## Wilson, Donna

**From:** David Garrett [david@davidgarrettpe.com]
**Sent:** Friday, October 01, 2010 1:07 PM
**To:** Wilson, Donna; 'gehle, dennis'
**Cc:** 'Nick Marotta'
**Subject:** RE: Remaining comments on Material Recovery Landfill application
**Attachments:** Brownfield Engineering Report.pdf

Donna, please find attached a "redline" copy of the replacement text in pdf format. This document is intended to address your comments listed below, items 1 through 9. I will take care of the drawings and wood yard text (Items 11 – 14) as soon as possible. WCA will need to respond to Item 10. Based on our conversations this week, I understand that WCA needs to establish a standby trust account for the financial assurance and update the financial assurance estimates for their two transfer stations in Wake County. Please notify me if you accept the redline changes in the application text, and I will make the formal electronic and paper submittal. Thank you for your input. David

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**From:** Wilson, Donna [mailto:donna.wilson@ncdenr.gov]
**Sent:** Monday, September 27, 2010 5:14 PM
**To:** David Garrett; gehle, dennis
**Subject:** Remaining comments on Material Recovery Landfill application

Dave – I've completed review of the revised application and response to comments for the last several submittals. The remaining comments are follows:

1. Section 1.1 – Please revise the following sentence as indicated: "In early 2008 the facility received a ~~5 year~~ permit to operate ~~renewal~~ for Phase 1."
2. In several sections of the CQA it is implied that the text only applies to final cover installation. For example, see Section 6.1.1.1 – This section should apply to cell construction as well as final cover installation (two sentences). Section 6.3 should include the preconstruction meeting for cell construction. There are several more instances in the CQA Plan. Please correct.
3. CQA – Table 6A – Method ASTM D 4138 appears to be incorrect. Please list the requirement that the soils must be SC, SM, ML, CL, MH, or CH per the United Soil Classification System. Please add soil requirements for slope stability to the CQA Plan.
4. Closure Plan – Section 8.2 – Text should indicate the plan is for Phases 1 and 2A.
5. Closure costs – Gas vents should be 36.7 acres at 3 per acre.
6. Post-closure plan – Section 8.3.1.3 and Table 8B Note 3 – The plan for post-closure landfill gas monitoring should be consistent with the requirements of .0543 (e). The landfill gas remediation plan should be summarized.
7. Post-closure plan – Describe inspection and maintenance of groundwater and landfill gas monitoring wells, below grade stormwater piping, final cover gas vents, and frequency of inspection.
8. Post-closure costs – Please clarify calculation of annual cost for reseeding/mulching and monthly inspections. Please recheck multiplication and addition. Include maintenance/repair of fence, gate, sign, roads, and the below grade final cover stormwater piping and final cover gas vents. The unit cost for reseeding, mulching, and erosion repair seems low. After total cost, include cost per acre per year. List annual costs multiplied by 30 to determine the 30 year post-closure cost.
9. Financial assurance – Please see my email dated 9-17-10.
10. Please provide a copy of the revised 2008 and 2009 annual reports.
11. Drawing S2 – The label "North Disposal Area" should be adjusted.
12. Drawing E2 – On the first drawing, the base grade contours for Phase 2A should be updated to match the contours on Drawing E4. On the second drawing, the base grade contours for Phase 2B should be updated to match the contours shown on Drawing E4.
13. Drawing MP1 – Update the base contours in Phase 2A and 2B, or remove the base contour labels in those phases for this drawing only.

14. The compliance review portion of the application is not complete in that there is not a stand-by trust fund for the existing WCA financial assurance mechanisms (all WCA facilities). One stand-by trust fund may be used for all WCA facilities. Also, the existing financial assurance documents have not been adjusted for inflation for 2009 and 2010. Contact Donald Herndon to address this matter.
15. Wood waste processing area – Show both the processing area and storage areas on the diagram. What are the total dimensions of the processing and storage area? What is the end use of the processed wood material? Will it be distributed to the public? What equipment will be used for the operation? What is the maximum storage time for any wood material, unprocessed and processed? What is the plan for detecting and removing any unacceptable waste? Describe surface water control features, including run-on and run-off. Describe plan to control dust. Describe plan for fire prevention and actions to be taken in the event of an accidental fire. Address whether the operation will require a sedimentation and erosion control permit.

Please submit responses to comments as replacement pages to the application. Replacement pages should list the date the submittal was prepared, the revision number, and page number. Please provide two paper copies of the replacement pages, and one electronic copy of the complete application with the revised pages.

We request that the electronic copy of the response submittals be provided as one pdf document file, if possible. In the electronic copy, chapters or sections, figures, tables and appendices should be marked with bookmarks within the document and hyperlinked in the table of contents and within the text as appropriate.

When the staff review and application is complete, the report cover sheet should be modified to include revision or final dates, and the table of contents should be modified, as necessary.

If you have any questions or comments please let me know.
Thanks, Donna

Donna J. Wilson
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## TABLE OF CONTENTS

REFER TO THE VOLUME 2 – TABLE OF CONTENTS FOR A GUIDE TO THE GEOLOGICAL ASPECTS OF THE FACILITY (INCLUDING MONITORING)

TABLES *Refer to the in-text tables referenced by page number*



DRAWINGS *Refer to the folded drawing set that accompanies this report – a subset of drawings pertaining to this report are identified below*

## INTRODUCTION

WCA Waste Corporation and subsidiary WCA Material Recovery, LLC, hereby makes application to build Phase 2A of the Construction and Demolition debris landfill (CDLF), located at 2600 Brownfield Road (S.R. 2553) in Wake County, North Carolina. The planned Phase 2A is contiguous with existing Phase 1 and is located in the "North" disposal area shown in the original site suitability documents (prepared by others). This expansion and future operations at this facility will be conducted in accordance with **Solid Waste Rules 15A NCAC 13B .0531** *et seq.*, effective January 1, 2007 – known as the "**2006 C&D Rules**." This CDLF is an "existing facility" as of August 31, 2007, with respect to the **2007 Solid Waste Act (S1492)**, and the facility meets the vertical separation requirements of the 2006 C&D Rules.

As such, Phase 2A and subsequent expansions of this facility do not require a synthetic liner, but the soil-type requirements prescribed by the 2006 C&D Rules for the upper two (2) feet beneath the base grade do apply for Phase 2A and beyond – these soil types are present in abundance on the premises. The facility is regulated by the North Carolina DENR Division of Waste Management, Solid Waste Section, a.k.a. the "Division" or "SWS."

The permitted facility boundary encompasses approximately 210 acres. Original plans submitted to Division of Waste Management ca. 2001-02 included two disposal areas, the currently active "North" area (45 acres, 20 acres of which are developed as Phase 1) and the "South" area (24 acres, future development). Phase 2 includes the remaining 25 acres of the "North" area, matching the originally planned footprint and final grades. Earlier site investigations include the December 2001 Site Suitability Application, i.e., the Hydrogeologic Characterization Report) and the December 2001 Construction Plan Application, prepared by Joyce Engineering, Inc. Supplemental permitting documents include the Sedimentation and Erosion Control (S&EC) Plan submitted to Wake County Environmental Services, who has jurisdiction under authority from NC DENR Division of Land Resources, Land Quality Section.

This report augments earlier site studies relative to the planned Phase 2 CDLF construction, including the footprint and down gradient monitoring zones, along with engineering and design work performed in accordance with the 2006 C&D rules. This report was originally prepared and submitted in June 2008; regulatory agency review comments were received May 7, 2010, hence this updated and amended report has been prepared. The following presents **Volume 1** of two volumes – i.e., the Facility Plan Report, Closure and Post-Closure Plans, and Financial Assurance Calculations, while **Volume 2** presents Design Hydrogeologic Report and the Facility Monitoring Plan. A Sedimentation and Erosion Control (S&EC) Plan 2 has been submitted to Wake County as a separate document, which is currently under review.

***Phase 2 has been divided into two subphases: Phase 2A and Phase 2B reflect the permitted airspace that will approximate 5-years of capacity; Phase 2A has been further divided into two stages for construction, Stage 1 and Stage 2, to reflect a construction sequence based on drainage patterns. This application requests a Permit to Construct from the Division for the southern half of the Phase 2 footprint (Phase 2A), which, along with the airspace remains available in Phase 1, will provide the facility approximately 5 years of airspace. The reasoning behind making this request to initiate Phase 2A now, rather than filling Phase 1 to its maximum capacity and then commencing with Phase 2A, is to allow the Operator more physical space for truck and equipment access for more efficient operations and better compaction.***

## OWNER/OPERATOR INFORMATION

WCA Material Recovery, LLC
Mr. Dennis Gehle, General Manager
2600 Brownfield Road (S.R. 2553)
Raleigh, North Carolina 27610

Tel 919-838-6973 (administrative office)
Fax 919-779-3339 (scale house)

Please refer to the applicant signature page.

## SITE LOCATION DATA

Latitude N 35.7094
Longitude E -78.5042

Wake County Tax Department provides the following information on the parcel: PIN identification is 1741639103; deed book is 08806 and page number 0845; date of deed is 2/12/2001; acreage is 210.19. Refer to the Wake County GIS Parcel Map (see **Figure A**); also see http://imaps.co.wake.nc.us/imaps.

## REVISIONS

| | | |
|---|---|---|
| Rev 0 | Permit to Construct Application<br>Engineering and Design Report<br>WCA Material Recovery CDLF (Vol. 1 of 2) | June 2008 |
| Rev 1 | Update of Volume 1 of 2 in response to regulatory rule changes and comments | May-June 2010 |
| Rev 1.1<br>Rev 1.2<br>Rev 1.3 | Revision of Volume 1 of 2<br>in response to regulatory review<br>in response to regulatory review | <br>September 2010<br>September 2010 |

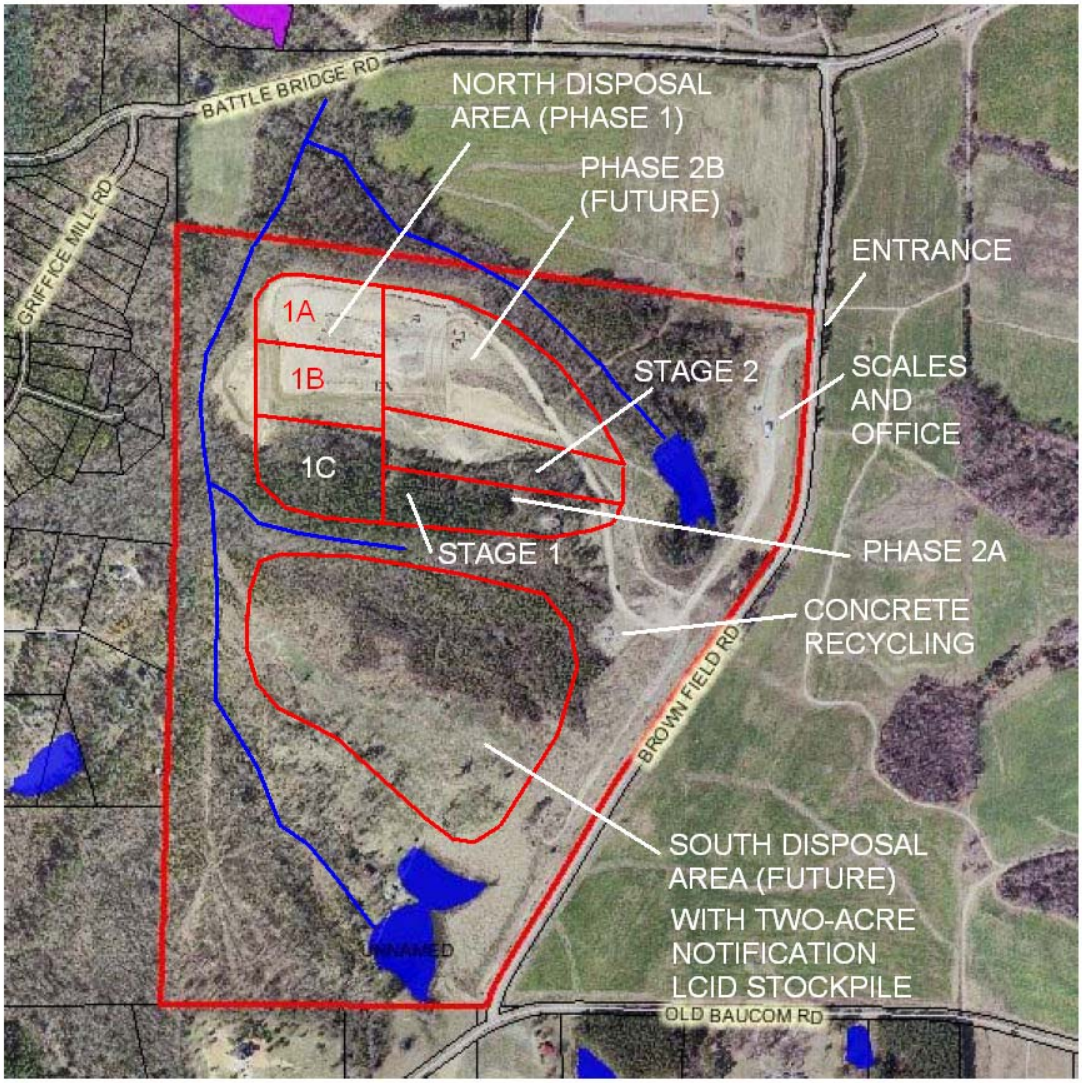


FIGURE A - Facility Layout
(Waste Boundaries are Approximate)

Wake County GIS aerial photography, 2005

0 866 ft

## CERTIFICATION

This engineering plan for the WCA Material Recovery C&D Landfill, Phase 2A disposal unit has been prepared by, or under the responsible charge of, one or more North Carolina Licensed Professional Engineers to meet the requirements of 15A NCAC 13B .0539. The individual signature and seal below attests to compliance with this rule requirement.

Signed _____


Printed G. David Garrett

Date June 18, 2010

Not valid unless this document bears the seal of the above-named licensed professional.

# 1.0 BACKGROUND INFORMATION

## 1.1 Existing Facilities and Development History

WCA Material Recovery, LLC, operates a C&D landfill that is permitted to accept construction and demolition (C&D) debris, including asbestos-containing material (ACM) subject to special operational and documentation requirements, land clearing inert debris (LCID) – which is handled within a two-acre notification stockpile – concrete debris – which is handled in a separate storage and processing area – and pallets, which are proposed to be ground into boiler fuel or mulch within the LCID area. Phases 1 and 2 encompass a 45-acre contiguous footprint within the "North" disposal area, contained within a 210-acre permitted facility boundary.

Phase 2 is located to the east (uphill) of Phase 1 within the "North" disposal area and will share the storm water management facilities. Phase 2A consists of the southern half of Phase 2. The facility has scales and office/scale house building, an inert debris stockpile (concrete debris only) used for making beneficial fill. An LCID stockpile is operated under a two-acre notification within the future "South" disposal area (**Figure A**). WCA seeks to amend the permit for the LCID stockpile to include pallets – please note that no "in-ground" LCID disposal activities occur on the premises. On-site fuel storage is permitted under Wake County ordinances; routine equipment maintenance (fueling and lubrication) takes place on-site, but there is currently no equipment maintenance depot. The Facility Plan is shown on **Drawings S4** and **S4A**.

Opened October 2003 and operated by Material Recovery and Recycling, LLC (MRR), the facility was acquired in 2005 by Waste Corporation of America (WCA) and is now operated by WCA Waste Corporation and subsidiary WCA Material Recovery, LLC. Phase 1 includes 20 acres and was permitted in three subphases (1A, 1B, and 1C), now operating in Phases 1B, and 1C. Portions of Phases 1A and 1 B have reached final grades along the outer slopes (north and west sides). Phase 1C grading was completed in 2007. In early 2008 the facility received a permit to operate for Phase 1.

The current franchise with Wake County was approved January 20, 2004. The approved Service Area includes all or parts of Wake, Johnston, Durham, Orange, Chatham, and Franklin Counties. A majority of the C&D waste stream is derived from two material-transfer/recycling facilities operated by WCA, located on Durant Road and Raleighview Road in Wake County. The permitted daily tonnage is **1,100 tons per day** in accordance with the Wake County Franchise and the current NC DENR permit. Wake County is currently reviewing the S&EC plan for the new construction; the S&EC permit will be forwarded to the Section when acquired.

## 1.2 Environmental Setting

The CDLF is located in eastern Wake County near the intersection of Brownfield Road (SR 2553) and Battle Bridge Road (SR 2552). The City of Raleigh owns and operates facilities adjacent to the subject site, including a municipal waste water treatment plant and associated former sludge disposal fields to the east and a police training ground to the north. Private residential development exists across a large wooded creek bottom to the west of the site, and mixed farmland and residential development exists to the south, several thousand feet from the disposal unit. The site is relatively isolated from the public by hilly topography and numerous streams (see **Drawings S1** and **S2**). The site is located within the Neuse River Basin and is subject to riparian buffer rules. Three perennial streams have been identified – the one between the North and South disposal areas is under evaluation for proposed future impacts and possible mitigation.

## 1.3 Future Facility Expansion

Based on the 2001 Joyce Engineering report, **Phase 1 will contain approximately 1.6 M cubic yards of total airspace, or 1,429,000 cubic yards (964,000 tons)** of C&D when completely full – according to the original PTC for Phase 1 (prepared by others – excluding a projected 11% soil use and a 2-foot thick final cover; thus the estimated initial airspace in Phase 1 is approximately 1,636,433 cubic yards. Based on volume calculations prepared for the Phase 2 PTC in 2008, there were approximately **762,000 cubic yards (514,000 tons) remaining** to reach the permitted grades in Phase 1. By this calculation, approximately 874,433 cubic yards of airspace had been consumed (including periodic cover soil).

Phase 2 will encompass a 25-acre footprint – contiguous with Phase 1 – with a planned vertical expansion over Phase 1 (included in the Operations Plan for Phase 2A) that will bring the final elevations to approximately El. 404 (MSL) – consistent with the original permitted final grades. Phase 2 will be constructed and operated as three subphases, beginning in the south (Phase 2A) and working toward the north (Phase 2B), culminating in a vertical expansion over both Phases 1 and 2 (Phase 2C). Phase 2A may be constructed in two stages due to drainage.

