E²S

ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY

3008 ANDERSON DRIVE, SUITE 102

RALEIGH, NC 27609

(919) 781-7798

Scanned by	Date	Doc ID #
Zinith Barbee	7/16/10	11163

LETTER OF TRANSMITAL

Date: June 29, 2010

To: Mr. Zinith Barbee
Hydorogeologist
Solid Waste Section

DENR RECEIVED JUL 16 2010 WASTE SECTION

From: Pat Shillington
E²S

Subject: Renewal Permit Suppliment
Hoke County LCID Landfill
LCID Permit No. 47-A

Submitted are five (5) copies of Sheets 4, 5 and 6 which reflect the boundaries of the areas of disposal for the next five years; the specified volume, acreage, tonnage and side slopes of the stockpiled area; and the specified time the material will be stock piled.

Also, submitted are (5) copies of the Operations Plan that reflects the disposal of dead animals.

Barbee, Zinith

From: Barbee, Zinith
Sent: Friday, July 16, 2010 3:45 PM
To: 'e2s@bellsouth.net'
Cc: 'Don Russell'; Hammonds, Andrew
Subject: Electronic Copy of Revised Application

Thank you for the prompt response to the Solid Waste Section (SWS) request (Doc ID 11110) regarding the LCID 47-A.

This afternoon the SWS received hard copies of the information listed in the Letter of Transmittal dated June 29, 2010 (Doc ID 11163). Please submit an electronic record of that information. In its initial letter (Doc ID 9262), the SWS requested "a pdf-formatted copy of the information combined on a disc." The electronic record will be entered into the SWS database and be more accessible.

Thank you for your attention and cooperation. If you have any questions, please contact me.

Zinith Barbee
Hydrogeologist
Solid Waste Section
Division of Waste Management

1646 Mail Service Center
Raleigh, NC 27699-1646
tel: 919.508.8401 fax: 919.733.4810

E-mail correspondence to and from this address may be subject to the North Carolina Public Records Law and may be disclosed to third parties.

Page Break

Carmen Johnson

Fac/Perm/Co ID #	Date	Doc ID#
47-A	7/21/10	DIN

E²S

ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY

3008 ANDERSON DRIVE, SUITE 102

RALEIGH, NC 27609

(919) 781-7798

Permit Application Renewal

For

Hoke County LCID Landfill

Permit No. 47A-LCID-1996

SR-1302 Raeford, NC

Carmen Johnson
Fac/Perm/Co # 47-A
Date 7/21/10
Doc ID#
DIN

Owner

Hoke County

Solid Waste Office

P.O. Box 179

Raeford, NC 28376

NORTH CAROLINA PROFESSIONAL SEAL 15472 ENGINEER T. PATRICK SHILLINGTON

6/29/10

April 5, 2010
Revised June 29, 2010

Engineering & Environmental Science Company (E^2S)
3008 Anderson Drive, Suite 102
Raleigh, NC 27609
Office (919) 781 – 7798
Fax (919) 781 - 7796

Applicant Signature Page

Name of facility HOKE COUNTY TRANSFER STATION

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

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

Signature	Print Name: JON RUSSELL	Date: 4/15/10
Title: Solid Waste Director	Business or organization name: HOKE COUNTY	Date: 4/15/10

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Attachment B: Deed Description
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Sheet 3: Existing Conditions
Sheet 4: Final Layout
Sheet 5: Cross-Section A-A'
Sheet 6: Cross-Section B-B'
Sheet 7: Cross-Sections C-C' and D-D'

1.0 Introduction

The existing LCID Landfill (Permit No. 47A-LCID-1996) is located on a 20 acre tract of land that is adjacent to the closed Solid Waste Landfill. A transfer station and several office and maintenance builds are on this parcel of land were the closed Solid Waste Landfill is located. Attachment A provides the local government (Hoke County) approval letter and Attachment B contains the deed description.

The LCID Landfill was originally permitted in 1994 and operated by the City of Raeford. Responsibility for the LCID Landfill operations was subsequently transferred to Hoke. Initial permitting of this site was for a Construction Demolition Debris Landfill but was subsequently changed to a LCID Landfill during the permitting process.

Presently, the foot print of the LCID Landfill is about 1.2 Acres. Proposed maximum extent of the landfill is 4.3 Acres.

In addition to the LCID Landfill, a wood and yard/landscape waste grind operation that will occupy about 1.5 acres of the site is proposed. The finished product will be sold as decorative landscaping material and for a renewable energy source. Specific potential sales volume has not been determined at this time. Excess produced material can always be deposed into the LCID Landfill.

2.0 Anticipated Lifetime of Project

The anticipated lifetime of the LCID Landfill is anticipated to last to 2025. The remaining capacity of the landfill is approximately 50,025 cubic yards. The following provides calculations for the life of the LCID landfill:

Total LCID Capacity Remaining:	50,215 yd^3
Projected Average Annual Weight:	700 tons/year
*Projected Average Annual Volume:	700 tons/year x 2,000 lbs/ton ÷ 600lbs/yd^3 = 2,333 yd^3 /year
**Annual Volume Consumed by Monthly Soil Cover & Finial Cover:	892 yd^3
Total Annual Consumed Volume:	2,333 yd^3 + 892 yd^3 = 3,225 yd^3
Projected Remaining Life of Landfill:	50,215 yd^3 ÷ 3,225 yd^3/year = 15.5 years

*600 lbs/yd^3 is estimated weight/volume ration for LCID waste
**See earthwork calculations for annual soil volume

3.0 Earthwork Calculations

For one (1) 5 year operation an area of 123 ft by 182 ft will be consumed. An average depth of 10 ft will be excavated. Total soil volume excavated is:

$$123 \text{ ft} \times 182 \text{ ft} \times 10 \text{ ft} \times (1 \text{ yd}^3 / 27 \text{ ft}^3) = 8{,}291.1 \text{ yd}^3$$

The LCID debris will be covered on a monthly basis with the debris being placed in four individual layers with the plan area of about 31 ft by 45 ft. The last layer will have the 2 ft finial cover while the lower 3 layers will have a 1 ft monthly soil cover. The vertical sides of each cell will also have 1 ft monthly soil cover.

Require Final Soil Cover

$$123 \text{ ft} \times 182 \text{ ft} \times 2 \text{ ft} \times (1 \text{ yd}^3 \div 27 \text{ ft}^3) = 1{,}658.2 \text{ yd}^3$$

Monthly Cover

$$[123\text{ft} \times 182\text{ft} \times 3\text{ft} + 2 \times 123\text{ft} \times 4\text{ft} \times 1\text{ft} + 2 \times 182\text{ft} \times 14\text{ft} \times 1\text{ft}] \times (1 \text{ yd}^3 / 27 \text{ ft}^3)$$
$$= 2{,}803.6 \text{ yd}^3$$

Net Excess Soil per 5-year Period

$$8{,}291.1 \text{ yd}^3 - 1{,}658.2 \text{ yd}^3 - 2{,}803.6 \text{ yd}^3$$
$$= 3{,}829.3 \text{ yd}^3$$

Approximate Annual Volume Consumed by Monthly Soil Cover & Final Soil Cover

$$(1{,}658.2 \text{ yd}^3 + 2{,}803.6 \text{ yd}^3) \div 5 \text{ years}$$
$$= 892 \text{ yd}^3 / \text{years}$$

4.0 Erosion Control Evaluation

Erosion control was provided during the original permitting of the landfill (see Land Quality approval letter dated May 31, 1994 in Attachment C).

With the new area of disturbance added for the grinding/stockpile area, the stormwater basin was re-evaluated. Based on this evaluation, the existing basin meets the erosion control requirements of the Land Quality Section. The calculations are provided in Attachment C.

Evaluation was also conducted for stormwater discharge leaving the top of the disposal area. This evaluation indicates suitable low surface water velocities at the 2:1 (H:V) slopes.

5.0 Description of Compliance with Rule 15A NCAC 1313.0564

Attachment D contains the Hydrogeologic Study that was conducted in the 1994 by E^2S for the initial permitting of this site.

6.0 Description of Compliance with Rule 15A NCAC 1313.0564

1. The facility is located outside of the 100 year flood plain per the Hoke County Flood Insurance Maps

2. The facility is active with the property vegetated in grass outside of the LCID Landfill area. Facility or practices do not cause or contribute to the taking of any endangered or threatened species of plants, fish, or wildlife.

3. This facility or practices will not cause destruction or adverse modification of critical habitat of endangered species or threatened species as identified in CFR Part 17.

4. The facility is not located in an area that will damage or destroy and archaeological or historical site.

5. The facility is more than 2 miles from a state park, recreation scenic area, or any other lands such as state nature and historic preserves. This facility and practices will not effect the above mentioned.

6. The facility is not located in a wetland or near a wetland as defined in the Clean Water Act, Section 404(b).

7. Sufficient on-site suitable soils are available for the landfill cover. A net volume of soil will be provided which will be used for fill at other Hoke County projects.

8. The LCID Landfill meets the following criteria:
    a) All stormwater is directed to the stormwater basin. From this basin the water must travel at least 2000ft to the nearest stream. The facility and practices will not violate the requirements of the NPDES, Section 402 of the Clean Water Act.
    b) The facility will not cause a discharge of dredged or fill material into the waters of the state per the requirements, Clean Water Act, Section 404.
    c) The facility will not cause non-point source pollution of waters of the state that violate assigned water quality standards.
    d) The waste base is at least 10ft above the seasonally high water table.
    e) Not Applicable, the facility is larger than 2 acres.

9. The Facility meets the following buffer requirements:
   a) The waste boundary is more than 1400ft from a surface water of the state. (50ft is required)
   b) A 100ft buffer is provided from the waste boundary and the property line. The waste boundary is more than 2900ft from any residence and 1050ft from the Hoke County office facilities. No water supply wells are within ½ mile of the site.

10. The facility is approved by Hoke County, the local government having zoning jurisdiction (See Attachment A).

7.0 Operation Plan

7.1 Responsible Individual and Operation Time

Hours of Operation: 7:00AM to 5:00PM Monday- Friday
7:00AM to 12:00PM Saturday

Responsible Individual: Mr. Don Russell
Solid Waste Office
Hoke County
P.O. Box 179
Raeford, NC 28376
Phone: (910) 875 - 3111

7.2 Land Use After Closure

Public access will not be allowed once the LCID Landfill is closed.

7.3 Description of Systematic Usage, Operation, Orderly Development, and Closure

Access Roads: An asphalt paved road that leads from the public roadway system to the weight scales. From the weight scales to the LCID Landfill, the road is exposed ground. The soils at the exposed ground meet the definition of a Class C Soil Base per NCDOT Specifications. This portion of the access road is periodically smoothed to remove the wash board effect caused by vehicle wheel loads. During the drier times of the year, the ground is wetted with a water truck to minimize dusting.

Material Handling: As each load of LCID debris enters the site and is dumped the type of waste is visually examined. Waste primarily consisting of wood and landscape or yard waste will be dumped at the grinding area. This type of waste is further sorted between wood and yard/landscape waste (leaves, small branches). This material is then ground

with a tub grinder and stockpiles. The ground material will be sold for landscaping needs and as renewable fuel.

The grinding operations will be conducted periodically during the year. Hoke County will not own the tub grinder but will contract or outsource this activity. The wood and yard/landscape waste will be stockpiled until it is economical for a contractor to mobilize at the site. The grinding operation will take about one to two weeks.

After the grinding has been complete, the material may not be sold immediately. If necessary, excess ground material can be disposed in the LCID Landfill area.

Debris containing brick and concrete will be deposited at the LCID Landfill area. The LCID Landfill deposition will continue at its present location and proceed towards the stormwater basin. Each cell is excavated about 10ft below ground with the soil stockpiled in front of the excavation. The LCID waste material is deposited to about 5ft above existing surrounding ground levels. Excess soil not used for cover will be stockpiled for later use at other Hoke County projects.

At closure at least 24 inches of soil cover will be placed over the LCID debris and revegetated with grass. The top of the LCID surface will be constructed to shed stormwater as sheet water flow off the deposition area.

Within the grinding area and stockpile area, the ground will be graded to promote positive drainage towards the stormwater basin. The area will be revegetated in grasses. The stormwater basin will remain in-place once the site is closed.

Stormwater Runoff: The runoff from the LCID Landfill area and the Grinding/Stockpile area all drain to the stormwater basin. The basin is checked once monthly for any operational defects, and when deficiencies are noted, they are corrected within a timely manner. Sediment accumulation is removed from the basin and incorporated into the soil used for landfill cover.

Leachate Management: Leachate production should be minimal to non-existing.

Additional Operational Requirements per 15A NCAC 13B.0566:

(1) Operational plans shall be approved and followed as specified for the facility.

(2) The facility shall only accept those wastes which it is permitted to receive.

(3) The waste shall be restricted to the smallest area feasible and compacted as densely as practical into cells.

(4) Adequate soil cover shall be applied monthly, or when the active area reaches one acre in size, whichever occurs first.

(5) 120 calendar days after completion of any phase of disposal operations, or upon revocation of a permit, the disposal area shall be covered with a minimum of 2 feet of suitable soil cover sloped to allow surface water runoff in a controlled manner. The Division may require further action in order to correct any condition which is or may become injurious to the public health, or a nuisance to the community.

(6) Adequate erosion control measures, structures, or devices shall be utilized to prevent silt from leaving the site and to prevent excessive on site erosion.

(7) Provisions for a ground cover sufficient to restrain erosion must be accomplished within 30 working days or 120 calendar days upon completion of any phase of landfill development.

(8) The facility shall be adequately secured by means of gates, chains, berms, fences, etc. to prevent unauthorized access except when an operator is on duty. An attendant shall be on duty at all times while the landfill is open for public use to assure compliance with operational requirements and to prevent acceptance of unauthorized wastes.

(9) Access roads shall be of all-weather construction and properly maintained.

(10) Surface water shall be diverted from the working face and shall not be impounded over waste.

(11) Solid waste shall not be disposed of in water.

(12) Open burning of solid waste is prohibited.

(13) The concentration of explosive gases generated by the facility shall not exceed:
   (a) Twenty-five percent of the lower explosive limit for the gases in facility structures.
   (b) The lower explosive limit for the gases at the property boundary.

(14) Leachate shall be properly managed on site through the use of current best management practices.

(15) Should the Division deem it necessary, ground water or surface water monitoring, or both, may be required as provided for under Rules .0601 and .0602 of this Subchapter.

(16) A sign shall be posted at the facility entrance showing the contact name and number in case of an emergency and the permit number. The permit number requirement is not applicable for facilities not requiring an individual permit.

Disposal of Dead Animal Requirements per 02 NCAC 52C .0102:

1. Dead animals will be disposed of by methods approved by the State Veterinarian and will be buried at least three feet below the surface of the ground.

Burial Standards

1. The bottom of the hole where dead animals are to be buried will be approximately 27 feet above the seasonal high water table. Dead animals will be disposed of by methods approved by the State Veterinarian and will be buried at least three feet below the surface of the ground.

2. Standing water in the hole does not preclude animal burial as the bottom of the hole is approximately 27 feet above the seasonal high water table.

3. There must be at least 3 feet of soil covering any buried animal. This can be interpreted to mean soil mounded over the animals above the adjacent ground zlevel.

4. The burial site must be at least 300 feet from any existing stream or public body of water.

5. The burial site must be at least 300 feet from any existing public water supply well.

6. The burial site must be at least 100 feet from any other type of existing well.

7. The burial site shall be located so as to minimize the effect of stormwater runoff.

8. A record of the location of the approved site (GPS latitude and longitude coordinates if available), the burial history of each burial site to include the date, species, head count and age must be kept by the owner and reported to the Local Health Director who will in turn report this information to the appropriate State agency - DENR Division of Water Quality, Groundwater Section

7.4 Type, Source, and Quantity of Waste to be accepted

Type of Waste:	Industrial asphalt, concrete (with incidental Rebar), brick, block, unpainted wood, land clearing debris, inert debris.
Source of Waste:	1. City & County Public Works projects 2. Private developers 3. Commercial developers 4. State Department of Transportation 5. Residential Homeowners

Quantity of Waste: 700 Ton/Year (2,333 yd^3)

7.5 Emergency Contingency Plan

Equipment used in the operation of the landfill shall be used to control accidental fires. This equipment shall include a backhoe and dump truck. If necessary, additional equipment will be acquired from other Hoke County Departments.

In the case of fire, the following actions shall be taken:

1. Notify the Hoke County and City of Raeford Fire Department and the North Carolina Division of Waste Management/Fayetteville Regional office.

