect wastes will be required to perform the paint filter test. Hazardous waste exhibits the following properties:

- | | |
|-----------------|--|
| 1. Ignitability | Flash Point of less than 140 degrees Fahrenheit |
| 2. Corrosivity | pH of less than or equal to 2.0 or greater than or equal to 12.5 |
| 3. Reactivity | Explosive, reactive with water or corrosive materials |
| 4. Toxicity | Exhibits Toxic Chemical Leaching Process (TCLP) constituent |
| above | regulatory level |

Key Personnel

The following names and telephone numbers shall be posted in the Scalehouse:

1. County Emergency Management Supervisor - R.C. Smith 399-2830
2. SWS Regional Waste Management Specialist - Ben Barnes (919) 571-4700

Procedures for Handling Excluded Wastes

If possible the hauler in violation shall be detained at the site and required to remove the non-conforming wastes from the facility. If wastes are identified and off-loaded from the vehicle, the inspector shall notify the County Emergency Management Supervisor for coordinating containment, temporary storage, and disposal. If waste is temporarily stored on-site, the maximum storage period is dictated by the amount of waste present. The SWS shall be notified within 24 hours of the attempted disposal of unauthorized waste. The following definitions exist for hazardous waste management.

1. **CONDITIONALLY EXEMPT SMALL QUANTITY GENERATOR:** Generates less than 220 pounds of hazardous waste in any calendar month.

2. SMALL QUANTITY GENERATOR: Generates between 220 and 2200 pounds of hazardous waste in a given calendar month.
3. LARGE QUANTITY GENERATOR: Generates greater than 2200 pounds of hazardous waste in any given calendar month, or greater than 2.2 pounds of acutely hazardous waste in a calendar month.

When possible the operator shall remove non-conforming wastes within 30 days. If the maximum storage period exceeds 90 days, the operator must request approval from the DEHNR Hazardous Waste Section.

Containers holding hazardous waste must be maintained in good condition and clearly labeled with the words "HAZARDOUS WASTE". If a container is not in good condition or begins to leak, the contents must be transferred to a good container. Containers must be constructed or lined with materials which will not react with the waste being stored. Containers holding hazardous waste must always be closed during storage. Containers must not be handled in such a manner which may rupture or damage container. Areas where containers are stored must be inspected on a weekly basis. A log of inspections must be maintained at the facility for a three year period.

Recordkeeping

The following records shall be maintained for waste inspections and haulers that are refused entry:

1. Vehicle and Driver Identification
2. Amount and Source of Waste
3. Date and Time of Inspection
4. Observations of Inspection
5. Required Notifications for Confirmed Wastes

4.5 COVER REQUIREMENTS

Due to the non-putrescible nature of the waste, the working lift shall be typically covered on a weekly basis. The top portion of the lift shall receive a minimum

cover of six inches. As the side slopes are completed, an intermediate 12-inch soil cover shall be placed and compacted.

4.6 STORMWATER MANAGEMENT

Management of stormwater and erosion control are integrated concepts for the landfill. Lift progression from upslope to downslope positions simplifies stormwater management for daily operations. Stormwater shall be directed away from the working face of the landfill to the perimeter stormwater berm or a temporary diversion. During operations, multiple temporary downdrains will convey drainage from the intermediate landfill surface to the perimeter channel network. Mulching or temporary seeding shall be utilized as necessary to stabilize the site; areas of the landfill that are not planned to receive additional waste within 120 days shall be stabilized with temporary cover.

4.7 ACCESS CONTROL

The facility is designed to limit access and comply with the following general safety requirements for MSWLFs.

- (a) *The MSWLF shall be adequately secured by means of gates, chains, berms, fences and other security measures approved by the Division to prevent unauthorized entry.*
- (b) *An attendant shall be on duty at the site at all times while it is open for public use to ensure compliance with operational requirements.*
- (c) *The access road to the site shall be of all-weather construction and maintained in good condition.*
- (d) *Dust control measures shall be implemented when necessary.*
- (e) *Signs providing information on dumping procedures, the hours during which the site is open for public use, the permit number and other pertinent information specified in the permit conditions shall be posted at the site entrance.*
- (f) *Signs shall be posted stating that no hazardous or liquid waste can be received.*

- (g) *Traffic signs or markers shall be provided as necessary to promote an orderly traffic pattern to and from the discharge area and to maintain efficient operating conditions.*
- (h) *The removal of solid waste from a sanitary landfill is prohibited unless the owner or operator approves and the removal is not performed on the working face.*
 - (i) *Barrels and drums shall not be disposed of unless they are empty and perforated sufficiently to ensure that no liquid or hazardous waste is contained therein, except fiber drums containing asbestos (asbestos area).*

4.8 AIR CRITERIA

The operator has an established relationship with the local Fire Department for controlling accidental fires. Hot loads should be unloaded in an area of the facility with at least 1 foot of soil cover and must be completely cool before transfer to the working face. The weighmaster shall be alert for smoke from disposal vehicles. If a "hot load" is detected, the vehicle shall be directed to a covered portion of the landfill for off-loading. The load shall be monitored and allowed to burn out prior to spreading the waste to cool. The fire department shall be notified to monitor/extinguish the fire.

In addition to contingency plans for accidental fires, the operator shall comply with the following requirements:

- (a) *Owners or operators of all landfills must ensure that the units do not violate any applicable requirements developed under a State Implementation Plan (SIP) approved or promulgated by the U.S. EPA Administrator pursuant to Section 110 of the Clean Air Act, as amended.*
- (b) *Open burning of solid waste, except for the infrequent burning of land clearing debris generated on site or debris from emergency clean-up operations, is prohibited at all*

MSWLF units. Any such infrequent burning must be approved by the Division.

- (c) Equipment shall be provided to control accidental fires or arrangements shall be made with the local fire protection agency to immediately provide fire-fighting services when needed.*
- (d) Fires that occur require verbal notice to the Division within 24 hours and written notification shall be submitted within 15 days.*

4.9 OPERATING RECORD

The Operating Record for the Wilson Westside CDLF shall be maintained at the Director's Office for the Department of Solid Waste Management. The operator shall continue to maintain records for C&D disposal according to the Rules and North Carolina Laws. A copy of all permit documents will be placed in the Operating Record.

4.10 COVER SOIL INFORMATION

Soil materials for base fill, temporary, intermediate and final cover applications will be obtained from dedicated off-site borrow sources. In 1996, Wilson County purchased the 226 acre Tucker Farm as a soil borrow site for landfill construction projects. Just recently, Wilson County acquired the 76 acre Mohesky Farm joining the Tucker Farm and the Westside site. The Mohesky site was purchased as a supplemental borrow site for landfill construction. Altogether, approximately 50 acres of borrow area are currently undeveloped and provide adequate soil resources for current and proposed landfill projects. An average excavation of 2 feet will provide over 165,000 cubic yards estimated for base construction, operational cover, and final cover. Typical excavation depths at the Tucker Site are in excess of 5 feet.

The Westside site was formerly the borrow site for landfill operations. Beginning in 1998, the Tucker Farm provided soils for intermediate cover, clay liner, and vegetative soil layer construction for closure of the MSWLF units. Presently, the Tucker site continues to supply soils for C&D landfill construction at the facility. Located between the Westside and Tucker sites, soils on the Mohesky Farm are typical of the local area. According to the SCS Soil Survey of Wilson County North Carolina, the mapped soil series include Wagram, Gritney, Altavista, and Tarboro Coastal Plain sediments. Several geotechnical investigations have been conducted on the Tucker site to define soil properties for landfill construction.

Closure and Post-Closure Plan

**Wilson County Westside C&D Landfill
Wilson County, North Carolina**

Prepared for:

**Wilson County Solid Waste Management Dept.
Wilson, North Carolina**

January 2010



14 N. BOYLAN AVENUE
RALEIGH, NORTH CAROLINA 27603
NC LIC. NO. C-0828 (ENGINEERING)

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WILSON COUNTY WESTSIDE C&D LANDFILL

CLOSURE AND POST-CLOSURE PLAN

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SECTION 1.0 CLOSURE PLAN

1.1 OVERVIEW

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.

1.2 MAXIMUM CLOSURE AREA AND WASTE CAPACITY

The following are the estimated areas and capacity for each landfill unit to be closed under this plan.

Landfill Unit	Closure Area (Acres) ¹	Gross Capacity (CY) ¹	Net (Waste) Capacity (CY/Tons) ¹
C&D Landfill Unit			
Cells 1-3	10.5	433,560	319,060 CY 215,000 Tons

Notes:

1. Values from approved Construction Plan Application prepared by Gary W. Ahlberg, P.E., dated December 2003. Note that the gross capacity reported is from bottom of waste (top of subgrade) to top of final cover.

1.3 FINAL COVER SYSTEM

The final cover systems for the C&D landfill unit 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 4H:1V. Surface water control devices and landfill gas (LFG) components 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.

1.4 LANDFILL GAS SYSTEM

For the C&D landfill unit, a landfill gas system is provided in the final cover design. This system includes a system of collection wells or vents placed within the waste to capture and passively vent the gas.

Refer to the appropriate permit application for a detailed discussion and details related to the design of the landfill gas system for each landfill unit.

1.5 SURFACE WATER SYSTEMS

Precipitation falling on the cover will infiltrate into the cover or run off 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 (rain gutters and/or diversion berms). Water captured by rain gutters or 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.

1.5.1 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 diversion berms must be installed if required to accomplish this run-off routing.

1.5.2 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.

1.6 CLOSURE SCHEDULE

Closure activities must begin 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.

1.7 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.
- 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.

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SECTION 2.0 POST-CLOSURE PLAN

2.1 OVERVIEW

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 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.

2.2 POST-CLOSURE CONTACT

All correspondence and questions concerning the post-closure care of the landfill should be directed to:

Wilson County Solid Waste Management Department
Attn: Andy Davis, Director
P.O. Box 1728
Wilson, NC 27894
Phone: (252) 399-2823.

2.3 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. Wilson 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.

2.4 MAINTENANCE

2.4.1 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.

2.4.2 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.

2.4.3 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.

2.4.4 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.

2.4.5 Landfill Gas System

While gas production from the waste is expected to be very low, a passive venting system is proposed for final closure. Surrounding groundwater levels and buffer areas minimize the potential for gas migration.

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, water), binding or corrosion, additional and/or replacement wells/vents can be installed if necessary.

2.4.6 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.

2.4.7 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. For contained leachate that will not flow into underlying waste, a pump may be required to route the leachate to a tanker truck for proper disposal off-site.
5. The use of soil (particularly clay) to plug the seepage may be successful in the case where flows are minor.
6. Remove and dispose of impacted cover soils accordingly.
7. Repair landfill cover as necessary.

2.5 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.

2.5.1 Inspection Frequencies

Inspections to be conducted during the post-closure care period will occur regularly as shown in **Table 2.1**.

2.5.2 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.

2.5.3 Record Keeping

Records of inspections and repairs will be kept on file by the County throughout the post-closure period.

2.6 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
Landfill Gas System	Quarterly ³	Semi-Annually ³
Groundwater Monitoring System	Semi-Annually	Semi-Annually ²
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 groundwater monitoring schedule described in the current Water Quality Monitoring Plan.
3. Or in accordance with the current Landfill Gas Management Plan and/or air quality permit(s), if applicable.

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SECTION 3.0 CLOSURE/POST-CLOSURE COST ANALYSIS

3.1 OVERVIEW

The purpose of this section is to provide a written estimate in current dollars of all costs associated with all activities specified in the written closure and post-closure plans which have been developed for the C&D landfill unit of the Wilson County Landfill.

3.2 ESTIMATED CLOSURE COSTS

Table 3.1 summarizes the estimated costs for complete closure of the C&D landfill unit. 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.

3.3 ESTIMATED POST-CLOSURE COSTS

Table 3.2 summarizes the estimated costs for the post-closure care maintenance activities for the C&D landfill unit. 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.

3.4 FINANCIAL ASSURANCE MECHANISM

Wilson County intends to continue to use the Local Government Financial Test to demonstrate financial assurance for this facility.

TABLE 3.1: C&D UNIT - CLOSURE COST ESTIMATE¹

ITEM	QUANTITY	UNITS	UNIT COST	ITEM COST (2010 \$)
Surface Preparation	10.5	Acre	\$2,000	\$21,000
Landfill Gas Wells/Vents	10.5	Acre	\$3,000	\$31,500
Compacted Soil Barrier (18")	25,500	CY	\$7.00	\$178,500
Vegetative Soil Layer (18")	25,500	CY	\$4.00	\$102,000
Erosion Control (Diversion Berms, Down Pipes, Drainage Channels, Etc.)	10.5	Acre	\$5,000	\$52,500
Revegetation	10.5	Acre	\$1,500	\$15,750
Surveying	10.5	Acre	\$2,000	\$21,000
Subtotal:				\$422,250
Bonds, Mobilization, & Insurance	(4% of Subtotal):			\$16,890
Subtotal:				\$439,140
Contingency (10%):				\$43,914
Construction Subtotal:				\$483,054
Engineering	10.5	Acre	\$2,000	\$21,000
CQA	10.5	Acre	\$6,500	\$68,250
TOTAL:				\$572,304

Notes:

1. Assumes closure of 10.5 acres (Cells 1-3).

TABLE 3.2: C&D UNIT - POST-CLOSURE COST ESTIMATE¹

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL (2010 \$)
Site Inspection And Record Keeping	20	HR	\$75	\$1,500
Revegetation (5% Total Area)	0.5	Acre	\$1,500	\$750
Mowing (once per year)	11	Acre	\$100	\$1,100
Erosion Control	1	LS	\$2,000	\$2,000
Gates/Fences/Access	1	LS	\$1,500	\$1,500
Groundwater/Surface Water Monitoring & Reporting (4 Long-Term Wells - Semi-Annual)	4	Each	\$1,200	\$9,600
Methane Monitoring & Reporting (Semi-Annual After Year 1)	2	Each	\$1,500	\$3,000
Subtotal:				\$19,450
Contingency (10%):				\$1,945
ANNUAL TOTAL:				\$21,395
30-YEAR TOTAL:				\$641,850

Notes:

1. Assumes post-closure of Cell 1-3 (10.5 Ac.).

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ATTACHMENT F

EROSION AND SEDIMENTATION CONTROL PLAN

**No changes to the Erosion and Sedimentation
Control Plan approved as part of the 2004
Construction Plan Application are proposed.
Attached is a copy of the approved plan.**

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**EROSION AND SEDIMENTATION CONTROL PLAN
WESTSIDE C&D LANDFILL FACILITY
WILSON COUNTY DEPARTMENT OF SOLID WASTE
WILSON COUNTY, NORTH CAROLINA**

1. Purpose

Wilson County currently operates a landfill for the disposal of construction and demolition debris generated in the County. Located east of Wilson, North Carolina, the proposed Westside Construction and Demolition Landfill Facility (CDLF) is adjacent and generally west of the existing landfill facility. The Westside facility property is 100.00 Acres owned by Wilson County and described as Tract 1 in the attached Recombination Plat for the Wilson County Landfill, prepared by Herring Sutton and Associates; a vicinity map is included in the plat. When originally purchased by the County as a dedicated landfill borrow site in 1990, the site contained 127.98 Acres and was described as the Williamson Borrow Site. While the Williamson Borrow Site was depleted in the mid 1990's, Wilson County has continued to use the property for soil stockpiles and other solid waste management activities. Land disturbing activities were originally approved by the NC Division of Land Resources on March 19, 1990; see attached Letter of Approval. The original Erosion and Sedimentation Control Plan includes permanent structures which continue to operate on the site. This plan evaluates existing conditions and the suitability of existing structures, and specifies new temporary and permanent measures to maintain compliance with the Sedimentation Pollution Control Act of 1973. Pursuant to the North Carolina Sedimentation Pollution Control Act, Wilson County is requesting review and approval of this plan by the North Carolina DENR DLR Land Quality Section.

