David Garrett & Associates
Engineering and Geology

January 14, 2011

Permit No.	Date	Document ID No.
41-17	**January 14, 2011**	**12725**

Ming-Tai Chao, P.E.
Environmental Engineer II
Permitting Branch, Solid Waste Section
Division of Waste Management
1646 Mail Service Center
Raleigh, NC 27699-1646

RECEIVED
January 14, 2011 via an e-mail
Solid Waste Section
Raleigh Central Office

RE: Response to Review Comments
A-1 Sandrock, Inc. – Phase 1 Cell B
Permit to Operate Application
C&D Landfill and Processing Facility
Guilford County, NC (Permit #41-17)

Dear Mr. Chao:

On behalf of A-1 Sandrock, I am pleased to present the following response to your comments of November 30, 2010, made pertaining to my Application for a Permit to Operate for Phase 1B. The responses are made in order of receipt. Your comments are presented in italics print.

> *1. According to the drawings in the approved PTC applications, there are five soil borings located in the Cell B – B12, B-22, B-23, B-26, and B-28. In compliance with Permit Condition No. 10 in Attachment 2 of PTC for the Phase 1 issued on June 1, 2006, the borings shall be properly abandoned. Please provide the documentations and records to demonstrate these borings are properly abandoned.*

Piezometer abandonment records for B-21 and B-22 are provided in Attachment 1, along with a map of the original piezometer locations and abandonment completed thus far. Please note that three test boring locations in Phase 1B (identified as "Cell 2" in the Figure), did not have piezometers. A slight difference in depths between the abandonment records and the original data reflects minor surface grade changes due to the mining operations; for instance, grades near B-21 were lowered by a few feet, leaving the piezometer on an isolated soil pedestal, and the difference was not included in the abandonment footage. All piezometers in the requested disposal areas have been properly abandoned. The other borings were excavated.

I have recommended to A-1 that the remaining piezometers within the approved landfill footprint (a total of 10) be abandoned prior to further grading work.

5105 Harbour Towne Drive • Raleigh • North Carolina • 27604
919-418-4375 (Mobile) • 919-231-1818 (Office/fax) • E-mail: david@davidgarrettpe.com

2. The final base grades of the Cell B – 785-ft amsl to 765-ft amsl as shown on Drawing E1A is changed from the original proposed ones – 790-ft amsl to 758-ft amsl as shown in "Phase 1 –Stage 2" on Drawing E1/Sheet No. 2 in the approved Facility and Operations Plan Updated dated February 2009. This variation was described in the Attachment 2 - the Geologist's Subgrade Report. Will this variation of final base grade result in the change of total gross capacity of the Phase 1 and the C&DLF as described in the Sections 1.3.2 & 8.2.2 in the updated PTC applications (Attachment 1)? Please clarify.

A comparison of the "as-built" grades and original design grades is shown in Attachment 2. Based on the calculations, the as-built grades are an average of 2 feet higher than design grades over a 1.9 acre area (excluding the sediment trap). This equates to a volume loss of 6,228 cubic yards, which shall be subtracted from the projected volumes for Phase 1B, all of Phase 1, and the entire facility, respectively. Please note that this volume loss represents approximately 1.3% of Phase 1 and less than 0.3% of the total permitted capacity of the facility. The table presented on Page 4 of the Updated Facility Plan (Rev. 0.2, 11/15/2010) has been revised accordingly, and Sections 1.3.2. and 1.3.4 (Page 3) and 8.2.2 (Page 75) are revised (see Attachment 2).

3. (Section 4 – Construction Quality Assurance) Please address the following concerns:

i. The Tables 7A, 7B, & 7C are likely typos because the QA/QC testing requirements are stated in Tables 4A, 4B, and 4C. Please conduct a global search in this Section 4 and make necessary correction.

References to table numbers have been corrected on Pages 21, 23, and 25 (see Attachment 3).

ii. In Table 4A, the referenced testing method – ASTM D4138 is incorrect. The correct method is D4318.

The reference to the ASTM standard on Table 4 has been corrected on Page 33 (Attachment 3).

iii. Please provide CQA testing results as specified in Table 4A. The test locations in Cell B need to be documented on the as-built drawings in accordance with Sections 4.4 and 4.5.