2. Separate the burning material from the remaining waste as soon a possible.

3. Attempt to smother the fire with soil if possible.

4. At the last resort, water should be used to extinguish the fire. Should it be necessary to use water, downslope collection berms should be constricted to collect the water. All efforts should be made to prevent contaminated water from directly flowing into creeks.

In the case of a hazardous spill, the following action shall be taken:

1. Notify the Fayetteville Regional Office and the Hoke County and Raeford Fire Department.

2. Isolate the spilled material and wait for instruction from Hoke County and Raeford Fire Department.

Emergency Numbers:

911 - The Raeford/Hoke County Emergency Communications Center is the Public Safety Answering Point (PSAP) for all emergency calls in the City of Raeford and Hoke County. The Communications Center is a centralized communications facility that utilizes an enhanced 911 (E-911) system that is wireless Phase II compliant. The Communications Center is staffed 24 hours per day.

Hoke County Emergency Management is located at:
429 East Central Avenue
PO Box 299

Raeford, NC 28376
(910) 875-4126
FAX: (910) 875-3726

NCDENR- Fayetteville Regional Office
225 Green Street, Suite 714, Fayetteville, NC 28301-5043
Telephone: (910) 433-3300
FAX: (910) 486-0707

Attachment A: Local Government Approval

Hoke County Planning & Inspection

Post Office Box 1556 – 423 E. Central Avenue
Raeford, North Carolina 28376
(910) 875-8407 – Fax (910) 875-1072

North Carolina Department of Environment and Natural Resources
Division of Waste Management
Zenith Barbee, Hydrogeologist

To Whom It May Concern:

The Hoke County LCID Landfill has been grandfathered in to all Hoke County zoning ordinances. Additionally, the landfill also meets all requirements in the Hoke County Land Use plan. The Planning and Zoning Department has no problems with this request. If you have any questions or concerns please feel free to contact me.

Regards,

Conrad G. Garrison
Planning and Zoning Director
Hoke County Government

423 E. Central Avenue
Raeford, NC 28376
910-875-8407
910-875-1072 (Fax)
cgarrison@hokecounty.org

Attachment B: Deed Description

by

fter recording

nstrument was prepared by R. PALMER WILLCOX

escription for the Index

NORTH CAROLINA GENERAL WARRANTY DEED

DEED made this 13th day of December, 19 93, by and between

GRANTOR	GRANTEE
ERT H. GATLIN, widower	COUNTY OF HOKE P. O. Box 217 Raeford, N. C. 28376

in appropriate block for each party: name, address, and, if appropriate, character of entity, e.g. corporation or partnership.

designation Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and
ll include singular, plural, masculine, feminine or neuter as required by context.

NESSETH, that the Grantor, for a valuable consideration paid by the Grantee, the receipt of which is hereby
owledged, has and by these presents does grant, bargain, sell and convey unto the Grantee in fee simple, all that
tain lot or parcel of land situated in the City of ....., Raeford Township,
County, North Carolina and more particularly described as follows:

certain tract or parcel of land in Raeford Township, Hoke County, North Carolina situated
bout two miles north of Raeford, N.C. and about 1400 feet northwest of the west terminus
N.C.S.R. No. 1321, adjoining the lands of Robert H. Gatlin on the southeast, Canal Land
d Timber Company on the northeast and northwest and by the County of Hoke on the southwest,
eing further described as follows:

ginning at a concrete monument, said monument being the westernmost corner of the Robert
Gatlin Tract No. II as described in Deed Book 208, Page 58 in the Hoke County Registry,
the northernmost corner of the County of Hoke "landfill tract" described in Deed Book 161,
Page 373 in the Hoke County Registry and a common corner with the tract of land conveyed
rom Robert H. Gatlin to Cape Fear Wood Corporation (now Canal Land and Timber Company) in
eed Book 94, Page 163, said monument also being a corner of the Federal Paper Board Company
tract as shown and recorded in Plat Cabinet 1, Slide 81, Map Book 4, Page 23; thence as a
ommon line of Robert H. Gatlin and said Cape Fear Wood Corp. tract, N29-39-00E 1046.64 feet
an axle with a pine pointer, common corner with said Cape Fear Wood Corp. tract, S71-09-45E
continuing a common line of Robert Gatlin and said Cape Fear Wood Corp. tract, S71-09-45E
an iron rod in said line; thence S00-00-00W 1261.51 feet to an iron rod in
the common line of Robert Gatlin and the aforementioned County of Hoke "landfill" tract;
thence as a common line with Robert Gatlin and the County of Hoke, N55-00-00W 758.19 feet
to the beginning containing 23.00 acres and being a portion of the Robert H. Gatlin Tract
No. II as described in Deed Book 208, Page 58 in the Hoke County Registry.

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Attachment C: Erosion Control Approval Letter and Evaluation

State of North Carolina
Department of Environment,
Health and Natural Resources
Fayetteville Regional Office

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
Andrew McCall, Regional Manager

DEHNR

RECEIVED JUN 02 1994

May 31, 1994

Mr. Michael Wood, County Manager
County of Hoke
PO Box 266
Raeford, NC 28376

Re: Approval of Soil Erosion and Sediment Control Plan
Landfill Closure Borrow Site
Hoke County, NC

Dear Mr. Wood:

The review of the above referenced erosion control plan has been completed.

The plan has been found to be acceptable subject to the following stipulations:

1. Enclosed is a Certificate of Plan Approval which must be displayed at the job site.

2. This project is subject to the National Pollutant Discharge Elimination System (NPDES) for point source stormwater discharges from construction activities. Enclosed is a copy of the necessary permit application. Please contact Ken Averitte, Environmental Technician, at (910) 486-1541 for further assistance regarding this permit.

3. In order to ensure the early coordination and implementation of the erosion control plan for this project, it is requested that a preconstruction conference be held. As a minimum, representatives of the owner, engineer, contractor, and this office should attend, subject to the availability of staff. Please notify Gerald Lee of this office as to when this conference is scheduled.

4. The developer is responsible for obtaining any and all permits and approvals necessary for the development of this project prior to the commencement of this land-disturbing activity. This could include the Division of Environmental Management under storm water regulations, the US Army Corps of Engineers under Article 404 jurisdiction, local county or town agencies under their local ordinances, or others that may be required. This approval cannot supersede any other permit or approval; however, in the case of a Cease and Desist Order from the Corps of Engineers, that Order would only apply to wetland areas. All other lands must still be in compliance with the Sedimentation Pollution Control Act.

5. If any area on site falls under the jurisdiction of Section 404 of the Clean Water Act, the developer is responsible to the orders of the US Army Corps of Engineers. Any erosion control measures that fall within jurisdictional wetland area must be relocated to the transition point between the wetlands and the highlands to assure that the migration of sediment will not occur. If that relocation presents a problem or contradicts any requirements of the Corps of Engineers, it is the responsibility of the developer to inform the Land Quality Section's Regional Office so that an adequate contingency plan can be made to assure sufficient erosion control on-site. Failure to do so will be considered a violation of this approval.

6. Following the completion of the project, you should notify this office to schedule a final inspection. The purpose of this inspection is to ensure that all erosion control requirements have been met.

This approval is subject to the satisfactory performance of the erosion control measures under field conditions. Should it be determined that the requirements of the Sedimentation Pollution Control Act of 1973 (GS 113A,51-66) are not being met, revisions to the plan and its implementation will be required.

This permit allows for a land disturbance, as called for on the application plan, not to exceed 18 acres and/or the limits of the submitted plans. Exceeding these limits will be a violation of this permit and would require a revised plan and additional application fee. Amendments to the plan should be submitted to this office under the same procedures as followed for the original plan.

Title 15, Section 4B.0017 (A) of the North Carolina Administrative Code requires that a copy of the approved plan be on file at the job site and that inspections of the project be made by this office to ensure compliance with the approved plan.

We look forward to working with you on this project.

Sincerely,

Gerald Lee
Assistant Regional Engineer
Land Quality Section

GL/bt

Enclosure

cc: Daniel W. Sundberg, ASLA
Billy Cox
Ken Averitte

BM
308
285
295
322
BM
279
R A E F O R D
SITE
275
274
264
287
East Freedom Church
258
Silver City
Robbin Heights
Industrial Waste Ponds
PROSPECT
BM
WT
McCaughan

Erosion Control Evaluation

Based on site observations, the site is predominantly grass covered. Ditches or swales are stable and in reasonable shape. Exposed areas primarily consist of the haul road and the area where the active placement of LCID is occuring.

Future disturbance and exposed ground will occur where the proposed grading and stockpile area will be conducted.

With new area to be disturbed, this evaluation is for the existing sediment basin.

Also, this evaluation is conducted for the side slopes of the mound formed by LCID landfill. Evaluation of the existing ditches is not conducted since they are grass covered and stable.

The Rational Design method is used for the evaluation. A C = 0.5 is used for the sandy soils that are grass covered. A C = 0.40 is used for exposed ground.

Table 8.03b
Value of Runoff Coefficient (C) for Rational Formula

Land Use	C
Business:	
Downtown areas	0.70-0.95
Neighborhood areas	0.50-0.70
Residential:	
Single-family areas	0.30-0.50
Multi units, detached	0.40-0.60
Multi units, Attached	0.60-0.75
Suburban	0.25-0.40
Industrial:	
Light areas	0.50-0.80
Heavy areas	0.60-0.90
Parks, cemeteries	0.10-0.25
Playgrounds	0.20-0.35
Railroad yard areas	0.20-0.40
Unimproved areas	0.10-0.30
Streets:	
Asphalt	0.70-0.95
Concrete	0.80-0.95
Brick	0.70-0.85
Drives and walks	0.75-0.85
Roofs	0.75-0.85

Land Use	C
Lawns:	
Sandy soil, flat, 2%	0.05-0.10
Sandy soil, ave., 2-7%	0.10-0.15
Sandy soil, steep, 7%	0.15-0.20
Heavy soil, flat, 2%	0.13-0.17
Heavy soil, ave., 2-7%	0.18-0.22
Heavy soil, steep, 7%	0.25-0.35
Agricultural land:	
Bare packed soil	0.30-0.60
Smooth	0.20-0.50
Rough	0.20-0.40
Cultivated rows	0.10-0.25
Heavy soil no crop	0.15-0.45
Heavy soil with crop	0.05-0.25
Sandy soil no crop	0.05-0.25
Sandy soil with crop	0.10-0.25
Pasture	
Heavy soil	0.15-0.45
Sandy soil	0.05-0.25
Woodlands	0.05-0.25

NOTE: The designer must use judgement to select the appropriate C value within the range for the appropriate land use. Generally, larger areas with permeable soils, flat slopes, and dense vegetation should have lowest C values. Smaller areas with slowly permeable soils, steep slopes, and sparse vegetation should be assigned highest C values.

Source: American Society of Civil Engineers

Raleigh, North Carolina 35.8706N, 78.7864W

ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	5.58	4.46	3.74	2.58	1.62	0.94	0.66	0.40	0.24	0.14
10	7.08	5.66	4.78	3.46	2.25	1.33	0.95	0.58	0.34	0.021
25	7.78	6.19	5.24	3.88	2.58	1.54	1.11	0.68	0.41	0.24
100	8.64	6.86	5.78	4.43	3.05	1.85	1.36	0.84	0.51	0.30

Fayetteville, North Carolina 35.0583N, 78.8583W

ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	6.11	4.88	4.09	2.83	1.77	1.04	0.74	0.44	0.26	0.15
10	7.96	6.36	5.36	3.88	2.53	1.54	1.10	0.66	0.39	0.23
25	8.94	7.13	6.02	4.46	2.97	1.83	1.32	0.80	0.47	0.28
100	10.44	8.29	6.99	5.35	3.69	2.29	1.69	1.03	0.62	0.36

Wilmington, North Carolina 34.2683N, 77.9061W

ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	7.39	5.92	4.96	3.42	2.15	1.28	0.91	0.56	0.33	0.19
10	9.70	7.75	6.54	4.74	3.08	1.94	1.39	0.87	0.51	0.30
25	10.98	8.75	7.40	5.48	3.65	2.36	1.73	1.08	0.64	0.38
100	12.92	10.27	8.65	6.63	4.56	3.18	2.37	1.49	0.89	0.53

Washington, North Carolina 35.5333N, 77.0167W

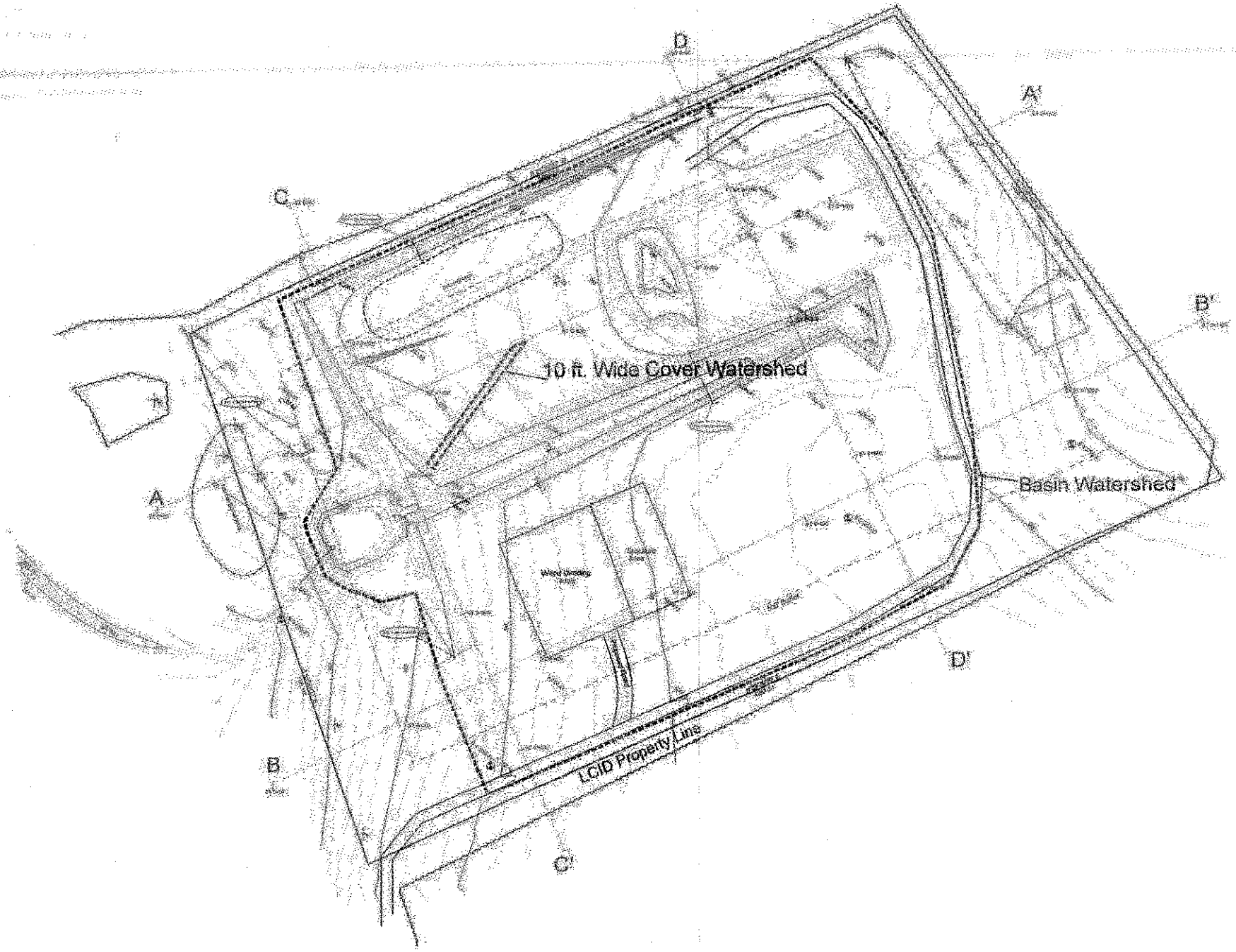
ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	6.41	5.12	4.29	2.96	1.86	1.10	0.78	0.47	0.27	0.16
10	8.38	6.70	5.65	4.09	2.66	1.64	1.19	0.72	0.42	0.25
25	9.48	7.55	6.38	4.73	3.15	1.99	1.46	0.88	0.52	0.31
100	11.16	8.87	7.47	5.72	3.94	2.58	1.93	1.18	0.70	0.42

Manteo Airport, North Carolina 35.9167N, 75.7000W

ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	6.46	5.16	4.32	2.99	1.87	1.08	0.79	0.48	0.29	0.17
10	8.47	6.77	5.71	4.14	2.69	1.62	1.20	0.74	0.44	0.27
25	9.58	7.62	6.44	4.77	3.17	1.96	1.47	0.91	0.54	0.33
100	11.26	8.95	7.54	5.77	3.98	2.54	1.95	1.21	0.73	0.44

Cape Hatteras, North Carolina 35.2322N, 75.6225W

ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	7.20	5.75	4.82	3.33	2.09	1.29	0.94	0.58	0.34	0.20
10	9.41	7.52	6.35	4.60	2.99	1.93	1.43	0.89	0.53	0.31
25	10.66	8.49	7.18	5.31	3.54	2.33	1.75	1.09	0.65	0.38
100	12.53	9.95	8.39	6.42	4.42	3.03	2.32	1.45	0.88	0.51


D
A'
C
B'
10 ft. Wide Cover Watershed
A
Basin Watershed
D'
LCID Property Line
B
C'

25-year: 12.3 − 6.4 = 5.9 cfs

$$h = \left(\frac{5.9}{2.8(22)}\right)^{2/3} = 0.21 \text{ ft}$$

Check water velocity over secondary spillway for 10-year rain event, Assume vertical sides.

$$V = \frac{43}{(22)(0.17)} = 1.1 \text{ ft/sec} \quad \therefore \text{ Velocity less than 2 ft/sec}$$

Outlet Stone Protection for Primary Spillway:

Max. Flowrate is 6.4 cfs – From Figure 8.066 of <u>ESCPDM</u> (see Attached), the $D_{50} = 0.25'$ and $L_a = 18$ ft. Existing stone extends more than 20 ft from the outlet and consists of Class B erosion control stone $D_{50} = 0.75'$. Outlet Protection O.K.