Based on projected volume calculations, the entire Phase 2 and the vertical expansion will add an estimated **4.2M cubic yards (2.8M tons)** of net disposal volume, relative to elevations established in a February 2008 aerial survey, allowing for 0.7M cubic yards remaining in Phase 1. The total waste volume in the North disposal area will be approximately 1.6M + 4.2M = **5.8M cubic yards (3.8M tons)**, assuming an in-place density of **0.67 tons/cubic yard**. The estimated remaining life of Phases 1 and 2 will be

16 years (from 2008), or 14 years from now, representing three 5-year permitting cycles (14 years from May 2010). The following is a summary of the waste volumes by phase:

| **EXISTING CONDITIONS** | **WCA Material Recovery CDLF (Permit #92-31)** | | |
|---|---|---|---|
| Solid Waste Units Present | C&D Landfill, Concrete Recycling, Wood Waste Processing | | |
| Other Activities/Infrastructure | Scales/Office, Alternative Cover Demonstration | | |
| CDLF Unit Footprint Acreage | 20 acres | | |
| CDLF Phases/Sub-Phases [1] | **1A** | **1B** | **1C** |
| New Ground Footprint Acreage [1] | 7 ac | 5.5 ac | 7 ac |
| Final Elevations (Phase 1) [1] | EL. 308 | | |
| Maximum Waste Thickness [2] | 88 feet | | |
| Permitted Side Slope Ratios | 3H:1V | | |
| Acreage of Closed Slopes | 0 | | |
| Facility Boundary Acreage | 210.19 acres | | |
| Permitted Capacity (Phase 1) [2] | 1,636,000 c.y. | | |
| Existing Permitted Capacity [3] | 83,166 c.y. | | |
| Remaining Operational Life [3] | 3.3 months | | |

| **PROPOSED PERMITTING** | **Phase 2 is contiguous to Phase 1** | | |
|---|---|---|---|
| Solid Waste Units Present [4] | Unchanged | | |
| Other Activities/Infrastructure [4] | Unchanged | | |
| New CDLF Unit Footprint Acreage [4] | 45 acres | | |
| New CDLF Phases/Sub-Phases [1] | **2A** | **2B** | **2C** |
| New Ground Footprint Acreage [1] | 16.7 ac | 8.2 ac | 0 [5] |
| Interim Capacities (Sub-Phases) [2] | 1,400,000 c.y. | 1,400,000 c.y. | 1,400,000 c.y. |
| Interim Operational Life [3] | 55.7 mos. | 55.7 mos. | 55.7 mos. |
| Interim Elevations (Sub-Phases) | EL. 310 | EL. 310 | EL. 404 |
| Final Elevations (Entire Unit) [2] | EL. 404 | | |
| New Phase 2 CDLF Unit Capacity [2] | 4,200,000 c.y. | | |
| Maximum Waste Thickness [2] | 184 feet | | |
| Permitted Side Slope Ratios [4] | 3H:1V | | |
| Acreage of Closed Slopes | 0 | | |
| Facility Boundary Acreage [4] | 210.19 acres | | |
| CDLF Footprint (Phases 1 and 2) [4] | 45 acres | | |
| Proposed Capacity (Phases 1 and 2A) [6] | 3,036,000 c.y. | | |
| Operational Life (Phases 1 and 2A) [6] | 4.9 years | | |
| Total Capacity (Phases 1 and 2) [4] | 5,836,000 c.y. | | |
| Remaining Capacity (Phases 1 and 2) [4] | 4,283,166 c.y. | | |
| Remaining Operational Life (Phases 1 and 2) [4] | 14.3 years | | |

| PROJECTED CONDITIONS | South Disposal Area | | |
|---|---|---|---|
| Solid Waste Units Present [4] | Unchanged | | |
| Other Activities/Infrastructure [4] | Unchanged | | |
| New CDLF Unit Footprint Acreage [4] | 24.2 acres | | |
| New CDLF Phases/Sub-Phases [1] | 3 | **4** | **5** |
| New Ground Footprint Acreage [1] | 12.2 ac | 12.2 ac | 0 [5] |
| Interim Capacities (Sub-Phases) [2] | 780,000 c.y. | 780,000 c.y. | 740,000 c.y. |
| Interim Elevations (Sub-Phases) | EL. 272 | EL. 272 | EL. 362 |
| Projected South Area CDLF Capacity [2] | 2,300,000 c.y. | | |
| Projected Operational Life (South area) [2] | 7.6 years | | |
| Facility Boundary Acreage [4] | 210.19 acres | | |
| Future CDLF Acreage (North and South areas) [4] | 69.2 acres | | |
| Future CDLF Capacity (North and South areas) [4] | 8,136,000 c.y. | | |
| Projected Operational Life (North and South areas) [6] | 21.9 years | | |

Notes:

1 Based on Drawing No. 5, 12/28/01, by Joyce Engineering

2 Includes Final Cap System and Operational Cover – Allocate one-third the airspace for Phase 2 to Phase 2A

3 Based on an analysis performed based on the February 2008 survey (see **Section 3.3.2**), the average total airspace consumption is approximately **25,142 c.y. per month**; considering that 2 years have passed since the Phase 2 permit application document was prepared, the airspace consumed between Feb 2008 and May 2010 will be approximately 25,142 * 27 months = 678,834 cy (assuming a consistent average); thus the current airspace consumed since the opening of Phase 1 is approximately 874,433 + 678,834 = 1,553,267 cy (subtract this from permitted capacity); remaining capacity in Phase 1 is 1,636,433 – 1,553,267 = 83,166 cy, which provides approximately 3 months of disposal volume, based on average airspace consumption; compaction may be reduced in the higher elevations of the waste pile – these calculations do not account for settlement and density variations

4 Subject to Approval of this Application – includes all of Phase 1 and Phase 2 in the North disposal area

5 Vertical Expansion – not actual ground disturbance

6 Add the remaining capacity of Phase 1 to the interim capacity associated with the area of interest

## 1.4 Regulatory Requirements

**Solid Waste Rules 15A NCAC 13B .0531** *et seq.* became effective January 1, 2007 – known as the "**2006 C&D Rules**." Rule .0547 requires that existing CDLF units, i.e., facilities that accepted waste prior to January 1, 2007 and wish to continue operating under the "**2006 C&D Rules**," submit an application to depict the proposed long-term development of the site and demonstrate compliance with the new rule requirements. This document constitutes said application and is organized in general accordance with the sequence of presentation of topics under **Rules .0531** through **.0547** (with references). This document includes provisions of the "2006 C&D Rules" that must be met:

(1) Existing C&D units that did not and will not receive solid waste after June 30, 2008 must be closed under the requirements of Rule .0510 (the previous rules).

*Final exterior slopes in Phase 1 were not reached by June 30, 2008*

(2) Financial Assurance must be demonstrated prior to July 1, 2008 to cover the estimated costs of closure and post-closure for C&D units (typically, a local government test for political subunits of the State, i.e., counties).

*WCA Material Recovery, LLC and WCA Waste Systems, Inc., has in place an appropriate fiduciary instrument within the specified time frame, based on costs estimates developed elsewhere in this document for Phase 2 and the remaining portions of Phase 1 at the time of closure.*

(3) A Permit to Construct application for a new phase must contain a comprehensive facility plan for long-range development, including the layout, aerial limits and capacity of various proposed waste management units, along with identification of the anticipated waste stream and criteria for waste acceptance and segregation; an Engineering Plan for the initial phase of development; a Construction Quality Assurance (CQA) plan; an Operation Plan prepared under the "**2006 C&D Rules**" that includes amended monitoring programs (both environmental and waste acceptance monitoring); a Closure and Post-Closure Plan (with cost estimates to facilitate the financial assurance demonstration).

*WCA Material Recovery, LLC and WCA Waste Corporation will have met the application requirements within this document (pending Division approval). The Facility Plan depicts the Phase 2 expansion; further development of the facility (the "southern" disposal area) remains in the long-range facility plan but no formal plans have been derived at this time, nor has a site specific design hydrogeologic investigation been performed.*

## 2.0 PHASE 1 CDLF CLOSURE (15A NCAC 13B .0510)

Portions of Phase 1 have reached final grades, i.e., exterior slopes on the north and west sides, near the northwest corner, up to a planned erosion control bench. These slopes have been covered with 24 inches of soil and stabilized with vegetation, but the slopes are not considered "closed" in the current C&D rules. As such, none of the final closure requirements of Rule .0510 apply. All slopes will be closed in due time under the current C&D rules – closure plan is described elsewhere in this report. A sedimentation and erosion control (S&EC) plan has been in place for Phase 1 throughout its operation; anticipated work associated with the closure of Phase 1 will include cleaning out and refurbishing the sediment basin, as needed, and maintaining miscellaneous ditches, traps, and check dams, as needed.

# 3.0 PHASE 2 CDLF FACILITY PLAN (15A NCAC 13B .0537)

## 3.1 Regulatory Summary

The Rules require that the facility plan define the comprehensive development of the property, consistent with the approved site suitability. This updated PTC application includes preliminary design information regarding the entire Phase 2 footprint within the "North" disposal area and future phases (tentatively identified as Phases 3, 4, and 5) within the "South" disposal area, which was included in the original site suitability but not reported for design volume (see **Section 1.3** and **Drawing S4**). The "2006 C&D Rules" emphasize vertical separation and minimum subgrade soil type requirements. The proposed C&D expansion meets or exceeds the 4-foot minimum vertical separation requirement to groundwater and bedrock, thus no liner or leachate collection system is required under these rules. Subgrade soil types that will be exposed via excavation and used in the compacted fill sections are anticipated to exhibit a mix of finer soil types, e.g., ML, MH, CL, CH, SM and mixed SM-ML classifications, based on site data, thus subgrade permeability is expected to be low, providing the soils are reworked and compacted (see **Section 4.2**).

## 3.2 Facility Drawings

### 3.2.1 Facility Layout

**Drawings E1** and **E3** are the base grades and final grades for Phase 2, respectively, while incremental grades are shown on **Drawing E2**. The aerial limits are set to provide a minimum 200-foot buffer to the facility boundary, a 50-foot buffer to jurisdictional water bodies, per the rules that were in effect when the project initiated – this is an "existing" facility relative to the 2007 Solid Waste legislation, hence the original setback requirement applies for jurisdictional waters. The Facility Plan (**Drawing S4**) shows the locations of current and future soil borrow areas and the inert debris stockpile area. The Phase 2 footprint contains no identified floodplains or wetlands (adjacent areas with these features will be avoided), unstable areas or cultural resource areas that affect project development.

### 3.2.2 Operational Sequence

The Phase 2 footprint will be developed as two "subphases," split east-to-west along a dividing ridge – Cell 2A along the south side of the ridge will be developed first. The operational sequence will mirror the development sequence for Phase 2 – Phase 2A (south side) will be filled first, during which time Phase 2B (north) side will be built then filled. Finally, Phase 2C (vertical expansion over Phases 1 and 2) will be built. The

sequence is expected to provide capacity for two 5-years permit cycles beyond the current operational permit. Stages or cells within the Phase 2 footprint may be constructed incrementally, as needed to manage surface runoff. Interior and exterior slopes will be maintained at a 3H:1V ratio, demonstrated to be adequate in **Section 4.5** and **Appendix 1**; upper surfaces shall be graded to promote positive drainage, ideally at a 5% slope.

Upon reaching final grades (**Drawings E2** and **E3**), exterior slopes will be covered with an interim cover soil with vegetation or mulch and allowed to settle for up to 6 months; the final cover will be placed incrementally. Soil excavated from the adjacent grading activities and/or existing stockpiles will be used for interim cover. Soils suitable for meeting the 2006 final cover permeability requirements will be segregated and stockpiled until needed (**Section 8.0**). Please refer to **Section 1.3** for a table-facilitated discussion of the operational sequence and approximate volumes of each phase and subphase.

## 3.3 Facility Report

### 3.3.1 Waste Stream

The CDLF is permitted for 1,100 tons per day. The facility operates 6 days per week (300 days per year) – this equates to approximately 330,000 tons per year. Scale-house records indicate the average daily intake is consistent with the original permit. Per the Wake County Franchise and the Solid Waste Permit, the following populations (by county) are potentially served by the facility:

| SELECTED COUNTY | 2000 Census[1] | 2009 Census | % Growth[2] | 2019 Pop Est[3] | % Growth | 2029 Pop Est[3] | % Growth |
|---|---|---|---|---|---|---|---|
| CHATHAM | 49,329 | 62,492 | 26.7% | 72,612 | 47.2% | 84,861 | 72.0% |
| DURHAM | 223,013 | 266,189 | 19.4% | 291,390 | 30.7% | 328,327 | 47.2% |
| FRANKLIN | 47,260 | 59,199 | 25.3% | 71,930 | 52.2% | 85,249 | 80.4% |
| JOHNSTON | 121,964 | 168,253 | 38% | 214,626 | 75.9% | 268,223 | 120% |
| ORANGE | 118,200 | 132,306 | 11.9% | 145,051 | 22.7% | 159,816 | 35.2% |
| WAKE | 627,816 | 892,607 | 42.2% | 1,111,606 | 77.1% | 1,382,214 | 120% |
| **MULTI-COUNTY SERVICE AREA** | 1,187,582 | 1,581,046 | 33.1% | 1,910,215 | 60.8% | 2,308,690 | 94.4% |
| **STATE OF NORTH CAROLINA** | 8,047,764 | 9,382,610 | 16.6% | 10,744,214 | 33.5% | 12,167,409 | 51.2% |

[1]Source data: 2009 Provisional County Population Estimates, North Carolina State Data Center, May 2010, http://demog.state.nc.us/

[2]All growth is relative to 2000 Census Data

[3]Source data: Projected Annual County Population Totals (for years given), North Carolina State Demographics, North Carolina State Data Center, http://demog.state.nc.us/

According to the NC DENR Solid Waste Section annual reports, found on-line at http://www.wastenotnc.org/swhome/, the actual annual disposal at the subject facility during FY 2008-09 was 121,393 tons, and for FY 2007-08 the annual disposal was 176,344 tons. Based on the population projections, there is expected to be an adequate supply of waste to keep the facility operational for the foreseeable future. It is understood that an increase in the waste intake will require modification of the Wake County Franchise Agreement and, if the increase is 10% or more, a permit modification (necessitating a public hearing) will be required.

### 3.3.2 Landfill Capacity

The volumetric analysis for Phase 2 (**Appendix 1)** compared a surface model for the February 2008 aerial survey and the final waste grades at full build-out. This analysis indicated an estimated 4,980,657 cubic yards of airspace, (average of three calculations methods facilitated by Land Desktop software interacting with AutoCAD), which includes interim cover soils but excludes final cover. A similar analysis for the projected interim grades within Phase 1 (relative to the February 2008 survey) indicated 762,442 cubic yards remaining in Phase 1 (at the time) – this subtracted from the total airspace yields approximately 4,218,215 cubic yards contributed by Phases 2A, 2B, and 2C.

A volume analysis comparing the February 2008 surface model, i.e., waste contours in Cells 1A and 1B (at the completion of Cell 1B grading), to the waste contours in Cell 1A in March 2005 determined that approximately 880,000 cubic yards of airspace had been consumed, mostly during the prior 35-month period. This equates to an average monthly airspace consumption of 25,142 cubic yards per month. Scale house records for a 25-month period spanning February 2006 through March 2008 indicate 357,412 tons were disposed, for an average of 14,300 tons per month. Assuming 15% soil use, 748,000 cubic yards of the consumed airspace was actual waste, or 21,370 cubic yards per month. This yields an in-place waste density of 0.66 tons per cubic yard – this agrees with earlier calculations by Joyce Engineering based on 0.68 tons per cubic yard.

Projecting the monthly airspace consumption (25,142 cubic yards) to the total airspace for the "North" disposal area (4,218,215 cubic yards for Phase 1 and Phase 2), the operational life relative to the February 2008 survey is 168 months, or approximately 14 years, which represents approximately three 5-year permitting cycles. These projections assume even waste intake (regional growth factors are not factored in). Using a projected 15% periodic soil use and assuming a 3-foot thick final cover (i.e., consistent with the 2006 C&D rules) the net disposal capacity in Phase 2 is as follows: 4,218,215 * 85% - 121,000 = 3,464,483 cubic yards * 0.66 = 2,286,558 tons. The estimated capacities in the each subphase (2A, 2B, and 2C) are one-third of the total.

### 3.3.3 Special Engineering Features

No seeps, springs, soft ground, or unstable conditions were identified in the characterization studies. As such, no special engineering design features are required. The subsurface investigations revealed differential weathering along the upper reaches of the bedrock – evidenced by variable depths to "auger refusal" within the central and eastern portions of Phase 2. This pattern suggests the presence of boulders embedded in a saprolite matrix, which does not constitute continuous "bedrock." A preliminary blasting plan has been prepared to allow the Owner the option of removing boulders to predetermined elevations via ripping and carefully controlled blasting, and backfilling to design grades that will maintain the regulatory minimum 4 feet of separation to continuous bedrock. The preliminary blasting plan (submitted under separate cover) has been prepared for regulatory review based on successful blasting performed at other landfill facilities in North Carolina (under the author's supervision) – once a contract has been let and the specifics of the weathered rock surface have been identified during construction of Phase 2, a detailed blasting plan will be prepared and made part of the CQA documentation for the Phase 2A construction.

### 3.3.4 Equipment Requirements

The minimum required equipment to operate the subject facility is as follows:

- One D-6 or equivalent dozer with single-tooth ripper
- One CAT 235 or equivalent track-mounted excavator
- One CAT 963D or equivalent track-mounted loader
- One CAT 826 or equivalent steel-wheel landfill compactor
- One 725 articulated off-road dump truck
- One water truck (make and model not specified)

Other equipment shall be contracted, rented, or purchased as needed to facilitate operation of the facility.

### 3.3.5 Other Solid Waste Activities

The facility operates an inert debris stockpile (concrete debris only) used for making beneficial fill and a LCID T&P Facility for clean wood waste recycling within the future "South" disposal area (see **Drawing S4** and **Figure A**). Upon approval of this plan, WCA will store and process pallets within the LCID area – subject to the SWS rules for storage of unprocessed and processed materials – with no "in-ground" LCID disposal activities on the premises (except within the approved C&D disposal facility).

# 4.0 ENGINEERING PLAN (15A NCAC 13B .0539)

## 4.1 Engineering Report

This section of the report describes the physical aspects of the facility design, with emphasis on waste containment and environmental control systems, based on the hydrogeologic data discussed in **Section 10.0**. The design was prepared by a qualified Professional Engineer, who is licensed to practice in North Carolina and is familiar with the requirements of the North Carolina Division of Waste Management (Division) rules. The design of the first operational cells of Phase 2 is set to provide approximately 5 years of capacity, in keeping with rules – normally 5 years of airspace are permitted at a time. Also, in keeping with the intent of the **2006 C&D Rules**, there is no liner or leachate collection system proposed for this facility since the site meets the rule requirements for soil types present within two feet below planned base grades, and there is at least 4 feet of vertical separation between the waste and seasonal high ground water and/or bedrock, (see **Rule .0540 (2)**). The planned base grades and outer slopes will have maximum slope ratios of 3H:1V, which have been demonstrated to be stable.