The earthwork specifications presented on Table 4A pertain to structural fills, e.g., large embankments and fill sections within the subgrade areas. Phase 1B (and most of Phase 1) is within a cut section, thus the rigorous testing required for embankment stability is not needed. There was some fill placed over a rocky area encountered during the mining operation to provide 4 feet of separation, hence the grades are slightly higher than the design grades. I made a judgment call regarding the compaction of the fill soil by observing the movement of earthwork equipment during my subgrade inspection. In my opinion, the soils are adequately compacted to prevent excess settlement – there are no groundwater separation issues at stake – and the soil types are appropriate to meet the regulations. Proof of both issues is provided in the photographs of the test pits – notice the smearing of the sidewalls, indicating the relative density and soil type. On that basis, in my professional opinion the scheduled soil density and classification tests are not needed and should be suspended for Phase 1B.

I have recommended to A-1 that full-scale testing of the embankment between the disposal area and the sediment basin will be required for certification of Phase 1C.

> *4. (Section 8.1.2) To consistent with the approved 3 (H) to 1(V) side slopes for the final cover system, the post-settlement surface slopes described in Section 8.1.2 shall range from 5% to 33.3%, not 25%.*

The reference to the slope ratio has been corrected on Page 70 (Attachment 3).

Please contact me at your earliest convenience if you have questions or comments, or if I may be of further service. Thank you.

G. David Garrett, PG, PE
Project Consultant

cc: Ronnie Petty, III – A-1 Sandrock, Inc.

Attachment 1
Piezometer Abandonment Records

WELL ABANDONMENT RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2579

1. WELL CONTRACTOR:

DANNY SUMMERS
Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC.
Well Contractor Company Name

STREET ADDRESS 176 COMMERCE BLVD.

STATESVILLE NC 28625
City or Town State Zip Code

(704) - 872-7686
Area code - Phone number

2. WELL INFORMATION:

SITE WELL ID # (if applicable) PZ-1 B-21

STATE WELL PERMIT # (if applicable) _____

COUNTY WELL PERMIT # (if applicable) _____

DWQ or OTHER PERMIT # (if applicable) _____

WELL USE (Check applicable use): ☑ Monitoring ☐ Residential
☐ Municipal/Public ☐ Industrial/Commercial ☐ Agricultural
☐ Recovery ☐ Injection ☐ Irrigation
☐ Other (list use) _____

3. WELL LOCATION:

COUNTY GUILFORD QUADRANGLE NAME _____

NEAREST TOWN: GREENSBORO

2091 BISHOP ROAD 27406
(Street/Road Name, Number, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other _____
(Check appropriate setting)

LATITUDE _____
LONGITUDE _____

May be in degrees, minutes, seconds, or in a decimal format

Latitude/longitude source: ☐ GPS ☐ Topographic map
(Location of well must be shown on a USGS topo map and attached to this form if not using GPS.)

4a. FACILITY- The name of the business where the well is located. Complete 4a and 4b. (If a residential well, skip 4a; complete 4b, well owner information only.)

FACILITY ID #(if applicable) _____

NAME OF FACILITY A-1 SANDROCK LANDFILL

STREET ADDRESS 2091 BISHOP ROAD

GREENSBORO NC 27406
City or Town State Zip Code

4b. CONTACT PERSON/WELL OWNER:

NAME A-1 SANDROCK LANDFILL

STREET ADDRESS 2091 BISHOP ROAD GREENSBORO, NC 27406

5. WELL DETAILS:

a. Total Depth: 57.0 ft. Diameter: 2.0 in.
b. Water Level (Below Measuring Point): _____ ft.
Measuring point is _____ ft. above land surface.

6. CASING:

	Length	Diameter
a. Casing Depth (if known):	N/A ft.	_____ in.
b. Casing Removed:	N/A ft.	_____ in.

7. DISINFECTION: N/A

(Amount of 65%-75% calcium hypochlorite used)

8. SEALING MATERIAL:

Neat Cement
Cement -- lb.
Water -- gal.

Sand Cement
Cement -- lb.
Water -- gal.