Required Basin Surface area:

$Q_{10} \times 435 = (10.7)(435) = 4654.5 \text{ ft}^2$

at top of riser – Surface area is 71' by 98' or 6958 ft^2

Require Storage volume

Area Disturbed × 3600 = 2.58 × 3600 = 9288 ft^3

Actual Volume

Elev.	Area	Average Area	Depth	Vol.	Cum. Vol.
246	4356	—	—	—	—
247	5369	4862.5	1	4862.5	4862.5
248	7044	6231.5	1	6231.5	11,094 ft³

∴ At El. 248 before discharge through top of pipe. Storage volume is 11,094 ft³ and is greater than required volume of 9288 ft³.

2-year

T	I	T_{cal}
30	2.83	42.7 ← use
60	1.77	52.6

10-year

30	3.88	40.1 ← use
60	2.53	44.9

25-year

30	4.46	34.9 ← use
60	2.97	41.8

Peak Flow rates

2-year $Q = (14.05)(0.196)(2.83) = 7.8$ cfs
10-year $Q = (14.05)(0.196)(3.88) = 10.7$ cfs
25-year $Q = (14.05)(0.196)(4.46) = 12.3$ cfs

The riser pipe is at EL 248.92 ft. The embankment crest is at 254.0 ft and the secondary spillway is about 253.0 ft for a length of at least 22 ft. The horizontal pipe is 48 ft long and outlet is at 245.54. The riser pipe is 18" Dia and the horizontal pipe is 12" Dia. CMP.

Check Flowrate of primary conduit with water level at 253 ft; level at the secondary spillway

Weir control

$Q = CLh^{3/2}$ $\quad h = 253 - 248.9 = 4.1\,ft$

$C = 3.1$ sharp crested weir

$L = \pi 1.5 = 4.71\,ft$

$Q = (3.1)(4.71)(4.1)^{3/2} = \underline{121\,cfs}$

Orifice Control

$Q = CA(2gh)^{0.5}$ $\quad C = 0.6$

$A = \frac{\pi(1.5)^2}{4} = 1.767\,ft^2$

$Q = (0.6)(1.767)\left[2(32.2)(4.1)\right]^{0.5}$ $\quad h = 253 - 248.9 = 4.1\,ft$

$= \underline{17.2\,cfs}$

Barrel Control

$Q = A\left(\frac{2gH}{1 + K_m + K_p L}\right)^{0.5}$ $\quad A = \frac{\pi(1)^2}{4} = 0.785$

$H = 253 - 245.54 = 7.46$

$K_m = 1$

$L = 48$

$K_p = \frac{5037 n^2}{d^{4/3}}$

$d = 12''$

$n = 0.024$ - CMP

$K_p = \frac{5037(0.024)^2}{12^{4/3}} = 0.107$

$$Q = 0.785 \left[\frac{(2)(32.2)(7.46)}{1+1+0.107(48)}\right]^{0.5}$$

$$= \underline{\underline{6.44 \text{ cfs}}}$$

∴ barrel condition controls

- Since the barrel flow will not significantly increase with additional water height - use this value 6.4 cfs to evaluate discharge at secondary spillway

$Q = CLh^{3/2}$ $\quad C = 2.8$ broad crested weir

$L = 22$ ft

$$h = \left(\frac{Q}{CL}\right)^{2/3}$$

2-year: $7.8 - 6.4 = 1.4$ cfs

$$h = \left(\frac{1.4}{(2.8)(22)}\right)^{2/3} = 0.08 \text{ ft}$$

10-year: $10.7 - 6.4 = 4.3$ cfs

$$h = \left(\frac{4.3}{2.8(22)}\right)^{2/3} = 0.17 \text{ ft}$$

25-year: $12.3 - 6.4 = 5.9$ cfs

$$h = \left(\frac{5.9}{2.8(22)}\right)^{2/3} = 0.21 \text{ ft}$$

Check water velocity over secondary spillway for 10-year rain event, Assume vertical sides.

$$V = \frac{43}{(22)(0.17)} = 1.1 \text{ ft/sec} \therefore \text{Velocity less than 2 ft/sec}$$

Outlet Stone Protection for Primary Spillway:

Max. Flowrate is 6.4 CFS - From Figure 8.066 of <u>ESCPDM</u> (see Attached), the $D_{50} = 0.25'$ and $L_a = 18$ ft. Existing stone extends more than 20 ft from the outlet and consists of Class B erosion control stone $D_{50} = 0.75'$. Outlet Protection O.K.

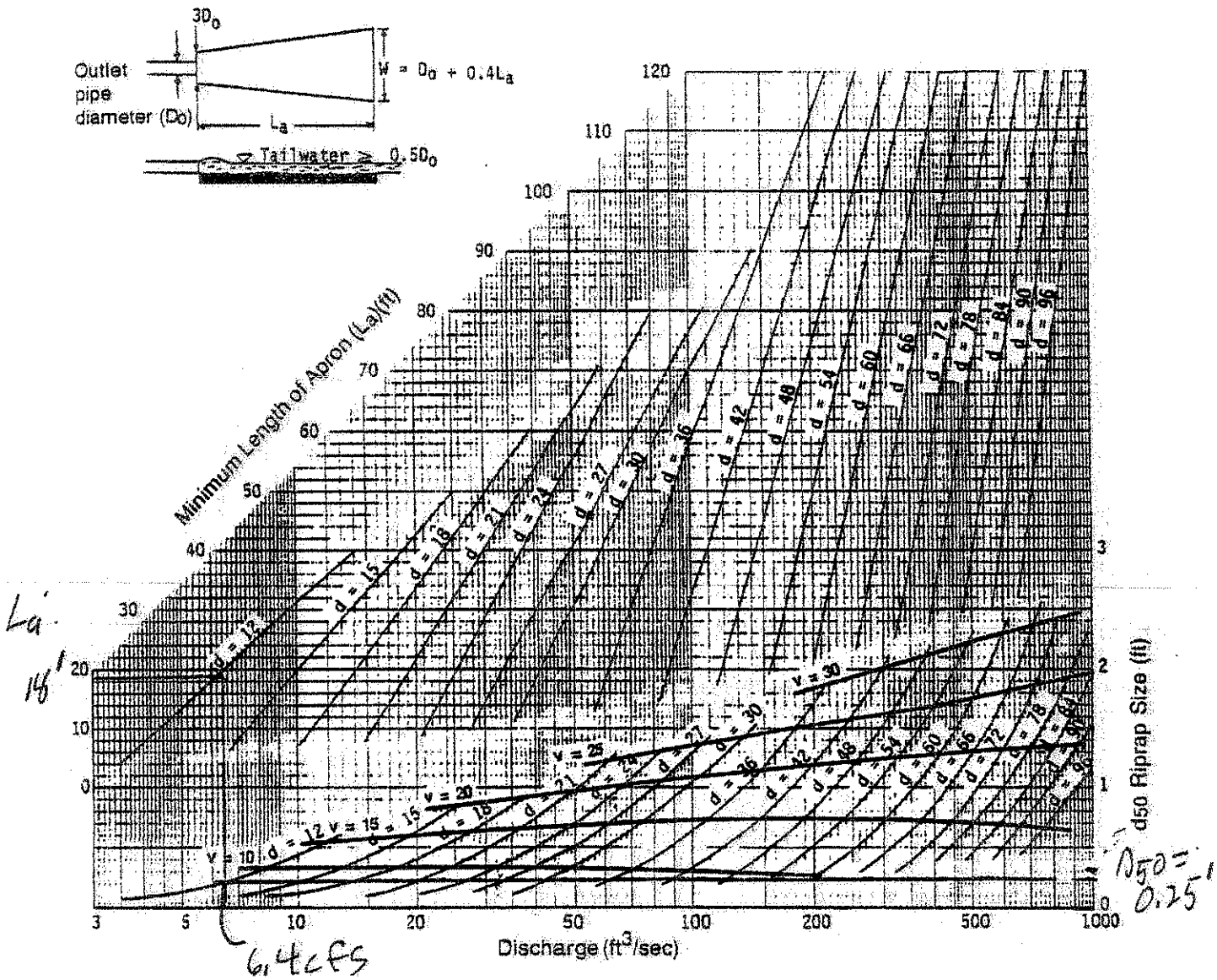
Required Basin Surface area:

$Q_{10} \times 435 = (10.7)(435) = 4654.5 \text{ ft}^2$

at top of riser - surface area is 75' by 95' or 7125 ft^2

Require Storage volume

Area Disturbed $\times 3600 = 2.58 \times 3600 = 9288 \text{ ft}^3$



Curves may not be extrapolated.

Figure 8.06b Design of outlet protection from a round pipe flowing full, maximum tailwater condition ($T_w \geq 0.5$ diameter).

Side Slope Drainage Evaluation.

The side slopes are proposed at 2:1 (H:V). Runoff from the top of the LCRD landfill will drain down this slopes.

For evaluation purposes, a 10ft wide strip is evaluated which would provide the most area for drainage.

Max area is $2035\ ft^2$ (0.0467 acres)
Coef of runoff = 0.15 assume $t = 5$ min although the time of concentration would be larger, use the Rain intensity for the 25-year rainevent, $I_{25} = 8.96\ in/hr$

$$Q = (0.0467)(0.15)(8.96) = 0.0628\ cfs$$

Check the maximum flow rate allowed to maintain a water velocity of 2 ft/s on the 2:1 (H:V) slope

$$V = \frac{1.49}{n} r^{2/3} \sqrt{S}$$

$S = 0.5$ for 2:1 (H:V) slope

$A = 10(d)$ $\quad r = A/wp = \frac{10d}{10} = d$

$wp = 10$

$n = 0.15$ for short grass

$$2 = \frac{1.49}{0.15} d^{2/3} \sqrt{0.5}$$

$$d = 0.152\ ft$$

Flow rate for this depth is

$Q = VA = (2)(1.52) = 3.04$ cfs $\quad A = 10(0.152)$
$= 1.52$

i. 2:1 (H:V) side slopes OK.

Attachment D: Hydrogeologic Study

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ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY
3008 ANDERSON DRIVE, SUITE 102
RALEIGH, NC 27609
(919) 781-7798

December 15, 1994

Mr. Dan Sundberg
Hobbs, Upchurch & Associates
P.O. Box 1737
Southern Pines, NC 28387

RE: Clarification Letter
Construction and Demolition
Debris Landfill Clarifications
Hoke County, North Carolina

Dear Mr. Sundberg:

The following discusses three topics: (1) the removal of the existing piezometers, (2) the proposed location of the monitoring wells, and (3) the effect of the proposed construction on the groundwater table.

REMOVAL OF EXISTING PIEZOMETERS

The existing piezometers will be removed by one of two alternatives:

1. A slury of neat concrete paste will be injected under pressure through the top of the piezometer pipe as the pipe is slowly removed from the ground.

2. Using hollow stem augers with the drill rig, the piezometer location will be redrilled and cement grout will be injected through the hollow stem as the augers are removed from the ground.

PROPOSED MONITORING WELL LOCATIONS

The locations for the monitoring wells have been altered for 5-year increments of disposal. Also, they will be situated to monitor the water perched above the semi-aquitard. The approximate surface elevation of this semi-aquitard at the various test locations is as follows:

Boring No.	Semi-Aquitard Surface Elevation, ft.	Depth Below Ground Surface
B-1	228	38.0
B-2	238	27.0
B-3	231	31.0
B-4	217	42.0
B-5	225	19.5

Groundwater levels in these peizeometers were measured on March 24, 1994, and again on March 24, 1994. On December 7, 1994, the water level depths and elevations were also determined at the three groundwater monitoring wells for the adjacent solid waste landfill. The following table displays the results:

Well No.	Top of Casing Elev., ft.	Depth to Groundwater, ft. 3/24/94	Depth to Groundwater, ft. 12/7/94	Water level Elevation, ft. 3/24/94	Water level Elevation, ft. 12/7/94
1	266.31	dry	dry	—	—
2	261.21	24.89	25.10	236.32	236.11
3	268.89	36.02	33.61	232.87	235.28
4	265.63	dry	(1) N/A	—	—
5	246.16	19.06	(1) N/A	227.06	—
SWL No.					
1	251.19	54.26	53.56	194.20	197.63
2	204.65	—	17.74	—	186.91
3	217.00	—	28.09	—	188.91

(1) Wells disturbed by construction activity.

In general, two groundwater conditions are present. The upper groundwater condition appears to be a result of water perched at or above the more clayey sands. These clayey sands were encountered after depths of 22 feet to 38 feet below ground level.

This semi-aquitard with variable soil texture did not appear to cause water to perch at B-1 and B-4. The semi-aquitard appears to slope downward in a southeasterly direction. The lower groundwater table appears to also move in a southeasterly direction, based on the topography and on the monitoring well measurement at the adjacent solid waste landfill (See attached figure).

The proposed monitoring wells for the 5-year limits of the Construction and Demolition Debris Landfill are shown on sheet 3 of 10 prepared by Hobbs, Upchurch & Associates. An upgradient and downgradient well is proposed to monitor the upper groundwater conditions. A Type III well is proposed downgradient to monitor the lower groundwater conditions. It is estimated that the two shallow wells will have about two to five feet of water.

It is recommended that the deep well be installed first so that the upper groundwater table can be verified as present before the installation of the two shallow wells. It is possible that the upper groundwater condition may not be encountered, and if this occurs, it may be advantageous not to install the shallow well. Also, it would be necessary to install a Type III well at the upgradient well location, in lieu of the proposed shallow well.

PROPOSED CONSTRUCTION EFFECTS ON GROUNDWATER

It is anticipated that the groundwater table and perched groundwater conditions will not be substantially affected by the landfill construction. Infiltration of precipitation will be minimized at this site due to promotion of runoff both around and within the landfill. The only area where surface water accumulation will occur will be at the sediment basin. Mounding of the water table beneath the sediment basin is possible, but the basin will only accumulate water during precipitation. Therefore, water recharge would be minimal and infrequent, and water table mounding beneath the sediment basin would be minimal.

We appreciate serving Hobbs, Upchurch & Associates on this project. Please contact us if you need further clarifications.