### 4.1.1 Analytical Methods

The facility design incorporates elements that are consistent with Division rules and guidelines, as well as sound engineering practice. Various analyses used in the design of the facility include evaluations of soil conditions, i.e., the consistency of subgrade soils and the availability of suitable soils for constructing stable embankments and other earthen structures (discussed below), and ground water characteristics, i.e., flow directions and seasonal water depth fluctuations, discussed in **Section 10.0** (see **Design Hydrogeologic Report**). Soil properties testing used to facilitate these evaluations included grain size analysis, shear strength, consolidation, and compaction characteristics. Stability and settlement of foundation soils were considered in setting base grades, as was outer slope stability for the final cover system (see **Appendix 1**). Other analyses included a detailed evaluation of S&EC and storm water management systems (see **Appendix 2**).

### 4.1.2 Critical Conditions

Based on the nature of the soils within the Phase 2 footprint and across the site, no inherent foundation stability or long-term settlement problems are anticipated. There are no wetlands identified within the Phase 2 footprint – either Phase 2A or 2B, based on the original site suitability report.

### 4.1.3 Technical References

Calculations found in **Appendix 1** are referenced within the various analyses.

### 4.1.4 Location Restriction Demonstrations

The site was granted a Site Suitability determination that meets the requirements of **15A NCAC 13B .0531** *et seq.***,** based on work completed in 2001-02. Relative to **Rule .0536** pertaining to C&D landfills, the site has no disqualifying conditions with respect to zoning, setbacks from residences or potable wells, historic or cultural sites, state or nature preserves, 100-year floodplains, wetlands, water supply watersheds, or endangered species. Documentation pertaining to these site selection criteria is found in the **December 2001 Site Suitability Application**.

## 4.2 Construction Materials and Practices

Based on the Design Hydrogeologic investigation (**Section 10.0**), on-site soils available for embankment and subgrade construction consist chiefly of variably silty sand (i.e., Unified Soil Classification System classifications of SM and SM-ML) with clayey sand (SC) and clayey silt (ML and MH). These soils meet the requirements for the upper two feet beneath the landfill subgrade referenced in **15A NCAC 13B .0540 (2)** (**Section 6.0**). The soils exhibit adequate compaction characteristics and shear strength (when properly compacted) to build stable embankments and subgrades that will not undergo excessive settlement. Some selective use of soils and/or field evaluation will be required to place the correct soil types within the upper two (2) beneath the subgrade elevations. During construction and operations, select soils capable of being compacted to meet final cover permeability requirements will be segregated and reserved for final cover construction.

Good construction practices for embankments and subgrades include compaction using steel-wheel rollers, sheep foot rollers, and/or smooth-drum rollers of sufficient weight – not bulldozers – making a minimum numbers of passes (typically three to five passes) in two perpendicular directions in order to achieve the desired strength properties for stability. Past experience at the site indicates that material selection (i.e., avoiding soils that are excessively wet or exhibit excess organic debris content) and/or blending soils to negate the effects of wet or slick soils will produce satisfactory results. The targeted compaction criterion is 95% of standard Proctor maximum dry density (**ASTM D-698**). Critical embankment and subgrade areas will be tested to ensure proper compaction in accordance with the CQA Plan (**Section 6.0**). General earthwork calculations for subgrade preparation, operational soil, and final cover are presented in **Appendix 1.**

## 4.3 Design Hydrogeologic Report

Refer to **Section 10.0** (**Volume 2**) of this report.

## 4.4 Engineering Drawings

Refer to the rolled plan set that accompanies this report. All relevant criteria required by the rules (except as noted) are depicted on the plans.

### 4.4.1 Existing Conditions

See **Drawings S1 – S5**.

### 4.4.2 Grading Plan

See **Drawing E1**.

### 4.4.3 Stormwater Segregation

See **Drawings E1** and **E2** – stormwater runoff will be diverted away from active disposal areas via ditches and berms, maintaining slopes with positive drainage (always directed toward approved stormwater control measures), and following an orderly waste placement.

### 4.4.4 Final Cap System

A general description of the final cover materials, including barriers, soil layers, drainage components, and gas extraction systems, is provided below (also see **Section 8.2** of the **Closure Plan**, later in this document). Detail drawings of the various components are provided on **Drawing E3** for final contours and **Drawing EC2** for the final cover cross-section and details.

**Final Cover Section** – Two alternative final cover sections are proposed: (1) the regulatory minimum cover, which consists of 18 inches of compacted soil barrier (minimum permeability of $1 \times 10^{-5}$ cm/sec) installed above an interim soil cover, overlain by 18 inches of vegetation support soil (see **Detail H** on **Drawing EC2**), and (2) a synthetic barrier (tentatively welded HDPE flexible membrane) with a synthetic polymer drainage net, overlain by 24 inches of vegetation support soil

(see **Detail J** on **Drawing EC2**); a compaction and soil type are specified for neither the interim soil cover nor the vegetative support layer;

**Erosion Control Breaks** – The use of "tack-on" compacted soil berms and swales integrated into the final cover is preferred by the Owner for final cover erosion control (see **Details A** and **D** on **Drawing EC2**); these features have a gentle slope (approximately 2%) and will be spaced on 30-foot vertical intervals; The resulting swales will be lined with a permanent erosion control mat and vegetated, as shown on **Drawing EC4**; the various swales were designed for peak flows associated with a 25-year, 5-minute storm (for volume and velocity), with each channel specific to the drainage area; a channel design schedule is provided on **Drawing EC5**;

**Drainage Components** – Runoff control will be accomplished via several strategically located "down pipes" that convey water from the erosion control breaks; the piping consists of corrugated HDPE and can either be buried within the final cover soil (shown on **Details B, C,** and **E** on **Drawing EC2**) or staked to the exterior of the slope (see **Detail F** on **Drawing EC2**); either way, the down pipes pass beneath the soil berm on the erosion control breaks (see **Detail A** on **Drawing EC2**), where the inlet protection consists of a stone filter berm that will curtail erosion and prevent soil and debris intrusion (see **Detail I** on **Drawing EC3**), and the pipes will be self-cleaning at the design side slopes; the pipes will discharge to the perimeter swales (which lead to the main sediment basin) and outlet protection will consist of rip-rap aprons underlain by geotextile scour protection (see **Detail J** on **Drawing EC3**); pipe sizes are provided in a schedule on **Drawing EC5**;

**Landfill Gas Vents** – Passive gas vents have been provided to prevent gas pressure build-up beneath the final cover components, to be installed at regularly spaced intervals of three vents per acre; the gas vents consists of perforated PVC or HDPE pipes – with a 2% slope up to a central riser pipe – in a shallow trench within the waste that is filled with filter stone (see **Detail K** on **Drawing EC2**); the trenches are installed beneath the barrier layer during the final cover construction; a supplemental pipe boot (not shown in the drawings) may be added to ensure a water tight seal at the riser pipe penetration;

**Vegetation** – A seeding schedule for vegetation that is appropriate to the local climate is provided on **Drawing EC5**.

### 4.4.5 Temporary and Permanent S&EC

See **Drawing EC1A** for temporary sedimentation and erosion control (S&EC) measures (for construction) and **Drawing EC1B** for final measures. A separate S&EC plan submittal to Wake County Environmental Services has been made. Minor design revisions to the S&EC plan, if any, resulting from the Wake County review will be incorporated during construction and shown on "as-built" drawings for the Permit to Operate application.

### 4.4.6 Vertical Separation

See **Drawings E4** and **E5** for base grades relative to ground water and bedrock, respectively; also see cross section **Drawings X1 – X2**.

### 4.4.7 Other Features

This rule pertains to liners and leachate collection systems, if proposed (none are).

## 4.5 Specific Engineering Calculations and Results

Calculations for settlement and slope stability were performed using site specific data. The calculations can be found in **Appendix 1**, the geotechnical lab data are found in **Appendix 8** of the approved **Phase 2 Design Hydrogeologic Report**. The following is brief description of the analyses and results.

### 4.5.1 Settlement

Settlement is a concern at unlined landfills for maintaining vertical separation between the bottom of the waste (or base liner) and the maximum long-term seasonal high water table. Settlements of the foundation soils result from time-dependent strain, i.e., a change in thickness within the various soil layers due to the vertical stress (weight of the landfill) applied at the surface, accompanied by drainage of the various soil layers. Vertical stresses beneath landfills gradually increase as the waste becomes thicker over long periods of time; strain-induced settlements within sands and/or well drained silts and clays are relatively short-term, thus long-term settlements are not typically a concern unless thick uniform clay deposits are present (which tend to drain slowly) – such is not the case at the subject landfill. The critical section for settlement, considering the maximum fill height and the deepest identified weathering profile (deepest soils) occurs at boring G-4. Relative to soil types that could be sampled with a Shelby tub and

subjected to laboratory consolidation tests, the soils at G-13 were selected to be representative of the softer materials (lower SPT values).

Settlements were calculated using elastic methods adapted from the US Federal Highway Administration (FHWA) for highway embankments. Ostensibly, a landfill is a large flexible embankment with the highest stresses impinging on the foundation soils near the center. The FHWA settlement calculation is based on the work of Hough (1959) and others, which considers both the material type and overburden depth for determining a "correction factor" for standard penetration test (SPT) values, from which the compressibility and load-induced strain of each soil layer can be evaluated. For sandy soils conventional sampling via Shelby tubes and laboratory consolidation testing is infeasible. For clayey soils, representative Shelby tube samples were acquired and laboratory consolidation tests were performed (see **Design Hydrogeologic Report**), and the consolidation data were substituted into the calculations for appropriate soil layers.

A spreadsheet facilitates the settlement calculation (see **Appendix 1**). Initially, the vertical stress increase resulting from varying embankment heights was calculated using an average unit weight of 1000 pounds per cubic yard (37 pcf) and by applying a depth-related "influence factor" based on elastic stress distribution theory. Next a subsurface stress distribution was developed for original and post-construction (final height) conditions, based on the depth and average unit weight of the soil layers, plus the added vertical stresses. The SPT correction factor was applied to determine the compressibility factor and strain within each sand layer. For the clays, consolidation theory was applied to determine the strain in those layers – using site-specific laboratory consolidation data – which was added to the strain in the sand layers to estimate total settlement under a given load. Time-dependent settlement was not considered due to the well drained conditions indicated by the subsurface data.

For this project, the maximum estimated settlement at the center of the landfill near G-4 is 1.3 feet. The base grade design provides nearly 10 feet of vertical separation at this location, (more than the minimum required 4 feet), which is sufficient to accommodate the anticipated settlement while maintaining the required minimum vertical separation. Differential settlement within the footprint is not a concern. Anticipated settlement over most of the site are expected to be negligible, since the "worst case" scenario represented at G-4 is an unusual circumstance, i.e., the deep soils encountered at this boring are not typical of a majority of the site, rather the presence of shallow rock and/or partially weathered rock is more typical across the site. The deeper soils at G-4 have been characterized as a "slot" of deeply weathered material extending vertically along a joint surface – these conditions are expected to be isolated to the Phase 2B area, not Phase 2A.

### 4.5.2 Slope Stability

Two primary concerns exist for landfills with respect to slope stability:

(1) Deep-seated or global stability involving a deep layer in the foundation or along the base of the landfill, which could potentially result in catastrophic (occurring relatively sudden) and costly slope failure, and

(2) Veneer stability (sliding of the cover), which can be catastrophic such as to expose the waste but is typically more of a maintenance issue relative to repairs in the event of a failure.

Subsurface conditions identified at this site are relatively sandy (high strength soils) with interspersed this clay layers with sand seams that are expected to drain readily under the applied embankment loads – only "effective" stresses (i.e., drained conditions) were considered. The site is not earthquake prone, with a design horizontal loading of 0.03g (USGS data). The water table is relatively deep and the soils are saprolite – with locked in stresses that typically exceed existing overburden pressures – so liquefaction is not a concern. No extremely soft layers that would pose stability concerns were identified by the SPT testing, and the foundation soils are expected to undergo a strain-hardening strength increase as settlement occurs, i.e., the foundation soils will become even more stable with time.

**4.5.2.1 Deep-seated stability** – Limit-equilibrium methods, i.e., the STABL-5M model used for this project, evaluate the balance of forces driving a slide (weight of the porous material and contained water) against the forces resisting a slide (shear strength, expressed as cohesion and friction) along a theoretical failure surface, which can be either a circular surface or a series of intersecting planar surfaces. A "static" analysis considers just the weight of the materials and the shear strength (tie-back loads may be considered for reinforced embankments); a "dynamic" analysis might consider external loads, such as linear loads at the top of the embankment (i.e., traffic forces) or additional horizontal loads to represent earthquakes (expressed as a fraction of the normal gravity field, specific to the region of interest). In more advanced routines, the mass above the failure surface is divided into many slices, the driving and resisting forces for each of which are calculated and summed up. This "method of slices" expresses the balance of resisting forces and driving forces as a ratio, e.g., 1.5:1, or simply 1.5, which is the "safety factor." Ratios less than unity (safety factor <1) indicate unstable conditions. Typical minimum safety factors for maintaining stable embankment conditions throughout the life of a project are 1.5 for static conditions, 1.2 for seismic conditions.

Shear strength inputs to the STABL-5M model were developed from the drilling and laboratory data (see **Design Hydrogeologic Report**). A circular failure surface was used with a Janbu method of slices analysis, which typically gives the most conservative results; then an irregular surface and a sliding block failure mechanism were analyzed. A representative soil profile was developed from the drilling data. A slope ratio of 3H:1V was modeled for both an interim slope height (Phase 2A) and a final slope height (Phases 2A – 2C). The following table shows a summary of the soil strength input values for the representative cross section at the project site (see **Appendix 1**):

| Soil Layer | Layer Thickness (feet) | Soil Layer Description | Saturated Unit Weight (pcf) | Drained Cohesion (psf)* | Drained Friction Angle (deg) |
|---|---|---|---|---|---|
| 1 | 80, 190 | Waste | 60 | 20 | 45 |
| 2 | Varies | Silty sand<br>N = 7 to 50 | 125 | 400 | 34 |
| 3 | Varies | Silty sand (PWR)<br>N = 100 | 130 | 800 | 35 |
| 4 | Undefined | Bedrock | 150 | 1000 | 45 |

*Apparent cohesion for waste is based on retrogression analysis from other projects; site specific laboratory data (see the **Design Hydrogeologic Report**) was used for the sands. The water table was modeled with a slope based on seasonal high conditions (as shown on the hydrogeologic profiles), assuming no pore pressure build-up in the waste.

The following slope stability safety factors were determined:

| Slope Condition | Analysis | Safety Factor |
|---|---|---|
| Phase 2 Interim | Janbu circular surfaces (auto-search), seismic | 1.8 |
| | Janbu irregular surface (auto-search), seismic | 2.3 |
| | Sliding block targeting weakest layer, seismic | 2.7 |
| Phase 2 Final | Janbu circular surfaces (auto-search), seismic | 1.5 OK |

**4.5.2.2 Veneer Stability –** Sliding of the final cover (or veneer failure) is dependent on slope angle, material strength, i.e., the interface friction angle and cohesion within the soils and between the soils and synthetic components (if any), and the degree of saturation. Veneer failure occurs when the pore pressures build up along a critical interface in excess of available shear strength. The severity of failure can range from minor sloughing of small areas (maintenance nuisances) to large-scale slides requiring complete replacement of large sections – this type of failure is expensive to repair, especially when synthetic components are involved. The analysis is typically performed for preliminary design conditions to anticipate (and try to avoid) the large-scale failures.

A worse-case scenario involves little (or no) cohesion, as in a geotextile-geomembrane interface, and complete saturation of the soils overlying that interface. Good engineering practice requires a drainage layer (typically a synthetic geonet) on slopes steeper than 10% when a flexible membrane barrier is used, e.g., an alternative final cover that might be considered. The regulatory minimum cover includes 18 inches of vegetative support soil overlying a compacted soil barrier. North Carolina Solid Waste regulations allow alternative final covers, subject to approval by the Solid Waste Section, but specific interface testing will be required to verify future designs.

Even when all natural soil covers are used, drainage is still important relative to veneer stability, so a final cover section will include higher permeability sand layer next to the barrier to prevent the soils above the barrier from becoming saturated. Assuming a regulatory minimum cover soil profile is used, the critical interface for veneer stability exists within a low-cohesion sand layer overlying the compacted soil barrier at full saturation on a 3H:1V slope. While a minimum cohesion could be assumed along the sand layer and the compacted soil barrier, the stresses near the base of the sand layer would control stability.

A veneer stability analysis (**Appendix 1**) adapted from Matasovic (1991) was performed to evaluate four conditions: static unsaturated and saturated conditions (with a required safety factor of 1.5) and seismic unsaturated and saturated conditions (with a safety factor of 1.1). For this site, the static (non-seismic) saturated case is the critical condition for design because of the higher required safety factor. The calculations start with the given slope geometry and saturation state, then for a given safety factor the required friction (with or without cohesion) is back-calculated to provide the desired safety factor.

The analysis assumed full saturation of the vegetation support layer (upper cover soil is at field capacity) with a 1-year, 60-minute design storm impinging, resulting in a head of just over 12 inches acting on the base of the upper soil layer. Assuming the deeper

compacted soil layer is stronger (due to cohesion) ***a minimum friction angle of 31 degrees is required within the upper soil layer***. Select soils available in the region (including the borrow sites on the premises) are capable of providing this minimum friction angle, combined with the required high permeability for drainage. The CQA program for the final closure will verify the available friction angles for the actual cover components (including alternative cover designs, if these are to be used).

# 5.0 CONSTRUCTION PLAN REQUIREMENTS (15A NCAC 13B .0540)

This section demonstrates compliance of the facility design for CDLF Phase 1A with the requirements of the **2006 C&D Rules, 15A NCAC 13B .0531 *et seq.*** Reference is made to the construction plan set and various appendices, in which the calculations are presented.

## 5.1 Horizontal Separation

The following regulatory criteria are addressed in project drawings specified below. Refer to the rolled plan set that accompanies this report.

### 5.1.1 Property Lines

The minimum setback to property lines is 200 feet (**Drawings S4** and **S5**).

### 5.1.2 Residences and Wells

The minimum setback to residences and wells is 500 feet (**Drawings S1 – S3**).

### 5.1.3 Surface Waters

The minimum setback to surface waters is 50 feet (**Drawings S4** and **S5**).

### 5.1.4 Existing Landfill Units

None are present.