Bentonite
Bentonite lb.
Type: ☑ Slurry ☐ Pellets
Water _____ gal.

Other
Type material PORTLAND BENTONITE SLURRY
Amount 9.5 GALLONS

9. EXPLAIN METHOD OF EMPLACEMENT OF MATERIAL:

VIA TREMIE PIPE WITH PORTLAND BENTONITE SLURRY

10. WELL DIAGRAM: Draw a detailed sketch of the well on the back of this form showing total depth, depth and diameter of screens (if any) remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.

11. DATE WELL ABANDONED 3/23/10

I DO HEREBY CERTIFY THAT THIS WELL WAS ABANDONED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR — DATE 04/05/10

SIGNATURE OF PRIVATE WELL OWNER ABANDONING THE WELL — DATE
(The private well owner must be an individual who personally abandons his/her residential well in accordance with 15A NCAC 2C .0113.)

DANNY SUMMERS
PRINTED NAME OF PERSON ABANDONING THE WELL

Submit a copy to the owner and the original to the Division of Water Quality within 30 days.
Attn: Information Management, 1617 Mail Service Center – Raleigh, NC 27699-1617, Phone No. (919) 733-7015 ext 568.

Form GW-30
Rev. 5/06

WELL ABANDONMENT RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2579

1. WELL CONTRACTOR:

DANNY SUMMERS
Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC.
Well Contractor Company Name

STREET ADDRESS 176 COMMERCE BLVD.

STATESVILLE NC 28625
City or Town State Zip Code

(704) - 872-7686
Area code - Phone number

2. WELL INFORMATION:

SITE WELL ID # (if applicable) PZ-2 B-22

STATE WELL PERMIT # (if applicable)

COUNTY WELL PERMIT # (if applicable)

DWQ or OTHER PERMIT # (if applicable)

WELL USE (Check applicable use): ☑ Monitoring ☐ Residential
☐ Municipal/Public ☐ Industrial/Commercial ☐ Agricultural
☐ Recovery ☐ Injection ☐ Irrigation
☐ Other (list use)

3. WELL LOCATION:

COUNTY GUILFORD QUADRANGLE NAME

NEAREST TOWN: GREENSBORO

2091 BISHOP ROAD 27406
(Street/Road Name, Number, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
(Check appropriate setting)

LATITUDE
LONGITUDE

May be in degrees, minutes, seconds, or in a decimal format

Latitude/longitude source: ☐ GPS ☐ Topographic map
(Location of well must be shown on a USGS topo map and attached to this form if not using GPS.)

4a. FACILITY- The name of the business where the well is located. Complete 4a and 4b. (If a residential well, skip 4a; complete 4b, well owner information only.)

FACILITY ID #(if applicable)

NAME OF FACILITY A-1 SANDROCK LANDFILL

STREET ADDRESS 2091 BISHOP ROAD

GREENSBORO NC 27406
City or Town State Zip Code

4b. CONTACT PERSON/WELL OWNER:

NAME A-1 SANDROCK LANDFILL

STREET ADDRESS 2091 BISHOP ROAD GREENSBORO, NC 27406

5. WELL DETAILS:

a. Total Depth: 35.0 ft. Diameter: 2.0 in.
b. Water Level (Below Measuring Point): ft.
Measuring point is ft. above land surface.

6. CASING: Length Diameter

a. Casing Depth (if known): N/A ft. in.
b. Casing Removed: N/A ft. in.

7. DISINFECTION: N/A
(Amount of 65%-75% calcium hypochlorite used)

8. SEALING MATERIAL:

Neat Cement
Cement = lb.
Water = gal.

Sand Cement
Cement = lb.
Water = gal.

Bentonite
Bentonite lb.
Type: ☑ Slurry ☐ Pellets
Water gal.

Other
Type material PORTLAND BENTONITE SLURRY
Amount 5.75 GALLONS

9. EXPLAIN METHOD OF EMPLACEMENT OF MATERIAL:
VIA TREMIE PIPE WITH PORTLAND BENTONITE SLURRY

10. WELL DIAGRAM: Draw a detailed sketch of the well on the back of this form showing total depth, depth and diameter of screens (if any) remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.