Sincerely,

T. Patrick Shillington

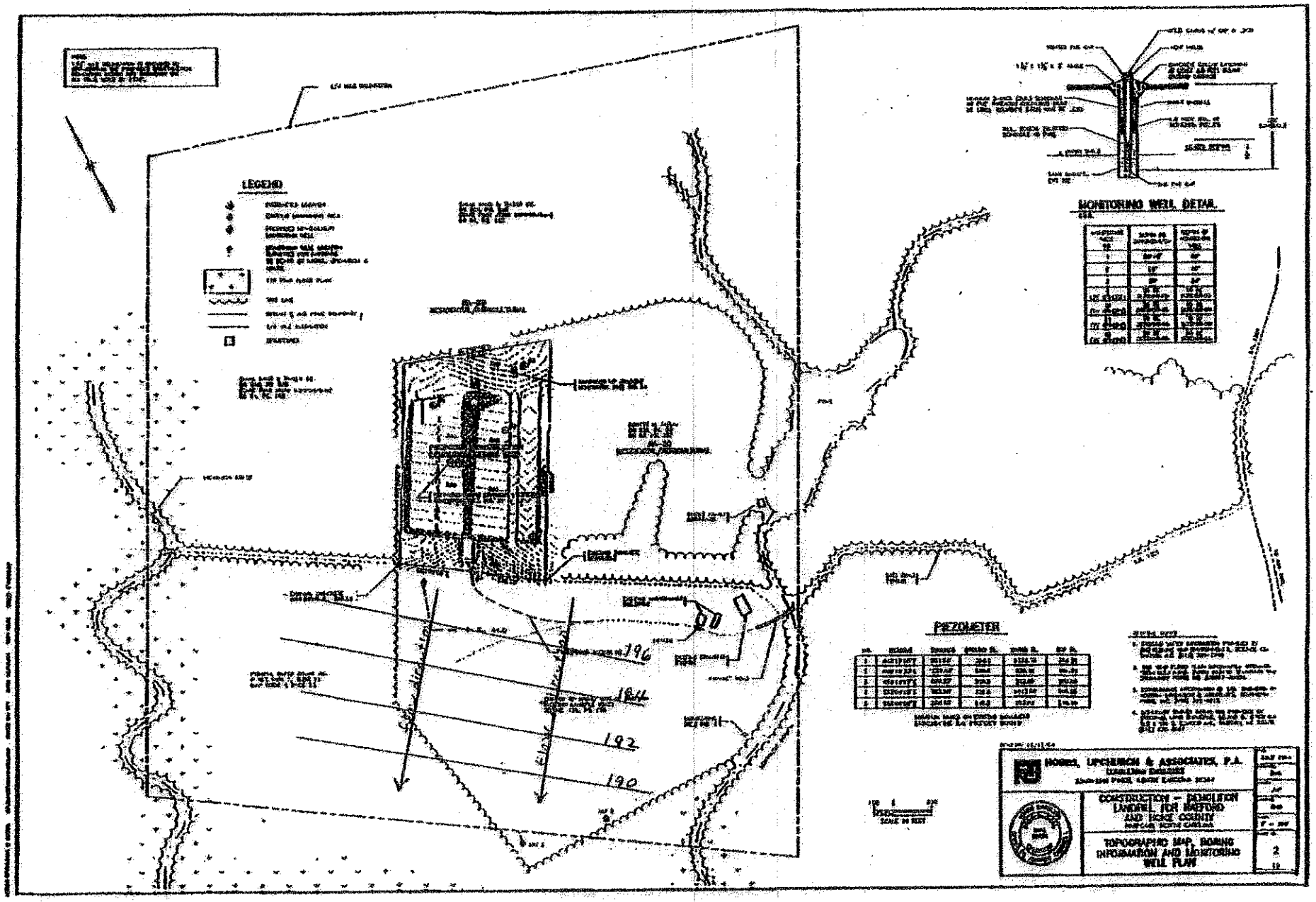
T. Patrick Shillington, P. E.
President

Attachment: Figure

PROFESSIONAL SEAL 15612 12/16/94 TPS

ATTACHMENT:

Figure


LEGEND
MONITORING WELL DETAIL
PIEZOMETER
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HOBBS, UPCHURCH & ASSOCIATES, P.A.
CONSTRUCTION – DEMOLITION LANDFILL FOR HAFFORD AND HOKE COUNTY
TOPOGRAPHIC MAP, BORING INFORMATION AND MONITORING WELL PLAN
2

HYDROGEOLOGIC STUDY
CONSTRUCTION AND DEMOLITION
DEBRIS LANDFILL
HOKE COUNTY, NORTH CAROLINA

April 9, 1994

Prepared For:

Hobbs, Upchurch & Associates
P. O. Box 1737
SouthernPines, NC 28388

Prepared By:

Engineering & Environmental
Science Company
3008 Anderson Dr., Ste. 102
Raleigh, NC 27609

E²S

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ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY

3008 ANDERSON DRIVE, SUITE 102

RALEIGH, NC 27609

(919) 781-7798

April 9, 1994

Mr. Dan Sundberg
Hobbs, Upchurch & Associates
P.O. Box 1737
Southern Pines, NC 28388

RE: Hydrogeologic Study
Construction & Demolition Debris Landfill
Hoke County, North Carolina

Dear Mr. Sundberg:

Engineering & Environmental Science Company (E^2S) has completed the Hydogeologic Study for the proposed Construction and Demolition Debris Landfill at the above referenced site. This Study was requested and authorized by Mr. Dan Sundberg of Hobbs, Upchurch & Associates, Inc. Following is a brief discussion of the project, subsurface conditions and evaluations and recommendations. More detailed information is contained in this report.

The proposed Construction & Demolition Landfill is located on approximately 20 acres of land that is immediately north of the existing Solid Waste Landfill operated by the City of Raeford and Hoke County. The exact base depth of the Construction and Demolition Debris Landfill has not been established at this time. However, maximum excavation will be approximately 10 ft. to 20 ft.

Subsurface soils predominantly consist of granular soils having varying amounts of silt and clay fines. Two groundwater conditions were noted. The upper groundwater condition appears to be a result of water perched in the more clayey sands that were encountered generally after depths of 22 ft. to 42 ft. below ground level (Elevation 227 ft. to 237 ft.). The limits of excavation for the demolition landfill should be several feet above the perched water level.

The lower groundwater table was found at elevation 194.2 ft. at the adjacent exist well for the Solid Waste Landfill. This water level is approximately 4 to 6 ft. higher than the surface water level at the intersection of Nicholson and Rockfish Creeks. The lower groundwater table appears to move in a southeast direction towards the intersection of Nicholson Creek and Rockfish Creek with a hydraulic gradient of approximately 0.003 ft./ft.

There is insufficient information to accurately determine the direction of the upper groundwater due to the variable permeability and possible lateral extent of the semi-aquitard. Because of the semi-pervious nature of this semi-aquitard, it is anticipated that this perched water will eventually peculate downward to the lower groundwater table.

Since groundwater perched above this layer will eventually reach the lower groundwater table, it is recommended that only the lower groundwater table be monitored. One additional well for up gradient testing is proposed along the west side of the demolition landfill. Depending on the water level measured in the new well relative to the existing well, one additional well may be required near the northeast corner of the demolition landfill.

We appreciate serving Hobbs, Upchurch & Associates on this project. Please contact us, if you have any questions about this Hydrogeologic Study.

Sincerely,

T. Patrick Shillington, P. E.
President

NORTH CAROLINA PROFESSIONAL SEAL 15472 ENGINEER T. PATRICK SHILLINGTON

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4.1 General Hydrogeology.....4

4.2 Proposed Monitoring Well System.....5

4.3 Soil Cover Materials.....6

Attachment A: Figures
Attachment B: Tables
Attachment C: Boring Logs

1.0 INTRODUCTION

The proposed Construction & Demolition Landfill is located on approximately 20 acres of land that is immediately north of the existing Solid Waste Landfill operated by the City of Raeford and Hoke County (see Figure 1, Attachment A). For this evaluation, Hobbs, Upchurch & Associates has provided preliminary drawings of the proposed construction.

Initially the site will provide borrow material for the adjacent Solid Waste Landfill. Approximately 5 ft. to 10 ft. of cut in some areas will be conducted for borrow material. Falling head permeability tests and Standard Proctor moisture density relationship tests were previously conducted on the shallow soils and where provided by Engineering & Environmental Science Company in the report dated November 22, 1993.

The exact base depth of the Construction and Demolition Debris Landfill has not been established at this time. However, excavation to establish the base of the landfill will be approximately 10 ft. to 20 ft. Cut slopes and fill slopes will be approximately 2:1 (H:V).

2.0 FIELD AND LABORATORY TESTING

Five (5) soil borings were drilled in the proposed Construction and Demolition Landfill to depths of 25 ft. to 50 ft. below the existing site grades. The borings were drilled at the approximate locations shown on the enclosed Figure No. 2. The locations and elevations of the borings were determined by Hobbs, Upchurch & Associates.

The borings were advanced using hollow-stem auger drilling techniques. Split-spoon samples were obtained at 5.0 ft. intervals and were obtained in accordance with the Standard Method for Penetration and Split-Barrel Sampling of Soils (ASTM D-1586). At Boring B-5, one shelby tube sample was taken in accordance with ASTM D-1587. The soils were sampled and logged in the field by a Geotechnical Engineer.

Upon completion of each boring, temporary piezometers were installed. The piezometers consisted of 10 ft. to 15 ft. lengths of No. 10 PVC screen (2" dia.) surrounded with sand extending from the bottom of the boring to the top of the screen. Solid PVC Pipe (2" dia.) connected to the screen continued to the ground surface. Water levels at each piezometer were measured to the nearest 0.01 ft. The water level was also measured in the existing groundwater monitoring well, for the Solid Waste Landfill. During the determination of water levels, downhole permeability tests were conducted in three (3) piezometers by hand bailing the well and

then monitoring the rise in water with time. Table 1 shows the test results and Figure No. 3 shows the measured water level elevations at each boring and the existing monitoring well.

Representative samples from each boring were sealed in glass jars and were returned to the E^2S laboratory. The soil samples were classified in accordance with the Unified Soil Classification System. To aid in the evaluation and classification of the soils, moisture content, Atterberg Limits and wash No. 200 sieve tests were conducted. Falling head permeability and density tests were conducted on the undisturbed soil sample taken from Boring B-5. Laboratory test results are shown on Table No. 2.

3.0 FIELD AND LABORATORY TEST RESULTS

3.1 SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered in the borings are presented in the Boring Logs in Attachment C. Strata divisions shown on the boring logs were estimated based on visual examination of the recovered boring samples. In the field, strata changes could occur gradually and/or at slightly different levels than indicated. Generalized subsurface conditions, based on the finds of the borings, are described below.

Beneath approximately 6 inches of topsoil, the underlying soils predominantly consisted of granular materials having non-plastic silt or low-plastic clay fines. These soils were classified as SM, SM-SC, SC, and SM-SP soil types. The less fines content soils (SM-SP) commonly were found after depths of 17 ft. below ground surface. At Boring B-5, the SM-SP soils were encountered after 4 ft. below ground level.

Some minor random cohesive (CL & ML) layers and seams were encountered in some of the borings and were commonly layered with the granular SC soil types.

The majority of the granular soils were medium dense with standard penetration resistance values of 11 blow per foot (bpf) to 38 bpf. Loose granular soils (Standard Penetration Resistance values ranging from 8 bpf to 10 bpf) typically were found near the ground surface and dense to very dense granular soils (47 to 77 blows per foot) were found in association with a trace of gravel in the soil matrix.

Groundwater conditions were noted during drilling and also measured several days after drilling. Table No. 1 shows the static groundwater levels measured several days after drilling. At that time, Borings B-1 and B-4 were dry, Borings B-2, B-3 and B-5 had water levels ranging from 19.06 ft. to 36.02 ft. below the top of

the piezometer casing. The existing well outside of the demolition landfill had a water level 54.26 ft. below the top of the casing.

Although groundwater was not found in Borings B-1 and B-4, water was noted on the drilling rods during drilling at depths of 40 ft. and 42 ft. below ground level.

3.2 TEST RESULTS

Based on the laboratory test results, the following soil types, have the indicated range of percent volume water (moisture contents), fines content and Atterberg Limit Test results:

Soil Type	Moisture Content, %	% Fines (<#200)	Atterberg Limits, % LL	PL	PI
SM-SP	4.3-12.0	9.9-12.9	None Plastic		
SM	11.6-21.7	19.8-25.4	25	22	3
SM-SC	12.1-12.9	21.3-28.4	26-30	21	5-9
SC-CL	12.9-29.0	*28.4-29.2	33-48	20-26	22-12

* Only applies to SC soil types.

Figure No. 4 shows the various depths of these material types at the various boring locations.

Laboratory testing also included one permeability test on the SC-CL soil type at Boring B-5. The permeability and dry density were 6.7×10^{-6} cm/s and 117.0 pcf, respectively.

In the field, horizontal coefficient of permeability of the water bearing soils in Borings B-2, B-3 and B-5 were estimated. These water bearing zones were underlain by the SC soil types that typically have a lower vertical coefficient of permeability (6.7×10^{-6} cm/s).

In general, the SM and SM-SP soils had a horizontal coefficient of permeability of 2.6×10^{-4} cm/s to 5.5×10^{-4} cm/s in Borings B-2 and B-5. The SM-SC soils at Boring B-3 had a coefficient of permeability of 1.7×10^{-5} cm/s.

4.0 EVALUATIONS AND RECOMMENDATIONS

4.1 GENERAL HYDROGEOLOGY

Subsurface soils predominantly consist of granular soils having varying amounts of silt and clay fines. The more clayey sands have cohesive clay layers.

Two groundwater conditions were noted. The upper groundwater condition appears to be a result of water perched at or above the more clayey sands that were encountered generally after depths of 22 ft. to 38 ft. below ground level.

This semi-aquitard appeared variable in texture and permeability. In Borings B-2, B-3 and B-5, static groundwater was observed above these less permeable zones at approximately 21 ft. to 38 ft. below ground surface. During drilling at Borings B-1 and B-4, water was noted immediately above these less permeable zones at depths of 38 ft. to 42 ft. below ground level. However, no water was noted in these piezometers several days after drilling.

The laboratory and field observations and testing generally indicate that the semi-aquitard had a higher clay content and higher plasticity index where perched water was noted in the piezometers than at the areas where no perched ground water was noted. Conditions that may also influence the presents of perched water is lateral extent of the semi-aquitard. These layers may not be connected and the lateral extent of each zone could vary.

The following table lists the elevations of the anticipated minimum groundwater depth at each boring. The observed water levels in the three piezometers and the depth of the suspected semi-aquitard at other locations were used for the water level elevations.

Boring No.	Water Elev., ft.
B-1	229
B-2	237
B-3	233
B-4	228
B-5	227

The semi-aquitard was estimated to have a vertical coefficient of permeability of 6.7×10^{-6} cm/s for the undisturbed sample taken at Boring B-5. This sample also had a dry density of 117.0 pound per cubic foot and a volume percent water (moisture content) of 15.5. Volume percent water also varied from 14.0 to 18.5 percent at other borings. The porosity was determined at 0.293.

Based on the down hole permeability tests at Boring B-2, B-3 and B-5, the overlying more pervious soils have a horizontal coefficient of permeability of $2x10^{-4}$ cm/s to $1x10^{-5}$ cm/s. Volume percent water varied from 21.6 to 21.9 percent within this layer. Assuming saturated conditions, the porosity is estimated at approximately 0.22.

There is insufficient information to accurately determine the direction of the upper groundwater, due to the variable permeability and possible lateral extent of the semi-aquitard. Because of the semi-pervious nature of this semi-aquitard, it is anticipated that this perched water will eventually peculate downward to the lower groundwater table.

The lower groundwater table was found at elevation 194.2 ft. at the exist well. This water level is approximately 4 to 6 ft. higher than the surface water level at the intersection of Nicholson and Rockfish Creeks (see Figure No. 5). Based on the existing monitoring well and utilization of the USGS Nicholson Creek Quadrangle Map, the lower groundwater table appears to move in a southeast direction towards the intersection of Nicholson Creek and Rockfish Creek with a hydraulic gradient of approximately 0.003 ft./ft.

4.2 PROPOSED MONITORING WELL SYSTEM

At the Construction & Demolish Debris Landfill site, two groundwater systems were encountered. The upper groundwater system is a result of a semi-aquitard. Since groundwater perched above this layer will eventually reach the lower groundwater table, it is recommended that the lower groundwater table be monitored. The well should be cased and sealed at and above the semi-aquitard.

Based on the estimated directional trend of the lower groundwater table, the existing up gradient monitoring well for the existing Solid Waste Landfill can be used for the down gradient monitoring for the Construction & Demolition Debris Landfill. One additional well for up gradient testing is proposed along the west side of the demolition landfill (see Figure No.6).

The proposed new up gradient well will provide better data for determining the exact flow direction of the lower ground water. If the water level in this new well is lower than the existing monitoring well, then groundwater movement is in a more westerly direction, and this new well is more in line and down gradient from the demolition landfill than the existing monitoring well. Should this situation occur, a third up gradient well should be installed near the northeast corner of the demolition landfill.