The proposed Westside waste boundary is 10.5 Acres, and is defined as the landfill footprint. Limited to a portion of the originally disturbed borrow area, the construction limits include perimeter channels and access roads for a total disturbed area of 19.4 Acres. A NC DENR permit fee of \$1,000.00 is attached for plan review, with the Financial Responsibility and Ownership Form completed by Wilson County. The landfill will receive C&D waste and additional wastes compatible with the facility design. The estimated 5-year disposal capacity is approximately 100,000 tons. The calculated total landfill capacity is 215,000 tons yielding an estimated project life of 10 years. No additional borrow activities are proposed on the Westside site.

Prior to landfill operation, a compacted soil layer shall be constructed for the landfill base. The landfill base will be constructed in 3 contiguous cells within the first 5-year operating period. Previous restoration grading activities have established suitable condition to begin Cell 1 (2 Acres) landfill operations. Using existing grassed swales and temporary ditches, all of Cell 1 drainage is directed to the existing West Sediment Basin for control prior to discharge to Buck Branch. Plan approval is necessary for construction of new permanent channels and restoration of the Main Sediment Basin. All cover soils will be imported from Wilson County's dedicated landfill borrow site located to the west of the Westside Facility, identified as the Tucker Borrow Site and approved by the NC DLR in 1995.

2. Plan Elements

The S&EC Plan for the borrow site includes narrative descriptions, attachments, and drawings including the following elements:

- Vicinity Map
- Site Development/Existing Conditions Drawing
- Site Erosion and Sedimentation Control Drawings
- Detail Drawings for Specified Practices and S&EC Structures
- Design Calculations and Assumptions
- Vegetation Specifications for Temporary and Permanent Stabilization
- Construction Schedule
- Financial/Ownership Form.

3. Site Conditions

3.1. Facility Property

Attached to this report is a recombination plat of the Wilson County Landfill prepared by the surveyor, defining two tracts for the separate landfill facilities. The plat includes a vicinity map providing the general location of site to the east of the City of Wilson, and accessed via Landfill Road (SR 1503). Tract 2 contains 196.45 Acres and defines the property for the MSW Landfill Facility; this is provided for reference only in this application. By dedication and maintenance of a 50-foot buffer from the MSW Landfill Facility, the Westside CDLF is separate and apart from the MSW Facility.

Tract 1 contains the 100.00 Acres which delineates the Westside C&D landfill site proposed for this permit, and an additional 3.76 Acre buffer property. The site is in Gardners Township of Wilson County and bisected by the extraterritorial jurisdiction (ETJ) of the City of Wilson, North Carolina. The property boundary presented in site drawings and figures for this report is the 100.00 Acres delineated in the recombination plat by the surveyor.

The site's western boundary is established by the center-line run of Buck Branch. The adjoining properties on the west and east are owned by Wilson County. To the west, Wilson County recently purchased the 76.43 Ac property identified as the Mohesky Farm. The Mohesky Farm provides potential future off-site borrow resources for Wilson County landfill projects; NC DLR approval is required prior to development. Continuing upstream along Toisnot Swamp from the Mohesky Farm is the Tucker Borrow Site. The Tucker Borrow Site was purchased by Wilson County in 1995 and is the active borrow site for current landfill projects. The only surrounding property not owned by Wilson County is farmland located upslope and generally north of the site.

3.2. Topographic Mapping and GIS Resources

Topographic mapping (2-foot contour interval) for the site was included in the 1998 project completed by GeoData Corporation, of Zebulon, North Carolina. The 1998 topography is generally representative of current ground conditions. In order to provide updated mapping for

landfill construction, HSA surveyed the construction limits for the Westside landfill and mapped one-foot contours in July 2003. Floodplain, zoning, subdivision, and local property boundary (plat) data was provided by Wilson County's Mapping/GIS Department.

Topographic relief on the site is gradually sloping north to south, toward Buck Branch and Toisnot Swamp. The slope increases upgradient of the landfill footprint to the northern property boundary. Ditches were constructed with borrow site operation to convey stormwater to an existing sedimentation basins west and south of the footprint.

3.3. Soils

According to the SCS Soil Survey of Wilson County North Carolina, the mapped soil series include Wagram, Gritney, Altavista, and Tarboro Coastal Plain sediments. Within the construction limits, these soils have been removed by borrow operations and mostly clay soils, or sandy clays are exposed at the surface.

3.4. Wetlands

Jurisdictional wetlands are present within the floodplain regions bordering the surface waters on-site. According to a field delineation performed in 1994 and reviewed by the U.S. Army Corps of Engineers, wetlands on-site are contained within the existing woodland areas shown on the drawings. An approximate wetland boundary is illustrated on the map. These wetland areas will not be disturbed by construction activities on the site. According to the irregular relief within the swamp areas, surface water accumulating in the wetland areas likely form runs which drain to the streams.

3.5. Surface Waters

The site contains one stream and one intermittent stream. The site's western boundary is established by the center-line run of Buck Branch. Buck Branch is a named stream on the USGS Quadrangle Map for the area. Along the eastern site boundary, an intermittent stream is present in the vegetated area. This stream is identified as such on the Local Area Map. Both Buck Branch and the intermittent stream feed into Toisnot Swamp. All surface waters in the local area are classified by NC Surface Water Standards as Class C waters. Toisnot Swamp is a major tributary stream and groundwater discharge feature in the area. This site is subject to the Neuse Buffer requirements, which is illustrated on the drawings.

4. Design Procedures and Goals

The sediment and erosion control plan is designed based on the guidelines and procedures set forth in the North Carolina Erosion and Sediment Control Planning and Design Manual (E&SCP&DM) and "Elements of Urban Stormwater Design" (EOUSD), by H. Rooney Malcom, P.E. Drawing No. 2 – Drainage Plan illustrates the features of the S&EC plan for the site. Design calculations and a construction sequence for S&EC measures are attached to this report.

In accordance with the NC Sedimentation Pollution Control Act, all S&EC structures specified for the borrow site are designed for the 10-year storm event. Ditches and channels are oversized to allow for some sediment accumulation during construction. In general, this plan follows the

guidelines established in the North Carolina Erosion and Sediment Control Planning and Design Manual (E&SCP&DM).

Sedimentation and erosion occurs when cleared areas are allowed to remain disturbed for extended periods of time without a vegetative cover being established. Once vegetation has been established on the disturbed areas, the erosion potential is minimized and temporary sedimentation and erosion control measures may be removed. A seeding plan for disturbed areas is specified for permanent borrow area stabilization.

In general, this plan describes the various types of erosion control measures used on the site and specifies the design of channels, velocity controls, temporary sediment trap and permanent basin structures. Both the temporary and permanent erosion and sedimentation control devices employed in this project use a combination of filtration and settling to remove silt/sediment from stormwater.

All stormwater flow volumes are calculated using the Rational Method based on a 10-year storm event. Runoff coefficients for various ground cover conditions are referenced to Table 8.03a in the E&SCP&DM. Rainfall intensities used in the Rational Method are derived from Table 8.03d E&SCP&DM, using times of concentration calculated with the Kirpich Equation. Drainage areas, slope gradients and distances were determined using computer aided design techniques.

4.1. Phased Development of Landfill

The landfill base will be constructed in three cells over the initial 4 years of operation. Drainage from Cell 1 and the northwest landfill quadrant is controlled by the existing West Sediment Basin. Prior to construction of Cell 2, the Main Basin requires construction of a new access road for restoration and future maintenance. The embankments for the loop access road create the outboard bank for a perimeter channel loop around the landfill. For constructability, these permanent channels (PC) are constructed with a 7-ft base, and depths of 1-2 feet. Final Grade plans include diversion berms to capture drainage from the top landfill surface and route to the perimeter channels via permanent slope drains.

4.2. Permanent Structures

Design calculations are attached for all channels and ditches. Channel lining materials are specified for use according to the manufacturer's properties and recommendations for construction. At locations where temporary downpipes or permanent slope drains and culverts discharge, channel segments are improved with armoured rip rap lining to control flow dynamics. The design utilizes conventional liner materials to stabilize channels. The channels direct run-off to the sediment basins. The design incorporates the two (2) existing basins.

Design for the permanent sediment basins is consistent with E&SCP&DM Section 6.60. The structure provides a volume of 1800 ft³/acre of disturbed area and meets the surface area requirements set forth in E&SCP&DM. E&SCP&DM guidelines for permanent basins include riser/barrel principal spillways and emergency weir-type spillways. The principal spillway must be met with one foot of driving head. The crest of the emergency spillway is set one foot above the invert of the riser and must pass the peak run-off from the 10-year storm event with one foot of freeboard to crest of berm. The riser/barrel and emergency spillways were designed using spreadsheet based on methods provided in EOUSD. The riser/barrel assembly must be

constructed with an anchor displacing a buoyant weight of at least 1.1 times the weight of water displaced by the riser. The riser must also be provided with a method of dewatering the basin.

The existing Area A basin provides storage capacity that greatly exceeds the required 1800 ft³/acre design volume. This impoundment has been in-place for several decades and the surface features are in excellent condition, with well established vegetation. Based on its performance as an existing, functional structure, no spillway modifications are proposed for its use as a sediment basin. Evidently, when the transmission lines were constructed at this location, a rock trench was installed to drain impounded water through the embankment. The constructed swale under the transmission lines acts as an emergency spillway; however no flow condition has been observed where the water level from the impoundment has breached the swale. Superior vegetation is established in the swale and construction activities would compromise the established growth. If conditions prove otherwise, the S&EC plan would be modified to fit the feature with a standard riser/barrel principal spillway and reinforced emergency spillway.

4.3. Temporary Structures

The design utilizes existing grassed swales and temporary diversion ditching to convey stormwater to permanent channels and the control structures. Ditch design is standardized across the site to establish clear operating requirements for soil borrow operations. Ditch depth allows for sedimentation during construction, with a minimum freeboard of 6 inches. These measures are designed to provide temporary erosion control until permanent vegetative cover is established.

5. Maintenance and Sediment Disposal

All sedimentation and erosion control devices will be inspected at regular intervals and immediately following any significant rainfall event. Repairs will then be made as needed and accumulated sediment removed if necessary. All sediments which are removed during cleaning operations will be located in an area which is isolated from storm drainage and stabilized with vegetative cover.

Design allows for at least 6 inches of sediment to accumulate in channels and ditches. If accumulation exceeds 6 inches, sediment must be removed from channel or ditch. For the sediment basins and traps, sediment/silt will be removed prior to one-half of the basin volume becoming filled with sediment. A level gauge shall be set in each basin for monitoring sediment accumulation.

6. Vegetation Plan

Vegetative cover must be established as soon as possible in inactive areas of the landfill. The landfill will be constructed in 5-10 lifts, which establish intermediate elevations. Areas at intermediate grade are covered with 12 inches of soil and seeded for stabilization. At final grade, a final cover is constructed on the perimeter slopes and top landfill surface. The final cover design is a 2-foot soil layer, with a 6-in topsoil surface, vegetated with native grasses. Temporary seeding may be used when cover is required in a season outside the best dates for permanent seeding. Seeding requirements are included in the project details.

Prior to any seeding operation, the soil shall be limed, fertilized, and disked. Soil testing shall be performed to determine the specific nutrient requirements of the soil. Adequate nutrient inputs are critical to establishing good vegetation in exposed subsoils. Incorporating the appropriate amounts of organic matter into the soil by using composted materials can also help to establish a good seed bed. Mulch or compost shall be used to protect permanent seeding applications.

7. GENERAL CONSTRUCTION SCHEDULE

1. Inspect existing West Basin and clean as necessary to limits shown on Drawings.
2. Install TC-2 V ditch and perimeter landfill toe dikes for Cell 1 operation.
3. Evaluate existing swale TC-1 for performance, replace with PC-1 if necessary.
4. Improve main haul road and extend into Cell 1 landfill operation.
5. Construct access roads along west perimeter of Cell 1, PC-1 segments, and RCP1.
6. Extend access roads, PC-1 and PC-2 along west perimeter to access and restore Main Basin ahead of Cell 2 base construction.
7. Restore Main Basin as shown on Drawings.
8. Construct Haul Road and Roadside Ditch as lifts progress.
9. Install access roads and PC-3 along east perimeter to Main Basin.
10. Install temporary downpipes for top landfill surface as lifts progress.
11. Seed intermediate cover areas on landfill.
12. When Phase 1 operations are complete, install partial final cover on completed perimeter slopes.
13. Continue use of temporary measures to convey landfill operational drainage to perimeter channels and basins.
14. When Phase 2 operations are complete, install remaining final cover on perimeter slopes and top landfill surface, including stormwater berms and permanent slope drains.
15. Clean channels and basins, maintain until vegetation is full established through facility post closure plan.

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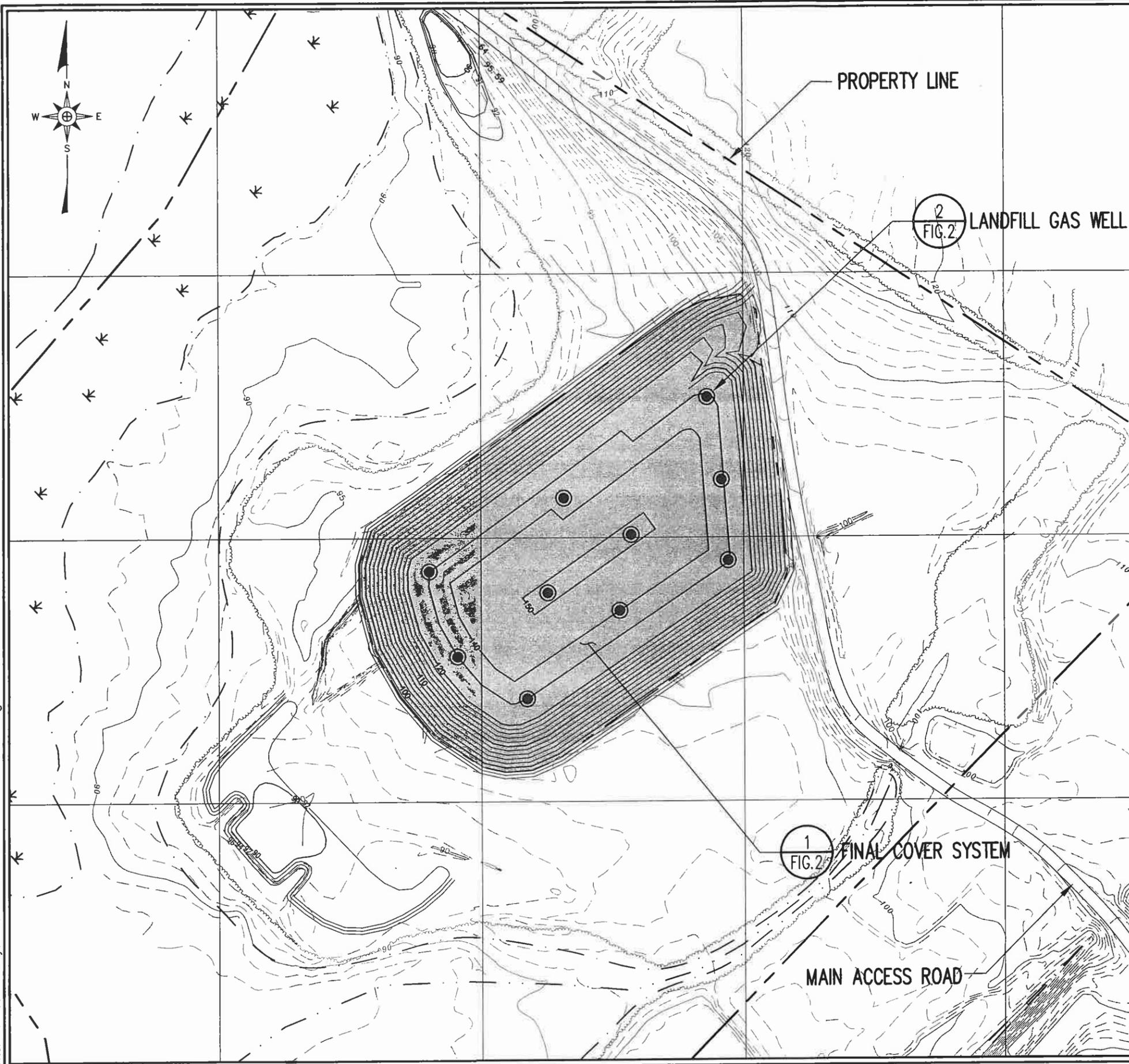
ATTACHMENT G

PERMIT AMENDMENT DRAWINGS

The only changes to the Permit Drawings approved as part of the 2004 Construction Plan Application relate to the change in the final cover profile and the addition of landfill gas wells/vents (See attached Figures 1 and 2). Also attached are the previously approved permit drawings.