## 5.2 Vertical Separation

### 5.2.1 Settlement

Maximum waste thicknesses are approximately 163 feet (middle of Phases 1 and 2); the waste density is approximately 0.66 tons/cubic yard. Foundation soils typically consist of very dense, normally consolidated silty sand, sandy silt and/or clayey sand (all saprolite), but there appears to the be a deeply weathered pocket near G-4 with SPT values varying from 8 to 15 that is anticipated to produce local settlement. A settlement calculation performed for this worst-case scenario (**Appendix 1**) indicates localized post-construction foundation settlements on the order of 1.4 feet, or less. Elsewhere the soils are stiffer, so settlements are expected to be less. Based on **Drawing E4**, the vertical separation to ground water on the order of 10 feet near G-4, i.e., near the maximum waste thickness. The settlements will not decrease the vertical separation to less than 4 feet.

### 5.2.2 Soil Consistency

Based on the laboratory data (**Section 10.1.4**), a majority of the on-site soils generally classify as silty sands (SM), silt (ML) or dual classify as sand-silt (SM-ML). A relatively small fraction of the near surface soils consist of low plasticity silty clay (CL), and there are minor high plasticity silty clay (MH-CH) soil types present. These soil types will be present either in-situ or within compacted subgrades, meeting the requirements of **Rule .0540 (2) (b)** for the upper two feet beneath the subgrade. No modification of the soils, i.e., admixtures, will be required to meet this rule requirement, but reworking to blend the soils to a more uniform consistency and proper compaction may be required to mitigate isolated pockets of granular soils. Soil types present within the upper two feet beneath subgrade shall be documented in the CQA program.

## 5.3 Survey Control Benchmarks

A permanent benchmark has been established by ASD Land Surveying, P.A., of Apex, NC. The permanent bench mark is located next to three steel pipes that convey storm water from the perimeter swale to the main sediment basin, just west (and across the perimeter road) from Phase 1, Cell A (northwest corner). The benchmark is tied into the North Carolina State Plan (NCSP) coordinate system with the following coordinates:

| | | | |
|---|---|---|---|
| BM-1 | N 714227.5410 | E 2146136.6030 | EL 212.14 (NAD 83) |

## 5.4 Site Location Coordinates

The latitude and longitude coordinates of the center of the site (determined from topographic mapping) are approximately:

| LATITUDE | LONGITUDE |
|---|---|
| DD MM SS.sssss | DDD MM SS.sssss |
| 35 42 33.62411 | 78 30 13.02853 |
| 35.70934 | 78.50361 |

## 5.5 Landfill Subgrade

### 5.5.1 Subgrade Inspection Requirement

The Owner/Operator shall have the Phase 2A subgrade inspected by a qualified engineer or geologist upon completion of the excavation (as part of the CQA) in accordance with **Rule .0540 (5) (a)**, to verify that subgrade conditions are consistent with expected conditions based on the Design Hydrogeologic Report.

### 5.5.2 Division Notification

The Owner/Operator shall notify the Division at least 24 hours in advance of the subgrade inspection.

### 5.5.3 Vertical Separation Compliance

The subgrade inspection shall verify to the Division that the minimum vertical separation requirements are met and that required subgrade soil types are present.

## 5.6 Special Engineering Features

This section of the rules generally pertains to liners and leachate collection systems, if any are present (none will be).

## 5.7 Sedimentation and Erosion Control

The sedimentation and erosion control structures described elsewhere (**Appendix 2**) are designed to accommodate the 25-year, 24-hour storm event, per the North Carolina Sedimentation Pollution Control Law (**15A NCAC 04**). An S&EC plan has been submitted to the Wake County Department of Environmental Services, and is depicted in the construction plan set (see **Drawings EC1A** and **EC1B**). Existing sediment basins and sediment traps remaining from the Phase 1 construction shall be cleaned out and upgraded as needed; new measures to be constructed for Phase 2will include staged grading practices to minimize soil exposure, silt fence, ditches/berms and sediment traps ("custom basins" meeting Wake County requirements.) The plan is under review and notification will be made available to the SWS upon issuance of the Wake County S&EC permit.

# 6.0 CONTRUCTION QUALITY ASSURANCE (15A NCAC 13B .0541)

## 6.1 General Provisions

This Construction Quality Assurance (CQA) Plan has been prepared to provide the Owner, Engineer, and CQA Testing Firm – operating as a coordinated team – the means to govern the construction quality and to satisfy landfill certification requirements under current solid waste management regulations. The CQA program includes both a quantitative testing program (by a third-party) and qualitative evaluation of construction materials to assure that the construction meets the desired performance criteria, i.e., sufficient strength and permeability. Variations in material properties and working conditions may require minor modification of handling and placement techniques throughout the project. Close communication between the various parties is paramount. The early stages of the construction activities will likely require closer attention by the CQA team, i.e., the Contractor, Engineer, Owner, and CQA Testing Firm.

It should be noted that this CQA plan pertains to both the base grading construction (all stages) and the final cover construction (all stages). Whereas both the base grades and final cover will be built in increments, the CQA program must also be implemented in corresponding stages. Separate CQA documentation must be prepared for each stage of construction.

### 6.1.1 Definitions

**6.1.1.1 Construction Quality Assurance (CQA) –** In the context of this CQA Plan, Construction Quality Assurance is defined as a planned and systematic program employed by the Owner to assure conformity of the base grade construction and final cover system installation with the project drawings and the project specifications. CQA is provided by the CQA Testing Firm as a representative of the Owner and is independent from the Contractor and all manufacturers. The CQA program is designed to provide confidence that the items or services brought to the job meet contractual and regulatory requirements and that the base grades and final cover will perform satisfactorily.

**6.1.1.2 Construction Quality Control (CQC) –** Construction Quality Control refers to actions taken by manufacturers, fabricators, installers, and/or the Contractor to ensure that the materials and the workmanship meet the requirements of the project drawings and the project specifications. The manufacturer's specifications and quality control (QC) requirements are included in this CQA Manual by reference only. A complete updated version of each manufacturer's QC Plan for any Contractor-supplied components shall be incorporated as part of the Contractor's CQC submittal. The Owner and/or the Engineer shall approve the Contractor’s QC submittal prior to initial construction.

Contractor submittals may be (but us not required to be) incorporated into the final CQA certification document at the Owner's discretion.

**6.1.1.3 CQA Certification Document –** The Owner and/or the Engineer will prepare a certification document upon completion of construction, or phases of construction. The Owner will submit these documents to the NC DENR Solid Waste Section. The CQA certification report will include relevant testing performed by the CQA Testing Firm, including field testing used to verify preliminary test results and/or design assumptions, records of field observations, and documentation of any modifications to the design and/or testing program. An "as-built" drawing (prepared by/for the Owner), showing competed contours, shall be included. The Certification Document may be completed in increments, i.e., as several documents, as respective portions of the base grades and final cover are completed. Section 2 discusses the documentation requirements.

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

### 6.1.2 Responsibilities and Authorities

The parties to Construction Quality Assurance and Quality Control include the Owner, Engineer, Contractor, CQA Testing Firm (i.e., a qualified Soils Laboratory).

**6.1.2.1 Owner** – The Owner is WCA, who operates and is responsible for the facility. The Owner or his designee is responsible for the project and will serve as liaison between the various parties.

**6.1.2.2 Engineer** – The Engineer (a.k.a. the "Design Engineer") is responsible for the engineering design, drawings, and project specifications, regulatory affairs, and communications coordinator for the project for the base grades and final cover system. The Engineer represents the Owner and coordinates communications and meetings as outlined in **Section 7.3**. The Engineer shall also be responsible for proper resolution of all quality issues that arise during construction. The Engineer shall prepare the CQA certification documents, with input from the Owner, the CQA Testing Firm, and the Owner's Surveyor. The Engineer shall be registered in the State of North Carolina.

**6.1.2.3 Contractor** – The Contractor is responsible for the construction of the subgrade, earthwork, and base grades and final cover system. The Contractor is responsible for the overall CQC on the project and coordination of submittals to the Engineer. Additional responsibilities of the Contractor include compliance with North Carolina Sedimentation and Erosion Control rules.

**Qualifications** – The Contractor qualifications are specific to the construction contract documents and are independent of this CQA Manual.

**6.1.2.4 CQA Testing Firm** – The CQA Testing Firm (a.k.a. Soils Laboratory) is a representative of the Owner, independent from the Contractor, and is responsible for conducting geotechnical tests on conformance samples of soils, and aggregates used in structural fills and the final cover system. The Owner will pay for the services of the Soils Laboratory. Periodic site visits shall be coordinated with the Contractor.

**Qualifications** – The CQA Testing Firm (Soils Laboratory) will have experience in the CQA aspects of the construction and testing of landfill base grades and final cover systems, and be familiar with ASTM and other related industry standards. The Soils CQA Laboratory will be capable of providing test results within 24 hours or a reasonable time after receipt of samples, depending on the test(s) to be conducted, as agreed to at the outset of the project by affected parties, and will maintain that standard throughout the construction.

### 6.1.3 Control vs. Records Testing

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

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

### 6.1.4 Modifications and Amendment

This document was prepared by the Engineer to communicate the basic intentions and expectations regarding the quality of materials and workmanship. Certain articles in this document may be revised, if so warranted based on project specific conditions. No modifications will be made without the Engineer's approval. Modifications to the CQA Plan will also be approved by the Solid Waste Section, as appropriate to meet Solid Waste Rules and Statutes, and for input regarding quality of construction.

### 6.1.5 Miscellaneous

**6.1.5.1 Units –** In this CQA Plan, and through the plans and specifications for this project, all properties and dimensions are expressed in U.S. units.

**6.1.5.2 References –** This CQA Plan includes references to the most recent version of the test procedures of the American Society of Testing and Materials (ASTM) and/or the Geosynthetic Research Institute (GRI), as applicable. **Table 6D** (following this section) contains a list of these procedures.

## 6.2 Inspection, Sampling and Testing

The requirements of the General Earthwork (perimeter embankments and subgrade) and Final Cover Systems (soil barrier, vegetative cover, storm water management devices) differ with respect to continuous or intermittent testing and oversight. The following two sections are devoted to the specific requirements of each work task.

### 6.2.1 General Earthwork

This section outlines the CQA program for structural fill associated with perimeter embankments, including sedimentation basins, and general grading of the subgrade. Issues to be addressed include material approval, disposal cell subgrade approval, field control and record tests, if any, and resolution of problems.

**6.2.1.1 Compaction Criteria** – All material to be used as compacted embankment shall be compacted to a minimum of **95% of the Standard Proctor Maximum Dry Density (ASTM D-698)**, or as approved by the Engineer or designated QC/QA personnel. Approval is based on visual evaluation for consistency with project specification and objectives. Such material evaluations may be performed either during material handling, i.e., delivery to or upon receipt at the landfill, or from existing stockpiles and/or the soil borrow site. Borrow soils shall be evaluated by the Engineer and QC/QA personnel prior to placement on the work site.

**6.2.1.2 Testing Criteria** – Periodic compaction (moisture-density) testing requirements are imposed on the structural fill, although compaction and testing requirements may not be as stringent as that required for the final cover construction. Initial compaction testing shall be in accordance with the project specifications. The Engineer may recommend alternative compaction testing requirements based on field performance. Additional qualitative evaluations shall be made by the Contractor Superintendent and the Engineer to satisfy the performance criteria for placement of these materials.

CQA monitoring and testing will not be "full-time" on this project. Rather, the CQA Testing Firm will test completed portions of the work at the Contractor's or Owner's request. The CQA Testing Firm may be called upon to test compacted structural fill for base grades and/or final cover at any time, ideally scheduling site visits to optimize his efforts. The Engineer will make an inspection at least monthly, more often as needed (anticipated more often in the initial stages of new construction).

**6.2.1.3 Material Evaluation –** Each load of soil will be examined either at the source, at the stockpile area, or on the working face prior to placement and compaction. Any unsuitable material, i.e., that which contains excess moisture, insufficient moisture, debris or other deleterious material, will be rejected from the working face and routed to another disposal area consistent with its end use. Materials of a marginal natural, i.e., too dry or too wet, may be stockpiled temporarily near the working face for further evaluation by designated QC/QA personnel. The Contractor may blend such materials with other materials (in the event of dryness) or dry the materials (in the event of excess moisture).

**6.2.1.4 Subgrade Approval –** Designated QC/QA personnel shall verify that the compacted embankment and/or subgrade are constructed in accordance with the project specifications prior to placing subsequent or overlying materials.

**6.2.2 General Earthwork Construction**

**6.2.2.1 Construction Monitoring –** The following criteria apply:

A. Earthwork shall be performed as described in the project specifications. The Construction Superintendent has the responsibility of assuring that only select materials are used in the construction, discussed above.

B. Only materials previously approved by the Engineer or his designee shall be used in construction of the compacted embankment. Unsuitable material will be removed and replaced followed by re-evaluation to the satisfaction of the Engineer and retesting, as may be required.

C. All required field density and moisture content tests shall be completed before the overlying lift of soil is placed – as applicable. The surface preparation (e.g. wetting, drying, scarification, compaction etc.) shall be completed before the Engineer (or his designate) will allow placement of subsequent lifts.

D. The CQA Testing Firm and/or the Engineer shall monitor protection of the earthwork, i.e., from erosion or desiccation during and after construction.

**6.2.2.2 Control Tests –** The control tests, as shown on **Table 6A**, will be performed by the CQA Testing Firm prior to placement of additional compacted embankment.

**6.2.2.3 Record Tests –** The record tests, as shown on **Table 6A**, will be performed by the CQA Testing Firm during placement of compacted embankment. The CQA Testing Firm may propose and the Engineer may approve an alternative testing frequency. Alternatively, the Engineer may amend the testing frequency, without further approval from the regulatory agency, based on consistent and satisfactory field performance of the materials and the construction techniques.

**6.2.2.4 Record Test Failure** – Failed tests shall be noted in the construction report, followed by documentation of mitigation. Soils with failing tests shall be evaluated by the Engineer (or his designee), and the soils shall either be recompacted or replaced, based on the Engineer's judgment. Recompaction of the failed area shall be performed and retested until the area meets or exceeds requirements outlined in the specifications.

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

- Rollers slip during rolling operation;
- Lift thickness is greater than specified;
- Fill material is at an improper moisture content;
- Fewer than the specified number of roller passes is made;
- Dirt-clogged rollers are used to compact the material;
- Rollers may not have used optimum ballast;
- Fill materials differ substantially from those specified; or
- Degree of compaction is doubtful.

**6.2.2.6 Deficiencies –** The CQA Testing Firm will immediately determine the extent and nature of all defects and deficiencies and report them to the Owner and Engineer. The CQA Testing Firm shall properly document all defects and deficiencies – this shall be more critical on the final cover construction, although this applies to structural fill, as well. The Contractor will correct defects and deficiencies to the satisfaction of the Owner and Engineer. The CQA Testing Firm shall perform retests on repaired defects.

### 6.2.3 Final Cover Systems

This section outlines the CQA program for piping, drainage aggregate, geotextiles, compacted soil barrier layer, and the vegetative soil layer of the final cover system, as well as the related erosion and sedimentation control activities. Issues to be addressed include material approval, subgrade approval, field control and record tests, if any, and resolution of problems.

**6.2.3.1 Material Approval** – The Engineer and/or the CQA Testing Firm shall verify that the following materials (as applicable) are provided and installed in accordance with the project drawings, specifications, and this CQA Manual. In general, the Contractor shall furnished material specification sheets to the Engineer for review and approval. In certain cases, materials furnished by the Contractor may need to meet the Owner's requirements, in which case the Owner shall approve of the materials with the Engineer's concurrence. The materials approval process may involve the submittals furnished by the Owner, (for documentation purposes) in the event that the Owner decides to furnish certain materials.

A. <u>High Density Polyethylene (HDPE) Pipe</u>

(1) Receipt of Contractor's submittals on HDPE pipe.

(2) Review of submittals for HDPE pipe for conformity to the project specifications.

B. <u>Corrugated Polyethylene (CPE) Pipe</u>

(1) Receipt of Contractor's submittals on CPE pipe.

(2) Review of submittals for CPE pipe for conformity to the project specifications.

C. <u>Aggregates</u> (Verify for each type of aggregate)

(1) Receipt of Contractor's submittals on aggregates.

(2) Review of submittals for aggregates for conformity to the project specifications.

(3) Verify that aggregates in stockpiles or at borrow sources conform to the project specifications - quarry certification will be sufficient.

(4) Perform material evaluations in accordance with **Table 6B**.

D. Vegetative Soil Layer

(1) Review the proposed source of vegetative soil layer for conformance with the project specifications.

(2) Perform material evaluations in accordance with **Table 6C**.

E. Compacted Barrier Layer

(1) Review the proposed source material for compacted barrier layer for conformance with the project specifications.

(2) Conduct material control tests in accordance with **Table 6C**.

F. Erosion and Sedimentation Control

(1) Receipt of Contractor's submittals on erosion and sedimentation control items (including rolled erosion control products and revegetation).

(2) Review of submittals for erosion and sedimentation control items for conformity to the project specifications.

**6.2.3.2 Final Cover Systems Installation –** The CQA Testing Firm, in conjunction with the Engineer, will monitor and document the construction of all final cover system components for compliance with the project specifications. Monitoring for the components of the final cover system includes the following:

- Verify location of all piping;
- Monitoring for minimum vertical buffer between field equipment and piping;
- Monitoring thickness and moisture-density of the final cover layers and verification that equipment does not damage the compacted barrier layer or other components; and
- Monitoring that erosion and sedimentation control items are properly installed.

**6.2.3.3 Deficiencies –** The CQA Testing Firm and/or the Engineer will immediately determine the extent and nature of all defects and deficiencies and report them to the Owner. The CQA Testing Firm and/or the Engineer shall properly document all defects and deficiencies. The Contractor will correct defects and deficiencies to the satisfaction

of the Engineer. The CQA Testing Firm and/or the Engineer shall observe all retests on repaired defects.

## 6.3 CQA Meetings

Effective communication is critical toward all parties' understanding of the objectives of the CQA program and in resolving problems that may arise that could compromise the ability to meet those objectives. To that end, meetings are essential to establish clear, open channels of communication. The frequency of meetings will be dictated by site conditions and the effectiveness of communication between the parties.

### 6.3.1 Project Initiation CQA Meeting

A CQA Meeting will be held at the site prior to placement of the compacted barrier layer. At a minimum, the Engineer, the Contractor, the CQA Testing Firm and a representative of the Owner will attend the meeting. The purpose of this meeting is to begin planning for coordination of tasks, anticipate any problems that might cause difficulties and delays, and, above all, review the CQA Manual with all of the parties involved.

During this meeting, the results of a prior compaction test pad will be reviewed, and the project specific moisture-density relationships and it is very important that the rules regarding testing, repair, etc., be known and accepted by all. This meeting will include all of the activities referenced in the project specifications. The Engineer shall document the meeting and minutes will be transmitted to all parties.