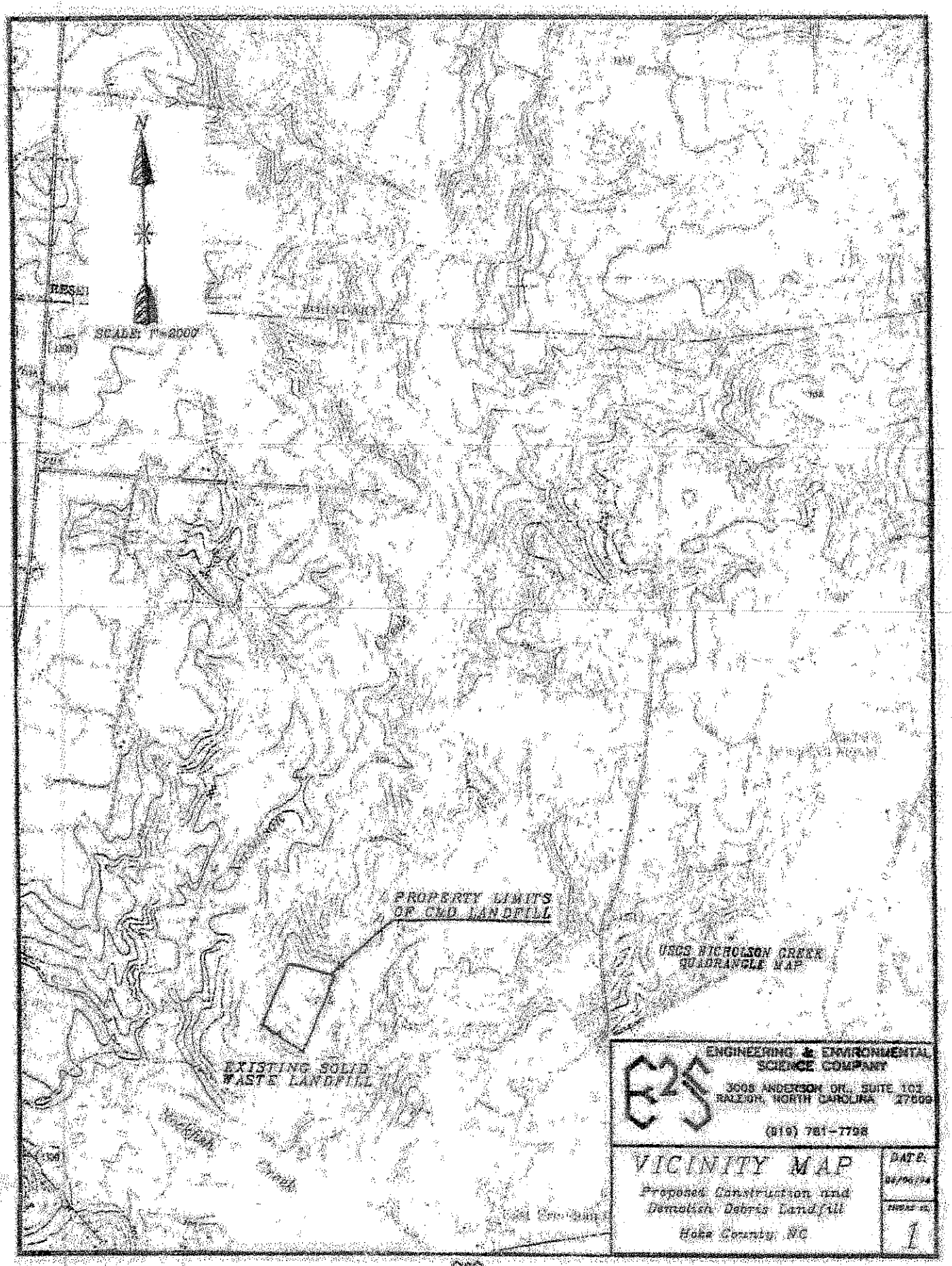
4.3 SOIL COVER MATERIALS

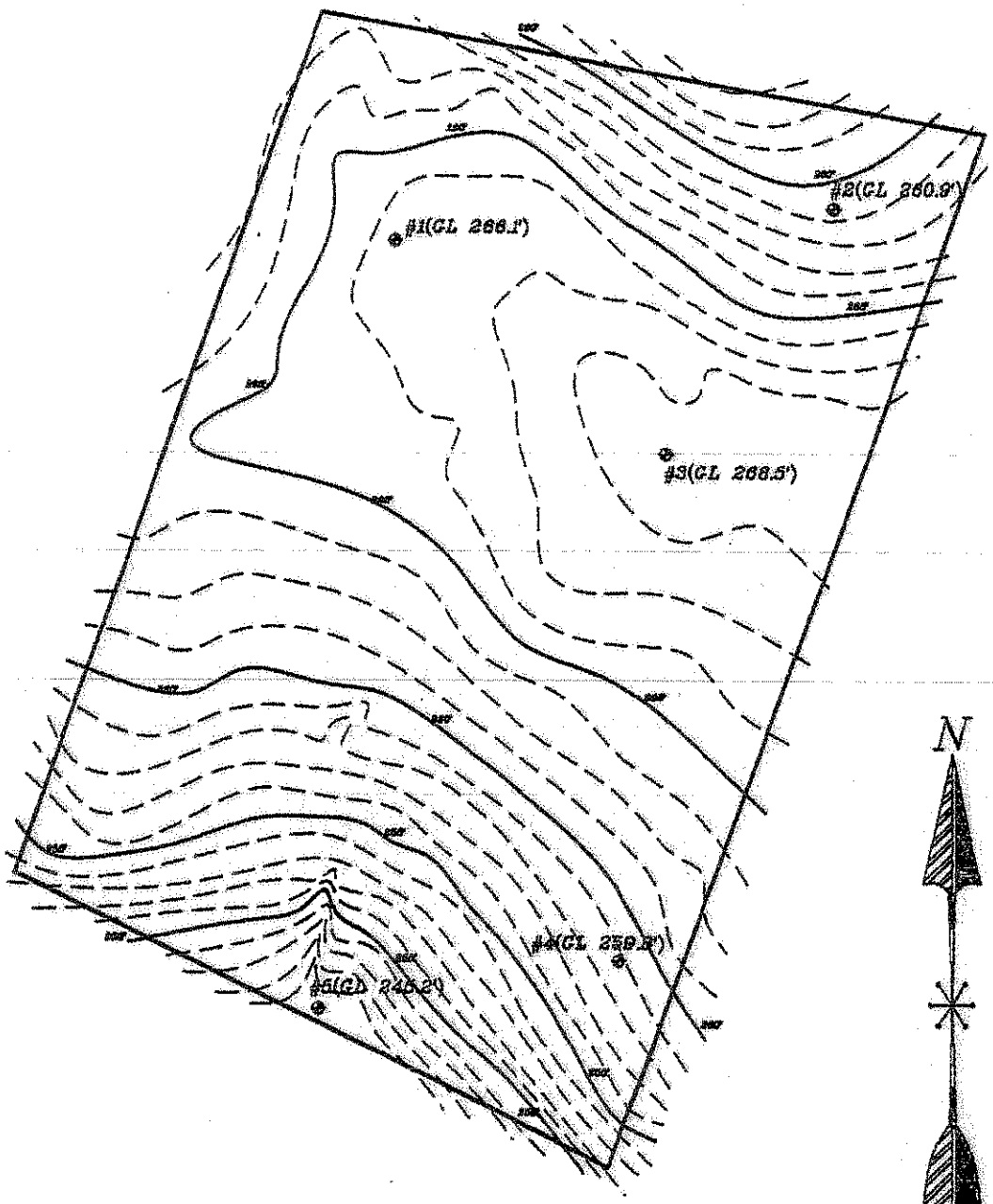
With the existing adjacent Solid Waste Landfill closure, evaluation of the coefficient of permeability of the surficial soils was conducted by E^2S and the information was provided in the report dated November 22, 1993. Degree of compaction to achieve a coefficient of permeability of at least $1x10^{-5}$ cm/sec. is 98 percent of standard Proctor maximum dry density (ASTM-D-698). Testing was conducted on the shallow SM, SM-SC and SC soil types. These soils commonly were found from below the topsoil to depths of at least 17 ft. below ground level.

To achieve 98 percent compaction, in-place density of these soils will need to be compacted to a dry density of 114.8 to 119.1 pounds per cubic foot. This correlates to a porosity of approximately 0.298 to 0.280.

ATTACHMENT A

Figures


N
SCALE: 1"=2000'
PROPERTY LIMITS OF CED LANDFILL
USGS NICHOLSON CREEK QUADRANGLE MAP
EXISTING SOLID WASTE LANDFILL
ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY
3005 ANDERSON DR., SUITE 102
RALEIGH, NORTH CAROLINA 27609
(919) 781-7798
VICINITY MAP
Proposed Construction and Demolish. Debris Landfill
Hoke County, NC
DATE:
FIGURE #:
1



NOTE: GL 268.5' INDICATES GROUND LEVEL AT EACH BORING ELEVATION

SCALE: 1"=200'

ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY
3008 ANDERSON DR., SUITE 102
RALEIGH, NORTH CAROLINA 27609
(919) 781-7798

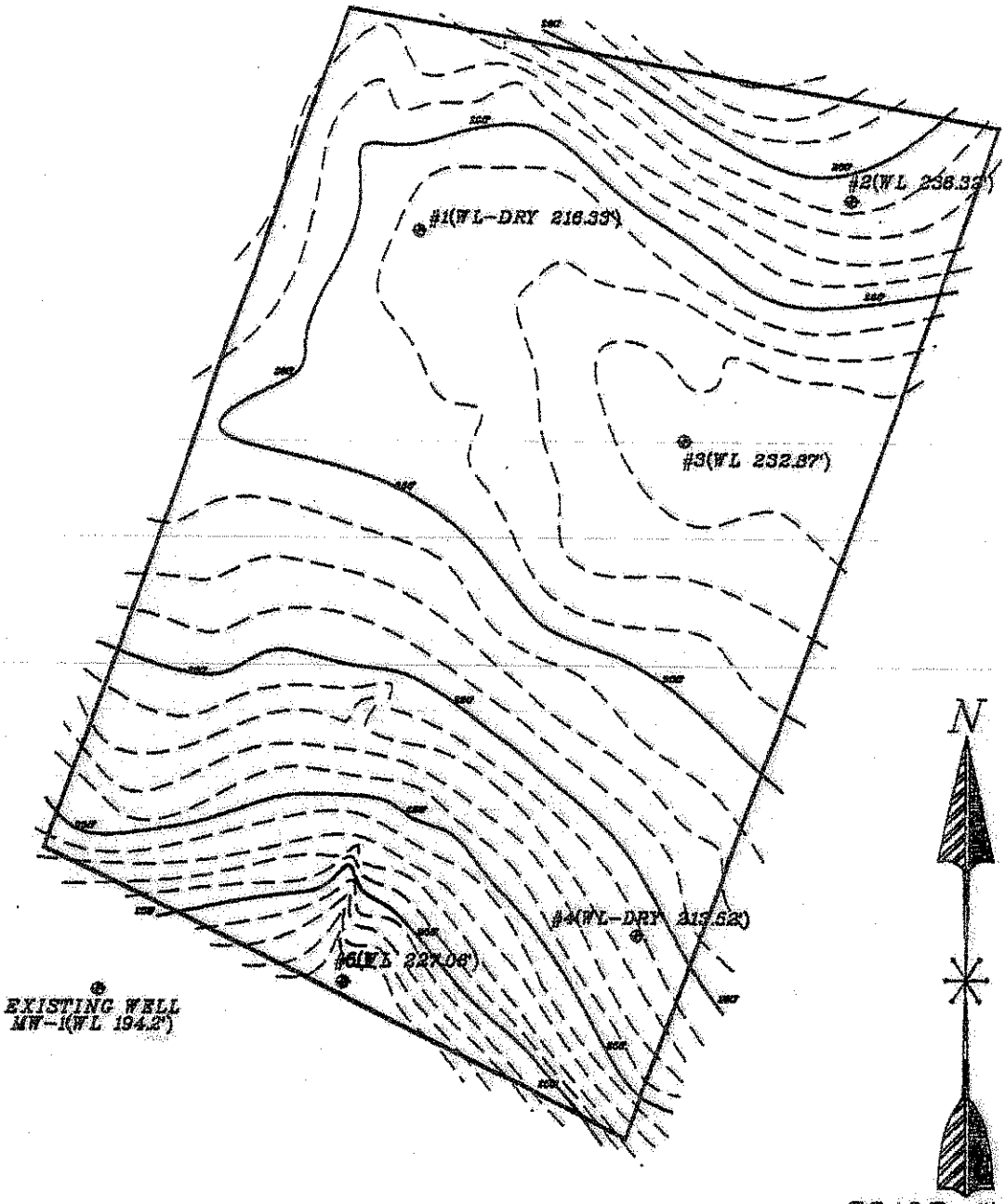
BORING LOCATION

Demolition Landfill

Hoke County, NC

DATE: 04/01/04

FIGURE NO. 2



SCALE: 1"=200'

NOTE: WL 194.2' INDICATED WATER ELEVATION

ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY
3008 ANDERSON DR., SUITE 102
RALEIGH, NORTH CAROLINA 27609
(919) 781-7798