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LEGEND

- EXISTING 10' CONTOUR (SEE REFERENCE 1)
- EXISTING 2' CONTOUR
- PROPOSED GRADING 10' CONTOUR (SEE REFERENCE 2)
- PROPOSED GRADING 2' CONTOUR
- PROPERTY LINE (SEE REFERENCE 2)
- WETLAND AREA (SEE REFERENCE 2)
- STREAM (SEE REFERENCE 2)
- AREA TO CLOSE (±10.5 AC.)
- PROPOSED LANDFILL GAS WELL OR VENT

NOTES

1. THE COUNTY WILL EVALUATE GAS PRESSURES UPON INSTALLATION OF THE FINAL COVER SYSTEM AND WILL INSTALL A NUMBER OF WELLS/VENTS AS NECESSARY TO ADEQUATELY RELIEVE GAS PRESSURE.

REFERENCES

1. TOPOGRAPHY FROM DRAWING "FINAL COVER PLAN", DATED 9/1/04, PREPARED BY GARY W. AHLBERG, P.E.
2. SITE PROPERTY LINE, WELLS, FINAL COVER GRADES, WETLAND AREAS, STREAMS AND FEATURES FROM DRAWING "FINAL COVER PLAN", DATED 9/1/04, PREPARED BY GARY W. AHLBERG, P.E.



BLACKROCK ENGINEERS, INC.

POST OFFICE BOX 58
 WILMINGTON, NORTH CAROLINA 28401
 107 PLUMTREE LANE
 CASTLE HAYNE, NORTH CAROLINA 28429
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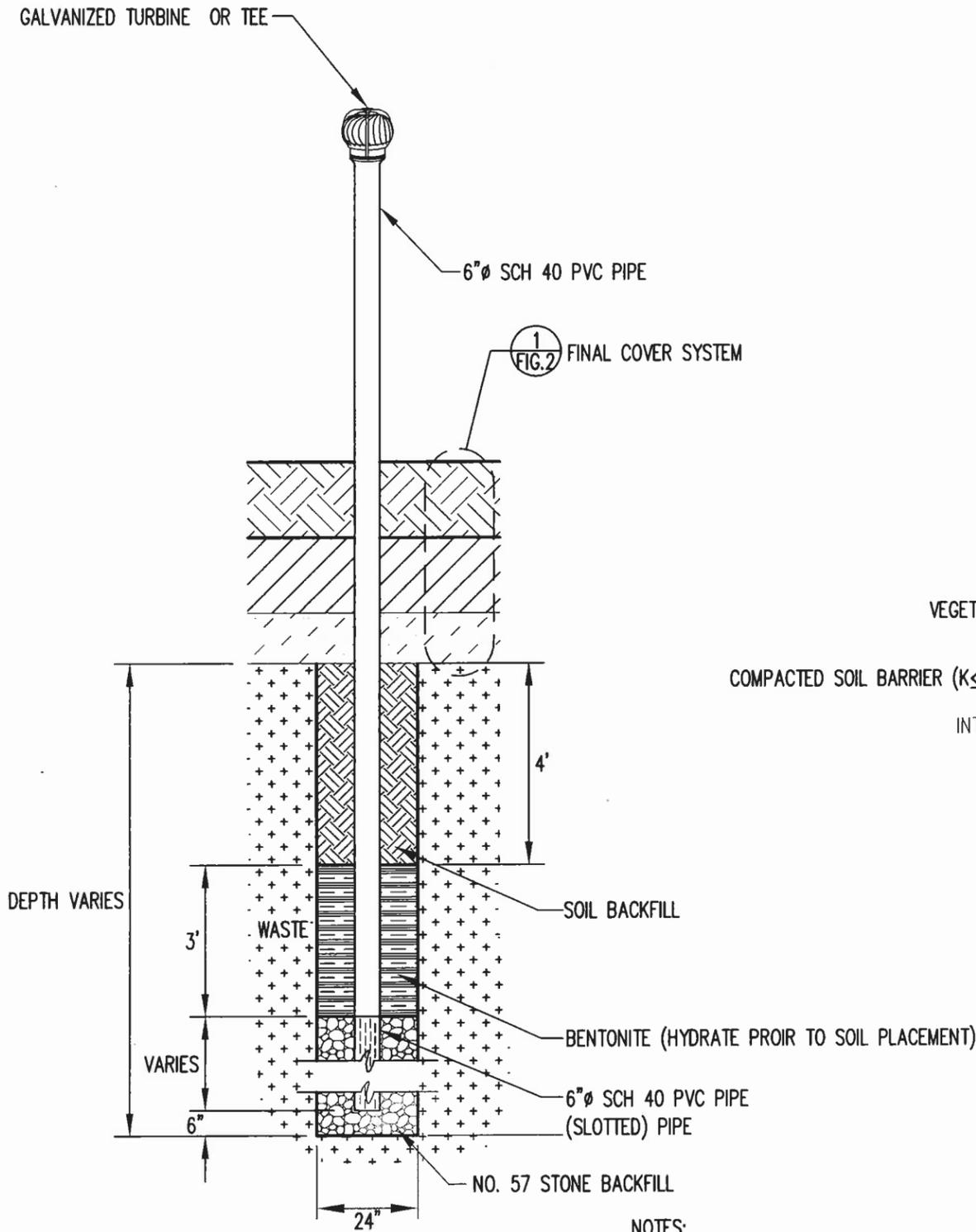


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FIGURE NO.	1	FILE NAME	WESTSIDE-B0001
SCALE:	AS SHOWN	PROJECT NO.	WESTSIDE 08-1
CHECKED BY:		DATE:	Nov. 2009
DRAWN BY:	J.A.L.		

TITLE:
**WILSON COUNTY
 WESTSIDE C&D LANDFILL
 CLOSURE AREA**

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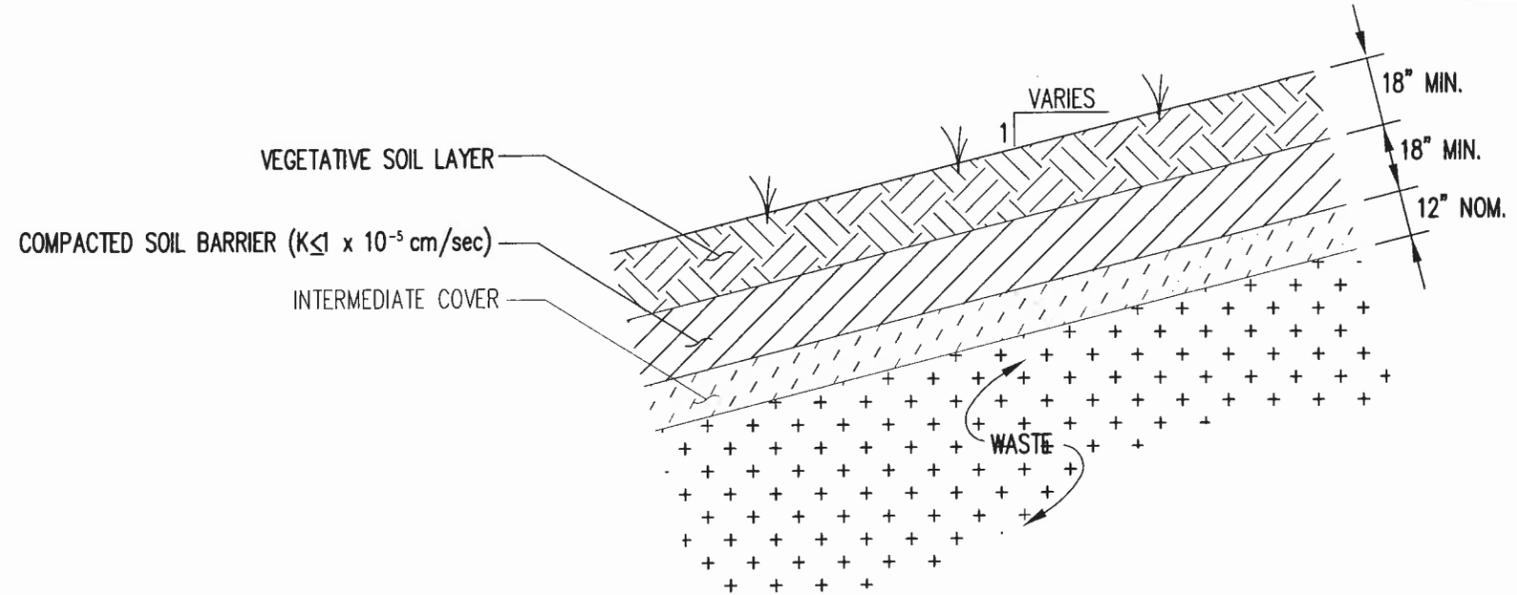


TYPICAL LANDFILL GAS WELL

DETAILS
NOT TO SCALE

2
FIG. 2

- 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 AND WRAPPED IN A NONWOVEN GEOTEXTILE. TRENCHES SHALL HAVE NOMINAL SIZE OF 6' WIDE x 20' LONG x 2' DEEP.



FINAL COVER SYSTEM

DETAILS
NOT TO SCALE

1
FIG. 2

BLACKROCK ENGINEERS, INC.

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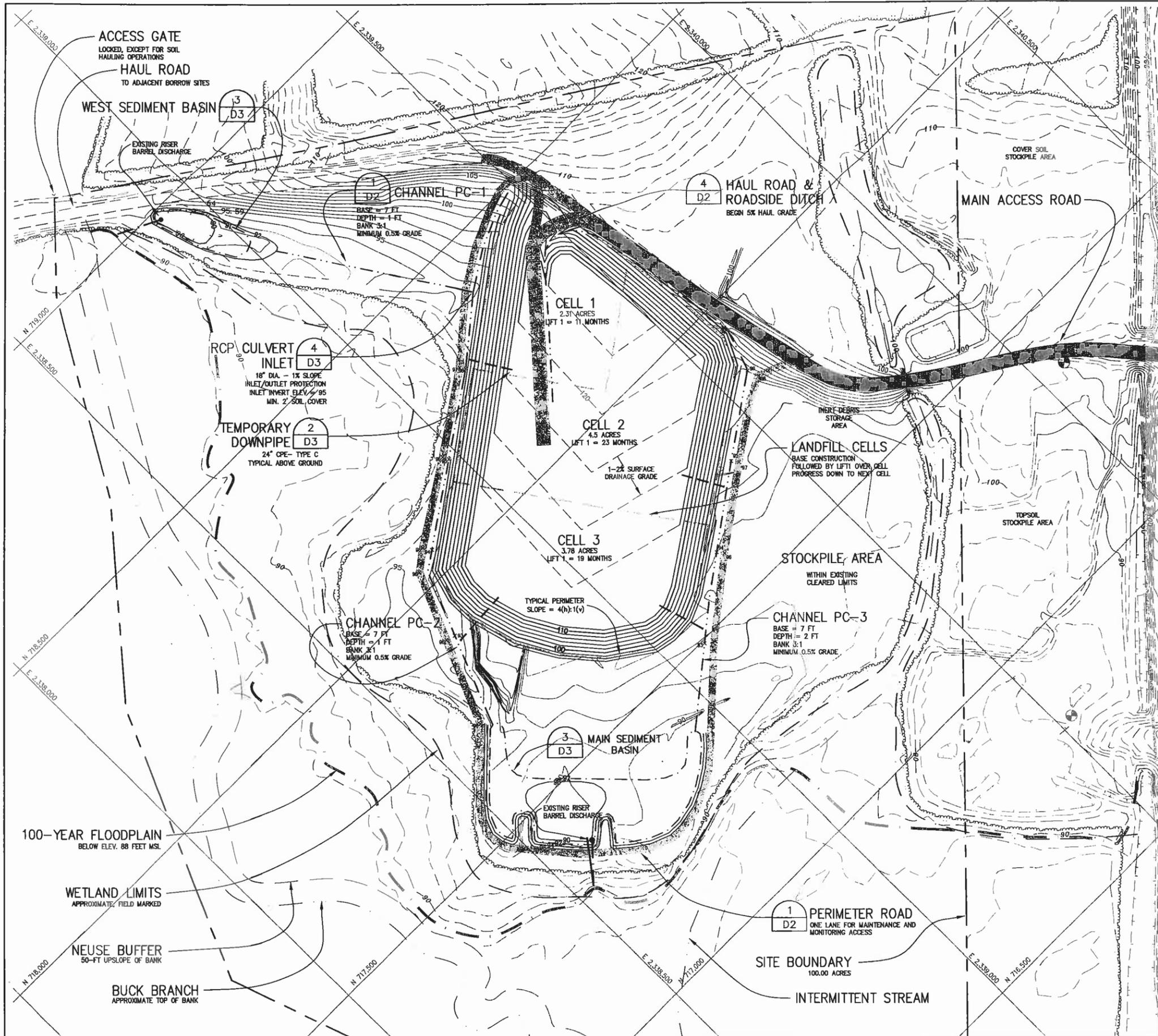


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DRAWN BY:	J.A.L.	CHECKED BY:	AS SHOWN	SCALE:	AS SHOWN	FIGURE NO.	2	FILE NAME	WESTSIDE-B0002
DATE:	Nov. 2009	PROJECT NO.	WESTSIDE 08-1						

WILSON COUNTY
WESTSIDE C&D LANDFILL
DETAILS

TITLE:

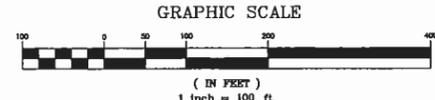


CONSTRUCTION NOTES:

- PURPOSE.** THIS PLAN FOR THE WESTSIDE CONSTRUCTION AND DEMOLITION LANDFILL FACILITY, OWNED BY WILSON COUNTY, NORTH CAROLINA, IS PREPARED FOR A PERMIT TO CONSTRUCT ISSUED BY THE NC DENR DIVISION OF WASTE MANAGEMENT IN ACCORDANCE WITH THE 15A NCAC 13B.
- WASTE STREAM AND DISPOSAL RATE.** THE LANDFILL WILL RECEIVE CONSTRUCTION AND DEMOLITION WASTE GENERATED WITHIN WILSON COUNTY, NORTH CAROLINA. OTHER WASTE TYPES APPROVED BY THE DIVISION FOR DISPOSAL: SEE PERMIT CONDITIONS OR AGENCY CORRESPONDENCE FOR SPECIFIC APPROVED WASTE TYPES, INCLUDING SPLIT TIRES AND TOBACCO DUST. THE ESTIMATED AVERAGE ANNUAL DISPOSAL RATES IS 20,000 TONS/YEAR.
- ACCESS CONTROL.** NATURAL TOPOGRAPHIC AND VEGETATIVE CONDITIONS AND CONTROL MEASURES LIMIT PUBLIC ACCESS TO THE SITE. WILSON COUNTY WILL MAINTAIN THE GATED ENTRANCE TO THE EXISTING MSW FACILITY. ACCESS TO THE WESTSIDE SITE WILL BE CONTROLLED VIA THE EXISTING MANNED SCALEHOUSE DURING OPERATING HOURS.
- LANDFILL OPERATIONAL GRADE.** THE LANDFILL WILL BE OPERATED IN 5 TO 10-FOOT LIFTS, PROGRESSING EVENLY ACROSS THE FOOTPRINT. AT THE INTERMEDIATE HEIGHT OF 10 FEET ABOVE BASE GRADE, THE ENTIRE 10.5 ACRE FOOTPRINT PROVIDES APPROXIMATELY 4 YEARS OF CAPACITY. INTERMEDIATE GRADE WITH A 1-2% SURFACE SLOPE SOILS SHALL BE MAINTAINED TO DIVERT STORMWATER OFF THE LANDFILL.
- LANDFILL CAPACITY AND CELL CONSTRUCTION SCHEDULE.** THE BASE SOIL LAYER SHALL BE CONSTRUCTED IN THREE CELLS. THE OPERATING LIFE FOR EACH INITIAL LIFT OVER A CELL AREA IS ESTIMATED AT 5 MONTHS/ACRE AS FOLLOWS:
 CELL 1 - 2.31 ACRES: 11 MONTHS
 CELL 2 - 4.50 ACRES: 23 MONTHS
 CELL 3 - 3.78 ACRES: 19 MONTHS
- COVER SOILS.** DUE TO THE NON-PUTRESCIBLE NATURE OF THE WASTE, THE WORKING LIFT SHALL BE TYPICALLY COVERED ON A WEEKLY BASIS. THE TOP PORTION OF THE LIFT SHALL RECEIVE A MINIMUM COVER OF SIX INCHES. AS SECTIONS OF THE PERIMETER SLOPES ARE COMPLETED, THE 24-INCH FINAL COVER VSL SHALL BE PLACED AND COMPACTED. THE TOTAL SOIL VOLUME REQUIRED FOR THE WESTSIDE C&D LANDFILL PROJECT IS APPROXIMATELY 165,000 CUBIC YARDS. BASED ON AN AVERAGE EXCAVATION DEPTH OF 5 FEET BELOW THE EXISTING LAND SURFACE FROM THE 50 ACRES AVAILABLE FROM THE TUCKER AND MOHESKY SITES, THE MINIMUM ESTIMATE OF REMAINING SOIL RESOURCES FOR THE OFF-SITE BORROW AREAS IS 400,000 CUBIC YARDS. THE ENGINEER SHALL SPECIFY SOIL PROPERTIES FOR SPECIFIC LANDFILL APPLICATIONS.
- FILL PROGRESSION.** LANDFILL OPERATIONS ARE DESIGNED TO FILL THE CELLS IN SEQUENTIAL ORDER, WITH A TOP-DOWN PROGRESSION. SURFACE DRAINAGE SHALL BE MAINTAINED FROM THE CENTER TOWARD THE PERIMETER SLOPES. TEMPORARY DOWNPIPES SHALL BE USED TO CONVEY SURFACE DRAINAGE TO CHANNELS.
- PERIMETER SLOPES.** EXCEPT FOR SOIL EMBANKMENTS, PERIMETER SLOPES SHALL BE CONSTRUCTED AT A MAXIMUM GRADE OF 4(h):1(v).
- INERT DEBRIS STORAGE (IDS) AREA.** INERT DEBRIS MAY BE STORED TEMPORARILY FOR FUTURE USE IN HAUL OR ACCESS ROAD BASE CONSTRUCTION. NO LAND CLEARING DEBRIS OR OTHER WASTES ARE ALLOWED IN THE IDS AREA.

LEGEND

- 24" CPP TYPE C-DOWNDRAIN
- WESTSIDE SITE BOUNDARY
- LANDFILL CELLS
C1+C2+C3=10.59 ACRES TOTAL
- EXISTING LANDFILL LIMITS
- 100-YEAR FLOODPLAIN
- NEUSE BUFFER
- SURFACE WATER
- WETLAND BOUNDARY
- P1 INTERMEDIATE GRADE 2-FT CONTOUR
- FINAL GRADE 2-FT CONTOUR
- 2003 TOPOGRAPHY 1-FT CONTOUR
- 1998 TOPOGRAPHY 2-FT CONTOUR
- DRAINAGE CHANNEL



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PROJECT:
 WESTSIDE C&D LANDFILL
 CONSTRUCTION PLAN PERMIT
 WILSON, NORTH CAROLINA

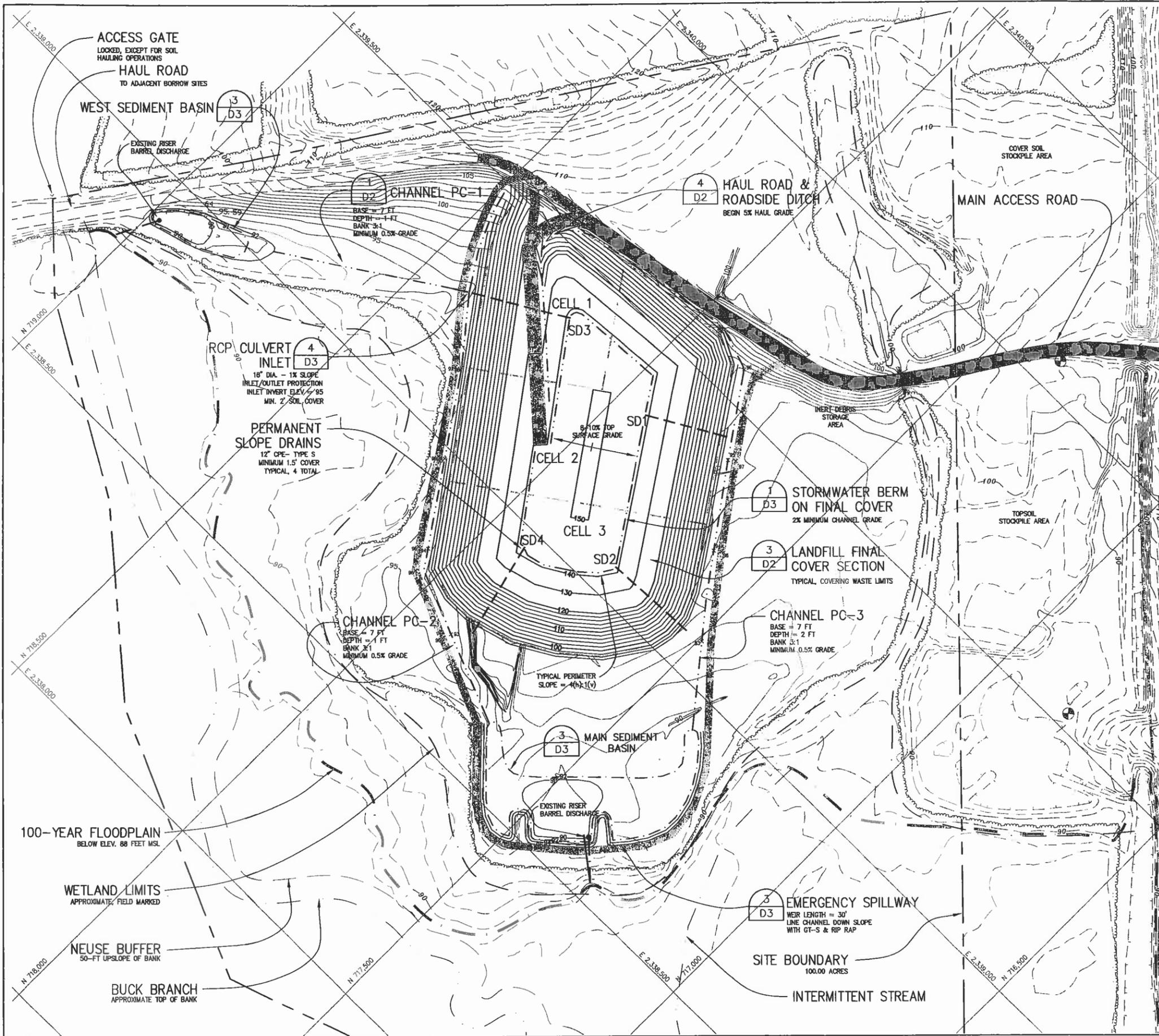
PREPARED FOR:
 WILSON COUNTY
 DEPARTMENT OF SOLID WASTE
 113 E. NASH STREET
 WILSON, NORTH CAROLINA 27894

NO.	DESCRIPTION	DATE
REVISIONS		

PHASE 1 OPERATION PLAN

SCALE: 1"=100'
 DATE: 9/01/04
 DRN. BY: GWA
 CHECKED BY: GWA
 PROJECT NO:

DRAWING NO. C2



CONSTRUCTION NOTES:

- PURPOSE.** THIS FACILITY PLAN FOR THE WESTSIDE CONSTRUCTION AND DEMOLITION LANDFILL FACILITY, OWNED BY WILSON COUNTY, NORTH CAROLINA, IS PREPARED FOR A PERMIT TO CONSTRUCT ISSUED BY THE NC DENR DIVISION OF WASTE MANAGEMENT IN ACCORDANCE WITH THE 15A NCAC 136.
- ACCESS CONTROL.** NATURAL TOPOGRAPHIC AND VEGETATIVE CONDITIONS AND CONTROL MEASURES LIMIT PUBLIC ACCESS TO THE SITE. WILSON COUNTY WILL MAINTAIN LOCATED GATES AT THE WEST AND MAIN ENTRANCES TO THE FACILITY.
- FINAL GRADE.** DESIGN GRADES PROVIDED ARE FOR TOP OF FINAL COVER. ANY ADJUSTMENTS TO INCREASE THE FINAL COVER THICKNESS WILL REQUIRE MODIFICATION TO INTERMEDIATE COVER GRADES TO ALLOW FOR FINAL COVER CONSTRUCTION.
- ALL CHANNELS** SHALL BE STABILIZED WITH EXCELSIOR CUREX 2 MATTING OR EQUIVALENT TO SECURE SEED AND ESTABLISH GRASSED CHANNEL. OUTLET PROTECTION SHALL BE CONSTRUCTED WITH D50 = 6-9 INCH RIP RAP, UNDERLAD WITH G1-S.
- CLOSURE AND POST CLOSURE.** WHEN OPERATIONS HAVE REACHED FINAL DESIGN GRADE, THE LANDFILL WILL BE COVERED WITH AT LEAST TWO FEET OF COMPACTED SOIL COVER. THE FINAL SOIL COVER WILL BE VEGETATED WITH NATIVE GRASSES ACCORDING TO THE SITE'S VEGETATION PLAN. INSPECTIONS WILL BE CONDUCTED PERIODICALLY TO OBSERVE THE INTEGRITY OF THE FINAL COVER. REPAIRS WILL BE MADE AS NECESSARY TO RESTORE THE VEGETATIVE SOIL COVER.

LEGEND

- 24" CPP TYPE C--DOWNDRAIN
- WESTSIDE SITE BOUNDARY
- LANDFILL CELLS
C1+C2+C3=10.59 ACRES TOTAL
- EXISTING LANDFILL LIMITS
- 100-YEAR FLOODPLAIN
- NEUSE BUFFER
- SURFACE WATER
- WETLAND BOUNDARY
- FINAL COVER GRADE 2-FT CONTOUR
- FINAL COVER GRADE 10-FT CONTOUR
- 2003 TOPOGRAPHY 1-FT CONTOUR
- 1998 TOPOGRAPHY 2-FT CONTOUR
- DRAINAGE CHANNEL



**PERMIT ISSUE
NOT FOR CONSTRUCTION**

GRAPHIC SCALE

(IN FEET)
1 inch = 100 ft.

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PROJECT:
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PREPARED FOR:
 WILSON COUNTY
 DEPARTMENT OF SOLID WASTE
 113 E. NASH STREET
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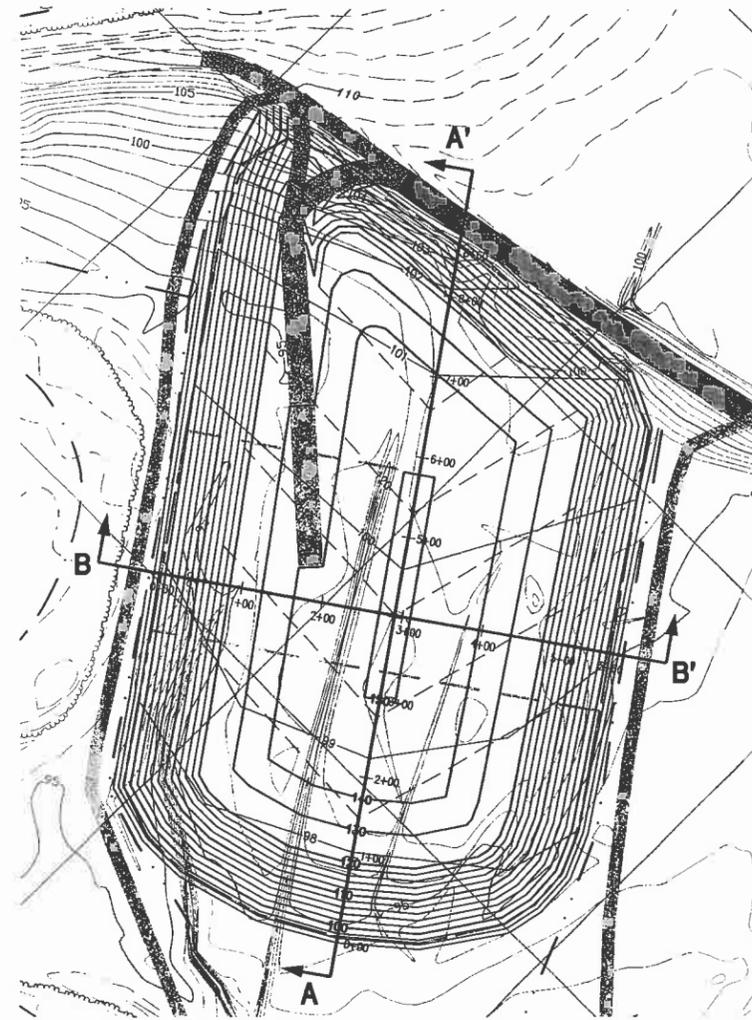
NO.	DESCRIPTION	DATE
REVISIONS		

FINAL COVER PLAN

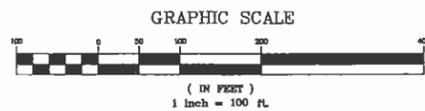
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 DATE: 9/01/04
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PROJECT NO:

DRAWING NO.
C3

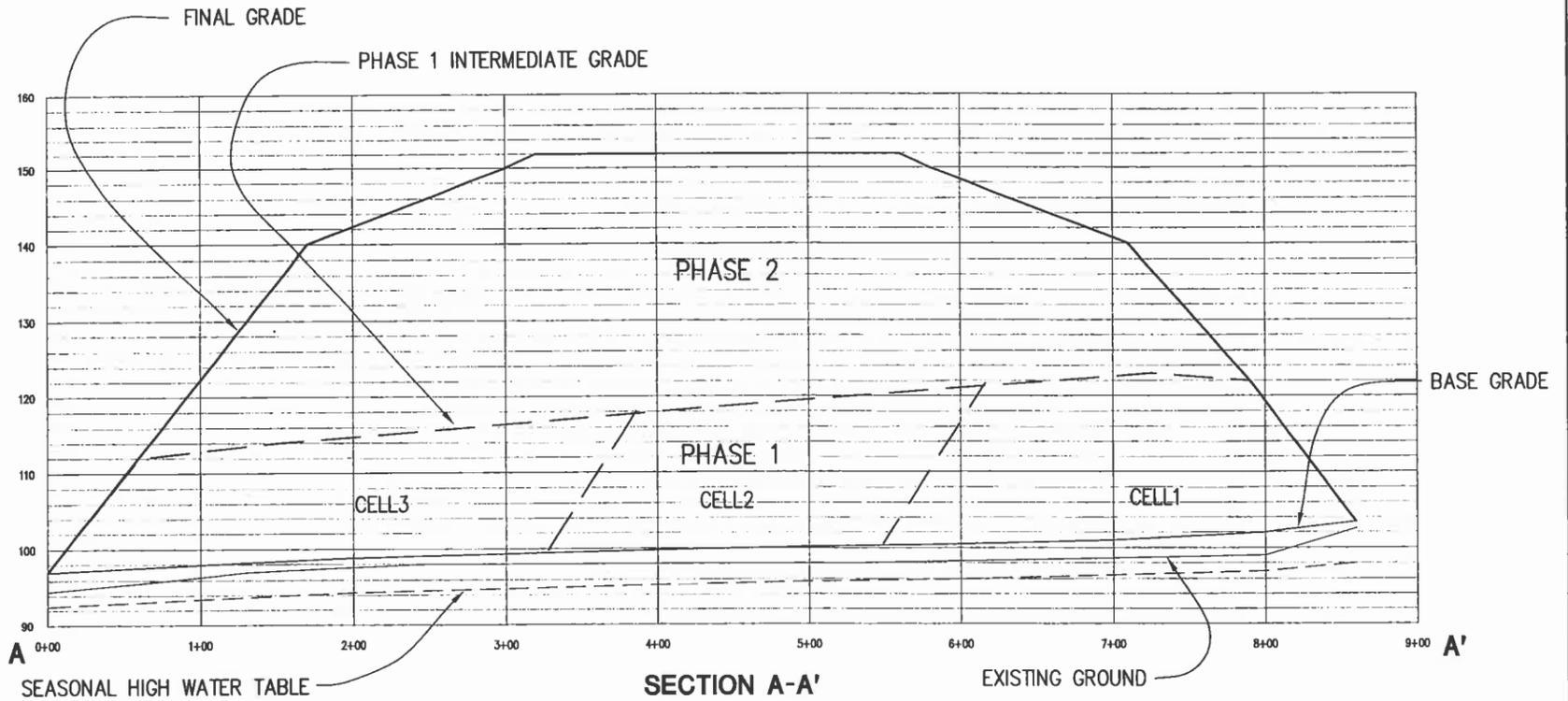


PLAN SECTION ALIGNMENT
SCALE 1" = 100'