### 6.3.2 CQA Progress Meetings

Progress meetings will be held between the Engineer, the Contractor, a representative of the CQA Testing Firm, and representatives from any other involved parties. Meeting frequency will be, at a minimum, once per month during active construction or more often if necessary during critical stages of construction (i.e., initial stages of base grades and final cover). These meetings will discuss current progress, planned activities for the next week, and any new business or revisions to the work. The Engineer will log any problems, decisions, or questions arising at this meeting in his periodic reports. Any matter requiring action, which is raised in this meeting, will be reported to the appropriate parties. The Engineer will document these meetings and minutes will be transmitted to affected parties.

### 6.3.3 Problem or Work Deficiency Meetings

A special meeting will be held when and if a problem or deficiency is present or likely to occur. At a minimum, the Engineer, the Contractor, the CQA Testing Firm, and

representatives will attend the meeting from any other involved parties. The purpose of the meeting is to define and resolve the problem or work deficiency as follows:

- Define and discuss the problem or deficiency;
- Review alternative solutions; and
- Implement an action plan to resolve the problem or deficiency.

The Engineer will document the meeting; minutes will be transmitted to all parties.

## 6.4 Documentation and Reporting

An effective CQA plan depends largely on recognition of which construction activities will be monitored and on assigning responsibilities for the monitoring of each required activity. This is most effectively accomplished and verified by the documentation of quality assurance activities. The CQA Testing Firm will provide documentation to address quality assurance requirements. Monitoring will not be continuous and full-time, although the CQA Testing Firm representative (typically this is a Soil Technician) and the Engineer will make frequent and periodic visits to inspect and/or test the work. Both parties shall keep records of their visits and observations.

The Soils Technician will visit the site periodically (e.g., once per week) to document activities during placement of the structural fill and during base grades and final cover construction. Site visits by the CQA Testing Firm shall be coordinated between the Contractor and the CQA Testing Firm. The Engineer will make monthly site visits during these critical stages to review the work.

The Construction Superintendent or his representative shall be present on-site daily and shall keep a record of the general construction progress, noting specifically any problems or inconsistencies that need to be brought to the Owner's attention. The specifics of the Contractor's records will not be spelled out, but at a minimum, daily or weekly progress records shall be kept and made available to the Owner upon request.

The CQA Testing Firm will provide the Owner (or his designee) with periodic progress reports including signed descriptive remarks, data sheets, and logs to verify that required CQA activities have been carried out. These reports shall also identify potential quality assurance problems. The CQA Testing Firm will also maintain at the job site a complete file of project drawings, reports, project specifications, the CQA Plan, periodic reports, test results, and other pertinent documents. The Owner shall furnish a location to keep this record file. Occasional documentation by the Contractor and the Engineer will be kept in the record file.

### 6.4.1 Periodic CQA Reports

**T**he CQA Testing Firm representative's reporting procedures will include preparation of a periodic report that will include the following information, where applicable:

- A unique sheet number for cross referencing and document control;
- Date, project name, location, and other identification;
- Data on weather conditions;
- A Site Plan showing all proposed work areas and test locations;
- Descriptions and locations of ongoing construction;
- Descriptions and specific locations of areas, or units, of work being tested and/or observed and documented;
- Locations where tests and samples were taken;
- A summary of test results (as they become available, in the case of laboratory tests);
- Calibration or recalibration of test equipment, and actions taken as a result of recalibration;
- Off-site materials received, including quality verification documentation;
- Decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard quality;
- Summaries of pertinent discussions with the Contractor and/or Engineer;
- The Technician's signature.

The periodic report must be completed by the end of each Technician's visit, prior to leaving the site. This information will keep at the Contractor's office and reviewed periodically by the Owner and Engineer. The CQA Testing Firm on a weekly basis will forward copies of the Periodic CQA Reports electronically to the Engineer. Periodic CQA Reports shall be due to the Engineer no later than Noon on the next working day (typically Monday) following the end of a work week (typically Friday). If a periodic visit is postponed or cancelled, that fact will be documented by the CQA Testing Firm and noted in the next periodic report.

### 6.4.2 CQA Progress Reports

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

- Date, project name, location, and other information;
- A summary of work activities during the progress reporting period;
- A summary of construction situations, deficiencies, and/or defects occurring during the progress reporting period;
- A summary of all test results, failures and retests, and
- The signature of the Engineer.

The Engineer's progress reports must summarize the major events that occurred during that week. This report shall include input from the Contractor and the CQA Testing Firm. Critical problems that occur shall be communicated verbally to the Engineer immediately (or as appropriate, depending on the nature of the concern) as well as being included in the Periodic CQA Reports.

### 6.4.3 CQA Photographic Reporting

Photographs shall be taken by the CQA Testing Firm at regular intervals during the construction process and in all areas deemed critical by the CQA Testing Firm. These photographs will serve as a pictorial record of work progress, problems, and mitigation activities. These records will be presented to the Engineer upon completion of the project. Electronic photographs are preferred, in which case the electronic photos will be forwarded to the Engineer (the CQA Testing Firm shall keep copies, as well). In lieu of photographic documentation, videotaping may be used to record work progress, problems, and mitigation activities. The Engineer may require that a portion of the documentation be recorded by photographic means in conjunction with videotaping.

### 6.4.4 Documentation of Deficiencies

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

### 6.4.5 Design and/or Technical Specification Changes

Design and/or project specification changes may be required during construction. In such cases, the Contractor will notify the Engineer and/or the Owner. The Owner will then notify the appropriate agency, if necessary. Design and/or project specification changes will be made only with the written agreement of the Engineer and the Owner, and will take the form of an addendum to the project specifications. All design changes shall include a detail (if necessary) and state which detail it replaces in the plans.

## 6.5 Final CQA Report

A certified CQA report shall will be prepared and submitted to the SWS upon completion of each major construction activity at the landfill unit, i.e., the completion of a CDLF cell or phase base grading and/or the installation of a portion of a final cap, in accordance with **Rule .0541 (d) (1) and (2)**, whereas both activities are expected to be incremental. The Engineer will provide one or more final reports, pertinent to each portion of completed work, which will certify that the work has been performed in compliance with the plans and project technical specifications, and that the supporting documents provide the necessary information.

The Engineer will provide Record Drawings, prepared with input from the Owner's Surveyor, which will include scale drawings depicting the location of the construction and details pertaining to the extent of construction (e.g., depths, plan dimensions, elevations, soil component thicknesses, etc.). All final surveying required for the Record Drawings will be performed by the Owner's Surveyor. At a minimum, the items shown below shall be included in the Final CQA Report(s). Note that some items may not be applicable to all stages of the project.

**FINAL CQA REPORT GENERAL OUTLINE**

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

Appendices
A Design Clarifications/Modifications
B Photographic Documentation
C CQA Reporting

C1. CQA Reports
C2. CQA Meeting Minutes
D Earthwork CQA Data
D1. CQA Test Results - Control Tests
D2. CQA Test Results - Record Tests
E Final Cover System CQA Data
E1. Manufacturer's Product Data and QC Certificates
E2. CQA Test Results - Drainage Aggregate
E3. CQA Test Results - Vegetative Soil Layer
E4. CQC Test Results - Pressure Testing of HDPE Piping
F Record Drawings
F1. Subgrade As Built
F2. Vegetative Soil Layer As Built

## 6.6 Storage of Records

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

## 6.7 Protection of Finished Surfaces

The only relevant systems exposed after construction will be the finished slopes, including both interior and exterior slopes, various drainage systems, and the subgrade,. Ground cover shall be established on all finished surfaces shall to prevent erosion, i.e., seeding of the finished surfaces within 20 days, per NC DENR Division of Land Quality rules, or other measures for preventing erosion (e.g., mulch, rain sheets). Maintenance of finished slopes and subgrade until waste is placed is required. Exterior slopes shall be vegetated in accordance with application sediment and erosion control regulations. The Engineer shall document that the finished surfaces are adequately protected upon completion, and said documentation shall be recorded in the CQA report.

The Owner/Operator shall be responsible for maintaining the finished surfaces, including exterior slope vegetation and drainage conveyances, along with the interior slopes and subgrades. If finished surfaces within the waste disposal area will be required to sit completed for more than 30 days following completion, the Engineer shall examine the finished surfaces prior to waste disposal and the Owner shall be responsible for any necessary repairs, e.g., erosion that might affect embankment integrity or vertical separation with a subgrade. The Engineer shall document any required maintenance or repairs prior to commencing disposal activities, placing said documentation into the Operating Record.

**TABLE 6A**
**CQA TESTING SCHEDULE FOR GENERAL EARTHWORK (BASE GRADES)**

| PROPERTY | TEST METHOD | MINIMUM TEST FREQUENCY |
|---|---|---|
| **CONTROL TESTS:** | | |
| Consistency Evaluation | ASTM D 2488 (visual)[1] | Each Material |
| **RECORD TESTS:** | | |
| Lift Thickness[5] | Direct Measure | Each compacted lift |
| In-Place Density | ASTM D 2922[2] | 20,000 $ft^2$ per lift |
| Moisture Content | ASTM D 3017[3] | 20,000 $ft^2$ per lift |
| Subgrade Consistency within the upper 24 inches[4] | Visual | 4 tests per acre |
| Subgrade Consistency within the upper 24 inches[4] | ASTM D 422<br>ASTM D 4318 | 1 test per acre |

Notes:

1. To be performed by Contractor Superintendent, Engineer, or CQA Testing Firm. Direct measure shall be facilitated with hand auger borings.
2. Optionally use ASTM D 1556, ASTM D 2167, or ASTM D 2937. For every 10 nuclear density tests perform at least 1 density test by ASTM D 1556, ASTM D 2167, or ASTM D 2937 as a verification of the accuracy of the nuclear testing device. ***Minimum required soil density is 95 percent of the standard proctor maximum dry density, which is dependent on the moisture-density characteristic developed for the specific soil during initial construction; lower density or incorrect moisture results in a failed test and the lift must reworked and retested.***

***2a.*** ***If "beneficial fill" materials are used to construct embankments or structural fill, the Contractor shall spread large particles evenly and fill all voids with finer soil – this is referred to as "choking off" the voids; density testing shall be suspended at the discretion of the Engineer, but judgment testing shall be applied and the use of these materials and evaluation thereof shall be documented as would any other soil placement activity***

3. Optionally use ASTM D 2216, ASTM D 4643, or ASTM D 4959. For every 10 nuclear density-moisture tests, perform at least 1 moisture test by ASTM D 2216, ASTM D 4643, or ASTM D 4959 as a verification of the accuracy of the nuclear testing device.
4. Subgrade evaluation shall be conducted via continuous inspection with the indicated testing frequency, in order to evaluate the full 24 inch depth, of an intrusive investigation (e.g., hand auger borings) may be performed after portions of the subgrade are completed with the indicated testing frequency – all testing locations, testing types and test results shall be recorded on a site map and made part of the construction record
5. The maximum allowable uncompacted lift thickness is 9 inches, targeting a maximum compacted lift thickness of 6 inches, depending on soil characteristics.

**TABLE 6B**
**CQA TESTING SCHEDULE FOR DRAINAGE AND FINAL COVER SOIL**

| COMPONENT | PROPERTY | TEST METHOD | MINIMUM TEST FREQUENCY |
|---|---|---|---|
| **RECORD TESTS:** | | | |
| **Coarse Aggregate:** | Confirm Gradation | Visual | 5,000 CY[1] |
| **Vegetative Soil Layer:** (In-Situ Verification) | Visual Classification | ASTM D 2488 | 1 per acre |
| | Layer Thickness | Direct measure | Survey[4] |

Notes:

1. A quarry certification is acceptable for aggregate from a commercial quarry. If a byproduct is used, i.e., crushed concrete aggregate, the gradation test frequency may be adjusted based on project specific conditions. The Engineer shall approve all materials and alternative test frequencies. ***Materials that do not meet relevant ASTM or ASHTO standard gradation specifications (either may be used at the discretion of the Engineer) shall be rejected.***

**TABLE 6C**
**CQA TESTING SCHEDULE FOR FINAL COVER COMPACTED SOIL BARRIER**

| PROPERTY | TEST METHOD | MINIMUM TEST FREQUENCY |
|---|---|---|
| **RECORD TESTS:** | | |
| Lift Thickness | Direct measure | Survey[4] |
| Permeability | ASTM D5084[1] | 1 per acre per lift |
| In-Place Density | ASTM D 2922[2] | 4 per acre per lift |
| Moisture Content | ASTM D 3017[3] | 4 per acre per lift |

Notes:

1. Optionally use ASTM D6391. ***Maximum allowable soil permeability is 1 x $10^{-5}$ cm/sec; higher permeability results in a failed test and the lift must reworked and retested.***
2. Optionally use ASTM D 1556, ASTM D 2167, or ASTM D 2937. For every 10 nuclear density tests perform at least 1 density test by ASTM D 1556, ASTM D 2167, or ASTM D 2937 as a verification of the accuracy of the nuclear device. ***Minimum required density is dependent on the moisture-density-permeability characteristic developed for the specific soil during initial construction; lower density or incorrect moisture may result in higher permeability. Permeability criteria shall govern the determination of a passing test.***
3. Optionally use ASTM D 2216, ASTM D 4643, or ASTM D 4959. For every ten nuclear-moisture tests, perform at least 1 moisture test by ASTM D 2216, ASTM D 4643, or ASTM D 4959 as a verification of the accuracy of the nuclear testing device.
4. Topographic graphic survey by licensed surveyor
5. The maximum allowable uncompacted lift thickness is 9 inches, targeting a maximum compacted lift thickness of 6 inches, depending on soil characteristics.

**TABLE 6D**
**REFERENCE LIST OF TEST METHODS**

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

| | |
|---|---|
| ASTM C 136 | Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates. |
| ASTM D 422 | Standard Test Method for Particle Size Analysis of Soils. |
| ASTM D 698 | Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/$ft^3$). |
| ASTM D 1556 | Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method. |
| ASTM D 2167 | Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method. |
| ASTM D 2216 | Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass. |
| ASTM D 2488 | Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). |
| ASTM D 2922 | Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth). |
| ASTM D 2937 | Standard Test Method for Density of Soil in Place by the Drive Cylinder Method. |
| ASTM D 3017 | Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth). |
| ASTM D 4318 | Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils. |
| ASTM D 4643 | Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method. |
| ASTM D 4959 | Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method. |
| ASTM D5084 | Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter |
| ASTM D 5993 | Standard Test Method for Measuring Mass per Unit of Geosynthetic Clay Liners. |
| ASTM D6391 | Standard Test Method for Field Measurement of Hydraulic Conductivity Limits of Porous Materials Using Two Stages of Infiltration from a Borehole |
| ASTM D 6768 | Standard Test Method for Tensile Strength of Geosynthetic Clay Liners. |

# 7.0 OPERATION PLAN (15A NCAC 13B .0542)

## 7.1 General Conditions

This Operations Plan was prepared for WCA Material Recovery, LLC, to provide landfill personnel with an understanding of relevant rules and how the facility will be operated. While deviations from the operation plan outlined here may be acceptable, significant changes will be reviewed and approved by the Design Engineer and/or regulatory personnel.

### 7.1.1 Facility Description

The landfill entrance is located at 2600 Brownfield Road (S.R. 2553). The scales and office are located near the front gate, which is the only means of accessing the site by the public. After crossing the scales, incoming loads are directed either to one of the stockpile areas (LCID or inert concrete debris) or to the working face of the C&D disposal unit. Tires are not accepted at the facility. Refer to the Facility Plan Map (**Drawing S4**).

### 7.1.2 Geographic Service Area

The current service area authorized by the Wake County Commissioners includes a multi-county area (see **Section 3.3**). The facility receives C&D from commercial haulers, contractors, and private individuals, most of which is processed off-site at either a material recovery center or a C&D transfer station, both operated by WCA subsidiaries. The operator will be responsible for knowing his customer base and waste stream characteristics, such that the approved service area is observed.

### 7.1.3 Hours of Operation

The landfill is open to the public from 7 AM to 4 PM on Monday – Friday and 7 AM to 12 PM on Saturday. All current operations for the C&D landfill are within those hours.

### 7.1.4 Personnel Training and Certification

NC DENR Division of Waste Management rules require that a certified Operator be present on-site at all times during operations. As many of the facility staff as practical will receive Operations Specialist training from a credible organization, e.g., SWANA. Certificates will be posted prominently in the scale house and kept up-to-date.

### 7.1.5 Utilities

Electrical power, water, telephone, and restrooms are provided at the scale house.

### 7.1.6 Equipment Requirements

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

### 7.1.7 Safety

All aspects of the facility operation were developed with the health and safety of the landfill's operating staff, customers, and neighbors in mind. The Owner or General Manager of the facility is the designated Site Safety Officer and is responsible for the safe operation of the facility in keeping with Occupational Safety and Health Administration (OSHA) requirements. Regular safety meetings with staff (minimum one per month) shall be conducted.

Safety equipment to be provided includes (at a minimum) equipment rollover protective cabs, seat belts, audible reverse warning devices, hard hats, safety shoes, and first aid kits. Landfill personnel will be encouraged to complete the American Red Cross Basic First Aid Course with CPR. Safety for customers will be promoted by the Operator and his staff knowing where the equipment and customer vehicles are moving at all times. Radio communications between the scale house and the field staff will help keep track of the location and movement of customers.

## 7.2 CONTACT INFORMATION

### 7.2.1 Emergencies

**For fire, police, or medical/accident emergencies dial 911.**

A partial listing Emergency and other Useful Contacts, published on the NC DENR Division of Waste Management web site, is provided in **Appendix 3B**.

All correspondence and questions concerning the operation of the C&D Landfill will be directed to the appropriate County staff and/or State personnel listed below.

### 7.2.2 WCA Material Recovery, LLC

Mr. Dennis Gehl, General Manager
421 Raleighview Road
Raleigh, North Carolina 27601
Tel 919-422-1519 (cell)

### 7.2.3 North Carolina Department of Environment and Natural Resources

**Division of Waste Management**

Raleigh Regional Office
1628 Mail Service Center
Raleigh, NC 27699-1628
Location:
3800 Barrett Drive
Raleigh, NC 27609
Tel. 919/791-4200

Central Office
1646 Mail Service Center
Raleigh, NC 27699-1646
Location:
401 Oberlin Road
Raleigh, NC 27605
Tel. (919)508-8400

**Division of Waste Management - Solid Waste Section Staff**

Eastern Regional Supervisor: Dennis Shackelford Tel. (910) 433-3349
Fayetteville Regional Office dennis.shackelford@ncdenr.gov

Environmental Engineer: Donna Wilson Tel. (919) 508-8510
DWM Central Office donna.wilson@ncdenr.gov

`Waste Management Specialist: Brad Baily Tel. (919) 508-8565
DWM Central Office Bradley.bailey@ncdenr.gov

Groundwater Hydrogeologist: Jaclynne Drummond Tel. (919) 508-8500
DWM Central Office jaclynne.drummond@ncdenr.gov

**Division of Land Resources - Land Quality Section**

Regional Engineer: John Holley, P.E Tel. (919) 791-4200
Raleigh Regional Office john.holley@ncmail.net

### 7.2.4 Wake County Department of Environmental Services

**Water Quality Division**

Sedimentation and Erosion Control
336 Fayetteville Street
Raleigh, NC 27602
Tel. 919-856-6195

Jennifer Sjaardema Jennifer.Sjaardema@co.wake.nc.us
Environmental Engineer

## 7.3 Facility Operation Drawings

A copy of the approved Facility Plan and construction drawings must be kept on-site at all times. Periodically, the Owner/Operator shall note the location of the active working area on a copy of the drawing, noting areas that have come to final grade and are ready to be closed. The drawings show special waste areas (asbestos, animal carcasses) and the locations of soil borrow and stockpile areas.