WATER ELEVATIONS

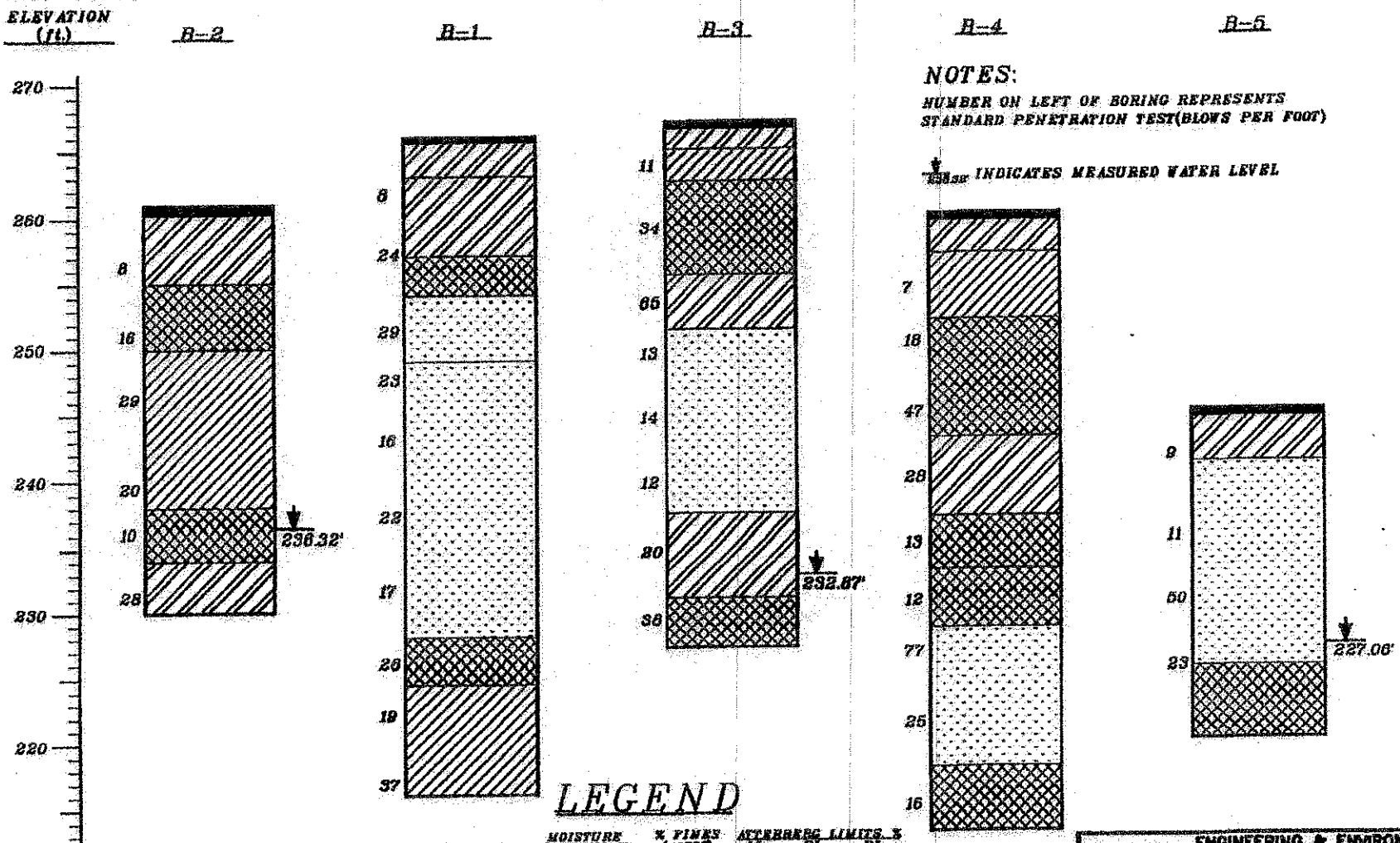
Demolition Landfill

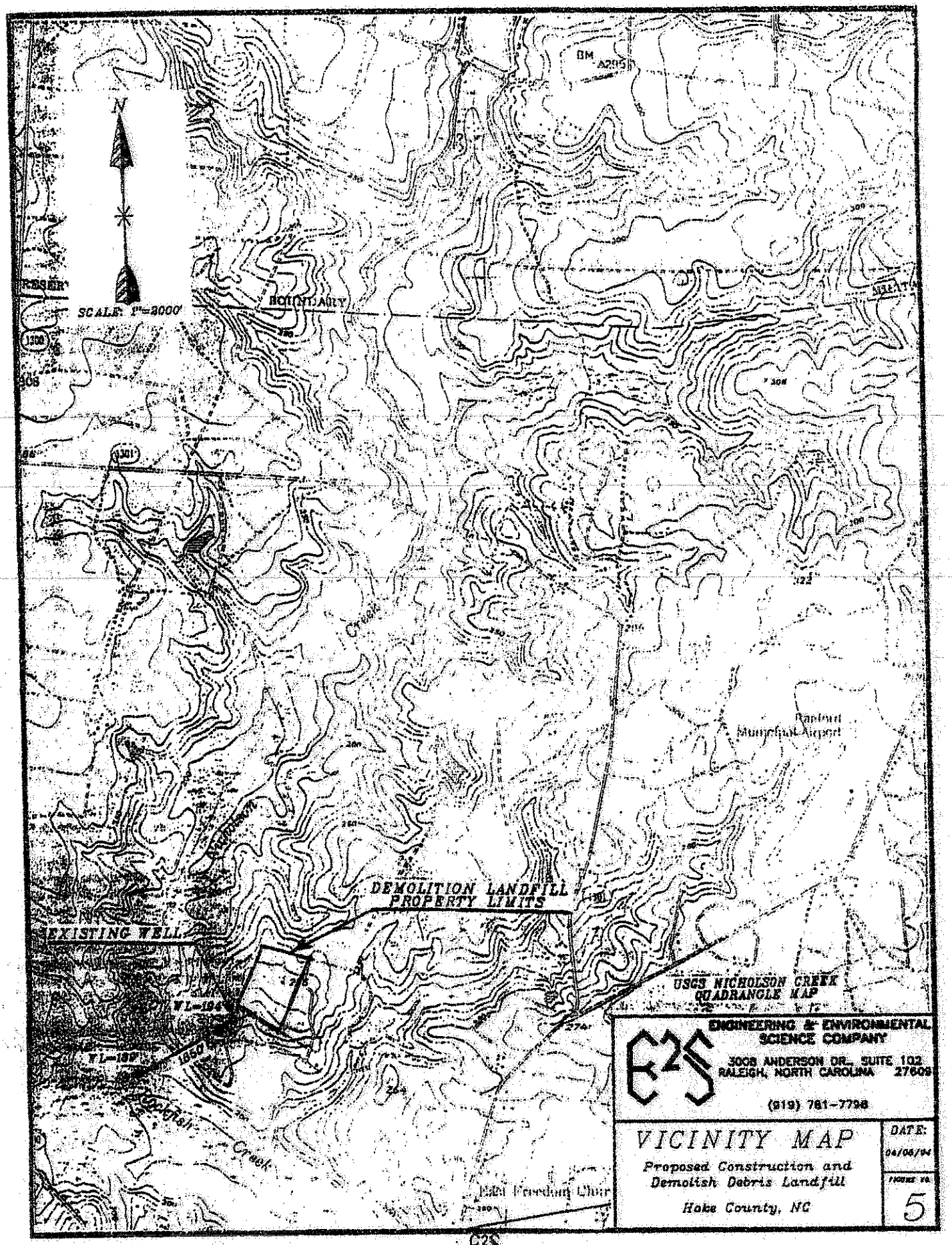
Hoke County, NC

DATE: 04/01/94

FIGURE NO. 3

E2S


ELEVATION (ft.)
270
260
250
240
230
220
210
B-2
8
16
29
20
10
28
236.32'
B-1
8
24
29
23
16
22
17
26
19
37
B-3
11
34
65
13
14
12
20
38
232.87'
B-4
7
18
47
28
13
12
77
25
16
B-5
9
11
60
23
227.06'
NOTES:
NUMBER ON LEFT OF BORING REPRESENTS STANDARD PENETRATION TEST(BLOWS PER FOOT)
INDICATES MEASURED WATER LEVEL
LEGEND
SOIL TYPE | MOISTURE CONTENT % | % FINES (<#200) | ATTERBERG LIMITS % LL | PL | PI
TOPSOIL | — | — | — | — | —
SM-SP | 4.3-13.0 | 9.9-12.9 | NONE PLASTIC
SM | 11.9-21.7 | 19.8-25.4 | 25 | 22 | 3
SM-SC | 12.1-18.9 | 21.9-28.4 | 26-30 | 21 | 5-9
SC & CL | 12.9-29.0 | *25.4-29.2 | 33-48 | 20-40 | 22-12
* ONLY APPLIES TO SC SOIL TYPES
ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY
3008 ANDERSON DR., SUITE 102
RALEIGH, NORTH CAROLINA 27609
(919) 781-7798
STRATAGRAPHIC CROSS-SECTION
Demolition Landfill
Hoke County, NC
DATE: 04/07/94
FIGURE NO. 4



ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY
3008 ANDERSON DR., SUITE 102
RALEIGH, NORTH CAROLINA 27609
(919) 781-7798

VICINITY MAP

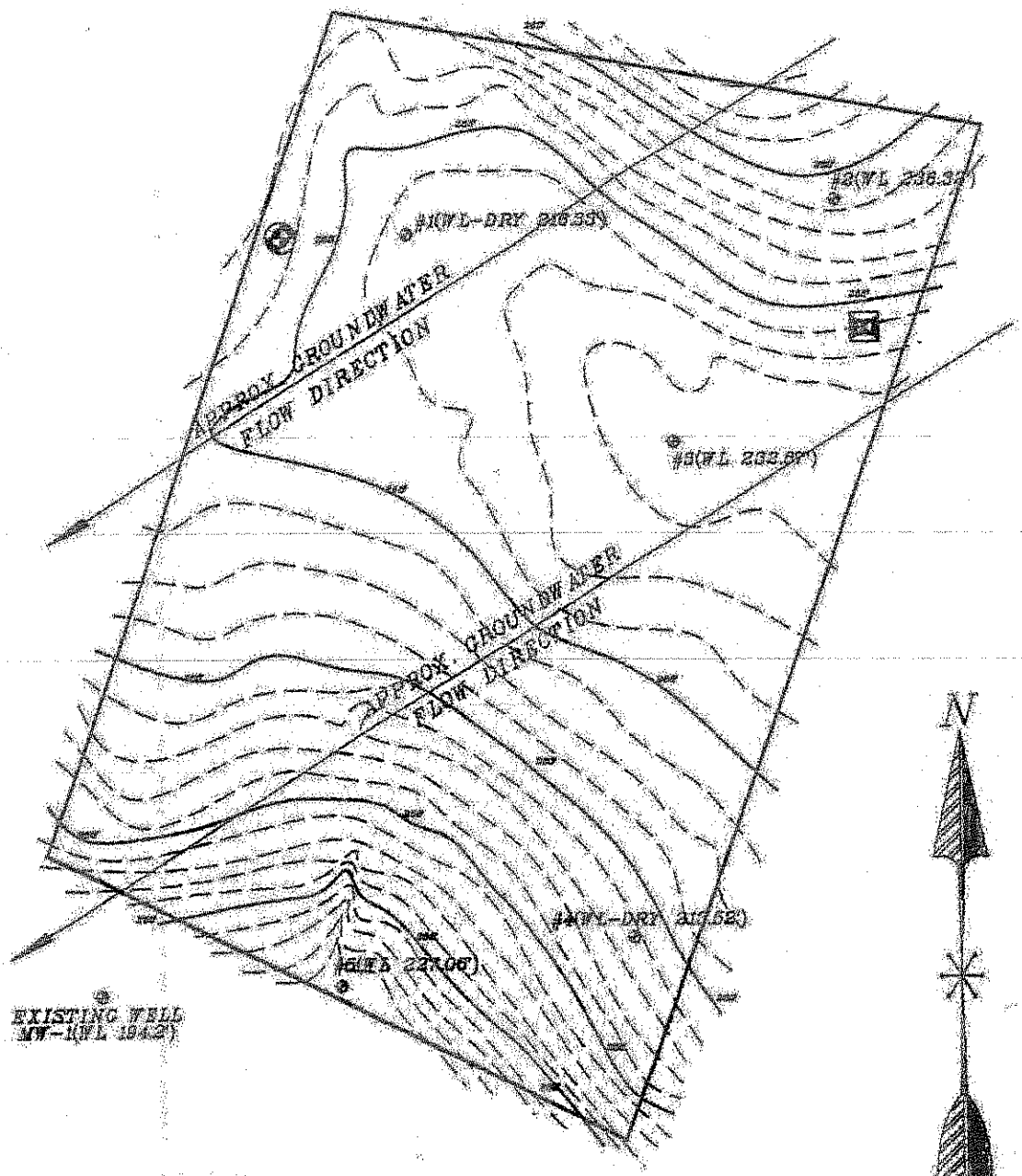
Proposed Construction and Demolish Debris Landfill

Hoke County, NC

DATE: 04/06/94

FIGURE NO. 5

E2S



SCALE: 1"=200'

NOTES:

INDICATES PROPOSED WELL LOCATION

INDICATES POSSIBLE WELL LOCATION

ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY
3008 ANDERSON DR., SUITE 103
RALEIGH, NORTH CAROLINA 27609
(919) 781-7798

PROPOSED MONITORING WELL LOCATION

Demolition Landfill

Hoke County, NC

DATE: 04/01/94

FIGURE NO. 6

ATTACHMENT B

Tables

Table No. 1: Water Level Elevations & Downhole Permeability Tests Results

Boring No.	Elevation, ft.	Water, ft.	Elevation, ft.	Down Hole Perm., cm/s
B-1	266.31	Dry-49.98	>216.33	
B-2	261.21	24.89	236.32	2.6×10^{-4}
B-3	268.89	36.02	232.87	1.7×10^{-5}
B-4	260.63	Dry-47.11	>213.52	
B-5	246.12	19.06	227.06	5.5×10^{-4}
Existing Well	248.50	54.26	194.2	

TABLE NO. 2: Laboratory Test Results

Boring No.	Sample Depth, ft.	Moisture Content, %	% Passing No. 200 Sieve	Atterber Limits, % LL	PL	PI
B-1	3.5- 5.0	14.8	19.8	25	22	3
	8.5- 9.5	15.6				
	9.5-10.0	14.9				
	13.5-15.0	4.3	10.6			
	23.5-25	8.4	9.9			
	33.5-35	21.9	10.1			
	38.5-40	17.7	25.2	33	21	12
	48.5-50	12.0	12.9			
B-2	8.5-10.0	12.9	28.4	41	25	16
	13.5-15.0	12.1	21.3	31	24	16
	28.5-30.0	14.0		40	22	18
B-3	23.5-25.0	9.1	11.0			
	33.5-35.0	21.7	25.4	26	21	5
	38.5-40.0	15.1	25.2	39	20	19
B-4	3.5- 5.0	11.6				
	8.5-10.0	13.4	29.2			
	23.5-25.0	5.2	29.0			
	38.5-40	7.0	11.7			
	43.5-45	18.5	21.6			
B-5	13.5-15	8.0	10.9			
	18.5-20	21.6		48	26	22

		Wet Density, pcf	Moisture Content, %	Dry Density pcf	Coef. of Perm. cm/s
B-5	23' - 25'	135.2	15.5	117.0	6.7×10^{-6}

ATTACHMENT C

Boring Logs

CLIENT: Hobbs, Upchurch & Associates

PROJECT NAME: Demolition Landfill

PROJECT LOCATION: Hoke County, NC

BORING METHOD: 4 1/2" HSA

ROCK CORE DIA.: N/A

SHELBY TUBE O.D.: 3" Dia.

BORING NO.: B-1 DATE: 02/18/94

JOB NO.:

STATION:

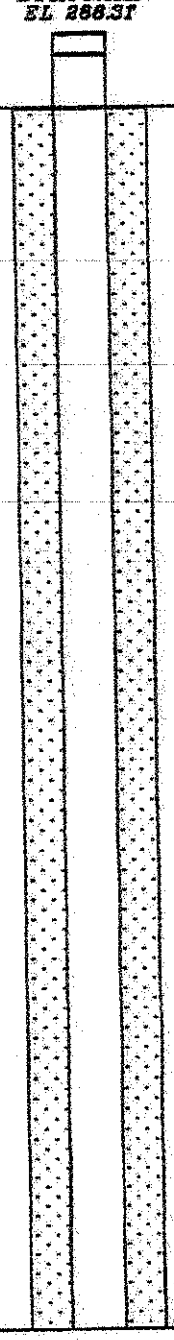
FOREMAN: Sanford Sweeting

INSPECTOR: Pat Shillington

SURFACE ELEVATION: 266.1 ft.

DEPTH (ft)	DESCRIPTION & REMARKS	STRATUM DEPTH, ft.	SAMPLE NUMBER	**SPT BLOWS/6 in.	**SPT RECOVERY %	*OVM, PPM	MOISTURE CONTENT, %	CALIBRATED PENETROMETER TSF
	TOPSOIL	0.5'						
	Loose, gray silty medium SAND(SM), moist	3.0'						
			1	3 3-3	90			
5	Medium dense, brown silty fine SAND(SM), moist							
		9.5'	2	4 6-18	95			
10	Very stiff, brown, gray, & maroon silty CLAY(CL), moist with sandy zones (SC)							
		12.0'						
	Medium dense, light brown silty medium to coarse SAND(SM-SP), moist, trace of mica		3	9 14-15	100			
15								
		17.0'						
			4	6 11-12	85			
20	Medium dense, brown minor maroon, and light gray silty fine SAND(SM-SP), moist, trace of mica							
			5	7 8-8	90			
25								
	Sand grades to coarse after 28'		6	8 9-13	85			
30								
			7	8 8-9	90			
35	(CONTINUED ON NEXT PAGE)							

PIEZOMETER DIAGRAM
EL 266.3'



BORING METHOD
HSA - HOLLOW STEM AUGER
CFA - CONTINUOUS FLIGHT AUGER
DC - DRIVEN CASING
MD - MUD DRILLING
RC - ROCK CORING

*ORGANIC VAPOR METER, PARTS PER MILLION

**STANDARD PENETRATION TEST

GROUND WATER

NOTED ON RODS 40 FT.
AT COMPLETION DRY FT.
AFTER 864 HRS. DRY FT.
AFTER ____ HRS. ____ FT.
AFTER ____ HRS. ____ FT.
AFTER ____ HRS. ____ FT.

CLIENT: Hobbs, Upchurch & Associates

BORING NO.: B-1 DATE: 02/16/94

PROJECT NAME: Demolition Landfill

JOB NO.:

PROJECT LOCATION: Hoke County, NC

STATION:

BORING METHOD: 4 1/2" HSA

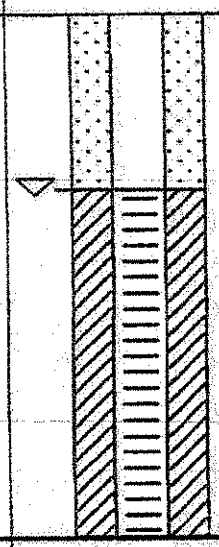
FOREMAN: Sanford Sweating

ROCK CORE DIA.: N/A

INSPECTOR: Pat Shillington

SHELBY TUBE O.D.: 3" Dia.

DEPTH (ft)	DESCRIPTION & REMARKS SURFACE ELEVATION: 266.1 ft	STRATUM DEPTH, ft.	SAMPLE NUMBER	**SPT BLOWS/6 in.	**SPT RECOVERY %	*OVM, PPM	MOISTURE CONTENT, %	CALIBRATED PENETROMETER TSF	PIEZOMETER DIAGRAM
	Medium dense, brown minor maroon, and light gray silty fine to coarse SAND(SM-SP), moist, trace of mica	38.0'							
40	Medium dense, gray clayey medium SAND(SC), very moist, trace of mica		8	9 11-15	100				
		42.0'							
45	Medium dense to dense, brown and light gray silty fine to medium SAND(SM-SP), very moist		9	8 9-10	86				
50		50.0'	10	10 12-23	80				
55									
60									
65									
70									



LEGEND

- SOIL BACKFILL
- 2" PVC SOLID PIPE
- SAND PACK
- 2" PVC No.10 SCREEN

BORING METHOD

HSA - HOLLOW STEM AUGER
CFA - CONTINUOUS FLIGHT AUGER
DC - DRIVEN CASING
MD - MUD DRILLING
RC - ROCK CORING

*ORGANIC VAPOR METER, PARTS PER MILLION

**STANDARD PENETRATION TEST

GROUND WATER

NOTED ON RODS 40 FT. — AFTER ____ HRS. ____ FT.