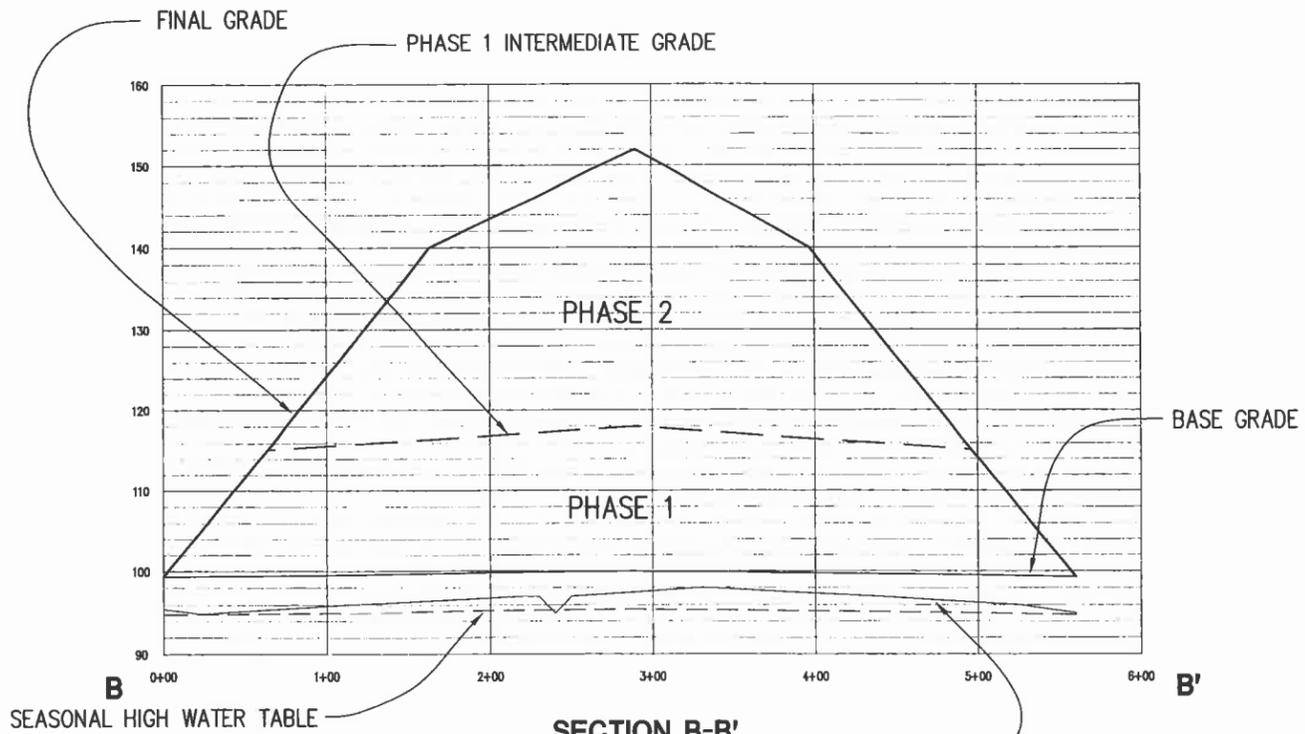
LEGEND

- LANDFILL FOOTPRINT
10.5 ACRES
- LANDFILL BASE GRADE 1-FT CONTOUR
- P1 INTERMEDIATE GRADE 2-FT CONTOUR
- FINAL GRADE 2-FT CONTOUR
- 2003 TOPOGRAPHY 1-FT CONTOUR
- 1998 TOPOGRAPHY 2-FT CONTOUR
- DRAINAGE CHANNEL



SECTION A-A'

HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 10'



SECTION B-B'

HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 10'

PERMIT ISSUE
NOT FOR CONSTRUCTION

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PROJECT:
WESTSIDE C&D LANDFILL
CONSTRUCTION PLAN PERMIT
WILSON, NORTH CAROLINA

PREPARED FOR:
WILSON COUNTY
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113 E. NASH STREET
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NO.	DESCRIPTION	DATE

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LANDFILL
CROSS
SECTIONS

SCALE: 1" = 100'
DATE: 9/01/04
DRN. BY: GWA
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PROJECT NO:

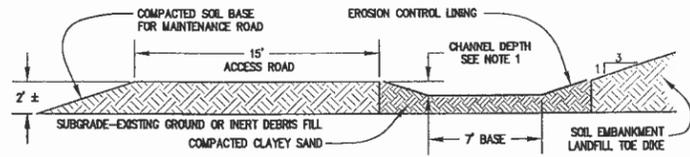
DRAWING NO.

D1

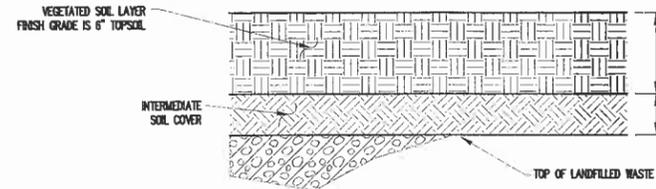
NOTES:

1. TYPICAL CHANNEL DEPTH IS 1 FOOT. PC-3 DEPTH IS 2 FEET. APPARENT DEPTH INCREASES WITHIN 300 FEET OF CHANNEL DISCHARGE TO THE MAIN BASIN DUE TO FIXED ELEVATION OF ACCESS ROAD AT 96.0.

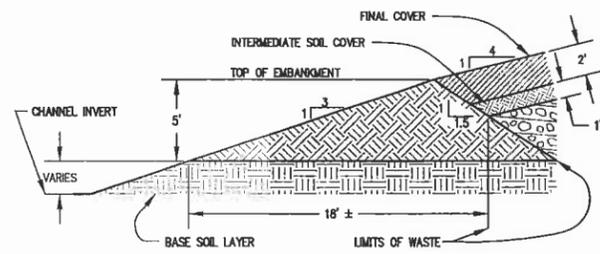
2. RECP LINING IS EXCELSIOR CURLEX 2 OR EQUIVALENT, INSTALLED ACCORDING TO MANUFACTURERS GUIDELINES.



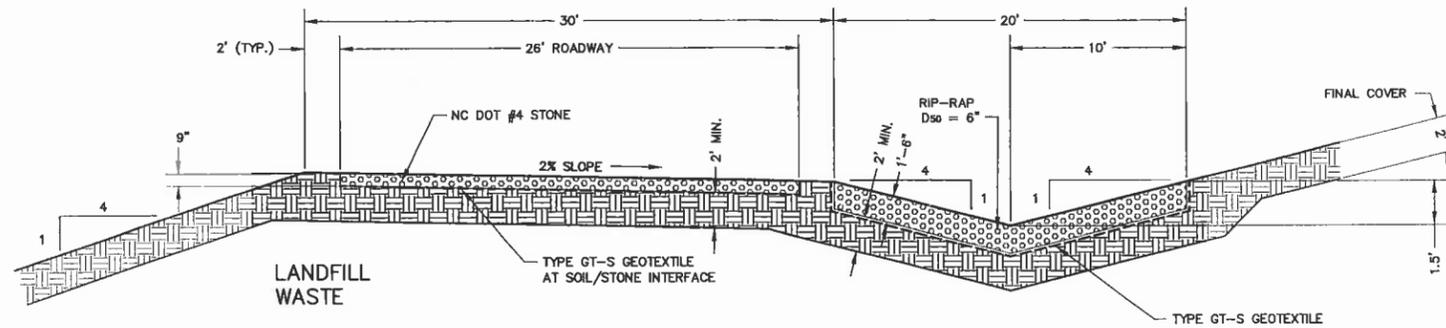
① - ACCESS ROAD & PERIMETER CHANNEL
SCALE: 1" = 5'



③ - TYPICAL LANDFILL FINAL COVER SECTION
SCALE: 1" = 2'-0"



② - LANDFILL PERIMETER TOE DIKE
SCALE: 1" = 5'



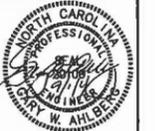
④ - HAUL ROAD AND ROADSIDE DITCH
NOT TO SCALE

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DETAILS

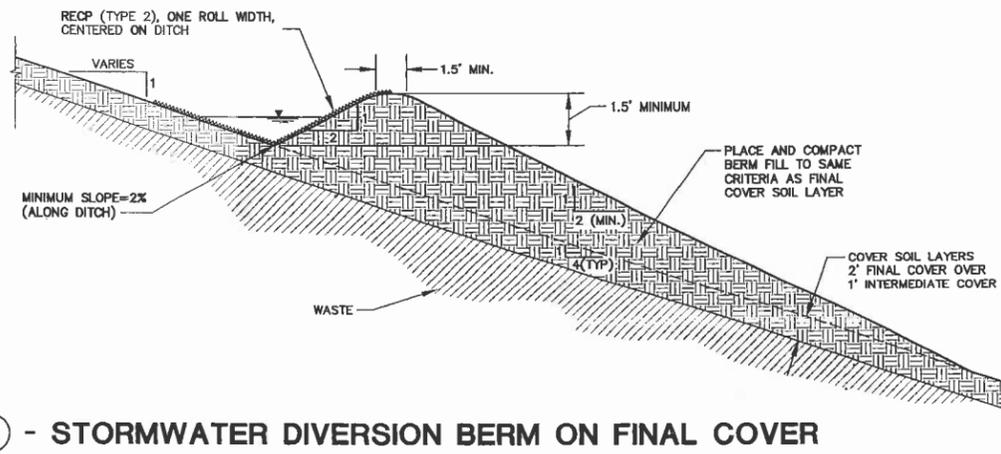
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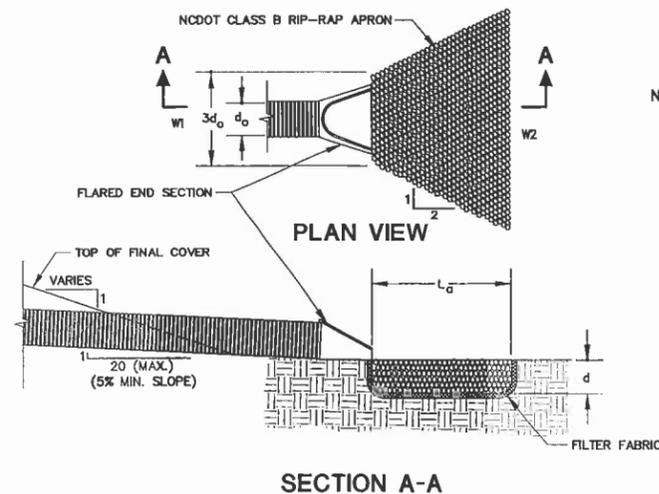
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D2

PERMIT ISSUE
NOT FOR CONSTRUCTION



1 - STORMWATER DIVERSION BERM ON FINAL COVER
NOT TO SCALE

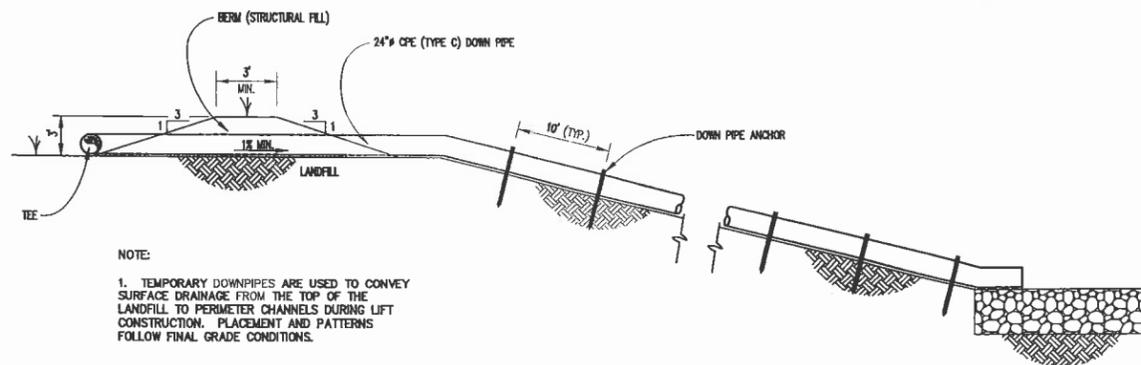


4 - SLOPE DRAIN/CULVERT OUTLET
NOT TO SCALE

NOTES:

1. L_d IS THE LENGTH OF THE RIP-RAP APRON (MIN. $4d_0$).
2. $d=1.5$ TIMES THE MAXIMUM SPECIFIED STONE DIAMETER (MIN. 12").
3. d_0 =PIPE DIAMETER.
4. IN A WELL-DEFINED CHANNEL, EXTEND THE APRON UP THE CHANNEL BANKS TO THE TOP OF THE BANK.
5. AN APPROVED FILTER FABRIC SHALL BE INSTALLED BETWEEN THE RIP-RAP AND SOIL FOUNDATION, WITH THE EDGES ANCHORED, PER MANUFACTURER'S GUIDELINES.
6. OUTLET PROTECTION SHALL CONFORM TO NC EROSION AND SEDIMENT CONTROL STANDARDS AND SPECIFICATIONS.

CULVERT DIAMETER	LENGTH	DEPTH	WIDTH 1	WIDTH 2
d_0	L_d	D	W1	W2
1	4	1.25	3	7
1.5	6	1.25	4.5	10.5



NOTE:

1. TEMPORARY DOWNPIPES ARE USED TO CONVEY SURFACE DRAINAGE FROM THE TOP OF THE LANDFILL TO PERIMETER CHANNELS DURING LIFT CONSTRUCTION. PLACEMENT AND PATTERNS FOLLOW FINAL GRADE CONDITIONS.

2 - TEMPORARY DOWNPIPE
NOT TO SCALE - TYPICAL

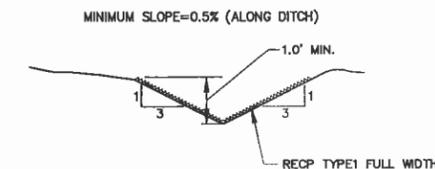
SEEDING REQUIREMENTS

1. SEEDBED PREPARATION. APPLY LIME AND FERTILIZER AT RATES LISTED IN (2) AND INCORPORATE INTO THE TOP 4-6 INCHES OF SOIL BY DISKING OR OTHER SUITABLE MEANS. HYDROSEEDING MAY BE USED FOR APPLICATION.
2. SOIL AMENDMENTS. THE FOLLOWING LIME AND FERTILIZER APPLICATION RATES ARE MINIMUM REQUIREMENTS. CONTRACTOR SHOULD TEST SOIL FOR DETERMINING SPECIFIC RATES.