11. DATE WELL ABANDONED 3/23/10

I DO HEREBY CERTIFY THAT THIS WELL WAS ABANDONED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

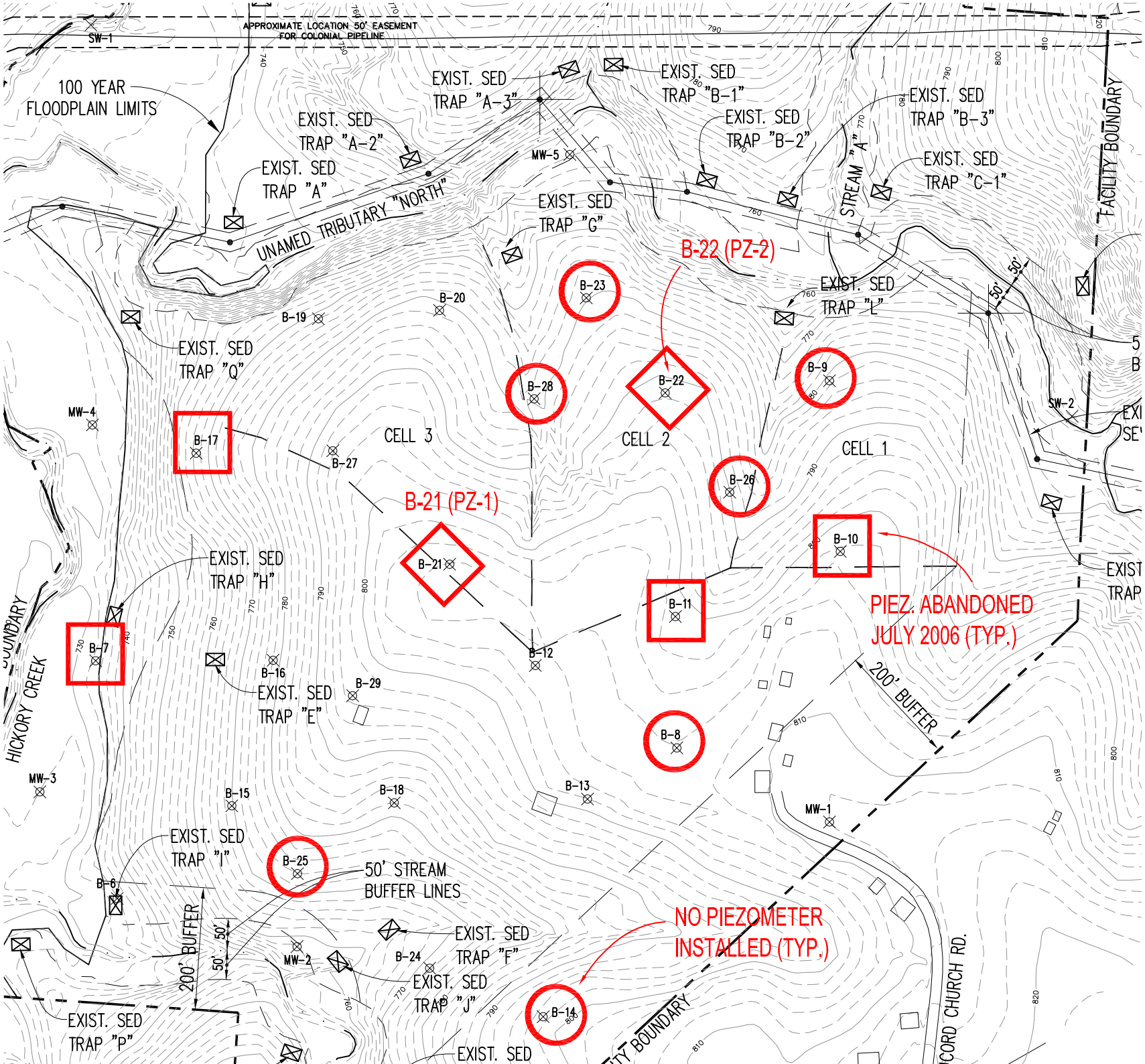
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE 04/05/10

SIGNATURE OF PRIVATE WELL OWNER ABANDONING THE WELL DATE
(The private well owner must be an individual who personally abandons his/her residential well in accordance with 15A NCAC 2C .0113.)