AT COMPLETION DRY FT. — AFTER ____ HRS. ____ FT.

AFTER 846 HRS. DRY FT. — AFTER ____ HRS. ____ FT.

CLIENT: Hobbs, Upchurch & Associates

BORING NO.: B-2 DATE: 02/18/94

PROJECT NAME: Demolition Landfill

JOB NO.:

PROJECT LOCATION: Hoke County, NC

STATION:

BORING METHOD: 4 1/2" HSA

FOREMAN: Sanford Sausing

ROCK CORE DIA: N/A

INSPECTOR: Pat Shillington

SHELBY TUBE O.D.: 3" Dia.

SURFACE ELEVATION: 260.9 ft.

DEPTH (ft)	DESCRIPTION & REMARKS	STRATUM DEPTH, ft.	SAMPLE NUMBER	**SPT BLOWS/6 in.	**SPT RECOVERY %	*OVM, PPM	MOISTURE CONTENT, %	CALIBRATED PENETROMETER TSF
	TOPSOIL	0.5'						
	Loose, brown silty fine to medium SAND(SM), moist to very moist							
5			1	3 4-4	80			
		6.0'						
	Medium dense, brown and reddish-brown clayey fine SAND(SC), moist, trace of mica							
10			2	8 8-8	90			
		11.0'						
	Medium dense, brown and reddish-brown clayey silty fine to medium SAND(SM-SC), moist to very moist							
15			3	10 12-17	100			
20			4	6 10-10	95			
		23.0'						
25	Medium dense, reddish-brown and light gray silty coarse SAND(SM), wet, trace of mica		5	4 4-8	95			
		27.0'						
30	Medium dense, reddish-brown and light gray clayey coarse SAND(SC), moist, trace of mica, random CLAY(CL) layers		6	35 9-19	95			
		31.0'						
35								

PIEZOMETER DIAGRAM
EL. 261.21'

LEGEND:
- SOIL BACKFILL
- SAND PACK
- 2" PVC SOLID PIPE
- 2" PVC No.10 SCREEN

BORING METHOD
HSA - HOLLOW STEM AUGER
CFA - CONTINUOUS FLIGHT AUGER
DC - DRIVEN CASING
MD - MUD DRILLING
RC - ROCK CORING

*ORGANIC VAPOR METER, PARTS PER MILLION

**STANDARD PENETRATION TEST

GROUND WATER
NOTED ON RODS 27.0 FT.
AT COMPLETION ____ FT.
AFTER 882 HRS. 24.6 FT.
AFTER ____ HRS. ____ FT.
AFTER ____ HRS. ____ FT.
AFTER ____ HRS. ____ FT.

CLIENT: Hobbs, Upchurch & Associates

BORING NO.: B-3 DATE: 02/17/94

PROJECT NAME: Demolition Landfill

JOB NO.:

PROJECT LOCATION: Hoke County, NC

STATION:

BORING METHOD: 4 1/2" HSA

FOREMAN: Sanford Sweesting

ROCK CORE DIA.: N/A

INSPECTOR: Pat Shillington

SHELBY TUBE O.D.: 3" Dia.

DEPTH (ft)	DESCRIPTION & REMARKS SURFACE ELEVATION: 268.5 ft.	STRATUM DEPTH, ft.	SAMPLE NUMBER	**SPT BLOWS/6 in.	**SPT RECOVERY %	*OVM, PPM	MOISTURE CONTENT, %	CALIBRATED PENETROMETER TSF	PIEZOMETER DIAGRAM EL. 268.89'
	Topsoil	0.8'							
	Loose, brown silty fine to medium SAND(SM), moist	2.5'							
	Medium dense, reddish-brown clayey silty fine SAND(SM-SC), moist		1	5 5-6	90				
5		6.0'							
	Dense, brown, minor reddish-brown mottling clayey fine SAND(SC), moist		2	9 11-23	80				
10		12.0'							
	Dense, light gray and light brown, minor red silty fine SAND(SM), moist, trace of mica		3	15 25-10	80				
15		17.0'							
	Medium dense, reddish-brown and light gray silty coarse SAND(SM-SP), very moist		4	6 6-7	100				
20									
			5	5 6-8	100				
25	Minor light gray clayey SAND(SC) seams after 27'								
			6	4 6-8	96				
30		31.0'							
	Medium dense, maroon and light gray silty clayey micaceous fine SAND(SM-SC), very moist		7	3 4-18	90				
35	(CONTINUED ON NEXT PAGE)								

BORING METHOD

HSA - HOLLOW STEM AUGER
CFA - CONTINUOUS FLIGHT AUGER
DC - DRIVEN CASING
MD - MUD DRILLING
RC - ROCK CORING

*ORGANIC VAPOR METER, PARTS PER MILLION

**STANDARD PENETRATION TEST

GROUND WATER

NOTED ON RODS 33 FT.
AT COMPLETION ____ FT.
AFTER 860 HRS. 35.6 FT.

AFTER ____ HRS. ____ FT.
AFTER ____ HRS. ____ FT.
AFTER ____ HRS. ____ FT.

CLIENT: Hobbs, Upchurch & Associates

BORING NO.: B-3 DATE: 02/17/94

PROJECT NAME: Demolition Landfill

JOB NO.:

PROJECT LOCATION: Hoke County, NC

STATION:

BORING METHOD: 4 1/2" HSA

FOREMAN: Sanford Sussetino

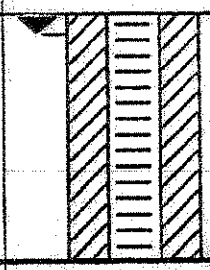
ROCK CORE DIA.: N/A

INSPECTOR: Pat Shillington

SHELBY TUBE O.D.: 3" Dia.

SURFACE ELEVATION: 268.5 ft.

DEPTH (ft)	DESCRIPTION & REMARKS	STRATUM DEPTH, ft.	SAMPLE NUMBER	**SPT BLOWS/6 in.	**SPT RECOVERY %	*OVM, PPM	MOISTURE CONTENT, %	CALIBRATED PENETROMETER TSF	PIEZOMETER DIAGRAM
		36.0'							
	Dense, gray minor brown and dark red mottling clayey medium to coarse SAND(SC), moist, trace of mica		6	14 15-23	90				
40		42.0'							
45									
50									
55									
60									
65									
70									



LEGEND

- SOIL BACKFILL
- 2" PVC SOLID PIPE
- SAND PACK
- 2" PVC No.10 SCREEN

BORING METHOD

HSA - HOLLOW STEM AUGER
CFA - CONTINUOUS FLIGHT AUGER
DC - DRIVEN CASING
MD - MUD DRILLING
RC - ROCK CORING

*ORGANIC VAPOR METER, PARTS PER MILLION

**STANDARD PENETRATION TEST

GROUND WATER

NOTED ON RODS 33 FT.
AT COMPLETION ____ FT.
AFTER 860 HRS. 35.8 FT.

AFTER ____ HRS. ____ FT.
AFTER ____ HRS. ____ FT.
AFTER ____ HRS. ____ FT.

CLIENT: Hobbs, Upchurch & Associates — BORING NO.: B-4 — DATE: 02/17/24

PROJECT NAME: Demolition Landfill — JOB NO.:

PROJECT LOCATION: Hoke County, NC — STATION:

BORING METHOD: 4 1/2" HSA — FOREMAN: Sanford Sweeting

ROCK CORE DIA.: N/A — INSPECTOR: Pat Shillington

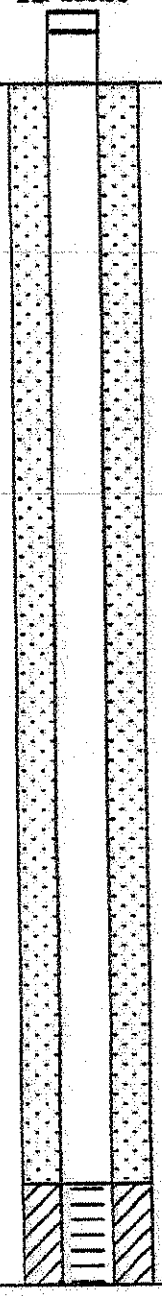
SHELBY TUBE O.D.: 3" Dia.

SURFACE ELEVATION: 259.8 ft.

DEPTH (ft)	DESCRIPTION & REMARKS	STRATUM DEPTH, ft.	SAMPLE NUMBER	**SPT BLOWS/6 in.	**SPT RECOVERY %	*OVM, PPM	MOISTURE CONTENT, %	CALIBRATED PENETROMETER TSF
	TOPSOIL	0.5'						
	Loose, brown silty fine SAND(SM), moist	2.5'						
5	Loose, reddish-brown silty clayey fine SAND(SM-SC), moist	8.0'	1	3 3-4	95			
10			2	8 12-16	75			
15	Medium dense to very dense, brown and reddish-brown clayey medium SAND(SC), moist	17.0'	3	11 23-26	66			
20	Medium dense to dense, brown and light gray silty medium to coarse SAND(SM), moist	23.0'	4	9 13-15	95			
25	Medium dense, gray and maroon clayey coarse SAND(SC), moist	27.0'	5	4 6-7	100			
30	Medium dense, alternating layers of reddish brown silty medium SAND(SM), maroon clayey SILT(ML), and light gray clayey fine SAND(SC), moist	31.0'	6	11 8-8	100			
35	Very dense, reddish-brown silty fine to medium SAND(SM-SP), moist, trace of gravel. Gravel content increases after 34ft.		7	8 27-50	40			

(CONTINUED ON NEXT PAGE)

PIEZOMETER DIAGRAM
EL. 260.63'



BORING METHOD
HSA - HOLLOW STEM AUGER
CFA - CONTINUOUS FLIGHT AUGER
DC - DRIVEN CASING
MD - MUD DRILLING
RC - ROCK CORING

*ORGANIC VAPOR METER, PARTS PER MILLION
**STANDARD PENETRATION TEST

GROUND WATER
NOTED ON RODS 42 FT. — AFTER ___ HRS. ___ FT.
AT COMPLETION ___ FT. — AFTER ___ HRS. ___ FT.
AFTER 832 HRS. DRY FT. — AFTER ___ HRS. ___ FT.

CLIENT: Hobbs, Upchurch & Associates

BORING NO.: B-4 DATE: 02/17/94

PROJECT NAME: Demolition Landfill

JOB NO.:

PROJECT LOCATION: Hoke County, NC

STATION:

BORING METHOD: 4 1/2" HSA

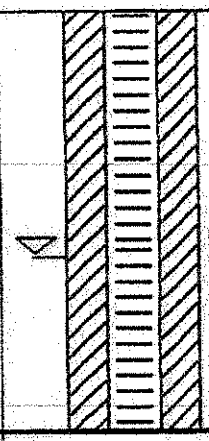
FOREMAN: Sanford Sweeting

ROCK CORE DIA.: N/A

INSPECTOR: Pat Shillington

SHELBY TUBE O.D.: 3" Dia.

DEPTH (ft)	DESCRIPTION & REMARKS	STRATUM DEPTH, ft.	SAMPLE NUMBER	**SPT BLOWS/6 in.	**SPT RECOVERY %	*OVM, PPM	MOISTURE CONTENT, %	CALIBRATED PENETROMETER, TSF	PIEZOMETER DIAGRAM
	SURFACE ELEVATION: 259.8 ft.								
40	Medium dense, reddish-brown silty fine to medium SAND(SM-SP), moist, trace of gravel		8	30 15-10	60				
		42.0'							
	Medium dense, gray clayey medium SAND(SC), wet, trace of mica								
45			9	7 7-9	100				
		47.0'							
50									
55									
60									
65									
70									



LEGEND

- -SOIL BACKFILL
- -2" PVC SOLID PIPE
- -SAND PACK
- -2" PVC No.10 SCREEN

BORING METHOD

HSA - HOLLOW STEM AUGER
CFA - CONTINUOUS FLIGHT AUGER
DC - DRIVEN CASING
MD - MUD DRILLING
RC - ROCK CORING

*ORGANIC VAPOR METER, PARTS PER MILLION

**STANDARD PENETRATION TEST

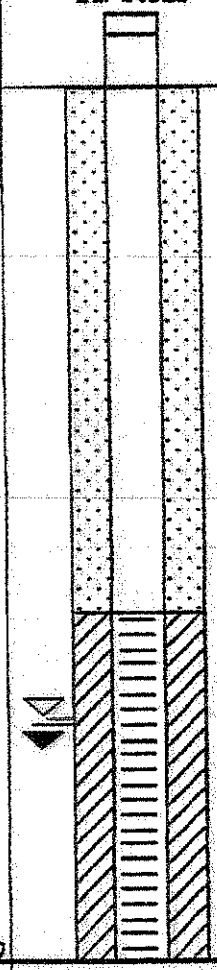
GROUND WATER

NOTED ON RODS 42 FT.
AT COMPLETION ____ FT.
AFTER 832 HRS. DRY FT.
AFTER ____ HRS. ____ FT.
AFTER ____ HRS. ____ FT.
AFTER ____ HRS. ____ FT.

CLIENT: Hobbs, Upchurch & Associates
BORING NO.: B-5 DATE: 02/17/94
PROJECT NAME: Demolition Landfill
JOB NO.:
PROJECT LOCATION: Hoke County, NC
STATION:
BORING METHOD: 4 1/2" HSA
FOREMAN: Sanford Sweeting
ROCK CORE DIA.: N/A
INSPECTOR: Pat Shillington
SHELBY TUBE O.D.: 3" Dia.

DEPTH (ft)	DESCRIPTION & REMARKS	STRATUM DEPTH, ft.	SAMPLE NUMBER	**SPT BLOWS/6 in.	**SPT RECOVERY %	*OVM, PPM	MOISTURE CONTENT, %	CALIBRATED PENETROMETER TSF
	SURFACE ELEVATION: 245.2 ft.							
	TOPSOIL	0.5'						
	Loose, gray silty medium SAND(SM), moist, trace of fine pebbles	4.0'	1	3 3-3	100			
5	Loose to dense, reddish-brown silty fine SAND(SM-SP), moist							
	Sand grades to medium after 7'		2	10 5-6	90			
10								
	Trace of gravel after 14'		3	16 26-26	65			
15								
		19.5'	4	8 8-16	90			
20	Very stiff to hard, gray silty CLAY(CL), moist, trace of sand							
		25.0'	5					+4.0
25								
30								
35								

PIEZOMETER DIAGRAM
EL. 246.12'



NOTES:

Sample 5 is Shelby Tube Sample

LEGEND

- SOIL BACKFILL
- 2" PVC SOLID PIPE
- SAND PACK
- 2" PVC No.10 SCREEN

BORING METHOD
HSA - HOLLOW STEM AUGER
CFA - CONTINUOUS FLIGHT AUGER
DC - DRIVEN CASING
MB - MUD DRILLING
RC - ROCK CORING

*ORGANIC VAPOR METER, PARTS PER MILLION
**STANDARD PENETRATION TEST

GROUND WATER
NOTED ON RODS 18.0 FT.
AT COMPLETION FT.
AFTER 828 HRS. 18.14 FT.
AFTER HRS. FT.
AFTER HRS. FT.
AFTER HRS. FT.