AGRICULTURAL LIME 1.5 TONS/ACRE
5-10-10 FERTILIZER 0.5 TON/ACRE
3. SEED. LEGUME SEED SHALL BE INOCULATED WITH RHIZOBIUM BACTERIA. ALL SEED SHALL BE "CERTIFIED SEED". APPLY SEED UNIFORMLY AND MULCH WITH STRAW OR WOOD FIBER MULCH AT A RATE OF 1 TON/ACRE.
4. EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL, NC LAND QUALITY SECTION. INCLUDING HYDROSEEDING, ALL SEEDING APPLICATIONS SHALL BE CONSISTENT WITH THE REQUIREMENTS PROVIDED IN THE ESCPD MANUAL. UPON REQUEST, ENGINEER SHALL PROVIDE CONTRACTOR WITH SPECIFIC SECTIONS.

NOTES:

1. TC-2 IS INSTALLED AS A TEMPORARY DIVERSION ROUTING ALL CELL 1 RUNOFF TO THE WEST BASIN.



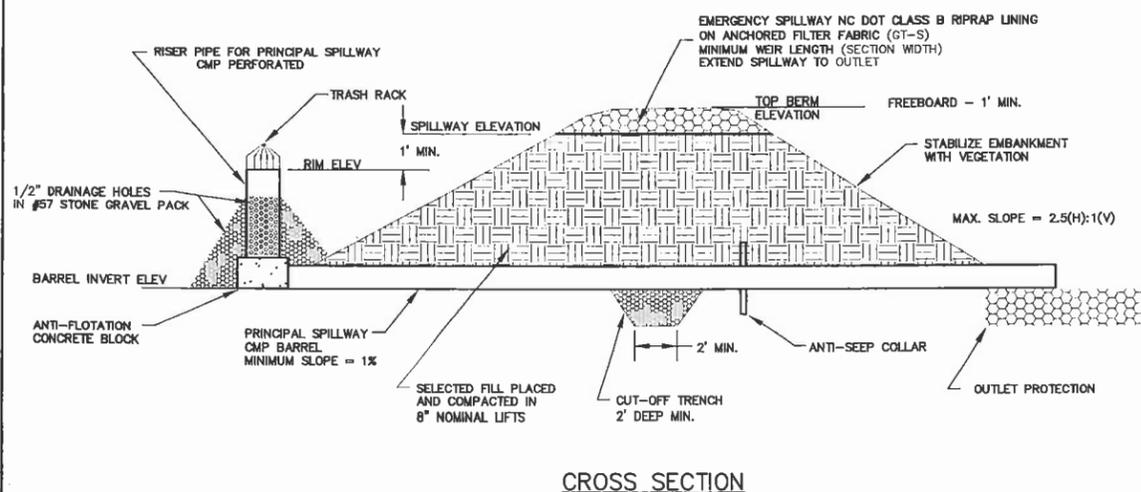
5 - V-DITCH TC-2
NOT TO SCALE

TABLE 1: SEDIMENT BASIN DATA

BASIN	MAIN	WEST
Q 10-YR	85	26
VOLUME (CF)	84,050	17,000
SURFACE AREA (SF)	57,800	12,000
RISER DIA.	36"	15"
RIM ELEVATION	92	91
BARREL DIA.	30"	12"
INVERT ELEV.	87	88
SPILLWAY ELEV.	94	92
TOP OF BERM	96	94
WEIR LENGTH	30'	20'

TABLE 2: SEEDING SCHEDULE

APPLICATION AREA	SEEDING MIX	RATE (lb/acre)	BEST DATES	POSSIBLE DATES
Gross Lined Channels	Tall Fescue	100	late Aug - Oct	Feb - mid April
	Millet	100	Mar - Aug	
Borrow Areas	Tall fescue	80	8/15 - 9/15 or 2/15 - 3/21	8/20 - 10/25 or 2/1 - 4/15
	Sericea lespedeza	25		
Landfill - temporary	Tall fescue	80	8/15 - 9/15 or 2/15 - 3/21	8/20 - 10/25 or 2/1 - 4/15
	Sericea lespedeza	25		
Landfill - final	Tall fescue	80	2/15 - 3/20 or 9/1 - 9/30	2/15 - 4/30 or 9/1 - 10/31
	Kobe lespedeza	40		



CROSS SECTION

3 - SEDIMENT BASIN
NOT TO SCALE

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PROJECT:
WESTSIDE C&D LANDFILL
CONSTRUCTION PLAN PERMIT
WILSON, NORTH CAROLINA

PREPARED FOR:
WILSON COUNTY
DEPARTMENT OF SOLID WASTE
113 E. NASH STREET
WILSON, NORTH CAROLINA 27894

NO. DESCRIPTION DATE

REVISIONS



DETAILS

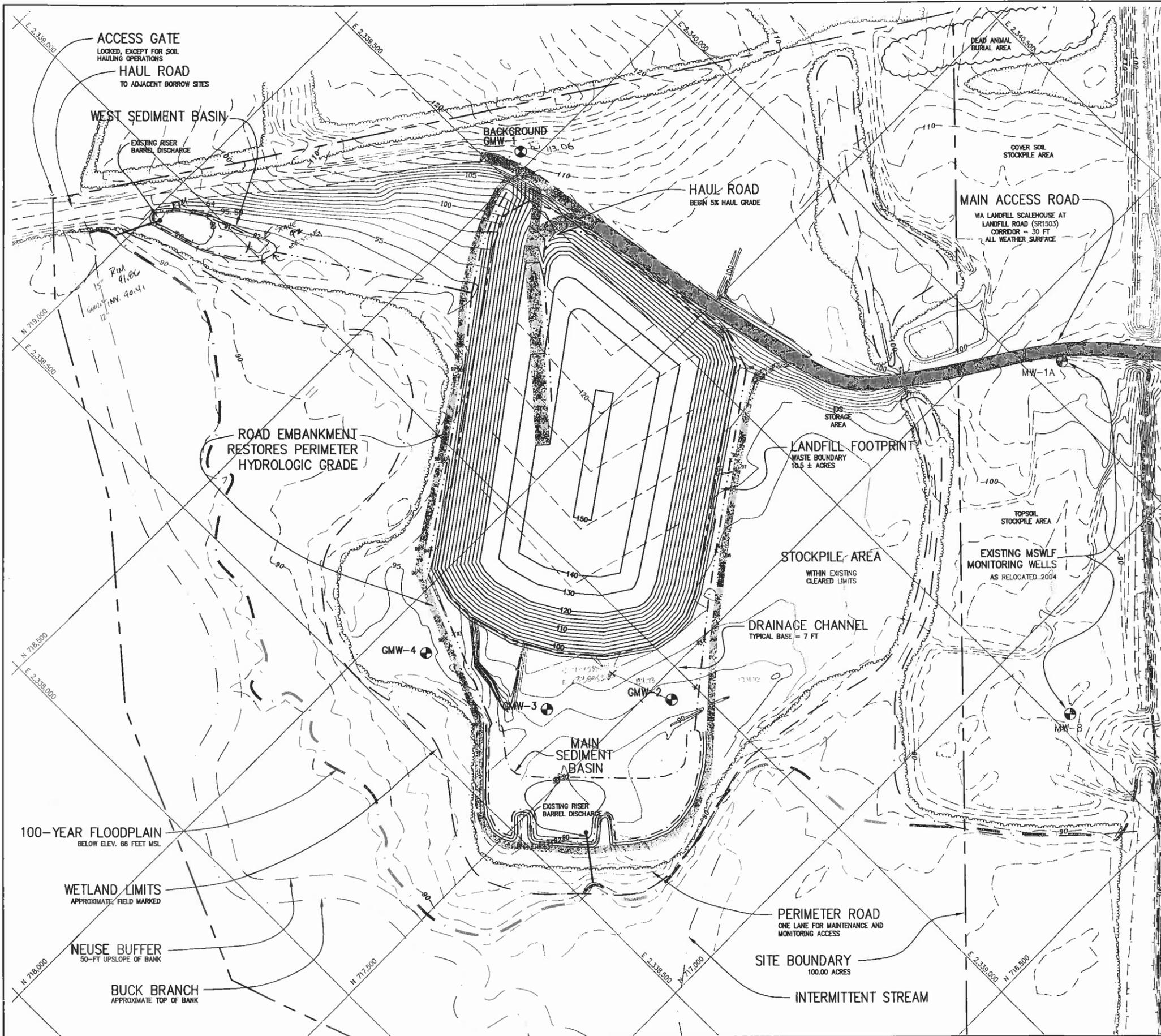
SCALE: AS SHOWN
DATE: 8/31/04
DRN. BY: GWA
CHECKED BY: GWA

PROJECT NO:

DRAWING NO.

PERMIT ISSUE
NOT FOR CONSTRUCTION

D3



CONSTRUCTION NOTES:

- PURPOSE:** THIS FACILITY PLAN FOR THE WESTSIDE CONSTRUCTION AND DEMOLITION LANDFILL FACILITY, OWNED BY WILSON COUNTY, NORTH CAROLINA, IS PREPARED FOR A PERMIT TO CONSTRUCT ISSUED BY THE NC DENR DIVISION OF WASTE MANAGEMENT IN ACCORDANCE WITH THE 15A NCAC 13B.
- FACILITY DESCRIPTION:** THE PROPOSED FACILITY PROPERTY IS 100.00 ACRES OWNED BY WILSON COUNTY. THE PROPOSED WASTE BOUNDARY IS 10.5 ACRES, AND IS DEFINED AS THE LANDFILL FOOTPRINT. IN ADDITION TO THE LANDFILL, THE PLAN ALSO DELINEATES SEDIMENT BASINS, ROADS, EARTHEN EMBANKMENTS, AND BUFFER ZONES. THE ESTIMATED FACILITY LIFE IS 10.8 YEARS.
- WASTE STREAM AND DISPOSAL RATE:** THE LANDFILL WILL RECEIVE CONSTRUCTION AND DEMOLITION WASTE GENERATED WITHIN WILSON COUNTY, NORTH CAROLINA. OTHER WASTE TYPES APPROVED BY THE DIVISION FOR DISPOSAL; SEE PERMIT CONDITIONS OR AGENCY CORRESPONDENCE FOR SPECIFIC APPROVED WASTE TYPES, INCLUDING SPLIT TIRES AND TOBACCO DUST. THE ESTIMATED AVERAGE ANNUAL DISPOSAL RATES IS 20,000 TONS/YEAR.
- ACCESS CONTROL:** NATURAL TOPOGRAPHIC AND VEGETATIVE CONDITIONS AND CONTROL MEASURES LIMIT PUBLIC ACCESS TO THE SITE. WILSON COUNTY WILL MAINTAIN THE GATED ENTRANCE TO THE EXISTING MSW FACILITY. ACCESS TO THE WESTSIDE SITE WILL BE CONTROLLED VIA THE EXISTING MANNED SCALEHOUSE DURING OPERATING HOURS.
- LOCAL GOVERNMENT APPROVAL:** THE PROPOSED LAND USE HAS BEEN APPROVED BY THE CITY OF WILSON AND WILSON COUNTY, ESTABLISHING PRIOR APPROVAL FOR THE DIVISION'S LANDFILL PERMIT.
- HYDROLOGIC GRADE RESTORATION:** APPROXIMATELY 1000 LINEAR FEET OF SOIL EMBANKMENT FILL WILL BE PLACED TO RESTORE HYDROLOGIC CONDITIONS AND ESTABLISH STORMWATER CONTROL FOR THE LANDFILL CONSTRUCTION LIMITS. THE MINIMUM PEAK ELEVATION FOR THE EMBANKMENT FILL IS 94 MSL.
- BASE GRADE:** AN AVERAGE 2-FOOT LAYER OF COMPACTED SOIL WILL BE ADDED TO THE EXISTING GRADE WITHIN THE FOOTPRINT. UNDER THE INITIAL 5-YEAR PERMIT TO CONSTRUCT, THE COMPACTED SOIL LAYER WILL BE CONSTRUCTED IN THREE TO FOUR LIFTS WITH SOILS APPROVED BY THE ENGINEER. AT AN AVERAGE LAYER THICKNESS OF 3.0 FEET, THE REQUIRED SOIL VOLUME FOR BASE CONSTRUCTION IS APPROXIMATELY 50,000 CUBIC YARDS. SEE ENGINEERING PLAN AND BASE GRADE PLAN DRAWING C1 FOR REQUIREMENTS.
- LANDFILL OPERATIONAL GRADE:** THE LANDFILL WILL BE OPERATED IN 5 TO 10-FOOT LIFTS, PROGRESSING EVENLY ACROSS THE FOOTPRINT. AT THE INTERMEDIATE HEIGHT OF 10 FEET ABOVE BASE GRADE, THE ENTIRE 10.5 ACRE FOOTPRINT PROVIDES APPROXIMATELY 4 YEARS OF CAPACITY. SOILS FOR COVER CONSTRUCTION ARE AVAILABLE FROM THE DEDICATED BORROW SITES ADJACENT TO THE SITE AND OWNED BY WILSON COUNTY.
- LANDFILL CAPACITY AND PROJECT LIFE:** THE FINAL GRADING PLAN FOR THE LANDFILL'S CONCEPTUAL DESIGN PROVIDES 433,560 CUBIC YARDS OF AIRSPACE FOR LANDFILL OPERATION AND FINAL COVER CONSTRUCTION. USING AN IN-PACE DENSITY OF 0.86 TONS/CUBIC YARD AND A 1:8 SOIL TO WASTE RATIO (1:167), THE AVERAGE DISPOSAL RATE OF 20,000 TONS/YEAR YIELDS A PROJECT LIFE = 10.8 YEARS.
- COVER SOILS:** DUE TO THE NON-PUTRESCIBLE NATURE OF THE WASTE, THE WORKING LIFT SHALL BE TYPICALLY COVERED ON A WEEKLY BASIS. THE TOP PORTION OF THE LIFT SHALL RECEIVE A MINIMUM COVER OF SIX INCHES. AS SECTIONS OF THE PERIMETER SLOPES ARE COMPLETED, THE 24-INCH FINAL COVER VSL SHALL BE PLACED AND COMPACTED. THE TOTAL SOIL VOLUME REQUIRED FOR THE WESTSIDE C&D LANDFILL PROJECT IS APPROXIMATELY 165,000 CUBIC YARDS. BASED ON AN AVERAGE EXCAVATION DEPTH OF 5 FEET BELOW THE EXISTING LAND SURFACE FROM THE 50 ACRES AVAILABLE FROM THE TUCKER AND MOHESKY SITES, THE MINIMUM ESTIMATE OF REMAINING SOIL RESOURCES FOR THE OFF-SITE BORROW AREAS IS 400,000 CUBIC YARDS. THE ENGINEER SHALL SPECIFY SOIL PROPERTIES FOR SPECIFIC LANDFILL APPLICATIONS.
- WATER QUALITY MONITORING PLAN:** THE DETECTION MONITORING NETWORK INCLUDES FOUR GROUNDWATER MONITORING WELLS. OVERALL, ONE UPGRADIENT AND THREE DOWNGRADIENT LOCATIONS PROVIDE A MONITORING WELL DENSITY OF 1 DETECTION STATION PER 3.5 ACRES OF LANDFILL AREA. DOWNGRADIENT WELL INSTALLATIONS ARE SPACED EQUALLY ACROSS A 125-FOOT OFFSET (REVIEW BOUNDARY) TO THE LANDFILL FOOTPRINT. COMPLETION INTERVALS SHALL BE WITHIN THE UPPERMOST 10-15 FEET OF THE SEASONAL HIGH WATER TABLE AND SHALL TARGET THE TAN AND ORANGE SAND UNITS IN THE CHARACTERIZED STRATIGRAPHY. GROUND SURFACE ELEVATIONS LEADING TO (HW DRIVE PATH) AND SURROUNDING THE WELLS SHALL BE AT LEAST 93 FEET MSL.
- CLOSURE AND POST CLOSURE:** WHEN OPERATIONS HAVE REACHED FINAL DESIGN GRADE, THE LANDFILL WILL BE COVERED WITH AT LEAST TWO FEET OF COMPACTED SOIL COVER. THE FINAL SOIL COVER WILL BE VEGETATED WITH NATIVE GRASSES ACCORDING TO THE SITE'S VEGETATION PLAN. INSPECTIONS WILL BE CONDUCTED PERIODICALLY TO OBSERVE THE INTEGRITY OF THE FINAL COVER. REPAIRS WILL BE MADE AS NECESSARY TO RESTORE THE VEGETATIVE SOIL COVER.