DANNY SUMMERS
PRINTED NAME OF PERSON ABANDONING THE WELL

Submit a copy to the owner and the original to the Division of Water Quality within 30 days.
Attn: Information Management, 1617 Mail Service Center – Raleigh, NC 27699-1617, Phone No. (919) 733-7015 ext 568.

Form GW-30
Rev. 5/06


APPROXIMATE LOCATION 50' EASEMENT FOR COLONIAL PIPELINE
SW-1
100 YEAR FLOODPLAIN LIMITS
EXIST. SED TRAP "A-3"
EXIST. SED TRAP "B-1"
EXIST. SED TRAP "B-3"
EXIST. SED TRAP "A-2"
EXIST. SED TRAP "B-2"
EXIST. SED TRAP "C-1"
EXIST. SED TRAP "A"
MW-5
STREAM "A"
FACILITY BOUNDARY
UNAMED TRIBUTARY "NORTH"
EXIST. SED TRAP "G"
B-22 (PZ-2)
B-23
B-20
B-19
EXIST. SED TRAP "L"
50'
EXIST. SED TRAP "Q"
B-28
B-22
B-9
SW-2
MW-4
B-17
CELL 3
CELL 2
CELL 1
B-27
B-26
B-21 (PZ-1)
B-21
B-10
EXIST. SED TRAP "H"
B-11
PIEZ. ABANDONED JULY 2006 (TYP.)
B-7
B-12
B-16
EXIST. SED TRAP "E"
B-29
200' BUFFER
HICKORY CREEK
B-8
MW-3
B-15
B-18
B-13
MW-1
EXIST. SED TRAP "I"
B-25
50' STREAM BUFFER LINES
B-6
200' BUFFER
50'
50'
EXIST. SED TRAP "F"
MW-2
B-24
EXIST. SED TRAP "J"
NO PIEZOMETER INSTALLED (TYP.)
B-14
EXIST. SED TRAP "P"
EXIST. SED
FACILITY BOUNDARY
CHURCH RD.

Attachment 2
Volumetric Capacity Corrections

1.3.2 Landfill Capacity

A volumetric analysis for the CDLF performed using an AutoCAD Digital Terrain Model (DTM), as presented in the original permitting documents, is discussed below.

> Based on the grading plan and final waste contours (**Drawing E5**), the landfill will have a total volumetric capacity of 2,233,772 cubic yards. Subtracting the final cover (106,000 cy), 10% of the remaining airspace will be lost due to periodic cover (consuming approximately 212,777 c.y.), the net disposal capacity is 1,914,995 c.y., or approximately 1,148,997 tons in place (at 0.5 ton/cy, including an estimated 20% compaction factor). The landfill is being planned to receive an average of 225 tpd, or 450 c.y./day. It is assumed that the landfill will operate 5.5 days per week, with 280 working days per year. These assumptions yield an estimated annual airspace consumption of 100,800 cubic yards, plus 10% for periodic cover, resulting in a total annual airspace consumption equaling 110,880 c.y. ***The planned operational life is approximately 20 years.***

A tabulation of the disposal capacity and life expectancy by phase follows this section.

1.3.3 Special Engineering Features

No seeps, springs, soft ground or other deleterious conditions were identified in the site characterization studies. As such, no special engineering features are required.

1.3.4 Soil Volume Analysis

The following soil data was developed using the airspace calculations (discussed above) and the permitted grading plan (relative to regulatory vertical buffer requirements). The excavated volume may understate the allowable excavation if "beneficial fill" as defined by the Solid Waste Rules is used to restore site grades to design values. These data were presented in the original (2002) Facility Report, adjusted per the recent recalculation of volumes for the current operational sequence and current cover requirements.

