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January 9, 2009

Mr. Allen Gaither
North Carolina Department of Environmental and Natural Resources
Division of Waste Management
Solid Waste Section
2090 US Highway 70
Swannanoa, NC 28778

Subject: Buncombe County
C&D Landfill Permit Modification
Response to Comments

Dear Mr. Gaither:

On behalf of Buncombe County, CDM is pleased to amend the Buncombe County Construction and Demolition Debris Landfill Permit Modification submitted on June 2008 per your technical review letter received on December 16, 2008 (see Attachment 1). As requested, a complete Construction Quality Assurance (CQA) Plan, in accordance with the requirements of 15A NCAC 13B.0541, is provided as Attachment 2.

If you have any questions or need additional information, please do not hesitate to call me at (919) 787-5620.

Very truly yours,

Kenton J. Yang, P.E.
Camp Dresser & McKee

Enclosures

xc: Ed Mussler, NCDENR SWS
J. Creighton/J. Mears/K. Smith, BCGSD
J. Wiseman, CDM

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SOLID WASTE SECTION
ASHEVILLE REGIONAL OFFICE

Attachment 1

NCDENR SWS

Technical Review Letter

Dated December 16, 2008



North Carolina Department of Environment and Natural Resources

Dexter R. Matthews, Director

Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary

SOLID WASTE SECTION

December 16, 2008

Mr. Jerry Mears
Buncombe County - Solid Waste Manager
85 Panther Branch Road
Alexander, North Carolina 28701

Subject: Technical Review Letter
C&D Landfill Permit Modification
Buncombe County, Permit #11-07, Document ID No. 6316

Mr. Mears:

The Division of Waste Management, Solid Waste Section (Section) has completed the technical review of the document titled *Buncombe County, North Carolina, Buncombe County Solid Waste Management Facility, C&D Landfill Permit Modification, Permit No. 11-07*. This application was submitted on your behalf by Camp, Dresser & McKee and was received by the Section on June 17, 2008. It has been determined that additional information is required for completing the technical review. Please provide the information requested below:

Closure Plan

1. Please submit a complete Construction Quality Assurance Plan in accordance with the requirements of 15A NCAC 13B.0541.

The Section has determined Closure and Post-closure Cost Estimates have been prepared in accordance with 15A NCAC 13B.0546(c)(1) and (c)(3), respectively, and are acceptable. However, to fully comply with the Financial Responsibility requirement you must contact Mr. Donald Herndon in the Field Operations Branch, (919) 508-8502, for approval of the mechanism for demonstrating Financial Assurance.

As a reminder, the current Permit to Operate for this facility expires on September 12, 2011. No later than March 12, 2011 the County must submit a Permit to Operate amendment application prepared in accordance with 15A NCAC 13B.0535. If the existing facility will reach capacity prior to this date the County must submit a Permit to Construct application in accordance with 15A NCAC 13B.0547(3). This application should be submitted at least 120 days prior to the expiration date of the effective Permit to Operate or at least 180 days prior to the date scheduled for constructing a new phase not approved in the effective Permit to Operate.

Page 2 of 2
Mr. Jerry Mears
December 16, 2008
Permit #11-07

If you should have any questions regarding this matter please contact me at (828) 296-4703, or by email at allen.gaither@ncmail.net .

Sincerely,



Allen Gaither
Environmental Engineer

Cc: Kenton Yang – Camp, Dresser & McKee
Kristy Smith – Buncombe County
Ed Mussler – SWS/CO
Bill Wagner – SWS/ARO

Attachment 2

CQA Plan

Closure Cap

Construction Quality Assurance Plan

Closure Cap

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Section 1

Introduction

1.1 Purpose

The Construction Quality Assurance (CQA) Plan is intended to fulfill Rule .0541, which requires that a CQA Plan be developed to ensure that the design materials meet the design specifications and the construction and certification requirements set forth in Rule.0540 for the closure of C&D landfills. This plan describes the observations and tests that will be used before, during, and upon completion of closure construction to ensure that the construction materials and workmanship meet the design specifications and the requirements set forth in Rule .0543.

1.2 Quality Assurance and Quality Control

In the context of this CQA Plan, quality assurance and quality control are defined as follows:

- **Quality Assurance:** A program of tests and observations, executed by a party independent of the contractor, performed in order to confirm that completed work meets contractual and regulatory requirements and will perform satisfactorily in service.
- **Quality Control:** Those actions performed by the contractor or an agent of the contractor which provide a means to monitor the quality of the work being performed.