## 7.4 Waste Acceptance Criteria

### 7.4.1 Permitted Wastes

The facility shall only accept (for disposal) the following wastes generated within approved areas of service:

- Construction and Demolition Debris Waste: (Waste or debris from construction, remodeling, repair, or demolition operations on pavement or other structures);

- Land Clearing and Inert Debris Waste: (yard waste, stumps, trees, limbs, brush, grass, concrete, brick, concrete block, uncontaminated soils and rock, untreated and unpainted wood, etc.);

- Other Wastes as approved by the NC DENR Solid Waste Section.

In addition, the special wastes, i.e., asbestos (see **Section 7.6.3.3**) may also be accepted at this facility. Municipal solid waste (MSW) shall be rejected of placed in roll-off boxes and removed from the site. Animal carcasses may not be disposed on the working face – a special designated area within the premises may be permitted, subject to requirements by the State Veterinary's office (e.g., ground water separation and immediate covering).

### 7.4.2 Asbestos

The facility may dispose of asbestos within a designated area within the normal footprint, only if the asbestos has been processed, packaged and transported in accordance with State and Federal (40 CFR 61 Subpart M) regulations. Handling asbestos requires advance arrangements between the hauler and the landfill with 24 hours notice and special placement techniques (see (**Section 7.6.3.3**). No friable asbestos will be accepted by the facility.

### 7.4.3 Wastewater Treatment Sludge

WWTP sludge may **not** be disposed in the C&D Landfill, per Division rules. WWTP sludge may be used as a soil conditioner to enhance the final cover, upon receipt of permission from the Division, to be applied at agronomic rates.

### 7.4.4 Wood Waste

The Wood Recycling (LCID T&P) facility shall only accept the following wastes:

1. Naturally occurring vegetative debris (i.e., stumps, trees, limbs, brush) – no grass, leaves or yard waste.

2. Clean wood waste derived from construction only (i.e., dimension lumber) and pallets – no demolition materials, no painted or treated wood, no engineered or laminated wood products.

Refer to **Section 7.6.3.4**.

## 7.5 Waste Exclusions

No municipal solid waste (MSW), hazardous waste as defined by 15A NCAC 13A .0101, or hazardous waste from conditionally exempt small quantity generators (CESQG waste), or liquid waste will be accepted. No drums or industrial wastes shall be accepted. No tires, batteries, polychlorinated biphenyl (PCB), electronic devices (computer monitors), medical wastes, radioactive wastes, septage, white goods, yard trash, fluorescent lamps, mercury switches, lead roofing materials, transformers, of CCA treated wood shall be disposed. No pulverized or shredded C&D wastes may be accepted.

The Facility will implement a waste-screening program, described in **Section 7.6** below, to control these types of waste. The reader is directed to **Solid Waste Rule .0542 (e)** for further exclusions.

## 7.6 Waste Handling Procedures

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

### 7.6.1 Waste Receiving and Inspection

All incoming vehicles must stop at the scale house located near the entrance of the facility, and visitors are required to sign-in. All waste transportation vehicles shall be uncovered prior to entering the scales to facilitate inspection; all incoming loads shall be weighed and the content of the load assessed. The scale attendant shall request from the driver of the vehicle a description of the waste it is carrying to ensure that unacceptable waste is not allowed into the landfill.

Signs informing users of the acceptable and unacceptable types of waste shall be posted at the entrance near the scale house. The attendant shall visually check the vehicle as it crosses the scale. Any suspicious loads will be pulled aside for a more detailed inspection prior to leaving the scale house area. Loads with unacceptable materials will be required to be recovered (with a tarp) and turned away from the facility. Wastes generated from outside of the service area will be turned away.

Once passing the scales, the vehicles containing C&D wastes are routed to the working face. **Vehicles shall be selected for random screening a minimum of three times per week.** The selection of vehicles for screening might be based on unfamiliarity with the vehicle/driver or based on the driver's responses to interrogation about the load content.

Selected vehicles shall be directed to an area of intermediate cover adjacent to the working face where the vehicle will be unloaded and the waste shall be spread using suitable equipment. An attendant trained to identify wastes that are unacceptable at the landfill shall inspect the waste discharged at the screening site. The Operator shall use the **Waste Screening Form** (see **Appendix 9A**) to document the waste screening activities. If no unacceptable waste is found, the load will be pushed to the working face and incorporated into the daily waste cell.

- If unacceptable waste is found, the load will be isolated and secured via soil berms, barricades, or cordons. Unacceptable wastes that are non-hazardous will be isolated and removed from the facility.

- For unacceptable wastes that are hazardous, the Hazardous Waste Contingency Plan outlined in **Section 7.7.3** will be followed.

The hauler is responsible for removing unacceptable waste from the landfill property. The rejection of the load shall be noted on the **Waste Screening Form**, along with the identification of the driver and vehicle. A responsible party to the load generator or hauler shall be notified that the load was rejected. The generator or hauler may be targeted for more frequent waste screening and/or banished from delivering to the

facility, depending on the nature of the violation of the waste acceptance policy. If the violation is repetitive or severe enough, State and/or County authorities may be notified.

### 7.6.2 Disposal of Rejected Wastes

Attempts will be made to inspect waste as soon as it arrives in order to identify the waste hauler; ideally, the hauler can be stopped from leaving the site and the rejected materials reloaded onto the delivery vehicle. Non-allowed materials that are found in the waste during sorting or placement, i.e., after the delivery vehicle has left the site, shall be placed in a roll-off box and sent to a facility that may accept these wastes.

Small quantities of garbage (chiefly food containers) are not acceptable at the C&D landfill and will be source separated or removed from the waste stream. A separate container will be provided for non-acceptable wastes that may be detected at the working face. If large quantities of garbage, "black bags," or any prohibited wastes are detected, the Operator shall be responsible for removing these materials.

### 7.6.3 Waste Disposal Procedures

**7.6.3.1 Access** – The location of access roads during waste placement will be determined by operations personnel in order to reflect waste placement strategy.

**7.6.3.2 General Procedures** – Waste transportation vehicles will arrive at the working face at random intervals. There may be a number of vehicles unloading waste at the same time, while other vehicles are waiting. In order to maintain control over the unloading of waste, only a certain number of vehicles will be allowed on the working face at a time. The working face superintendent and/or equipment operator(s), who will serve as 'spotters', will determine the actual number. This procedure will be used in order to minimize the potential for disposal of unacceptable waste.

Operations at the working face will be conducted in a manner that will encourage the efficient movement of transportation vehicles to and from the working face, and to expedite the unloading of waste. At no time during normal business hours will the working face be left unattended. Scale house and field staff shall be in constant communication regarding incoming loads and the movement of vehicles on the site, irrespective of facility vehicles or private vehicles. It is the responsibility of the working face superintendent to know the location of each vehicle in the facility.

The use of portable signs with directional arrows and portable traffic barricades will be used to direct traffic to the disposal area. These signs and barricades will be placed along the access route to the working face of the landfill or other designated disposal areas that may be established. The approaches to the working face will be maintained such that two

or more vehicles may safely unload side by side – a tipper may also be used. A vehicle turn-around area large enough to enable vehicles to arrive and turn around safely with reasonable speed will be provided adjacent to the unloading area. The vehicles will back to a vacant area near the working face to unload. Upon completion of the unloading operation, the transportation vehicles will immediately leave the working face. Personnel will direct traffic as necessary to expedite safe movement of vehicles.

Waste unloading at the landfill will be controlled to prevent disposal in locations other than those specified by site management. Such control will also be used to confine the working face to a minimum width, yet allow safe and efficient operations. The width and length of the working face will be maintained as small as practical in order to maintain the appearance of the site, control windblown waste, and minimize the amount of required periodic cover.

Normally, only one working face will be active on any given day; all waste in other areas shall be covered, as appropriate. The procedures for placement and compaction of solid waste include: unloading of vehicles, spreading of waste into 2 foot lifts, and compaction on relatively flat slopes (i.e., 5H: IV max.) using a minimum number of three full passes. Depending on the nature of the wastes and long-term volume analysis of in-situ density, the waste placement geometry and compaction procedures may require adjustment to optimize airspace.

**7.6.3.3 Special Wastes: Asbestos Management** – Asbestos will arrive at the site in vehicles that contain only the asbestos waste and only after advance notification by the generator and if accompanied by a proper NC DMV transport manifest. Once the hauler brings the asbestos to the landfill, operations personnel will direct the hauler to the designated asbestos disposal area. Operations personnel will prepare the designated disposal area by leveling a small area using a dozer or loader. Prior to disposal, the landfill operators will stockpile cover soil near the designated asbestos disposal area. The volume of soil stockpiled will be sufficient to cover the waste and to provide any berms, etc. to maintain temporary separation from other landfill traffic.

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

The Owner/Operator will review pertinent disposal and location information to assure compliance with regulatory requirements and enter the information into the Operating

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

**7.6.3.4 Wood Wastes** – Clean wood waste may be accepted at the facility for recycling, subject to the acceptance criteria (see **Section 7.4.4**). Unprocessed wood shall be stockpiled and ground periodically, whereupon the processed wood may be stockpiled in windrows and stored until distributed. The stockpile for unprocessed wood waste shall be no more than 25 feet in height and shall have stable side slopes. A maximum recommended volume for the unprocessed wood waste is 6,000 cubic yards – this translates to approximate pile dimensions of 140 feet square at the base for a height of 25 feet and a 1:1 side slope. If storage after grinding is needed, the windrows shall conform to the approximate maximum dimensions of 8 feet high at the center by 20 feet wide at the base, and the windrows shall be separated by a minimum of 25 feet for access in the event of a fire. Temperature monitoring is not required, whereas the acceptable materials are so designated to prevent excess composting temperatures from occurring. The location and dimensions of the LCID T&P Facility are shown on **Drawing S4A**.

## 7.7 Cover Material

### 7.7.1 Periodic Cover

Wastes shall be covered with a minimum 6 inch thick layer of earthen material at least weekly, or whenever the exposed waste area exceeds one-half acre in size. This periodic cover is intended to control vectors, fire, odors, and blowing debris. Alternative periodic cover may be considered, including ground LCID, WWTP sludge and/or other non-C&D waste materials, but any alternative cover must be approved by the Division. Areas which will not have additional wastes placed on them for three months or more, but where final termination of disposal operations has not occurred, must be covered and stabilized with vegetative ground cover or other stabilizing material.

### 7.7.2 Final Cover

Exterior slopes shall be closed upon reaching final grades in increments throughout the operation of the facility. The regulatory minimum final cover shall consist of at least 18 inches of compacted soil (with a minimum $10^{-5}$ cm/sec permeability requirement), overlain by 18 inches of vegetation support soil. An interim soil cover (at least 12 inches in thickness) may be placed on exterior slopes that have attained final grade and left for no more than 20 days without temporary vegetation, until an area of approximately 2 to 3 acres is ready to be closed simultaneously. An alternative final cover under consideration shall consist of a flexible membrane (40-mil LDPE or HDPE) overlain by a single-sided

geocomposite drainage layer and 24 inches of vegetative support soil (see **Section 8.1.3**). Alternative final cover designs are allowed by the 2006 C&D rules.

All final soil cover shall be spread in at least two uniform lifts (maximum of 9 inches before compaction, 6 inches after compaction), and all soils shall be compacted by "tracking" with dozers or other equipment. All disturbed soils shall be vegetated with a seed mix that is suitable to climatic conditions (see construction plans) within 20 days following completion of the grading. All seeded areas will be provided with lime, fertilizer, and straw mulch. An emulsified tack may be required to prevent wind damage. Other stabilization treatments, e.g., curled wood matting of synthetic slope stabilization blankets may be employed.

At the operator's discretion, wood mulch may be spread evenly over the final surfaces to provide nutrient (without immediate vegetation); this treatment can be allowed to remain until the wood mulch undergoes partial decomposition, as long as the slopes are stable (not eroding). This allows the operator some flexibility is establishing vegetation at optimum times of the year. The maximum allowable depth of mulch is 3 inches. The operator shall ensure that all protective measures are functioning prior to placing soil cover on exterior slopes.

If settlement occurs after the cover is placed, the cover shall be fortified with additional soil. In the case of extreme settlement (unlikely), the old cover can be stripped and the affected area built up with waste prior to replacing the cover. Long-term post-closure maintenance is phased in incrementally, as such, final cover maintenance (erosion repair, reseeding as needed). The sedimentation and erosion control criteria that govern the final closure (final reclamation) of this facility are performance-based; some trial and error may be required, but the goal is to protect the adjacent water bodies and buffers throughout the operational and post-closure periods.

### 7.7.3 Unacceptable Waste Contingency

The owner or operator shall notify the Section within 24 hours of attempted disposal of a waste that is not permitted to receive, in accordance with Rule .0542 (c) (1).

**7.7.3.1 Hot Loads Contingency Plan** – In the event of a "hot" load detected entering the landfill, the vehicle will be isolated from structures and other traffic, and the fire department will be called. The vehicle will be unloaded and, if safe to do so, the vehicle will be moved from the unloaded material. If a hot load is detected on the working face, the load will be treated as a fire condition (see **Section 7.10.2**), whereas the load will be covered with soil immediately (a water truck may be used to help extinguish the fire). Other traffic will be redirected to another tipping area (away from the fire), or other waste

deliveries may be suspended until the fire is out. The fire will be monitored to ensure it does not spread. If the fire cannot be controlled, the fire department will be notified and the area cleared of non-essential personnel.

**7.7.3.2 Hazardous Waste Contingency Plan** – In the event that identifiable hazardous waste or waste of questionable character is detected at the scales or in the landfill, appropriate protective equipment, personnel, and materials will be employed as necessary to protect the staff and public. Hazardous waste identification may be based on (but not limited to) strong odors, fumes or vapors, unusual colors or appearance (e.g., liquids), smoke, flame, or excess dust. The fire department and/or emergency response personnel will be called immediately in the event a hazardous material is detected – typically, fire departments have haz-mat response capabilities or can coordinate the necessary responders. An attempt will be made to isolate the wastes in a designated area where runoff is controlled, preferably prior to unloading, and the vicinity will be cleared of personnel until trained emergency personnel (fire or haz-mat) take control of the scene.

Staff will act prudently to protect personnel but no attempt will be made to remove the material until trained personnel arrive. A partial listing of Emergency and Other Useful Contacts is found in **Appendix 3B**. The Owner/Operator is encouraged to compile a list of regional **Hazardous Waste Responders** and disposal firms – these are available on the **NC Division of Waste Management** Hazardous Waste Section web site – and keep it handy in the event of an incident. These firms have the training and equipment to deal with hazardous materials, as needed.

The Operator will notify the Division (see **Section 7.2.3**) that an attempt was made to dispose of hazardous waste at the landfill. If the vehicle attempting disposal of such waste is known, attempts will be made to prevent that vehicle from leaving the site until it is identified (license tag, truck number driver and/or company information) or, if the vehicle leaves the site, immediate notice will be served on the owner of the vehicle that hazardous waste, for which they have responsibility, has been disposed of at the landfill.

The landfill staff will assist the Division as necessary and appropriate in the removal and disposition of the hazardous waste (acting under qualified supervision) and in the prosecution of responsible parties. If needed, the hazardous waste will be covered with on-site soils, tarps, or other covering until such time when an appropriate method can be implemented to properly handle the waste. The cost of the removal and disposing of the hazardous waste will be charged to the owner of the vehicle involved. Any vehicle owner or operator who knowingly dumps hazardous waste in the landfill may be barred from using the landfill or reported to law enforcement authorities. Any hazardous waste found at the scales or in the landfill that requires mitigation under this plan shall be

documented by staff using the **Waste Screening Form** provided in **Appendix 3A**. Records of information gathered as part of the waste screening programs will be maintained throughout the operational life of the facility.

### 7.7.4 Severe Weather Contingency

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

**7.7.4.1 Ice Storms** – An ice storm can hinder access to the landfill, prevent movement or placement of periodic cover, and, thus, may require closure of the landfill until the ice is removed or has melted and the access roads are passable without risk to personnel of the side slopes cover.

**7.7.4.2 Heavy Rains** – Exposed soil surfaces can create a muddy situation in some portions of the landfill during rainy periods. The control of drainage and use of crushed stone (or recycled aggregates) on unpaved roads will provide all-weather access for the site and promote drainage away from critical areas. In areas where the aggregate surface is washed away or otherwise damaged, aggregate will be replaced. Intense rains can affect newly constructed drainage structures such as swales, diversions, cover soils, and vegetation. After such a rain event, inspection by landfill personnel will be initiated and corrective measures taken to repair any damage found before the next rainfall.

**7.7.4.3 Electrical Storms** – Landfill activities will be temporarily suspended during an electrical storm. To promote the safety of field personnel, refuge will be taken in buildings or in rubber-tire vehicles.

**7.7.4.4 Windy Conditions** – High winds can create windblown wastes, typically paper and plastic, but larger objects have been known to blow in extreme circumstances. Operations will be suspended if blowing debris becomes a danger to staff, after the working face is secured. The proposed operational sequence minimizes the occurrence of unsheltered operations relative to prevailing winds. If this is not adequate during a particularly windy period, work will be temporarily shifted to a more sheltered area.

When this is done, the previously exposed face will be immediately covered with daily cover. Soil cover shall be applied whenever windblown wastes become a problem. Staff shall patrol the perimeter of the landfill periodically, especially on windy days, to remove windblown litter from tress and adjacent areas. Windscreens of various sorts have been used with mixed success at other facilities in the region. Good planning is essential on the operator's part to be prepared for windy conditions.

**7.7.4.5 Violent Storms** – In the event of a hurricane, tornado, or severe winter storm warning issued by the National Weather Service, landfill operations will be temporarily suspended until the warning is lifted. Daily cover will be placed on exposed waste; equipment will be properly secured. In the event of eminent danger to staff, personal safety shall take precedence over concerns regarding the waste or equipment.