Total Proposed Airspace	2,233,772 cy
Final Cover Required	
(3' x 21.89 ac x 1613 cy/ac/ft)	106,000 cy
Intermediate Cover (10% Volume)	212,777 cy
Structural Fill for Construction	16,000 cy
Total Required Soil	334,777 cy
Excavated Volume	*753,772 cy*
Net Soil Balance	**418,995 cy surplus**

PHASE 1 CONDITIONS	**A-1 Sandrock, Inc., CDLF Phase 1 (Permit #41-17)**		
Solid Waste Units Present	C&D Recycling Facility, CDLF		
Other Activities/Infrastructure	Scales/Office, Permitted Mining, LCID Processing		
CDLF Unit Footprint Acreage	21.89 acres		
CDLF Phases/Sub-Phases [1]	1**A**	**1B**	**1C**
New Ground Footprint Acreage [1]	2.54 ac	3.18 ac	2.46 ac
Interim Capacities (Sub-Phases) [2]	62,370 cy	186,242 cy	223,644 cy
Interim Elevations (Sub-Phases)	EL. 810	EL. 830	EL. 840
Volumetric Capacity (Phase 1) [2]	472,256 cy		
Final Elevations (Phase 1) [2]	EL. 840		
Maximum Waste Thickness [2]	60 feet [5]		
Permitted Side Slope Ratios	3H:1V		
Permitted Footprint Acreage [3]	8.18 ac		
Facility Boundary Acreage	75 acres		
Total Permitted Capacity [2, 3]	472,256 cy		
Operational Life Expectancy	4.74 years		

FUTURE CONDITIONS	**Phases 2 through 4 are contiguous with Phase 1**		
Solid Waste Units Present [4]	Unchanged		
Other Activities/Infrastructure [4]	Unchanged		
New CDLF Unit Footprint Acreage [4]	21.9 acres		
New CDLF Phases/Sub-Phases [1]	**2**	**3**	**4**
New Ground Footprint Acreage [1]	7.82 ac	5.89 ac	11.06 ac [5]
Interim Capacities (Sub-Phases) [2, 6]	608,193 cy	647,787 cy	505,536 cy
Interim Elevations (Sub-Phases)	EL. 846	EL. 854	EL. 904
New CDLF Unit Capacity [2, 6]	1,761,516 cy		
Final Elevations (Entire Unit) [2]	EL. 904		
Maximum Waste Thickness [2]	110 feet		
Permitted Side Slope Ratios [4]	3H:1V		
Total CDLF Footprint Acreage [4]	21.89 acres		
Facility Boundary Acreage [4]	75 acres		
Total Permitted Capacity [6]	2,233,772 cy		
Operational Life Expectancy	20.20 years		

1 Corresponding to 5-year Operating Capacity
2 Includes Final Cap System and Operational Cover – Phase 1C volume was adjusted to match the permit issue
3 Covered by current Permit to Construct application
4 Subject to Division approval of future applications
5 Vertical Expansion – not actual ground disturbance (does not add to total footprint area)
6 Consistent with the February 2004 Permit to Construct – Phase 4 volume was adjusted to match permit issue

Intermediate cover shall be used on areas that have achieved final elevations until the final cover is installed. It is fully anticipated that portions of Phase 1 (i.e., Phase 1A) will be closed prior to the opening of Phase 2. An annual adjustment is required by the Division for the open area (and the bond requirement). Based on the volumetric analysis for Phase 1 (**Appendix 1**), the volume of Phase 1 is 472,256 cubic yards (**Section 1.3**).

8.2.3 Closure Schedule

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

8.2.4 Closure Cost Estimate

The foregoing cost estimate is considered suitable for the **Financial Assurance** requirements (see **Section 9.0**).

TABLE 8A
ESTIMATED FINAL CLOSURE COSTS FOR PHASE 1 (2010 dollars) [1]

VSL (topsoil)[2] – 8.18 ac	19,795 c.y.	@	$4 / cubic yard	$ 79,182
CSB (barrier)[2] – 8.18 ac	22,764 c.y.	@	$10 / cubic yard	$227,640
Establish Vegetation	8.18 acres	@	$1,800 per acre	$ 14,724
Storm Water Piping [3]	200 LF	@	$35.00 / LF	$ 7,000
Erosion Control Stone [3]	10 tons	@	$40.00 / ton	$ 400
Cap Gas Vents (3/acre)	24	@	$100 ea	$ 2,400
Testing and Surveying [4]	Estimated 20 percent of above			$ 65,781
Contingency	Estimated 15 percent of above			$ 49,343
	Total Construction Cost (if contracted out)			**$ 446,470**