1.3 Units

In this CQA Plan, all properties and dimensions are expressed in U.S. units, with "equivalent" SI units in parentheses. It should be noted that the conversion is typically only accurate within ten percent. In cases of conflict or clarification, the U.S. units shall be deemed to govern.

1.4 References

The CQA Plan includes references to test procedures of the American Society for Testing Materials (ASTM).

1.5 Overview of Manual

Per .0541(b)(1) through (5) this CQA Plan addresses:

1. Responsibilities and authorities. The plan establishes responsibilities and authorities for the construction management organization. This includes a pre-construction meeting conducted prior to beginning construction of the closure cap. The meeting shall include a discussion of the construction management organization, respective duties during construction, and periodic reporting requirements for test results and construction activities. This information is presented in subsequent sections.
2. Inspection activities: A description of all field observations, tests, and equipment that will be used to ensure that the construction meets or exceeds all design criteria established in accordance with Rule .0543(c) is presented in Sections 4 through 6 of the CQA Plan.
3. Sampling strategies. A description of all sampling protocols, sample size, methods for determining sample locations and frequency of sampling is presented in Sections 4 and 5.
4. Documentation. Reporting requirements for CQA activities are described in detail in Sections 3 through 6
5. Progress and troubleshooting meetings. A plan will be prepared for holding periodic troubleshooting meetings. The proceedings of the meetings will be documented. Meeting information is included in Section 3 of the Plan.

Section 2

Definitions, Responsibilities, and Qualifications of Parties

The parties discussed in this section are associated with the ownership, design, construction, and quality assurance of the landfill closure cap. The definitions, responsibilities, and qualifications of these parties are summarized in Table 2-1 and outlined in the following subsections.

2.1 Contractor

2.1.1 Definition

The Contractor is the company with which the Owner has entered into agreement to construct the project.

2.1.2 Responsibilities

The Contractor is ultimately responsible for meeting the requirements of the Contract Documents and the successful completion of the landfill closure cap construction. Some of the Contractor's specific responsibilities include: providing qualified personnel to perform quality control, providing submittals for the various materials as required by the specifications, scheduling and coordinating the work with suppliers and subcontractors, providing a representative at all times during construction activity, provide surveying services, furnish progress and record drawings, attending progress meetings, and notifying the Engineer of design discrepancies.

2.1.3 Qualifications

The Contractor shall be experienced in all aspects of the work required to successfully construct the project. The Contractor shall be registered in the State of North Carolina and shall provide references from previous projects.

2.2 Contractor's Representative

2.2.1 Definition

The Contractor's Representative (CR) is a qualified individual assigned by the Contractor to represent him/her onsite during construction activities.

2.2.2 Responsibilities

The CR is responsible for: communication with the Engineer and Owner, coordinating and supervising his crew, subcontractors, and quality control personnel, ensuring that construction activities are conducted in accordance with the plans and specifications, immediately notifying the Engineer's Field Representative (EFR) of any discrepancies between the plans and specifications and the field conditions, attending all meetings held on the project, and keeping a daily log of all construction activities onsite.

**Table 2-1
Project Personnel Responsibilities**

PARTY	DEFINITION	RESPONSIBILITIES	QUALIFICATIONS	REPORT TO
Contractor	Company contracted by Owner to construct project in accordance with plans and specifications	Page 2-1	Licensed in North Carolina and similar project experience	Owner, Engineer, and EFR
Contractor's Representative (CR)	Person assigned by the Contractor to act as the CR onsite	Pages 2-1 and 2-3	Similar project experience	Contractor and EFR
Engineer	Company contracted by Owner for design of the project and to provide services during construction	Page 2-3	Registered professional engineer in North Carolina	Owner
Engineer's Field Representative (EFR)	Person assigned by the Engineer to perform QA inspection and document construction activities	Pages 2-3 and 2-4	Similar project experience	Engineer and Owner
Quality Assurance Laboratory (QAL)	Lab assigned by Owner or Engineer to conduct materials testing	Page 2-4	Experience in testing in accordance with ASTM.	EFR and Owner

2.2.3 Qualifications

The CR shall be an individual who demonstrates the capability to direct all tasks required for landfill closure cap construction. The CR shall demonstrate experience similar to the nature of the project and be knowledgeable of all aspects of the work.