LEGEND

- WESTSIDE SITE BOUNDARY
- LANDFILL FOOTPRINT
10.5 ACRES
- EXISTING LANDFILL LIMITS
- 100-YEAR FLOODPLAIN
- NEUSE BUFFER
- SURFACE WATER
- WETLAND BOUNDARY
- P1 INTERMEDIATE GRADE 2-FT CONTOUR
- FINAL GRADE 2-FT CONTOUR
- 2003 TOPOGRAPHY 1-FT CONTOUR
- 1998 TOPOGRAPHY 2-FT CONTOUR
- DRAINAGE CHANNEL
- ⊕ GMW-4 GROUNDWATER MONITORING WELL

**PERMIT ISSUE
NOT FOR CONSTRUCTION**

GRAPHIC SCALE
1 inch = 100 ft

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PROJECT: WESTSIDE C&D LANDFILL CONSTRUCTION PLAN PERMIT WILSON, NORTH CAROLINA

PREPARED FOR: WILSON COUNTY DEPARTMENT OF SOLID WASTE
 113 E. NASH STREET
 WILSON, NORTH CAROLINA 27894

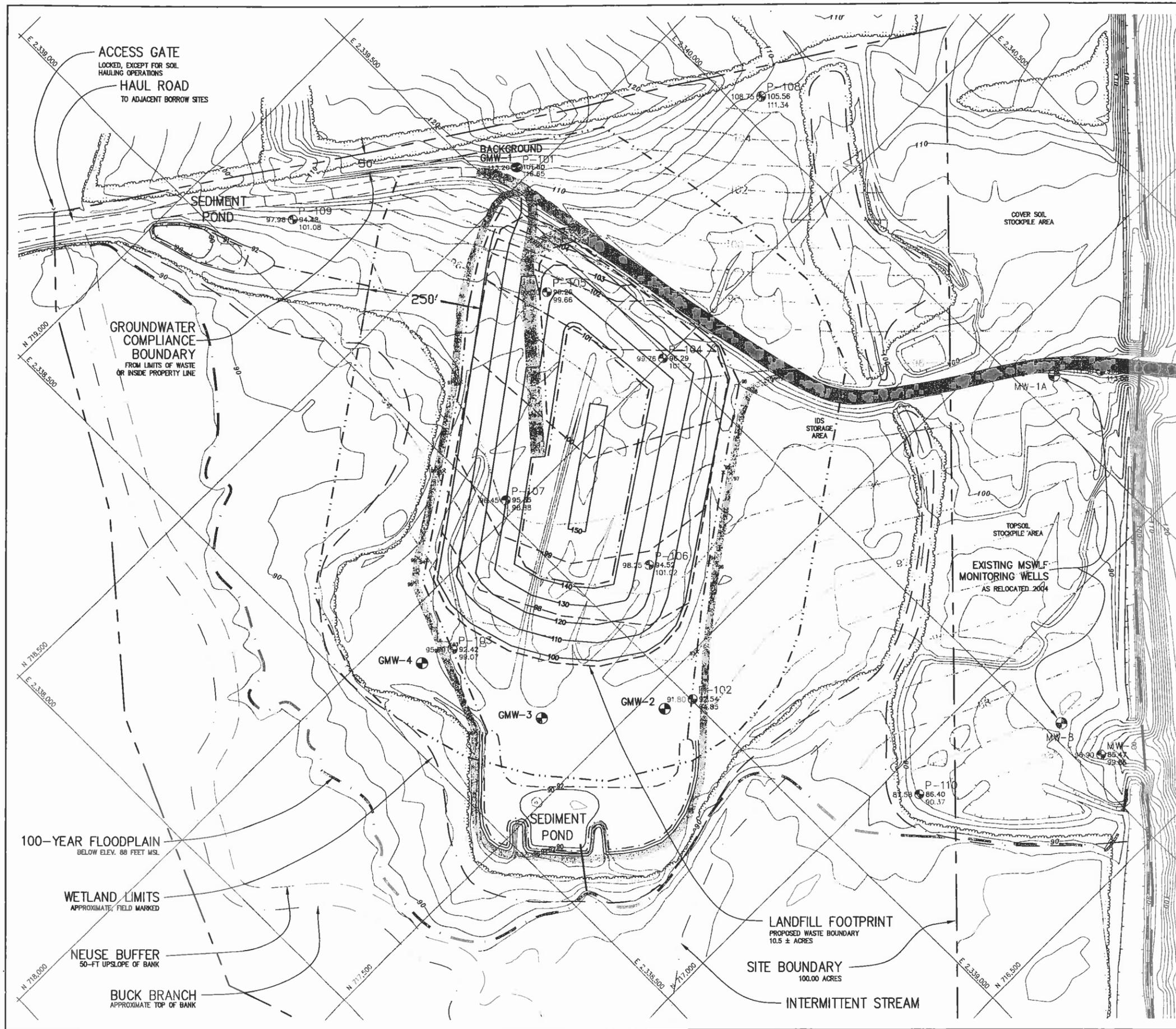
NO.	DESCRIPTION	DATE
REVISIONS		

WESTSIDE FACILITY PLAN

SCALE: 1"=100'
 DATE: 9/01/04
 DRN. BY: GWA
 CHECKED BY: GWA

PROJECT NO:

DRAWING NO. **F1**



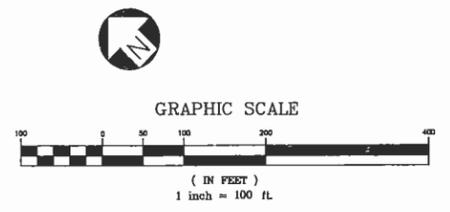
NOTES:

- PURPOSE.** THIS DETECTION MONITORING PLAN IS PROPOSED FOR THE WESTSIDE CONSTRUCTION AND DEMOLITION LANDFILL FACILITY, OWNED BY WILSON COUNTY, NORTH CAROLINA, PREPARED FOR APPROVAL BY THE NC DENR DIVISION OF WASTE MANAGEMENT IN ACCORDANCE WITH THE 15A NCAC 13B. THE PLAN WAS PREPARED UNDER THE SUPERVISION OF MR. GARY D. BABB, PG.
- TOPOGRAPHIC FEATURES.** SITE TOPOGRAPHY IS FROM AERIAL PHOTOGRAMMETRIC MAPPING PERFORMED BY GEODATA CORP., ZEBULON, NC. MAPPED CONDITIONS FROM MARCH 1998 ARE GENERALLY REPRESENTATIVE OF EXISTING CONDITIONS (JULY 2003). REFERENCE DRAWING SC1 FOR STREAM, WETLAND, FLOODPLAIN, AND OTHER SOURCES.
- WESTSIDE C&D LANDFILL SITE.** THE 100.00 ACRE SITE PROPERTY BOUNDARY ILLUSTRATED ON THIS DRAWING IS REPRESENTATIVE OF THE "RECOMBINATION PLAN FOR THE WESTSIDE C&D LANDFILL SITE" PREPARED BY HERRING-SUTTON & ASSOCIATES, P.C. (WILSON, NORTH CAROLINA), APRIL 2003.
- MONITORING NETWORK.** EXISTING WELL P-101 SHALL BE DESIGNATED AS THE UPGRADIENT BACKGROUND WELL GMW-1. THREE NEW WELLS WILL BE INSTALLED IN THE UPPER 15-20 FEET OF THE IN-SITU SOIL. DOWNGRADIENT WELL INSTALLATIONS ARE SPACED EQUALLY ACROSS A 125-FOOT OFFSET (REVIEW BOUNDARY) TO THE LANDFILL FOOTPRINT. GROUND SURFACE ELEVATIONS LEADING TO (4W DRIVE PATH) AND SURROUNDING THE WELLS SHALL BE AT LEAST 93 FEET MSL.
- PIEZOMETER ABANDONMENT.** ALL PIEZOMETERS SHALL BE ABANDONED ACCORDING TO 15A NCAC 2C, WITH ASSOCIATED DOCUMENTATION.
- SURVEY DATA.** NORTH CAROLINA REGISTERED LAND SURVEYORS, HERRING-SUTTON & ASSOCIATES, WILSON, NORTH CAROLINA, SHALL SURVEY THE LOCATION AND ELEVATION POSITIONS OF EACH WELL AFTER INSTALLATION.
- MONITORING SYSTEM DESIGN.** THE LANDFILL BASE DESIGN INCLUDES CONSTRUCTION OF A COMPACTED SOIL LAYER THAT WILL PROVIDE FOR VERTICAL SEPARATION FROM THE SEASONAL HIGH WATER TABLE AND CONTROL INFILTRATION FROM THE LANDFILL BASE. DEEPER IN THE SURFICIAL AQUIFER, THE PRESENCE OF LOW-PERMEABILITY CLAYS DEPOSITED IN HORIZONTAL LENSES SIGNIFICANTLY LIMITS VERTICAL GROUNDWATER FLOW POTENTIAL. MOST IMPORTANTLY, THE PREFERENTIAL LATERAL GROUNDWATER FLOW IN THE UNCONFINED SURFICIAL AQUIFER SANDS TOWARD A GROUNDWATER DISCHARGE ZONE PRESENTS HYDROGEOLOGIC CONDITIONS THAT CAN BE EFFECTIVELY MONITORED WITH SHALLOW GROUNDWATER MONITORING WELLS. DUE TO THE EXTENT OF WETLANDS AND DENSE VEGETATION SURROUNDING BUCK BRANCH, SURFACE WATER MONITORING IS NOT A NECESSARY COMPONENT OF THE SITE'S DETECTION MONITORING SYSTEM.
- DETECTION INTERVAL IN THE SURFICIAL AQUIFER.** COMPLETION INTERVALS SHALL BE WITHIN THE UPPERMOST 10-15 FEET OF THE SEASONAL HIGH WATER TABLE AND SHALL TARGET THE TAN AND ORANGE SAND UNITS IN THE CHARACTERIZED STRATIGRAPHY.

LEGEND

- GMW-2 MONITORING WELL**
DETECTION MONITORING STATION
- POTENTIOMETRIC CONTOUR**
1-FOOT CONTOUR INTERVAL, 19 NOV 02
- BASE CONTOUR 1-FOOT**
1-FOOT CONTOUR INTERVAL, 19 NOV 02
- WESTSIDE SITE BOUNDARY**
- LANDFILL FOOTPRINT**
PROPOSED 10.5 ACRES
- EXISTING LANDFILL LIMITS**
OFFSITE MSWLF UNIT
- 100-YEAR FLOODPLAIN**
- NEUSE BUFFER**
- SURFACE WATER**
- WETLAND BOUNDARY**
- CONTOUR 2-FOOT** MAR98 MAPPING
- CONTOUR 10-FOOT** MAR98 MAPPING
- GROUND ELEVATION**
- WELL COORDINATES ON CENTER**
- BORING/PIEZO ID**
- WATER ELEVATION AT INSTALLATION 11/19/02**
- TOP OF CASING SURVEYED ELEVATION**

PERMIT ISSUE
NOT FOR CONSTRUCTION



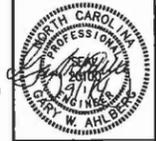
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PROJECT:
WESTSIDE C&D LANDFILL
CONSTRUCTION PLAN APPLICATION
WILSON, NORTH CAROLINA

PREPARED FOR:
WILSON COUNTY
DEPARTMENT OF SOLID WASTE
113 E. NASH STREET
WILSON, NORTH CAROLINA 27894

NO.	DESCRIPTION	DATE
REVISIONS		



GROUNDWATER MONITORING PLAN

SCALE: 1"=100'
DATE: 08/01/04
DRN. BY: GWA
CHECKED BY: GDB

PROJECT NO:

DRAWING NO.

M1

ATTACHMENT H

WATER QUALITY MONITORING PLAN

No changes to the Water Quality Monitoring Plan approved as part of the 2004 Construction Plan Application are proposed. Attached is a copy of the approved plan.

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6.0 WATER QUALITY MONITORING PLAN

This Water Quality Monitoring Plan (WQMP) is designed to address regulatory requirements as set forth in the Rules and to establish the compliance boundary for groundwater quality for the Westside C&D facility. The monitoring plan considers information and data gathered from previous and current studies of the Westside Site, adjacent MSWLF and Tucker Borrow Site and the Wilson County vicinity. Items that are addressed in this WQMP are:

- o Regional Geology
- o Existing Site Conditions
- o Monitoring System Design
- o Sampling and Analysis Procedures

Prepared under the supervision of Mr. Gary D. Babb, P.G., the final WQMP is presented in this Section. Based on the data and information provided, the monitoring system has been designed to provide early detection of any release of hazardous constituents to the uppermost aquifer, so as to be protective of the public health and the environment. Design of the monitoring system considers regional geology, data and conclusions from geologic and hydrogeologic investigations of the Westside Site and adjacent properties owned by Wilson County, characteristics of the waste, and the applicable state and federal rules and guidelines published for monitoring of RCRA Subtitle D facilities.

6.1 Regional Geology and Groundwater Use

6.1.1 Regional Geology

The Westside C&D facility is located in the western portion of the Carolina Coastal Plain near the Fall Line. The Fall Line is the province boundary between the Piedmont and the Coastal Plain provinces. It represents a significant change in lithology which in turn reflects a change in stream gradients. Lithology in the Piedmont province is primarily igneous and metamorphic while the Coast Plain province is primarily sedimentary. In general, rivers and streams in the Piedmont Province have higher flow rates with well defined channels while Coastal Plain rivers and streams are meandering with lesser defined channels resulting in swamps and bays. These streams, swamps, and bays are the major discharge point of the uppermost aquifer. Downgradient from the CDLF footprint, Toisnot Swamp and Buck Branch are regional streams that form the property boundary for the Westside site and adjoining Wilson County properties (Mohesky Farm and MSWLF).

The Carolina Coastal Plain is underlain by flat-lying to very gently eastward dipping sedimentary strata which overlay a foundation of crystalline rocks. These sediments were deposited during repeated marine transgressive and regressive cycles due to fluctuations in sea level caused by expansion and recession of glacial ice caps during the Pliocene and early Pleistocene epochs (approximately 2 to 5 million years ago).

Sediments in the area of the Westside C&D facility are classified as being in the Yorktown Formation. Information gathered from the 1985 edition of the Geologic Map of North Carolina and The Geology of the Carolina, published in 1991, sites that sediments of the Yorktown Formation are fossiliferous clay with varying amounts of fine-grained sand, silty sand, sandy silt, silty clay, and bluish gray shell material. These types of deposits are found mainly north of the Neuse River and

are commonly concentrated in lenses and vary in vertical and horizontal dimensions. The topography of the Coastal Plain is characterized by flat to gently undulating relief.

6.1.2 Original Site Conditions

The Westside Site is a depleted borrow site for the Wilson County Landfill. The borrow site operation was completed in the mid 1990's. Prior to excavation the upland portion of the site was agricultural land, bounded by woodlands which still incorporate wetlands adjacent to Buck Branch and the intermittent stream present on-site.

6.1.3 Groundwater Use

The primary use of groundwater in the Coastal Plain region is for agricultural operations and for residential water supply. Expansion of city water and sewer systems will eventually make agriculture operations the primary user of groundwater in this region. Ms. Georgia Boulo, with the Wilson County Environmental Health Department, stated that presently, groundwater usage is 50 percent agriculture and 50 percent residential. She also stated that once planned expansion of the Wilson water and sewer system is complete, residential groundwater usage will likely decrease to approximately 5 percent and agriculture usage will increase to approximately 95 percent. Currently, the City of Wilson is capable of providing water services to residents in the landfill area through a 12 inch water line along SR 1503 - Landfill Road.