Notes:

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 the 2006 C&D Rules, i.e., a minimum of 18 inches of compacted soil barrier (max. permeability of 1×10^{-5} cm/sec) and 18 inches of topsoil (total soil thickness is 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 costs

3 Conservative estimate based on similar project history; includes materials and installation

4 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

Attachment 3
CQA Reference Corrections

4.1.4 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 with input from all parties, if so warranted based on project specific conditions. No modifications will be made without the Division's approval.

4.1.5 Miscellaneous

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

4.1.5.2 References – This CQA Plan includes references to the most recent version of the test procedures of the American Society of Testing and Materials (ASTM). **Table 4D** at the end of this text contains a list of these procedures.

4.2 Inspection, Sampling and Testing

The requirements of the General Earthwork (perimeter embankments and subgrade) and Final Cover Systems (soil barrier, vegetative cover, and 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.

4.2.1 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, subgrade approval, field control and record tests, if any, and resolution of problems.

4.2.1.1 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. Specifically, field observation of the response of soils beneath equipment and the use of a probe rod and/or a penetrometer are other means of determining the adequacy of compaction. Skilled soil technicians working under the supervision of an engineer may make this determination, subject to concurrence by the engineer. 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

intervals, or there may be an exploratory sampling program at some time near the completion of the subgrade with confirmatory testing at specified intervals. The frequency of visual inspection and testing shall conform to **Table 4A**.

4.2.2 General Earthwork Construction

4.2.2.1 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.

4.2.2.2 Control Tests – The control tests, as shown on **Table 4A**, will be performed by the CQA Testing Firm prior to placement of additional compacted embankment.

4.2.2.3 Record Tests – The record tests, as shown on **Table 4A**, 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.

4.2.2.4 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.

A. High Density Polyethylene (HDPE) Pipe

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

(2) Review manufacturer's submittals for conformity with project specs.

B. Corrugated Polyethylene (CPE) Pipe

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

(2) Review manufacturer's submittals for conformity with project specs.

C. Aggregates (Verify for each type of aggregate)

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

(2) Review manufacturer's submittals for conformity with project specs.

(3) Verify aggregates in stockpiles or borrow sources conform to project specifications. Certifications from a quarry will be sufficient.

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

D. Vegetative Soil Layer and Drainage Layer

(1) Review manufacturer's submittals for conformity with project specs.

(2) Review contractor's submittals on seed specifications.

(3) Perform material evaluations in accordance with **Table 4C**.

E. Compacted Barrier Layer

(1) Review manufacturer's submittals for conformity with project specs.

(2) Conduct material control tests in accordance with **Table 4C**.

F. Erosion and Sedimentation Control

(1) Review Contractor's submittals on erosion and sedimentation control items (including rolled erosion control products and silt fence).

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

(3) Perform visual examination of materials for signs of age or deterioration.

TABLE 4A
CQA TESTING SCHEDULE FOR GENERAL EARTHWORK

PROPERTY	TEST METHOD	MINIMUM TEST FREQUENCY
CONTROL TESTS:		
Consistency Evaluation	ASTM D 2488 (visual)[1]	Each Material
RECORD TESTS:		
Lift Thickness	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 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

8.1 Summary of Regulatory Requirements

8.1.1 Final Cap

The final cap design for all phases of the CDLF 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 x 10^{-5} cm/sec. The overlying vegetative support layer shall be 18 inches thick. **Drawings E2 – E5** show final contours and **Drawings EC1 – EC3** show 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. The CQA plan must be followed (see **Section 4.0**) 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 33% (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. Past experience indicates that on-site soils may not meet the required field permeability of not more than 1.0 x 10^{-5} cm/sec, as supported by the laboratory data for the soils discussed in **Section 4.0**. Tentative final closure plans have assumed that on-site soils will be used for the compacted barrier layer – alternative cap designs may be researched and submitted for Division approval at a future time.

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.