2.3 Engineer

2.3.1 Definition

The Engineer is the party with which the Owner has entered into agreement with to provide project design and construction oversight.

2.3.2 Responsibilities

The Engineer is responsible for performing the engineering design and preparing the associated construction drawings and specifications. The Engineer is responsible for approving all design and specification changes, clarifying the design, reviewing and approving shop drawings, and other tasks as required during construction. The Engineer conducts the pre-construction meeting and progress meetings outlined in this plan. The Engineer will certify that the construction was completed in accordance with this CQA plan and the conditions of the closure plan in accordance with the requirements of Rule .0543 (c)(7), and acceptable engineering practices.

2.3.3 Qualifications

The Engineer shall be a professional engineer registered by the State of North Carolina. The Engineer shall have a working knowledge of landfill closure cap design and construction and all applicable regulatory requirements.

2.4 Engineer's Field Representative

2.4.1 Definition

The EFR is a qualified individual assigned by the Engineer to observe and document activities requiring quality assurance.

2.4.2 Responsibilities

The EFR is responsible for observing and documenting activities related to the quality assurance of the construction of the landfill closure cap. The EFR is responsible for implementation of this CQA Plan and coordination of the Quality Assurance Laboratory (QAL).

The specific duties of the EFR are as follows:

- a. Review all construction drawings and specifications.
- b. Review other site-specific documentation, including permits.
- c. Review all changes to design drawings and specifications as issued by the Engineer.

- d. Act as the Owner's representative.
- e. Attend all quality assurance related meetings, e.g., resolution, pre-construction, progress, trouble-shooting, etc.
- f. Review Contractor's Daily Reports, logs, and photographs.
- g. Report to the Engineer, and log any relevant observations.
- h. Review the results of laboratory testing.
- i. Report any unapproved deviations from the CQA Plan.
- j. Prepare the final certification report.

2.4.3 Qualifications

The EFR shall be experienced with the implementation and preparation of quality assurance documentation including: quality assurance forms, reports, certifications, and manuals; and shall have prior experience with soil liner installation.

2.5 Quality Assurance Laboratory

2.5.1 Definition

The QAL is a firm, independent from the Contractor and Owner, responsible for conducting tests on samples of materials for the closure cap construction.

2.5.2 Responsibilities

The QAL shall be responsible for conducting the appropriate laboratory tests as directed by the Engineer and in accordance with the project plans and specifications. The test procedures shall be done in accordance with the test methods outlined in this CQA Plan.

2.5.3 Qualifications

The QAL shall have experience in soil testing and be familiar with American Society for Testing and Materials (ASTM).

2.5.4 Submittals

The QAL shall deliver all test results to the Engineer in written form. Written test results shall be in an easily readable format and include references to the standard test methods used.

Section 3

Communication Between Involved Parties

Communication is essential to achieve a high level of quality during construction and to assure the final product that meets all project requirements. This section discusses the necessary lines of communication.

3.1 Lines of Communication

All communication between parties shall go through the EFR, who, in turn, will direct the communication through the proper channels.

3.2 Pre-Construction Meeting

A pre-construction meeting shall be held before construction activity begins. The meeting shall be conducted by the Engineer and attended by the Owner, EFR, Contractor, CR, and a Solid Waste Section representative.

Per Rule .0541(b)(1), the meeting will include a discussion of the construction management organization, the responsibilities and duties of each party during construction, and periodic reporting requirements for testing results and construction activities.

3.3 Progress and Troubleshooting Meetings

Per Rule .0541(b)(5) progress and troubleshooting meetings shall be conducted by the Engineer and attended by the Owner, EFR, and CR. Progress meetings shall be held as deemed necessary, but at a minimum frequency of one per month. These meetings shall discuss current progress, planned activities to be accomplished prior to the next progress meeting, issues requiring resolution, and any new business or revisions to the work. The EFR shall log any problems, decisions, or questions arising at this meeting. If any matter remains unresolved at the end of this meeting, the EFR will be responsible for obtaining a resolution of the matter and for forwarding communication of the decision to the appropriate parties.

Section 4

Low Permeability Soil Liner

The materials, construction and certification requirements in this Section are intended to comply with Rule .0543 (c)(1)(A) and (B).