## 7.8 Spreading and Compaction of Waste

The working face shall be restricted to the smallest possible area; ideally, the maximum working face area with exposed waste shall be one-quarter to one-half acre. Wastes shall be compacted as densely as practical. Appropriate methods shall be employed to reduced wind-blown debris including (but not limited to) the use of wind fences, screens, temporary soil berms, and periodic cover. Any wind-blown debris shall be recovered and placed back in the landfill and covered at the end of each working day.

## 7.9 Vector Control

Steps shall be employed to minimize the risk of disease carrying vectors associated with the landfill (e.g., birds, rodents, dogs, mosquitoes). The C&D wastes will be mostly inert and not attractive to animals, but care will be taken to bury animal carcasses or other putrescible wastes that are admitted to the landfill (subject to the waste screening procedures). Operations will be conducted to avoid pools of standing water in and around the disposal area.

## 7.10 Air Quality Criteria and Fire Control

### 7.10.1 Air Quality Criteria

Appropriate measures will be taken to control fugitive emissions (dust) that might be generated during dry seasons. Water shall be sprinkled on roads and other exposed soil surfaces as needed to control dust. No open burning of any waste shall be allowed. Prior to any burning of land clearing debris generated onsite or from emergency clean-up operations, a request must be submitted to the Section for approval.

### 7.10.2 Fire Control

The possibility of fire within the landfill or a piece of equipment must be anticipated in the daily operation of the landfill. A combination of factory installed fire suppression systems and/or portable fire extinguishers shall be operational on all heavy pieces of equipment at all times. Brush fires of within the waste may be smothered with soil, if combating the fire poses no danger to the staff. The use of water to combat the fire is allowable, but soil is preferable. For larger or more serious fire outbreaks, the local fire

department will respond. In the event of any size fire at the facility, the Owner shall contact NC DENR Division Waste Management personnel immediately and complete a **Fire Notification Form** (**Appendix 3C**), which will be placed in the Operating Record.

## 7.11 Access and Safety

### 7.11.1 Access Control

Access control to the C&D Landfill is required for the following reasons:

1. Prevention of unauthorized and illegal dumping of waste materials,
2. Trespassing, and possible injury resulting from such, is discouraged,
3. The risk of equipment theft or vandalism is greatly reduced.

Access to active areas of the landfill will be controlled by a combination offences and natural barriers, such as the creeks, and strictly enforced operating hours. A landfill attendant will be on duty at all times when the facility is open for public use to enforce access restrictions.

**7.11.1.1 Physical Restraints** – The site will be accessed by the existing entrance along Brownfield Road. Scales and a scale house are provided near the entrance. All waste will be weighed prior to being placed in the landfill. The entrance gates will be securely locked during non-operating hours.

**7.11.1.2 Security** – Frequent inspections of gates and fences will be performed by landfill personnel. Evidence of trespassing, vandalism, or illegal operation will be reported to the Owner.

**7.11.1.3 All-Weather Access –** The on-site roads will be paved or otherwise hardened and maintained for all-weather access.

**7.11.1.4 Traffic** – The Operator shall direct traffic to a waiting area, if needed, and onto the working face with safe access to an unloading site is available. Once a load is emptied, the delivery vehicle will leave the working face immediately.

**7.11.1.5 Anti-Scavenging Policy –** The removal of previously deposited waste by members of the public (or the landfill staff) is strictly prohibited by the Division for safety reasons. The Operator shall enforce this mandate and discourage loitering after a vehicle is unloaded. No persons that are not affiliated with the landfill or having business at the facility (i.e., customers) shall be allowed onto or near the working face.

### 7.11.2 Signage

A prominent sign containing the information required by the Division shall be placed just inside the main gate. This sign will provide information on operating hours, operating procedures, and acceptable wastes. Additional signage will be provided within the landfill complex to distinctly distinguish access routes. Restricted access areas will be clearly marked and barriers (e.g., traffic cones, barrels, etc.) will be used.

### 7.11.3 Communications

Visual and radio communications will be maintained between the C&D landfill and the landfill scale house and field operators. The scale house has telephones in case of emergency and for the conduct of day-to-day business. Emergency telephone numbers are displayed in the scale house.

## 7.12 Sedimentation and Erosion Control

Measures depicted in the approved S&EC plan (see construction plans) shall be installed and maintained throughout the operational life of the facility and into the post-closure period (see **Section 8.0**). Measures to curtail erosion include vegetative cover and woody mulch as ground cover. Measures to control sedimentation include stone check dams in surface ditches, sediment traps, and basins. The key to compliance with Sedimentation and Erosion Control rules is vegetative cover. A rule of thumb is that all exposed soils, regardless of whether they are inside or outside the disposal area, will be covered as soon as possible, not to exceed 20 days after any given area is brought to final grade.

## 7.13 Drainage Control and Water Protection

Coupled with the measures and practices intended to comply with the S&EC rules, steps to protect water quality include diverting surface water ("run-on") away from the disposal area, allowing no impounded water inside the disposal area, and avoiding the placement of solid waste into standing water. The facility is obligated by law not to discharge pollutants into the waters of the United States (i.e. surface streams and wetlands). Any conditions the Operator suspects might constitute a discharge will be brought to the immediate attention of the Engineer, who in turn, may prescribe mitigation and/or may need to contact proper regulatory authorities.

## 7.14 Survey for Compliance

### 7.14.1 Height Monitoring

The landfill staff will monitor landfill top and side slope elevations on a weekly basis or as needed to ensure proper slope ratios and to ensure the facility is not over-filled. This shall be accomplished by use of a surveyor's level and a grade rod. When such elevations approach the grades shown on the Final Cover Grading Plan, the final top-of-waste grades will be staked by a licensed surveyor to limit over-placement of waste.

### 7.14.2 Annual Survey

The working face shall be surveyed on an annual basis to verify slope grades and to track the fill progression. In the event of problems (slope stability, suspected over-filling), more frequent surveys may be required at the request of the Division.

## 7.15 Operating Record and Recordkeeping

The following related to the C&D landfill shall be maintained in an operating record:

A Waste inspection records (on designated forms); fire notification forms, as needed;

B Daily tonnage records - including source of generation;

C Quantity, location of disposal, generator, and special handling procedures employed for all special wastes disposed of at the site;

D List of generators and haulers that have attempted to dispose of restricted wastes;

E Employee training procedures and records of training completed;

F All ground water quality monitoring and surface water quality information including:

1. Monitoring well construction records;
2. Sampling dates and results;
3. Statistical analyses; and
4. Results of inspections, repairs, etc.

G All closure and post-closure information, where applicable, including:

1. Testing;

2. Certification; and

3. Completion records;

H Cost estimates for financial assurance documentation;

I Annual topographic survey of the active disposal phase intended to determine volume consumption;

J Records of operational problems or repairs needed at the facility, e.g., slope maintenance, upkeep of SE&C measures, other structures (excluding equipment);

K Methane monitoring data and documentation;

L Financial assurance documentation;

M Notation of date and time of placement of cover material;

N A copy of the approved engineering plan;

O A copy of the current Permit to Construct and Operate, and

P The water quality and landfill gas monitoring plan.

The Owner or his designee will keep the operating record up to date. Daily logbooks may be used for some items. Records shall be presented upon request to DWM for inspection. A copy of this Operations Manual shall be kept at the landfill and will be available for use at all times.

## 7.16 Annual Reporting

Reporting requirements for the C&D Landfill include a summary of waste intake by type and tonnage, and disposal practice. The Division requires an **Annual Report** be submitted, detailing the waste intake in tonnage. New rules for C&D landfills require an annual survey to determine slope, height, and volume (see **Section 7.14**). The reporting requirements include a map prepared by a licensed surveyor.

## 7.17 Permanent Edge of Waste Markers

The edge of waste boundary shall be permanent marked in all permitted sections, whether active or not, with a pole or other durable marker that is visible from a distance. The spacing of said markers shall not exceed 200 feet on-center. The height of said markers

shall be at least 4 feet. Two methods commonly used to mark the waste boundary are steel posts set in concrete – painted a bright, visible color – or metal "T-posts" (fence posts) with white PVC pipe sleeves. The initial staking of the waste limits will be performed by a licensed surveyor, using the original permit drawings, followed by setting the permanent markers.

# 8.0 CLOSURE AND POST-CLOSURE (15A NCAC 13B .0543)

## 8.1 Summary of Regulatory Requirements

### 8.1.1 Final Cap

The final cap design for Phases 1 and 2A shall conform to the minimum requirements of the Solid Waste Rules, i.e., the compacted soil barrier layer shall exhibit a thickness of 18 inches and a field permeability of not more than $1.0 \times 10^{-5}$ cm/sec. The overlying vegetative support layer shall exhibit a thickness of 18 inches. See **Drawing E3** for final contours and **Drawing EC2** for final cover cross-section and details.

### 8.1.2 Construction Requirements

Final cap installation shall conform to the approved plans (see accompanying plan set), inclusive of the approved Sedimentation and Erosion Control Plan (see **Section 7.12** and **Appendix 2**). The CQA plan must be followed (see **Section 6.0**) and all CQA documentation must be submitted to the Division. Post-settlement surface slopes must not be flatter than 5% (on the upper cap) and not steeper than 3H:1V (on the side slopes). Per the **2006 C&D Rules**, a gas venting system is required for the cap. A passive venting system will be specified, which will consist of a perforated pipe in crushed stone-filled trench – installed just below the final cap soil barrier layer – with a tentative minimum vent spacing of three vents per acre. **Drawing EC2** shows the gas vent system details.

### 8.1.3 Alternative Cap Design

The **2006 C&D Rules** make a provision for an alternative cap design, to be used in the event that the permeability requirements for the compacted soil barrier layer cannot be met. Laboratory testing indicates that on-site soils are available that will meet the required field permeability of not more than $1.0 \times 10^{-5}$ cm/sec (**Volume 2**, **Section 10.0**). Tentative final closure plans have assumed that on-site soils will be used for the compacted barrier layer – an alternative cap designs consisting of a 40-mil LDPE or HDPE barrier, overlain by a single-bonded geonet drainage layer and 24 inches of vegetative support soil is under consideration. Both final cap profiles are shown on **Drawing EC2**.

### 8.1.4 Division Notifications

The Operator shall notify the Division prior to beginning closure of any final closure activities. The Operator shall place documentation in the Operating Record pertaining to the closure, including the CQA requirements and location and date of cover placement.

### 8.1.5 Required Closure Schedule

The Operator shall close the landfill in increments as various areas are brought to final grade. The final cap shall be placed on such areas subject to the following:

- No later than 30 days following last receipt of waste;
- No late that 30 days following the date that an area of 10 acres or greater is within 15 feet of final grades;
- No later than one year following the most recent receipt of waste if there is remaining capacity.

Final closure activities **shall be completed within 180 days** following commencement of the closure, unless the Division grants extensions. Upon completion of closure activities for each area (or unit) the Owner shall notify the Division in writing with a **certification by the Engineer** that the closure has been completed in accordance with the approved closure plan and that said documentation has been placed in the operating record.

### 8.1.6 Recordation

The Owner shall record on the title deed to the subject property that a CDLF has been operated on the property and file said documentation with the Register of Deeds. Said recordation shall include a notation that the future use of the property is restricted under the provision of the approved closure plan.

## 8.2 Closure Plan

The following is a tentative closure plan for CDLF Phase1 and 2A, based on the prescribed operational sequence and anticipated conditions at the time of closure.

### 8.2.1 Final Cap Installation

**8.2.1.1 Final Elevations** – Final elevation of the landfill shall not exceed those depicted on Drawing E2 when it is closed, subject to approval of this closure plan. The elevations shown include the final cover. A periodic topographic survey shall be performed to verify elevations.

**8.2.1.2 Final Slope Ratios** – All upper surfaces shall have at least a 5 percent slope, but not greater than a 10 percent slope. The cover shall be graded to promote positive drainage. Side slope ratios shall not exceed 3H:1V. A periodic topographic survey shall be performed to verify slope ratios.

**8.2.1.3 Final Cover Section** – The terms "final cap" and "final cover" are used interchangeably. The final cover may subscribe to the following minimum regulatory requirement for C&D landfills (an alternative cover describes in **Section 8.1.3** is also under consideration):

- An 18-inch thick compacted soil barrier layer (CSB) with a hydraulic conductivity not exceeding 1 x $10^{-5}$ cm/sec, overlain by
- An 18-inch thick "topsoil" or vegetated surface layer (VSL).

**8.2.1.4 Final Cover Installation** – All soils shall be graded to provide positive drainage away from the landfill area and compacted to meet applicable permeability requirements. Suitable materials for final cover soil shall meet the requirements defined above. Care shall be taken to exclude rocks and debris that would hinder compaction efforts. The surface will then be seeded in order to establish a good stand of vegetation.

**Test Pad** – Whereas the lab data indicate that the required permeability is attainable, the ability to compact the materials in the field to achieve the required strength and permeability values shall be verified with a field trial involving a test pad, to be sampled with drive tubes and laboratory density and/or permeability testing, prior to full-scale construction. The materials, equipment, and testing procedures will be representative of the anticipated actual final cover construction. The test pad may be strategically located such that the test pad may be incorporated into the final cover.

**Compacted Soil Barrier** – Also known as the "infiltration layer." Materials shall be blended to a uniform consistency and placed in two loose lifts no thicker than 9 inches uncompacted (6 inches compacted), with the soils compacted by tamping, rolling, or other suitable method – the targeted final thickness is 18 inches minimum. A thicker compacted barrier is acceptable. The cover shall be constructed in sufficiently small areas that can be completed in a single day (to avoid desiccation, erosion, or other damage), but large enough to allow ample time for testing without hindering production. The Contractor shall take care not to over-roll the cover such that the underlying waste materials would pump or rut, causing the overlying soil layers to crack – adequate subgrade compaction within the upper 36 inches of waste materials and/or the intermediate cover soil underlying the final cover is critical. All final cover soils shall be thoroughly compacted through the full depth to achieve the required maximum permeability required by Division regulations of 1.0 x $10^{-5}$ cm/sec, based on site-specific test

criteria (see below). Compaction moisture control is essential for achieving adequate strength and permeability.

**Vegetated Surface Layer** – Also known as the "erosion layer." Materials shall be blended and placed in loose lifts no thicker than 9 inches and compacted by tamping, rolling, or other suitable method – the targeted final layer thickness is 18 inches minimum per the design criteria. A thicker soil layer is acceptable. A relatively high organic content is also desirable. The incorporation of decayed wood mulch or other organic admixtures (WWTP sludge, with advance permission from the Division) is encouraged to provide nutrient and enhanced field capacity. The target value for organic admixtures to the topsoil layer is 20%. Mulch may be added to the surface, not to exceed a thickness of 2 to 3 inches. These surface materials are not subject to a permeability requirement, thus no testing will be specified. Care will be taken to compact the materials sufficiently to promote stability and minimize erosion susceptibility, but not to over-compact the materials such that vegetation would be hindered. Following placement and inspection of the surface layer, seed bed preparation, seeding and mulching will follow immediately. The work will be scheduled to optimize weather conditions.

**Inspection and Testing** – Soils for the barrier layer are subject to the testing schedule outlined in the Construction Quality Assurance plan (see **Section 6.0**). The proposed testing program includes a minimum of one permeability test per lift per acre and four nuclear density gauge tests per lift per acre, to verify compaction of the compacted barrier layer. The moisture-density-permeability relationship of the materials has been established by the laboratory testing (discussed elsewhere in this report). The Contractor shall proof roll final cover subgrade materials (i.e., intermediate cover), which consist of essentially the same materials as the compacted barrier layer (without the permeability requirements), to assure that these materials will support the final cover.

**8.2.1.5 Final Cover Vegetation** – Seedbed preparation, seeding, and mulching shall be performed in accordance with the specifications provided in the Construction Plans (see **Drawing EC5**), unless approved otherwise (in advance) by the Engineer). In areas to be seeded, fertilizer and lime typically will be distributed uniformly at a rate of 1,000 pounds per acre for fertilizer and 2,000 pounds per acre for lime, and incorporated into the soil to a depth of at least 3 inches by disking and harrowing. The incorporation of the fertilizer and lime may be a part of the cover placement operation specified above. Distribution by means of an approved seed drill or hydro seeder equipped to sow seed and distribute lime and fertilizer at the same time will be acceptable. Please note that the seeding schedule varies by season.

All vegetated surfaces shall be mulched with wheat straw and a bituminous tack. Areas identified as prone to erosion mat be secured with curled-wood excelsior, installed and pinned in accordance with the manufacturer's recommendations. Certain perimeter channels may require excelsior or turf-reinforcement mat (TRM), as specified in the Channel Schedule (see **Drawing EC5**). Alternative erosion control products may be substituted with the project engineer's prior consent. All rolled erosion control materials will be installed according to the generalized layout and staking plan found in the Construction Plans or the manufacturer's recommendations.

Irrigation for landfill covers is not a typical procedure, but consideration to temporary irrigation may be considered if dry weather conditions prevail during or after the planting. Care will be taken not to over-irrigate in order to prevent erosion. Collected storm water will be suitable for irrigation water. Maintenance of the final cover vegetation, described in the **Post-Closure Plan** (see below), is critical to the overall performance of the landfill cover system.

**8.2.1.6 Documentation** – The Owner shall complete an "as-built" survey to depict final elevations and to document any problems, amendments, or deviations from the Construction Plan drawings. Records of all testing, including maps with test locations, shall be prepared by the third-party CQA testing firm. All materials pertaining to the closure shall be placed in the Operational Record for the facility. Whereas the closure will be incremental, special attention shall be given to keeping the closure records separate from the normal operational records.

### 8.2.2 Maximum Area/Volume Subject to Closure

The largest anticipated area that will require final closure at any one time, that is, the maximum area subject to financial assurance requirements under the 2006 C&D rules, is **20 acres (Phase 1) plus 16.7 acres (Phase 2A), for a total of 36.7 acres (Section 1.3)**. Intermediate cover shall be used on areas that have achieved final elevations until the final cover is installed – typically this will occur in 2 to 3 acre increments – but it will be more cost effective to close the landfill in larger sections. Based on the volumetric analysis (**Appendix 1**), the volume of waste within the anticipated maximum open area is 1.6 M c.y. (Phase 1) plus 1.4 M c.y. (Phase 2A), for a total of 3M c.y.

### 8.2.3 Closure Schedule

Refer to the requirements outlined in **Section 8.1.5** (above).

### 8.2.4 Closure Cost Estimate

The following cost estimate is considered suitable for the **Financial Assurance** requirements (see **Section 9.0)**. The cost analysis includes the alternative final cover profile discussed on **Table 8A**.