6.2 Existing Site Hydrogeological Conditions

The geologic and hydrogeologic investigations for the Westside CDLF were implemented in three phases to progressively define existing site conditions relevant to site suitability, and monitoring and engineering design. All data and evaluation of the hydrogeologic conditions are presented in the Site Plan

documents and Addendum No. 1. A summary of the investigations is provided in this section relative to monitoring system design.

As shown in the USGS topographic map for the area, the major groundwater recharge feature for the Westside C&D facility is a topographic high (130± feet mean sea level) located approximately 4,000 feet northeast of the facility. The major groundwater discharge features influencing groundwater flow direction on the site are the Toisnot Swamp and Buck Branch. The existing MSWLF facility is generally located to the east of the proposed CDLF footprint and is separated by a deep drainage canal that intercepts the uppermost aquifer.

In general, the site geology conforms to the regional Coastal Plain characteristics. The depositional environment is influenced by Buck Branch and Toisnot Swamp, where fluvial sediments are mixed with marine sediments in an estuarine setting. Where these streams once flowed into the Atlantic Ocean, a much broader river was likely present. Swift currents during flood conditions may have deposited lenticular beds of sand and other sediments. Incoming tidal currents rework the stream sediments, creating alternating layers of continental and marine sediments.

On the Westside Site, all groundwater level measurements and the modeled potentiometric surfaces through the course of investigation indicate that the general groundwater flow direction from the CDLF footprint to the southwest towards Toisnot Swamp. Based on the analysis of site stratigraphy and comparing aquifer testing results with laboratory clay unit permeability testing, it is clear that the potential for groundwater flow is highest through the water bearing sand layers in the uppermost 15 feet of the aquifer. The marine clays present a confining or semi-confining layer limiting potential vertical groundwater flow. Furthermore, the elevation of the wetlands adjacent to Buck Branch relative to the mapped potentiometric surface indicates an area of extensive groundwater discharge surrounding the stream.

As determined from the soil boring logs, the site stratigraphy is best illustrated in hydrogeologic profiles C and D, presented in Figure 4 of the Site Plan. The local stratigraphy is characterized by relatively thin layers of continental and marine silt, sand, and clay in varying textures and colors. Figure 4 illustrates the uniformities and unconformities associated with the depositional environment. Typically, the color of fluvial sediments are tan, brown, light grey or orange. With the unconformities expected in the depositional environment, the typical profile includes a lean clay overlying poorly graded sands, interbedded with thin clay and clayey sand lenses. The water bearing zone is present in coarse and well graded sand layers, typically beneath surficial clay. Below the fluvial sediments, a marine clay layer is consistently encountered. This marine clay unit is typically dark grey, fat, and laminated with microlenses of fine sand. Below the marine clay, a dark greenish grey silty clayey sand with shell fragments overlies the residual, fully weathered bedrock. As evidence of the site's proximity to the regional fall line, bedrock was encountered approximately 30-35 feet below the disturbed land surface, at an elevation of 60 to 64 feet mean sea level. Dip of the marine sediments mirror the southwest groundwater flow direction.

6.3 Monitoring System Design

Design of the monitoring system for the Westside Site considers the site an regional hydrogeologic conditions with the base design for the landfill unit. The site's adjacent, upgradient position to major stream features in the area (Buck Branch and Toisnot Swamp) provide relative hydrogeologic isolation in a groundwater discharge area. The landfill base design includes construction of a compacted soil layer that will provide for vertical separation from the seasonal high water table and control infiltration from the landfill base. Deeper in the surficial aquifer, the presence of low-permeability clays deposited in horizontal lenses significantly limits vertical groundwater flow potential. Most importantly, the

preferential lateral groundwater flow in the unconfined surficial aquifer sands toward a groundwater discharge zone presents hydrogeologic conditions that can be effectively monitored with shallow groundwater monitoring wells. Due to the extent of wetlands and dense vegetation surrounding Buck Branch, surface water monitoring is not a necessary component of the site's detection monitoring system.

6.3.1 Groundwater Monitoring System

Proposed monitoring well locations are shown on Drawing M1, Groundwater Monitoring Plan. Based on the geology and hydrogeology Section *and* the criteria for establishing the relevant point of compliance, the following detection monitoring stations are recommended for the WQMP.

The Westside WQMP will include a total of four groundwater monitoring wells to establish the relevant point of compliance. The following is a discussion of existing monitor well status, field conditions, and proposed location of the groundwater monitoring system for the proposed Westside C&D facility. The detection monitoring system utilizes one existing well (P-101) and requires installation of three additional downgradient wells. Overall, one upgradient and three downgradient locations provide a monitoring well density of 1 detection station per 3.5 Acres of landfill area. Downgradient well installations are spaced equally across a 125-foot offset (review boundary) to the landfill footprint. Completion intervals shall be within the uppermost 10-15 feet of the seasonal high water table and shall target the tan and orange sand units in the characterized stratigraphy. Ground surface elevations leading to (4W drive path) and surrounding the wells shall be at least 93 feet msl.

TABLE 6-1
PROPOSED MONITORING WELL NETWORK

WELL ID	TD	TOS	BOS	COMMENT	WELL TYPE	MONITORING SCHEDULE
GMW-1	17	7	17	UPGRADIENT	2	SEMI-ANNUAL
GMW-2	15-20	5	15-20	SOIL	2	SEMI-ANNUAL
GMW-3	15-20	5	15-20	SOIL	2	SEMI-ANNUAL
GMW-4	15-20	5	15-20	SOIL	2	SEMI-ANNUAL

Note:

All wells shall be constructed in accordance with 15A NCAC 2C .0108. All new and existing wells were surveyed to a known datum to provide groundwater elevations to determine flow characteristics. Ground surface and top of casing elevations were also surveyed to provide information for potentiometric maps of the uppermost aquifer at the facility. Accuracy requirements for the survey are ± 0.01 ft for elevation, and ± 0.1 ft for horizontal location.

In accordance with 15A NCAC 2C .0108, the wells will be constructed of schedule 40 PVC and installed with wash drilling methods (sands) in accordance with standard monitoring well installation procedures by a NC licensed driller. Split spoon samples will be collected at a minimum of five-foot intervals to document lithology; more frequent sampling may be directed during installation.

6.3.2 Piezometer Abandonment

All existing piezometers within the landfill footprint and as directed by the engineer shall be abandoned in accordance with 15A NCAC 2C. Abandonment may utilize either bentonite or cement grout, or a combination of the two materials.

Abandonment shall be documented with standard documentation and included in the pre-operative submittal.

6.3.3 Background Sampling

Prior to beginning landfill operations, one set of background samples shall be collected for the monitoring network. These baseline results will be submitted to the agency according to the plan reporting procedures. Following background sampling, routine detection monitoring

6.4 Sampling and Analysis Procedures

6.4.1 Sampling Equipment and Containers

Disposable Teflon bailers will be utilized for groundwater sample collection. Samplers will wear clean disposable vinyl or latex gloves during the sampling process. Bailing line shall be nylon, Teflon coated wire, or single stranded stainless steel wire. Groundwater sample containers will be obtained from the laboratory prior to sample collection. The laboratory will provide pre-cleaned sample containers with the appropriate preservatives (if any).

6.4.2 Cleaning Procedures

Prior to beginning sampling, field equipment should be deconned in the office laboratory. Documentation of proper cleaning protocol must be provided with disposable bailers. Between wells, field decontamination for field equipment will consist of a five step process: 1) deionized or distilled water rinse, 2) wash with a phosphate free soap/water mixture, 3) deionized or distilled water rinse, 4) isopropyl alcohol rinse or 10% nitric acid or 10% hydrochloric acid rinse, and 5) deionized or distilled water rinse. Clean unused disposable Teflon bailers will be used for monitor well sample collection and will not require decontamination.

6.4.3 Purging Procedures

Prior to the purging of any groundwater monitoring wells the water levels in all wells will be determined. The water levels are to be determined by using an electric water level meter. Any one of several commercial models of water level meters are acceptable for this purpose. The meter chosen for use will be able to determine the depth to groundwater to at least the nearest 0.01 foot. The water level for each well is to be recorded in the bound field notebook at the time of measurement. During the water level measurement procedure the personnel performing the measurement will wear clean protective gloves (i.e. disposable vinyl or latex gloves). The water level meter will be decontaminated between each well location by a distilled water rinse. The reference point for groundwater level measurements will be the top of the northern side of the inner well casing.

Due to the relatively shallow groundwater level on-site, each groundwater monitoring well will be purged with disposable Teflon bailers. Each well will be purged of approximately three to five well volumes of water or until dry prior to sampling. In order to determine the volume of water to be purged from each well the volume of one well casing volume will need to be determined. This volume is calculated by subtracting the depth to the water table from the total depth of the well to give the volume of standing water in the well casing. Then by using Table 1 (attached) the approximate volume of water in the well casing may be estimated. This volume is then multiplied by three, four or five to give the total purge volume necessary for each well. Once this volume is calculated the well may then be purged. Purging may need to be continued past the 3 to 5 volumes if pH and spec conductance are not initially stabilized.

6.4.4 Groundwater Sample Collection Procedure

Upon completion of the purging procedure and stabilization of field parameters, groundwater samples may be collected. Samples will be collected using disposable Teflon bailers. Separate bailers may be used during the purging and

sampling processes. Samples will be poured directly from the bailer into the laboratory supplied containers that they are to be transported to laboratory. Under no circumstances will an intermediate sample container be used, i.e. jar, beaker, etc., and then transferred to the sample container. Water samples will not be filtered.

Groundwater sample containers should be labeled prior to filling. Sample containers have a tendency to "sweat" when filled with groundwater, this makes it difficult to affix a label to the container. The sample label should be covered with a clear tape, which should be wrapped around the sample container. This prevents the label from detaching from the container during sample storage and shipment.

Each sample container should have its own label. The label should indicate at a minimum, the sample location (i.e. GMW-1), date and time of collection, and project site. Other pertinent sample information such as sample location, collector, etc. should be recorded in the field notes.

Samples will be placed in a sample cooler containing ice immediately after collection. After collection, samples are to be transported to the laboratory either in person or by some form of accepted courier service (Federal Express, etc). When practical, samples should be delivered to lab on the collection day.

6.4.5 Field QA/QC Procedures

Each sample will be recorded on a Chain-of-Custody record at the time of collection. A sample Chain-of-Custody form is attached to this plan for reference. The Chain-of-Custody form will contain sample and well identification, signature(s) of the sample collector and others who accept the samples from the collector, date and time of sample collection, requested laboratory analytical parameters, and other pertinent information or special requests etc.

One trip blank per sampling event will be collected and one equipment blank sample will be collected for each day that groundwater monitor wells are sampled. Blank samples will be analyzed for all constituents that are being analyzed in the groundwater and surface water quality samples.

6.4.6 *Laboratory QA/QC Procedures*

All water samples will be analyzed by a North Carolina certified laboratory for Appendix I VOCs and RCRA metals along with specific conductance, pH, and temperature. The laboratories will be certified for drinking water analysis and for the constituents being analyzed. The following is a list of the analytical parameters to be analyzed for this project. Each parameter has an appropriate EPA method number associated with the parameter. Samples are to be analyzed by the listed method or by an equivalent acceptable method. A copy of the laboratory Quality Assurance/Quality Control measures may be provided on request (100 pages). All analysis shall be in accordance with methods listed in the publication SW-846.

o Inorganic Constituents

Metals	Method	Detection Limit
Antimony	CLP/SW-846	0.06 mg/L
Arsenic	CLP/SW-846	0.010 mg/L
Barium	CLP/SW-846	0.20 mg/L
Beryllium	CLP/SW-846	0.005 mg/L
Cadmium	CLP/SW-846	0.005 mg/L
Chromium	CLP/SW-846	0.01 mg/L
Cobalt	CLP/SW-846	0.05 mg/L
Copper	CLP/SW-846	0.025 mg/L
Lead	CLP/SW-846	0.003 mg/L
Nickel	CLP/SW-846	0.04 mg/L
Mercury	CLP/SW-846	0.001 mg/L
Selenium	CLP/SW-846	0.005 mg/L

Silver	CLP/SW-846	0.01 mg/L
Thallium	CLP/SW-846	0.010 mg/L
Vanadium	CLP/SW-846	0.05 mg/L
Zinc	CLP/SW-846	0.02 mg/L

- o Organic Parameters
 - Volatile Organic Compounds (EPA Method SW-846 8240 or 8260**)

- o Field Parameters
 - Specific Conductance
 - pH
 - Temperature

* All metals analysis will be performed by acceptable methodology as described in EPA SW-846

** Specific constituents listed for these methods are not listed here, please refer to the EPA publication SW-846 for the complete list of volatile and semi-volatile parameters listed for the above references methods.

6.5 Field Logbook

The field technician will keep an up-to-date logbook documenting important information pertaining to the technician's field activities. The field logbook will document the following:

- Site Name and Location
- Date and Time of Sampling
- Climatic Conditions During Sampling Event
- Sampling Point/Well Identification Number
- Well Static Water Level
- Height of Water Column in Well
- Purged Water Volume and Well Yield (High or Low)
- Observations on Purging and Sampling Event
- Time of Sample Collection
- Temperature, pH, Turbidity, and Conductivity Readings

- Signature of Field Technician.

6.6 Record Keeping and Reporting

6.6.1 Sampling Reports

Copies of all laboratory analytical data will be forwarded to the DWM within 45 calendar days of the sample collection date. The analytical data submitted will specify the date of sample collection, the sampling point identification and include a map of sampling locations. Should a significant concentration of contaminants be detected in ground and surface water, as defined in North Carolina Solid Waste Rules, Ground Water Quality Standards, or Surface Water Quality Standards, the owner/operator of the landfill shall notify the DWM and will place a notice in the landfill records as to which constituents were detected.

Monitoring data will be compared to compliance standards established by Groundwater Standards 15A NCAC 2L .0202 and 15A NCAC 13B. If a standard is exceeded in any well, additional samples or assessment monitoring will begin following notification of the Division. In response to non-compliance data results, the Division of Solid Waste Management will be notified with a plan of action to further investigate, verify or assess the source of the observed contaminants.

6.7 Well Abandonment/Rehabilitation

Should wells become irreversibly damaged or require rehabilitation, the DWM shall be notified. If monitoring wells and/or piezometers are damaged irreversibly they shall be abandoned according to 15A NCAC 2C .0113, with notification to the Division. The abandonment procedure in unconsolidated materials will consist of over-drilling and/or pulling the well casing and plugging the well with an impermeable, chemically-inert sealant such as neat cement grout and/or bentonite clay (HolePlug or 15A NCAC 2L approved materials). For bedrock well

completions the abandonment will consist of plugging the interior well riser and screen with an impermeable neat cement grout and/or bentonite cement grout.

6.8 Additional Well Installations

The data will be analyzed to verify the correct placement of wells and determine locations for future monitoring wells, if necessary. Any additional well installations will be carried out in accordance with DWM directives. If the potentiometric maps reveal that the depths, location, or number of wells is insufficient to monitor potential releases of solid waste constituents from the solid waste management area, new well locations and depths will be submitted to the DWM for approval.

All monitoring wells shall be installed under the supervision of a geologist or engineer who is registered in North Carolina and who will certify to the DWM that the installation complies with the North Carolina Regulations. Upon installation of future wells the registered geologist or engineer will submit the documentation for the construction of each well within 30 days after well construction.

TABLE 6-2

CONVERSION OF FEET OF WATER
TO
VOLUME IN GALLONS
FOR A TWO INCH I.D. WELL CASING

FEET OF WATER	1	2	3	4	5	6	7	8	9	10
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VOLUME IN GALLONS	0.2	0.4	0.5	0.7	0.9	1.0	1.2	1.4	1.5	1.7
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FEET OF WATER	15	20	25	30	35	40	45	50	55	60
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VOLUME IN GALLONS	2.5	3.3	4.1	4.9	5.8	6.6	7.4	8.2	9.0	9.8
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FEET OF WATER	65	70	75	80	85	90	95	100	105	110
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VOLUME IN GALLONS	10.7	11.5	12.3	13.1	13.9	14.7	15.5	16.4	17.2	18.0
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