4.1 Materials

A. Low permeability soil liner materials shall conform to the following properties:

■ Passing the 1-inch Sieve	ASTM D422	100 percent
■ Passing the 200 Sieve	ASTM D1140	45 percent minimum*
■ Liquid Limit	ASTM D4318	30 minimum*
■ Plasticity Index	ASTM D4318	7 minimum*
■ Soil Classification	ASTM D2488	SC, CH, CL, CH, ML, MH
■ Hydraulic Conductivity	ASTM D5084	1.0×10^{-5} cm/s maximum
■ Internal Friction Angle	ASTM D4767	19° minimum
■ Organic Content	ASTM D2974	5% maximum

* The Engineer may modify these conformance test properties based on the results of initial conformance testing, provided modification of these results does not compromise the hydraulic conductivity or internal friction angle test results.

B. A soil-bentonite mixture can be used for the low permeability soil liner provided it achieves the specified hydraulic conductivity and internal friction angles as presented in Section 4.1 A. Both onsite and offsite soils may be used for soil-bentonite mix. Soil to be used for the soil-bentonite mix shall conform to the following properties:

■ Passing the 1-inch Sieve	ASTM D422	100 percent
■ Soil Classification	ASTM D2488	SC, SM, CL, CH, ML, MH
■ Soils with organic materials of any kind, particularly leaves and roots, shall not be used in the mixture.		

C. The soil-bentonite mixture shall consist of an acceptable soil described in Section 4.1 B containing a sealant consisting of free flowing, high swelling sodium-based Wyoming type bentonite. The bentonite sealant shall conform to all items of this specification with all supporting test data certified, submitted to, and approved by the Engineer, prior to bid, as follows:

- The bentonite shall be covered by the Manufacturer's warranty against defects in material and workmanship and shall have a useful life of 30 years under normal weathering and normal use conditions.
- D. The low permeability soil liner or soil-bentonite mixture material used for cap construction shall be uniform in character, and after compaction, shall have an in-place saturated hydraulic conductivity of 1.0×10^{-5} cm/s or less.
- E. The Contractor shall use adequate construction quality control (CQC) to verify the conformance of materials according to this section. The Contractor shall submit to the Engineer, within 30 days of the effective date of the agreement, representative samples from the soil source(s). In the case that the submitted samples fail to conform to the required criteria, the Contractor may locate another source, and upon approval of that source by the Engineer, submit samples from the new source for conformance testing at the cost of the Contractor.
- F. If the Contractor plans to use any blending of soils as low permeability soil liner material, the Contractor shall submit the blended soil for the Engineer's approval in accordance with the requirements.

4.2 Conformance Testing

- A. Initial conformance testing shall be performed by the quality assurance laboratory (QAL) on samples from the soil source to assure compliance with the Specifications. The samples will be obtained from multiple test pits to be dug by the Contractor under the direction of the QAL. The following tests shall be performed on the samples. For soil to be used in a soil-bentonite mix, test 8 will not be performed.
 1. Soil Classification (ASTM D2487)
 2. Sieve Analysis (ASTM D422) (including hydrometer analysis)
 3. Atterberg Limits (ASTM 4318)
 4. Moisture-Density Curves (ASTM D698)
 5. Specific Gravity (ASTM D854)
 6. Laboratory Hydraulic Conductivity (ASTM D5084)
 7. Natural Moisture (ASTM D2216)
 8. Shear Tests (ASTM D4767 or as approved by the Engineer)
- B. For natural low permeability soil sources, the QAL shall determine an acceptable zone of moisture contents, dry unit weights and compaction for which hydraulic

conductivities are less than or equal to 1.0×10^{-5} cm/s by performing the following testing and analysis procedures:

1. Using the samples extracted from the proposed source, perform Modified and Standard Proctor compaction tests to develop at least two moisture-density curves. For each of the compaction tests use up to five specimens at incremental moisture contents to develop a compaction curve showing dry density for each molding water content.
 2. Permeate each compacted specimen to determine its hydraulic conductivity in accordance with ASTM D5084.
 3. On the graph of dry density vs. moisture content, identify the samples which have hydraulic conductivities less than or equal to 1×10^{-5} cm/s.
 4. Draw an "acceptable zone" of water content and dry density around the passing samples.
 5. Perform Internal Shear Tests on one specimen from the high and low ends of the acceptable zone and plot the friction angles as a function of molding water content.
 6. Based on the shear test results and other pertinent factors such as constructibility, shrink/swell potential, desiccation cracks, and consolidation, the QAL shall modify the acceptable zone as required.
- C. For soil-bentonite mixes, prior to constructing the test pad, the QAL shall determine an acceptable zone of moisture contents and dry unit weights in which the hydraulic conductivity is less than or equal to 1.0×10^{-5} cm/sec by following the procedures described above in Section 4.2.B (with the exception that samples will be extracted from the pug mill operation). The samples will be taken from a soil-bentonite mix once the bentonite percentage for production has been firmly established. The Contractor shall be responsible for performing preliminary hydraulic conductivity tests on initial mix ratios (based on manufacturer's recommendation and adjusted based on Contractor's experience) in order to establish the percentage of bentonite to be used in production.
- D. For each delivery of material from the borrow source, the quality control laboratory (QCL) personnel of the Contractor shall note, on an approved form, the color of the material, date, time, and approximate quantity of material brought onsite and submit copies of completed forms to the Engineer. The soil source shall be conformance tested by the QCL during the excavation and stockpiling operation at the following frequency.

Test	Method	Frequency
Grain Size w/hydrometer	(ASTM D422)	Every 2,000 cy
Atterberg Limits	(ASTM D4318)	Every 2,000 cy
Moisture/Density	(ASTM D698)	Every 5,000 cy
Natural Moisture	(ASTM D2216)	Every 2,000 cy

Results of the tests will be submitted to the Engineer within 24 hours of test completion. The Engineer reserves the right to reject material based on the results of the conformance tests.

4.3 Construction

4.3.1 Test Pad

- A. A test pad of a dimension of no less than 40-ft by 60-ft and 18-inch thickness shall be constructed onsite using the same equipment, processing and installation procedures that will be used during full-scale liner construction. The low permeability soil or the soil-bentonite mixture to be used for the test pad shall be the same material that the Contractor proposes to use for construction of the base liner. If approved by the Engineer, the test pad may be installed within the cap limits and incorporated in the work, provided the pad passes all testing requirements.
- B. The construction of the pad shall be directed by the QCL. The QCL shall use the acceptable zone established by the QAL to set moisture contents and percent compaction. The QCL may perform tests as needed to assist in the construction of the test pad. However, only the results of the QAL's test will be recognized for determining the performance of the pad.
- C. For each lift, the QAL shall perform testing of moisture content and density at a minimum of three test locations. The QAL shall record moisture content, compaction procedures, and density throughout the construction of the test pad. Two Shelby Tube Samples shall be obtained per lift by the QAL. One tube will be used to perform a hydraulic conductivity test. The second tube will be kept as a backup in case of damage to the first sample or dispute of test results.
- D. For soil-bentonite mixtures, the bentonite content used for the test pad shall be set by the Contractor and written notification of the mix ratio will be submitted to the Engineer prior to constructing the test pad.
- E. One triaxial type hydraulic conductivity test (ASTM D5084) will be performed on each test pad per lift.

- H. The cap thickness shall be determined from four locations selected by the QAL per test pad using a method that is approved by the Engineer, which will be determined prior to test pad construction.

4.3.2 Soil Liner Installation

- A. The QCL shall supervise the soil liner installation. Work shall not be performed by the Contractor without the QCL onsite. The QCL shall perform field tests (ie. moisture content, densities, etc.) as required to ensure proper installation. The QAL shall perform tests as described in Section 4.4 to determine acceptance of the soil liner.
- B. The placement moisture content shall be within the acceptable zone of moisture content as determined by the QAL during the conformance testing of the low permeability soil described in Section 4.2. The acceptable zone may be modified by the Engineer based on results and observations of the test pad.
- C. Water for Compaction
 1. The Contractor shall provide water as required to guarantee constructability and proper condition of the in-place and stockpiled material.
 2. The water shall be of potable quality.
 3. Prior to installing the soil liner, the Contractor shall inspect the subgrade to ensure that it has been sufficiently wetted to prevent excessive absorption of moisture from the installed material.
 4. Should the material be stockpiled for any length of time the Contractor shall slope and compact the stockpile to prevent erosion and oversaturation.
 5. Should the material become oversaturated, the Contractor shall spread and dry the material as needed to adjust the moisture to the proper level.
- D. The materials shall be uniformly compacted to no less than the minimum dry density of the acceptable zone that corresponds to the placement moisture content. The acceptable zone shall be as specified by the QAL in accordance with the procedures outlined in Section 4.2. This minimum density shall be uniformly obtained throughout the entire thickness of the liner. The cap shall be constructed in lifts with a maximum compacted thickness of 6 inches per lift to assure achievement of the specified compaction in the lower part of the cap. However, the initial lift may be placed at 8 inches to prevent mixing with the existing operational cover during compaction.
- E. Soil liner material which has been contaminated with clusters of rock or gravel, sand lenses, organic debris or other deleterious material shall be removed and replaced with uncontaminated low permeability soil materials.