**TABLE 8A**
**ESTIMATED FINAL CLOSURE COSTS FOR PHASES 1 and 2A (2010 dollars)** [1]

## 1) Regulatory Minimum Cover with Compacted Soil Barrier

| | | | | |
|---|---|---|---|---|
| VSL (topsoil)[2] – 36.7 acres | 88,814 c.y. | @ | $3.25 / cubic yard [6] | $288,645 |
| CSB (barrier)[2] – 36.7 acres | 102,136 c.y. | @ | $8 / cubic yard [6] | $817,088 |
| Establish Vegetation | 36.7 acres | @ | $1,300 per acre | $ 47,710 |
| Storm Water Piping [3] | 2500 LF | @ | $35.00 / LF | $ 87,500 |
| Erosion Control Stone [3] | 100 tons | @ | $40.00 / ton | $ 4,000 |
| Gas Vents – 36.7 ac*3/ac [4] | 110 each | @ | $100 each | $ 11,000 |
| | | | Subtotal Construction Costs | $1,255,943 |
| Testing and Surveying [5] | Estimated 20 percent of subtotal | | | $251,189 |
| Contingency | Estimated 15 percent of subtotal | | | $188,391 |
| | | | **Total Construction Cost (if contracted out)** | **$1,695,523** |
| | | | **Cost per acre (if contracted out)** | **$46,200** |

1 Intended to represent likely third-party construction costs (hired contractor, not the Owner/Operator), based on knowledge of local construction costs for similar projects – these estimates provided to meet NC DENR Division of Waste Management financial assurance requirements; actual costs may be lower for construction by the Owner/Operator; final closure work will be performed incrementally, spreading out the costs over the life of the project.

2 Includes soil work for regulatory requirements of 15A NCAC 13B .0543 (c), i.e., a minimum of 18 inches of compacted soil barrier (CSB) with maximum permeability of $1 \times 10^{-5}$ cm/sec and 18 inches of vegetation support layer (VSL), or topsoil, with a total soil thickness of 36 inches. For the compacted soil barrier, use a shrinkage factor of 15%; costs include surface preparation, soil procurement and transport costs, soil placement and compaction, machine/equipment costs, fuel

3 Estimate based on similar project history; includes materials and installation

4 Three trench-style vents per acre on the 5% slopes

5 Includes Construction document and bidding, construction administrative fee, CQA field monitoring and lab testing, CQA reporting and certification, final survey for as-built drawings, recordation/notation fee

6 Suitable soil has been identified on the site in sufficient quantities to close the landfill, which would be available for third-party closure

**TABLE 8A (continued)**
**ESTIMATED FINAL CLOSURE COSTS FOR PHASES 1 and 2A (2010 dollars)** [1]

**2) Alternative Final Cover with Flexible Membrane Barrier**

| | | | | |
|---|---|---|---|---|
| VSL (topsoil)[2] – 36.7 ac | 118,418 c.y. | @ | $3.25 / cubic yard [6] | $288,645 |
| Single-bond Geocomposite Drainage Layer – 36.7 ac | 1,598,652 s.f. | @ | $0.45 / s.f. | $719,393 |
| 40-mil HDPE flexible Membrane– 36.7 ac | 1,598,652 s.f. | @ | $0.35 / s.f. | $559,528 |
| Establish Vegetation | 36.7 acres | @ | $1,300 per acre | $ 47,710 |
| Storm Water Piping [3] | 2500 LF | @ | $35.00 / LF | $ 87,500 |
| Erosion Control Stone [3] | 100 tons | @ | $40.00 / ton | $ 4,000 |
| Gas Vents – 36.7 ac*3/ac [4] | 110 each | @ | $100 each | $ 11,000 |
| | | | Subtotal Construction Costs | $1,717,776 |
| Testing and Surveying [5] | Estimated 20 percent of subtotal | | | $343,555 |
| Contingency | Estimated 15 percent of subtotal | | | $257,666 |
| | | | **Total Construction Cost (if contracted out)** | **$2,318,997** |
| | | | **Cost per acre (if contracted out)** | **$63,188** |

1 Intended to represent likely third-party construction costs (hired contractor, not the Owner/Operator), based on knowledge of local construction costs for similar projects – these estimates provided to meet NC DENR Division of Waste Management financial assurance requirements; actual costs may be lower for construction by the Owner/Operator; final closure work will be performed incrementally, spreading out the costs over the life of the project

2 Includes soil work for regulatory requirements of 15A NCAC 13B .0543 (c), with a minimum of 24 inches of vegetation support layer (VSL), or topsoil ; costs include surface preparation, soil procurement and transport costs, soil placement and compaction, machine/equipment costs, fuel

3 Estimate based on similar project history; includes materials and installation

4 Three trench-style vents per acre on the 5% slopes

5 Includes Construction document and bidding, construction administrative fee, CQA field monitoring and lab testing, CQA reporting and certification, final survey for as-built drawings, recordation/notation fee

6 Suitable soil has been identified on the site in sufficient quantities to close the landfill, which would be available for third-party closure

WCA Material Recovery, LLC, plans to complete the closure work using in-house forces. The costs shown above are for a third-party contractor to complete the work. Please note that the final closure work will be performed incrementally, thus spreading out the costs over the life of the project.

## 8.3 Post-Closure Plan

### 8.3.1 Monitoring and Maintenance

**8.3.1.1 Term of Post-Closure Care** – The facility shall conduct post-closure care for a minimum of 30 years after final closure of the landfill, unless justification is provided for a reduced post-closure care period. The post-closure care period may be extended by the Division if necessary to protect human health and the environment.

**8.3.1.2 Maintenance of Closure Systems** – Inspections of the final cover systems and sediment and erosion control (S&EC) measures shall be conducted quarterly. Maintenance will be provided during post-closure care as needed to protect the integrity and effectiveness of the final cover. The cover will be repaired as necessary to correct the effects of settlement, subsidence, erosion, or other events. Refer maintenance activities on the **Post Closure Monitoring and Maintenance Schedule** (see **Table 8B**). Inspection reports, along with maintenance records as work is completed, will be entered into a **Post Closure Record** (see **Section 8.3.1.5**) and maintained throughout the post-closure period. A log-book or checklist is recommended for documentation.

**8.3.1.3 Landfill Gas Monitoring** – Rule .0544 (1) requires that the concentration of methane gas or other explosive gases generated by the facility does not exceed 25 percent of the lower explosive limit in on-site facility structures (excluding gas control or recovery system components); the concentration of methane gas or other explosive gases does not exceed the lower explosive limit for methane or other explosive gases at the facility property boundary; and the facility does not release methane gas or other explosive gases in any concentration that can be detected in offsite structures. A methane monitoring program must be maintained during operations and throughout the post-closure period – typically this involves discrete sampling points (e.g., gas monitoring wells) around the facility and continuous monitoring (e.g. gas alarms) within occupied structures on the site. The frequency of monitoring shall be quarterly or as approved by the Division – quarterly monitoring was assumed for the post-closure monitoring costs.

If methane or explosive gas levels exceeding the limits specified above are detected, the owner and operator must: immediately take all steps necessary to ensure protection of human health and notify the Division; within seven days of detection, place in the operating record the methane or explosive gas levels detected and a description of the steps taken to protect human health; and within 60 days of detection, implement a remediation plan for the methane or explosive gas releases, place a copy of the plan in the operating record, and notify the Division that the plan has been implemented. The plan must describe the nature and extent of the problem and the proposed remedy.

For purposes of this Item, "lower explosive limit" means the lowest percent by volume of a mixture of explosive gases in air that will propagate a flame at 25 degrees C and atmospheric pressure. A **Landfill Gas Monitoring Plan** prepared for this PTC application is presented in **Volume 2 (Appendix 11)**, which was completed in January 2010 and approved by the Solid Waste Section. The plan specifies a number of permanent landfill gas monitoring wells and several "bar-hole punch" test locations. These monitoring points are shown on the Facility Monitoring Plan (**Drawing MP-1**).

In addition, there is an ongoing evaluation of a suspected landfill gas migration near the northwest corner of Phase 1 (near monitoring well MW-3). That work – unrelated to this application – involved the installation of a passive gas recovery trench near the northeast side of the landfill to alleviate suspected gas concerns near the perimeter. The Landfill Gas Monitoring Plan for this application is not intended to supplant the provisions of the gas evaluation; however, in the future, the sampling work described in the Landfill Gas Monitoring Plan for this application may need to be amended, in which case a revision of the Landfill Gas Monitoring Plan will be issued.

**8.3.1.4 Ground Water Monitoring** – Groundwater monitoring will be conducted under the current version of the approved Sampling and Analysis Plan (see **Section 11.0**). This plan will be reviewed periodically and may change in the future. Approximately one year prior to the landfill reaching permitted capacity, the facility will submit post-closure monitoring and maintenance schedules, specific to the ground water monitoring. Procedures, methods, and frequencies will be included in this plan. This future plan, and all subsequent amendments, will be incorporated by reference to this document. Monitoring wells shall be inspected annually and any needed repairs made.

**8.3.1.5 Record Keeping** – During the post closure period, maintenance and inspection records, i.e., a **Post Closure Record**, shall be kept as a continuation of the **Operating Record** that was kept during the operational period. The Post Closure Record shall include future inspection and engineering reports, as well as documentation of all routine and non-routine maintenance and/or amendments. The Post Closure Record shall include the ground water and gas monitoring records collected for the facility.

**8.3.1.6 Certification of Completion** – At the end of the post-closure care period the facility manager shall contact the Division to schedule an inspection. The facility manager shall make the Post Closure Record available for inspection. A certification that the post-closure plan has been completed, signed by a North Carolina registered professional engineer, shall be placed in the operating/post closure record. The Owner/Operator shall maintain these records indefinitely.

**TABLE 8B**
**POST-CLOSURE MONITORING AND MAINTENANCE SCHEDULE**

| Post Closure Activity | Frequency |
|---|---|
| **Site Security** – inspect gates, locks, fences, and signs on a monthly basis; make repairs as needed | Quarterly |
| **Site Access** – inspect on-site roads and ditches for erosion or surface; upgrade surface and drainage as needed for all-weather passability and minimum 25-clear width for maintenance vehicles and fire-fighting equipment | Quarterly |
| **Final Cover** – inspect cap and vegetation for erosion, cracking, settlement, sloughing, or bare spots; make corrections as needed | Quarterly |
| **Storm Water Systems (Final Cap)** – inspect drainage swales on slopes for erosion or sediment buildup; inspect below-grade piping for blockage and erosion at inlets and outlets; inspect above-grade piping for blockage, erosion, and anchorage to slope; make corrections as needed | Quarterly |
| **Landfill Gas Monitoring –** inspect well-head integrity and perform required sampling; make corrections as needed | Quarterly |
| **Vegetation** – mow final cover and remove trees in perimeter ditches and outer slopes; use weed-eater around landfill gas vents and ground water monitoring wells – USE NO HERBICIDE | Semi-Annually |
| **Storm Water Systems** – inspect perimeter drainage swales and main sediment basin(s) for erosion and excess sedimentation; inspect the outlet works of the basin(s) for blockage and erosion at inlets and outlets; check stone filters and dewatering devices (if any), e.g., perforations on pipes and/or skimmers for proper operation; check for scour on overflows and downstream of the outlets; check vegetation on the perimeter embankments; make corrections as needed | Semi-Annually |
| **Ground Water Monitoring –** check well head security, identification tags and visibility; perform required sampling and make corrections as needed | Semi-Annually |
| **Landfill Gas Vents** – inspect the vents for corrosion, erosion and damage (after mowing) | Semi-Annually |

Notes:

1. Inspect after every major storm event, i.e., 25-year 24-hour design storm
2. Dependent on vegetation type, less frequent mowing may be required
3. The Division may be petitioned to discontinue gas monitoring if no detections occur in monitoring wells or on-site buildings; however, this schedule complies with current rules
4. See current Ground Water Sampling and Analysis Plan

### 8.3.2 Responsible Party Contact

Vernon Smith
Regional Vice President
40 Estes Plant Rd
Piedmont, SC 29673
Office (864) 845-8354

### 8.3.3 Planned Uses of Property

Currently, there is no planned use for the landfill area following closure. The closed facility will be seeded with grass to prevent erosion. Any post-closure use of the property considered in the future will not disturb the integrity of the final cover or the function of the monitoring systems unless necessary (and to be accompanied by repairs or upgrades). Future uses shall not increase the potential threat to human health and the environment. Any proposed use of the landfill property after closure requires approval of the Solid Waste Section.

### 8.3.4 Post-Closure Cost Estimate

The following cost estimate (see **Table 8C**) is considered suitable for the **Financial Assurance** requirements. Refer to the 30-year cost projection (see **Section 9.0**).

**TABLE 8C**
**ESTIMATED POST-CLOSURE COSTS FOR PHASE 1 and 2A (in 2010 dollars)**

| Annual Events | Units | | Unit Cost | Cost/ Event | Annual Costs |
|---|---|---|---|---|---|
| Reseeding/mulching and erosion repair (Assume 10% cap, once per year) [1] | 5 | ac. | $1,500 | $7,500.00 | $7,500.00 |
| Mow final cap (twice per year) | 36.7 | ac. | $25 | $ 917.50 | $1,835.00 |
| Maintain storm water conveyances and gas vents for final cover [4] | 1 | ea. | $2,000 | $2,000.00 | $2,000.00 |
| Maintain access roads, gates, fences, gates, signs, buildings, ditches, ponds | 1 | ea. | $2,000 | $2,000.00 | $2,000.00 |
| Monthly inspection ("ride-through") | 1 | ea. | $200 | $ 200.00 | $2,400.00 |
| Engineering inspection (annual basis) | 1 | ea. | $1,500 | $1,500.00 | $1,500.00 |
| Annual engineering report | 1 | ea. | $1,200 | $1,200.00 | $1,200.00 |
| Ground and Surface Water Monitoring sampling and analysis (semi-annual) [1, 2] | 15 | ea. | $250 | $3,750.00 | $7,500.00 |
| Water quality evaluation and reporting [2] | 15 | ea. | $250 | $3750.00 | $7,500.00 |
| Landfill Gas Monitoring (quarterly) [2] | 1 | ea. | $1500 | $1500.00 | $6,000.00 |
| Landfill Gas Reporting (quarterly) [2] | 1 | ea. | $1000 | $1000.00 | $4,000.00 |
| Maintain Ground Water Wells (all) [2] | 1 | ea. | $500 | $500.00 | $500.00 |
| Maintain Gas Monitoring Wells (all) [2] | 1 | ea. | $500 | $500.00 | $500.00 |
| **Total Estimated Annual Cost (Real Cost to Owner/Operator)** | | | | | **$44,435.00** |
| Cost per acre | | | | | $1,210 |
| **Total Annual Cost Subject to Post-Closure Financial Assurance** | | | | | **$18,435.00** |
| Cost per acre | | | | | $502 |

Notes:

1 Appendix I detection monitoring only; number of wells is based on the most recent facility plan prepared by David Garrett and Associates, dated September 2010

2 Covered by $3M corrective action bond and may be deducted from the post-closure financial assurance

3. Four bar-hole punch locations and six landfill gas wells; sampling with gas detection meter

# 9.0 FINANCIAL ASSURANCE

## 9.1 Summary of Regulatory Requirements

Financial assurance is required, for both closure and post-closure of the landfill, and for potential assessment and corrective action, in accordance with NCGS 130A 295.2 (h). The Section will review and approve the calculation and amount of financial assurance required prior to the issuance of the Permit to Construct (PTC), and the actual financial assurance instrument is required to be submitted to the Section prior to the issuance of the Permit to Operate (PTO).

The financial assurance requirement applies to the entire facility that has a Permit to Operate – the liabilities both increase and decrease with time as phases or cells are opened and others are closed. Thus, the amount of the financial assurance instrument should be adjusted annually, consistent with Division policy.

## 9.2 Closure and Post-Closure

The **2006 C&D Rules** require that Owners/Operators demonstrate financial assurance for closure and post-closure activities. Typically, for local government-owned facilities, said demonstration is based on a local government test. For private facilities, acceptable financial assurance instruments include performance bonds, insurance policies, cash deposit, and/or irrevocable letter of credit. Cost estimates for closure and post-closure of the CDLF Phase 1 and 2A are presented in **Sections 8.2.4** and **8.3.4**, respectively.

## 9.3 Potential Corrective Action

Certain post-closure cost estimates, as listed in the application, may be deducted from the post-closure costs, and be considered part of the minimum $3 million for assessment and corrective action. These costs include groundwater and surface water monitoring and groundwater well maintenance/repair, along with costs for landfill gas perimeter well monitoring and perimeter gas well maintenance/repair. Landfill cap gas vents and vent maintenance/repair may not be included in the assessment and corrective action costs.

For the first year, the amount for potential assessment and corrective action financial assurance will be **$3 million for the WCA Material Recovery CDLF**. For subsequent years, the cost may be more than $3 million based on site specific factors. For private facilities, acceptable financial assurance instruments include performance bonds, cash deposit, and/or irrevocable letter of credit. ***Based on current guidance from the Section, insurance policies are not an acceptable financial assurance instrument for the Potential Corrective Action portion.***

## 9.4 Summary of Estimated Costs

The following is a detailed analysis of the closure and post closure costs, based on the preceding, all in 2010 dollars, projected over the anticipated life of the landfill and 30 years of post-closure care, plus the mandatory minimum for potential corrective action.

| | | |
|---|---|---|
| 1. | Final Closure Construction (see **Table 8A, Part 1**) | $1,695,523 |
| 2. | Projected Post-Closure Costs (see **Table 8C**) | |
| | $18,435 x 30 years = | $ 553,050 |
| | Subtotal Closure/Post-Closure Cost | $ 2,248,573 |
| 3. | Potential Corrective Action (see **Section 9.3**) | $ 3,000,000 |
| | **TOTAL REQUIRED FINANCIAL ASSURANCE** | **$ 5,248,573** |

Upon approval of the financial assurance amount (and issuance of the Permit to Construct by the NC DENR Division of Waste Management, Owners/Operators must furnish an acceptable financial assurance instrument (see requirements listed in **Section 8.2** and **8.3**) prior to issuance of the Permit to Operate. The documentation will be included as a future amendment to this report (see **Appendix 4**).

The bond will be reduced by the amount of the projected closure costs after final closure is completed. Maximum post-closure cost liabilities exist at the time of closure – these liabilities decrease with time and, thus, the amount of the post-closure instrument will be reduced over time. Once into the post-closure period, the financial assurance instrument will be recalculated periodically, ideally on an annual basis, and the posted amount (bond, insurance, etc.) will be adjusted accordingly on a periodic basis. The corrective action bond may increase over time, depending on the size and nature of the facility and whether any ground water or gas-related problems exist.