End of Book

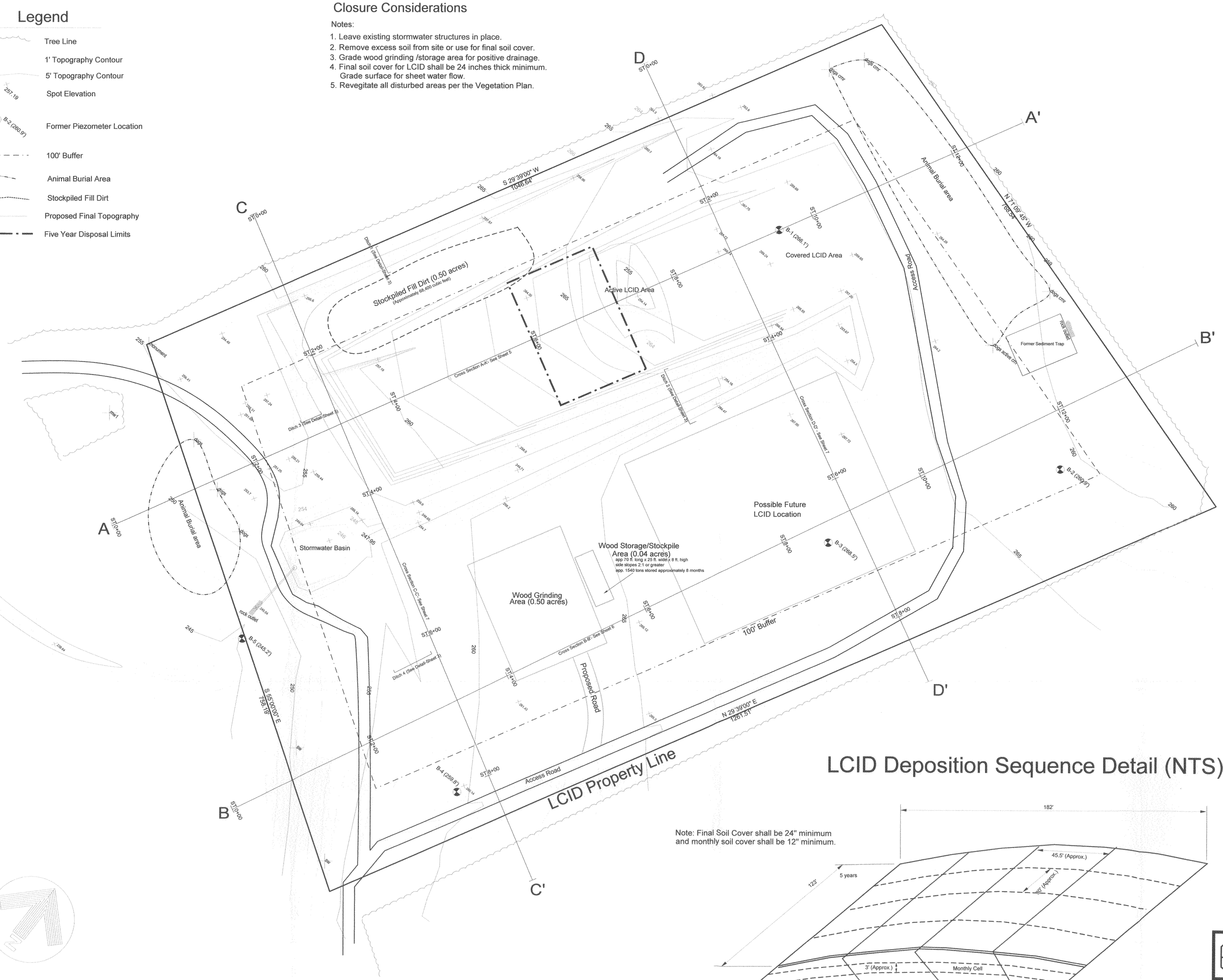
Legend

- Tree Line
- 1' Topography Contour
- 5' Topography Contour
- Spot Elevation (257.19)
- Former Piezometer Location (B-2 (260.8'))
- 100' Buffer
- Animal Burial Area
- Stockpiled Fill Dirt
- Proposed Final Topography
- Five Year Disposal Limits

Closure Considerations

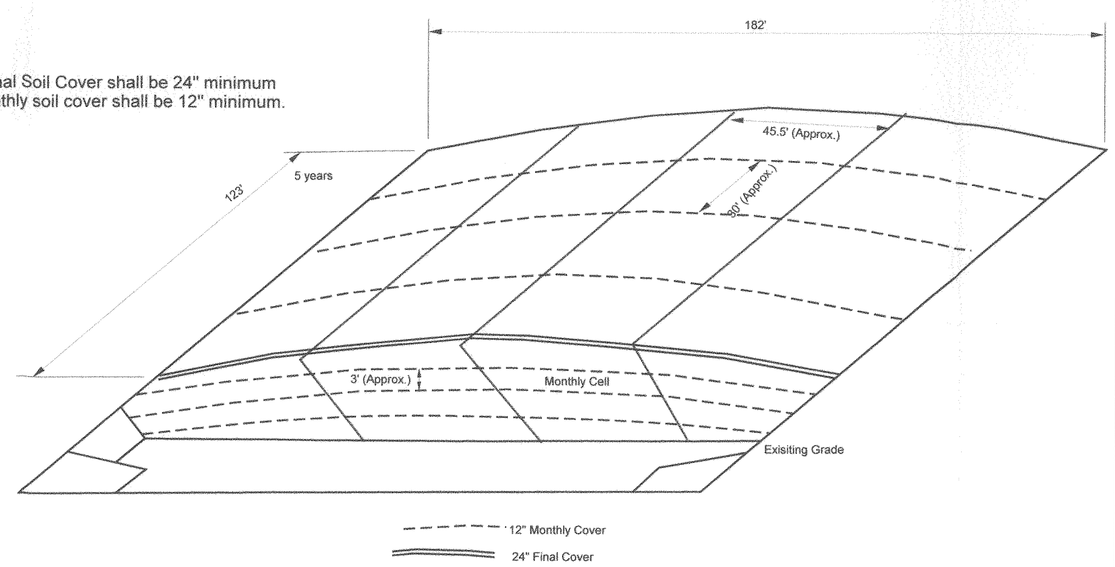
Notes:

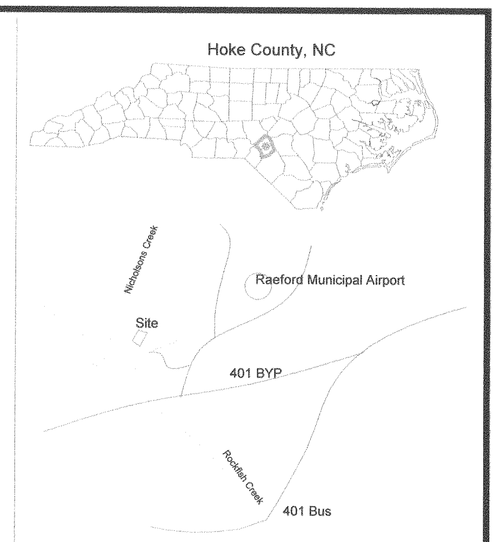
1. Leave existing stormwater structures in place.
2. Remove excess soil from site or use for final soil cover.
3. Grade wood grinding /storage area for positive drainage.
4. Final soil cover for LCID shall be 24 inches thick minimum. Grade surface for sheet water flow.
5. Revegitate all disturbed areas per the Vegetation Plan.



LCID Deposition Sequence Detail (NTS)

Note: Final Soil Cover shall be 24" minimum and monthly soil cover shall be 12" minimum.





Vicinity Map (NTS)

VEGETATION PLAN

1. Spread topsoil over disturbed areas and leave surface reasonably smooth and uniform.

2. Scarify surface to prepare a seedbed four to six inches deep. Use such equipment as tilling, discing, tracing or the teeth on a front endloader.

3. Mix lime and fertilizer with the soil during seedbed preparation.

4. Seed on freshly prepared seedbed following the application rates for the appropriate season.

5. Mulch all seeded areas immediately.

6. Tack mulch on slopes 3:1 (Horizontal to Vertical) or steeper by spraying with emulsified asphalt. Use an anchoring tool such as a farming disc set in a vertical position on slopes less than 3:1. Mulch netting may also be used on slopes.

7. Inspect seeded areas and make repairs within the planting season. If vegetation is over 60% damaged, repeat steps 2 through 5.

8. Permanent revegetation shall be accomplished at the specified times of the year. Temporary vegetative shall be applied outside of the optimal times for establishment of permanent vegetation.

9. Seeding Schedule.

TEMPORARY SEEDING SCHEDULE

Seeding Date: August 15 to April 15

	Rate
Rye (grain)	120 lbs./acre
10-10-10 Fertilizer	1000 lbs./acre
Lime	2000 lbs./acre
Mulch	4000 lbs./acre

Seeding Date: April 15 to August 15

	Rate
German Millet	40 lbs./acre
10-10-10 Fertilizer	750 lbs./acre
Lime	2000 lbs./acre
Mulch	4000 lbs./acre

PERMANENT SEEDING SCHEDULE

Seeding Date: February 15 to April 30
September 1 to October 31

	Rate
Pensacola Bahiagrass	50 lbs./acre
Sericea Lespedeza	60 lbs./acre
10-10-10 Fertilizer	1000 lbs./acre
Lime	3000 lbs./acre
Mulch	4000 lbs./acre

Note 1: Fertilizer and lime application rates may deviate from above if soils are analyzed for optimum rates.

Note 2: Mulch shall be tacked with emulsified asphalt at rate of 14 to 28 gallons/1000 sq. ft. on slopes of 3:1 (H:V) or steeper.

Note 3: Use Unscarified Sericea seed from September 1 to March 1 for permanent seeding period.

Note 4: Pensacola Bahiagrass and Seicea Lespedeza are to be planted separately with Sericea Lespedeza planted farthest from the lake shore line and Pensacola Bahiagrass planted along the sloped shore line.

0 15 30 60 120 180 FEET

SCALE: 1"= 60'-0"

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Raleigh, NC 27609
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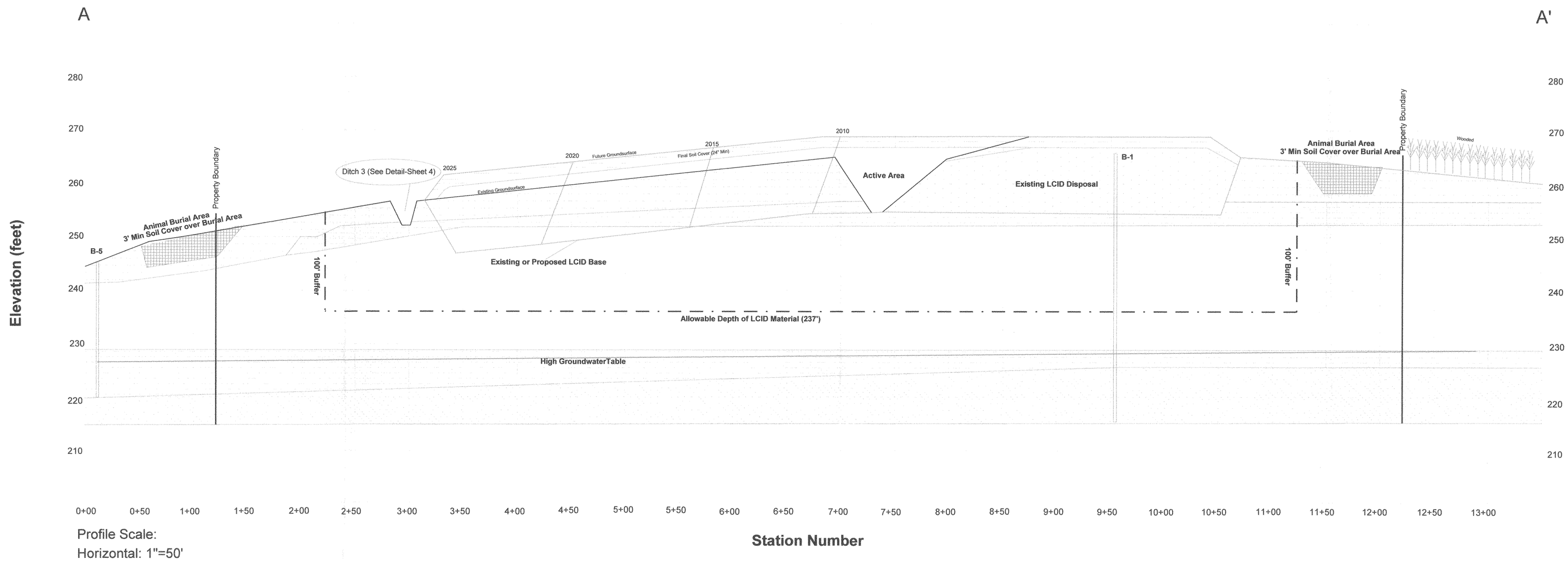
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 15472 T. PATRICK SHILLINGTON 06/29/10

Final Layout
Hoke County LCID Landfill
Raeford, NC

Hoke County Solid Waste
PO BOX 179
Raeford, NC 28376

DATE:	03-02-2010
DRAWN:	CPM
REVISED:	06-29-2010
SCALE:	See Drawing
Sheet No.	4 of 7

Hoke County LCID Landfill Cross-Section



Profile Scale:
Horizontal: 1"=50'
Vertical 1"=10'

Soils Legend

	Final Soil Cover		SM-SP		SM-SC
	LCID Material		SC & CL		
	Animal Burial		SM		

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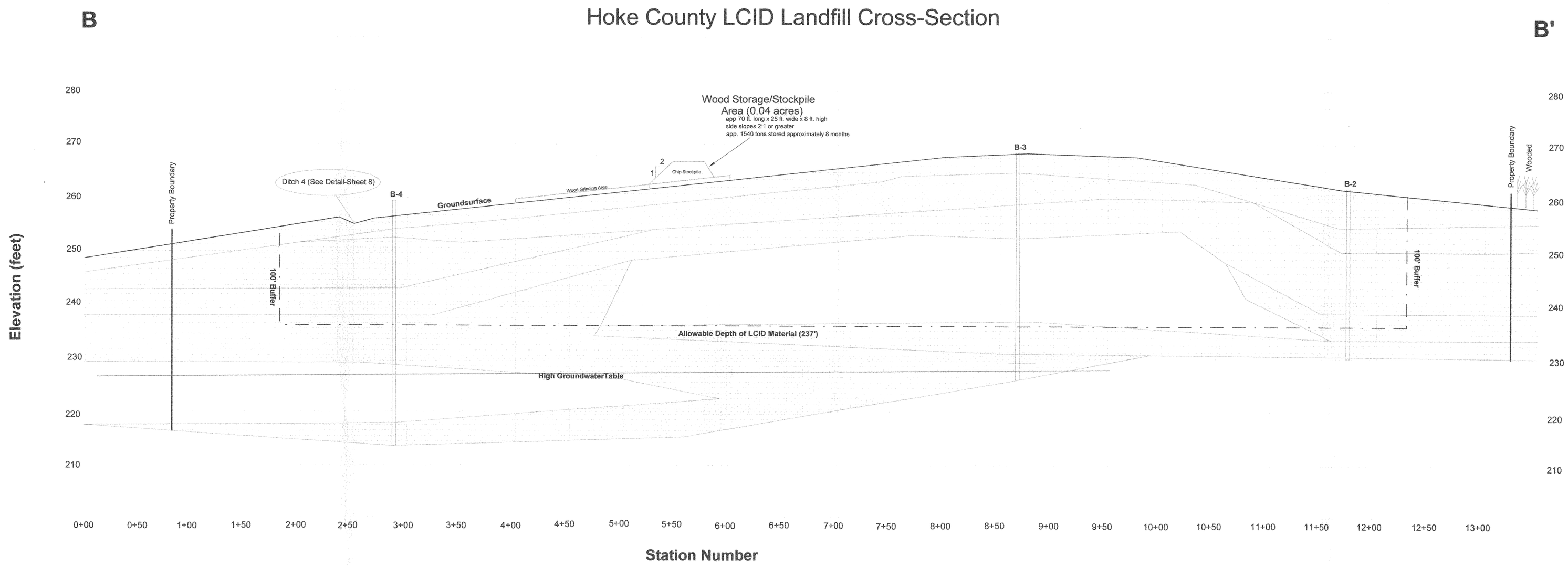
NORTH CAROLINA PROFESSIONAL SEAL 15472 ENGINEER T. PATRICK SHILLINGTON
06/29/10

Cross Section A-A'
Hoke County LCID Landfill
LCID Permit 47-A
Raeford, NC

Hoke County Solid Waste
PO BOX 179
Raeford, NC 28376

DATE:	04-05-2010
DRAWN:	CPM
REVISED:	06-29-2010
SCALE:	See Drawing
Sheet No.	5 of 7

Hoke County LCID Landfill Cross-Section



Profile Scale:
Horizontal: 1"=50'
Vertical 1"=10'

Soils Legend

- Final Soil Cover
- LCID Material
- SM-SC
- SM-SP
- SC & CL
- SM

Note: Red indicates proposed or future conditions.

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NORTH CAROLINA PROFESSIONAL SEAL 15472 ENGINEER PATRICK SHILLINGTON 06/29/10

Cross Section B-B'
Hoke County LCID Landfill
LCID Permit 47-A
Raeford, NC

Hoke County Solid Waste
PO BOX 179
Raeford, NC 28376

DATE:	04-05-2010
DRAWN:	CPM
REVISED:	06-29-2010
SCALE:	See Drawing
Sheet No.	6 of 7

End of Book