- F. The Contractor shall use a pugmill to produce the soil-bentonite mix at the required moisture content to achieve an in-place compacted minimum 18-inch thick layer of material with a hydraulic conductivity less than or equal 1×10^{-5} cm/sec. Based on the soil material to be used, the Engineer may direct the Contractor to screen the soils prior to placement in the pugmill. The pugmill must be approved by the Engineer prior to its arrival on site.
- G. No low permeability soil liner material shall be placed, spread, or compacted while the existing operational cover or soil liner material is frozen/thawing, saturated, desiccated, nor during unfavorable weather conditions or periods of precipitation. The cap surface must be made smooth and free from ruts or indentations at the end of any working day when significant precipitation is forecast and/or at the completion of the compaction operations in that area in order to prevent saturation of the soil liner material. Any regrading due to the above conditions or final preparation should be retested at those locations for liner thickness prior to placement of the next lift or erosion control layer. Thickness measurements should be performed as indicated in Section 4.4.1.
- H. Work shall be limited to an area where a lift can be completed in one working day and shall continue in that area until three lifts have been placed. Completion of an area shall be defined as the construction of a cap of a minimum 18-inches that is homogeneously installed at a moisture content and density within the acceptable zone, free rocks larger than 1-inch diameter, and possessing a smooth rolled surface.
- I. If a lift is not to receive a subsequent lift within 16 hours of its completion, the lift shall be sealed with a smooth wheel compactor at the end of each day's work to protect the material from desiccation. Should desiccation cracks develop, soil liner material shall be scarified, disked, rewetted, rehomogenized and recompacted in accordance with the Specifications to the depth of any such cracks or as instructed by the Engineer. If desiccation extends below half of the lift thickness, the lift shall be removed and replaced.
- J. During construction, the Contractor shall make all necessary provisions to deal with inclement weather conditions. The Contractor shall be fully responsible for control of stormwater during installation of the cap system and for moisture control and protection of the low permeability soil liner.
- M. After final grading and smooth rolling is completed, the compacted soil liner thickness shall not be less than 18-inches. Soil liner will be tested by the QAL on the final lift at a frequency as specified in Section 4.4.1 using a method of hand augering or push tube sampling (minimum 3/4" sample). Each test shall penetrate all underlying lifts to disposed waste. The thickness shall be measured from top of waste to top of low permeability soil liner. Areas not meeting the thickness requirements shall be augmented with additional low permeability soil

material at the expense of the Contractor. Any additional testing or CQA services associated with corrective action for achieving the 18-inch cap thickness requirement will be at the cost of the Contractor. The added material shall be worked into the in-place liner to ensure homogeneity and proper bonding. This shall be done by scarification of the surface prior to addition of the new material. As a minimum, the top 4-in of the soil liner shall be wetted, kneaded, compacted and reworked with the additional material to obtain the required thickness.

4.4 Certification

4.4.1 Field Quality Control

- A. The QAL shall conduct the following tests during installation of the low permeability soil or soil-bentonite liner at the specified frequencies.

Test	Method	Frequency
Atterberg Limits	(ASTM D4318)	2/acre/lift
Moisture of Undisturbed Hydraulic Conductivity Sample	(ASTM D2216)	1/two acres/lift
Undisturbed Hydraulic Conductivity	(ASTM D5084)	1/two acres/lift
Density	(ASTM D2937 or ASTM D2992)	4/acre/lift
Moisture	(ASTM D2216 or ASTM D3017)	4/acre/lift
Liner thickness	(Hand Auger or push tube)	4/acre
Grain Size	(Sieve Only)	2/acre/lift

- B. All holes made as a result of depth measurements, hydraulic conductivity samples, density tests, grade stakes or other means shall be completely filled by the Contractor with bentonite or soil-bentonite mix, as instructed by the Engineer.
- C. The Engineer shall have the authority to request additional hydraulic conductivity tests in areas that, in the Engineer's judgement, may be suspect or deficient. Hydraulic conductivity tests shall be conducted in accordance with ASTM D5084. For each sample tested, one back-up sample will be extracted in the proximity of the sample location. These samples will be held in a controlled environment at the QAL laboratory as a precautionary measure. If adequate demonstration is presented that a sample was not representative of the low permeability soil liner

or that an error in testing occurred, the backup samples will be tested and the original test will be disregarded.

- D. Any sample or area tested shall be rejected, removed and replaced if it does not meet the requirements of the technical specifications. Reconstructed areas shall have feathered, overlapping edges that tie into adjacent liner areas.
- E. Grade stakes for soil liner construction shall be numbered by the Contractor and located on an inventory map. The inventory map shall be submitted to the Engineer. Upon completion of an area, the removed stakes will be compared to the inventory map to ensure that none were left in place.
- F. The Contractor shall submit a survey plan with final elevation of top of low permeability soil liner for Engineer's approval.

4.4.2 Corrective Action

If soil has been desiccated to a depth less than or equal to the thickness of a single lift, the desiccated lift may be disked, moistened, and recompact. However, disking may produce large, hard clods that will require pulverization. Also, it should be recognized that if the soil is wetted, time must be allowed for water to be absorbed into the clods and hydration to take place uniformly. For this reason it may be necessary to remove the desiccated soil from the construction area, process the lift in a separate processing area, and replace the soil accordingly.

Section 5

Vegetative Cover Materials

The materials, construction and certification requirements in this Section are intended to comply with Rule .0543 (c)(1)(C).

5.1 Materials

A. Vegetative Cover Material

1. Vegetative cover material shall be capable of sustaining native plant growth. Vegetative cover soil shall not be compacted except by tracking during spreading operations.

B. Erosion Control Blanket

1. If needed, erosion control blankets shall consist of wood excelsior with 80% 6-inch fibers or greater fiber length with the top of the blanket covered with photo-degradable or biodegradable netting. Blanket shall be of consistent thickness with fibers evenly distributed throughout the entire area of the blanket. Blanket shall be recommended by manufacturer for use on slopes up to 1.5H:1V, stormwater channel velocities up to 5 feet per second, and flow shear stresses up to 2 pounds per square foot.

5.2 Conformance Testing

A. Vegetative cover material shall be tested for nutrient fertilizer requirements and pH requirements at a frequency of once per 5,000 cubic yards.

1. The pH value shall be between pH 6.0 and 7.0.
2. Fertilizer and lime shall be spread and incorporated as per soil test recommendations after the vegetative cover material is spread but prior to fine grading.

5.3 Construction

- A. The Contractor shall be responsible for identifying earthen material to be used for vegetative cover material and adding amendments to create suitable vegetative cover material. Stockpiled material may be used in areas disturbed by Contractor's activities as approved by the Engineer.
- B. Commercial fertilizer, lime, peat, humus, sand or other additives shall be used to counter act soil deficiencies as recommended by the soil analysis and as directed by the Engineer.

5.4 Certification

- A. Vegetative cover material thickness will be tested by the QAL on the final lift at a frequency four per acre using a method approved by the Engineer prior to construction of the vegetative cover construction. Each test shall penetrate to the low permeability soil liner material. The thickness shall be measured from top of vegetative cover to top of low permeability soil liner. Areas not meeting the thickness requirements shall be augmented with additional vegetative cover material.

Section 6

Documentation

This Section is intended to comply with Rules .0540(8) and .0541(b)(4) and .0543(c)(7).

Upon completion of construction activities, a Construction Quality Assurance Certification Report will be submitted to the Solid Waste Section in accordance with Rules .0541 and .0543. The report will summarize all quality assurance services performed during construction of the C&D landfill cap and will include, at a minimum the following:

- Field observation inspection reports;
- The results of all construction quality assurance and construction quality control testing required by this Plan;
- Documentation of any failed test results, descriptions of procedures used to correct the improperly installed material and results of all retesting performed;
- Record drawings documenting the completed project and noting any deviation from the approved engineering plans; and
- A comprehensive narrative including, but not limited to, daily reports from the project engineer and a series of color photographs of major project features.

The CQA Certification report shall bear the seal of a North Carolina Professional Engineer who was involved during the construction and a certification that construction was completed in accordance with:

1. This CQA Plan;
2. The conditions of the Permit to Construct;
3. The requirements of Rules .0540 through .0543; and
4. Good engineering practices.