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3/13/14 *(CS)*

LANDFILL DISPOSAL EFFICIENCY REPORT



CONSTRUCTION & DEMOLITION DEBRIS LANDFILL

Dewberry Project # 50046799

June 2012

SUBMITTED BY:

Dewberry & Davis, Inc.

2301 Rexwoods Drive

Suite 200

Raleigh, NC 27607

919.881.9939

919.881.9923 fax

NC License No.: F-0679

SUBMITTED TO:

County of Brunswick

P.O. Box 249

179 March 9, 1764 Drive Northeast

Bolivia, NC 28422



Dewberry & Davis, Inc.
2301 Rexwoods Drive, Suite 200
Raleigh, NC 27607-3366
919.881.9939
919.881.9923 fax
www.dewberry.com

June 28, 2012

Mr. Geof Little
Division of Waste Management
NC Department of Environment and Natural Resources
1646 Mail Service Center
Raleigh, NC 27699-1646



**Reference: Brunswick County, North Carolina C&D Debris Landfill
Landfill Disposal Efficiency Report
Dewberry Project # 50046799**

Dear Geof:

Dewberry & Davis, Inc. (Dewberry) has prepared a Landfill Disposal Efficiency Report for the Brunswick County Construction and Demolition Debris Landfill. This report addresses the occupied airspace for the period between September 28, 2009 and July 20, 2011. The report also discusses the estimated remaining capacity of the C&D Debris Landfill. Please find enclosed two (2) copies of the report for your review.

Should you have any questions or concerns, please call our office (919) 881-9939.

Sincerely,

Dewberry & Davis, Inc.

Matthew B. West, P.E., LEED AP
Project Manager

Enclosures

Cc: Wes Hare, Division of Waste Management
Stephanie Lewis, Brunswick County
Jeremy Baker, Brunswick County



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1. INTRODUCTION

Dewberry & Davis, Inc. (Dewberry) has performed a landfill disposal efficiency report for the Brunswick County C&D Debris Landfill (landfill) which is currently operational. The facility permit number for Phases 1-6 is No. 10-07. The facility permit expires on March 28, 2014. This landfill disposal efficiency report evaluates the period from September 28, 2009 to July 20, 2011. An intermediate check of the landfill disposal efficiency is provided based on the March 24, 2010 aerial survey of the landfill.

A survey was performed on July 20, 2011 for the Phases 6A and 6B areas. The Phases 6A and 6B areas have been receiving C&D debris since January 2005.

A composite survey was developed by combining the July 20, 2011 survey of these areas with the previous survey. This survey along with the survey dated September 28, 2009 and the final permitted grades for Phases 6A, 6B, and 6C comprise the data set analyzed in this report.

2. BACKGROUND AND PURPOSE

The Municipal Solid Waste portion of the landfill was closed on December 31, 1997 (Permit No. 10-04). Phase 1 of the C&D Debris Landfill was initially permitted, and subsequent phases were permitted as additional capacity was required. The capacity provided by each phase is as follows:

Phase 1 and Phase 1-New	223,500 cy
Phase 3	53,100 cy
Phase 4	133,700 cy
Phase 5	147,000 cy
Phases 6A, 6B, and 6C	<u>588,800 cy</u>
Total	1,146,100 cy

This report includes waste placed into Phase 6A and Phase 6B from September 2009 to July 2011 to determine the landfill efficiency for this period.

Brunswick County (County) entered into a contract with Sandlands Landfill during fiscal year 2007 – 2008. The County currently has a temporary loading operation on top of the C&D debris landfill which is permitted under Permit No. 10-07. C&D waste is loaded into containers and transferred by a contract hauler to Sandlands Landfill. This operation allows the County to divert a portion of the C&D waste stream in order to extend the life of the landfill. C&D waste diversion can continue in this manner as long as the landfill is operational. Sandlands Landfill went out of business in 2012. The County has now contracted with Waste Industries to divert a portion of the C&D debris waste stream through the MSW Transfer Station.

The purpose of this report is to:

- Estimate the change in total occupied airspace.
- Estimate the total remaining airspace (and the total remaining useable airspace) volume based on the design capacity.
- Estimate the remaining life expectancy of the landfill.

3. DISCUSSION

The July 20, 2011 topographic survey for the landfill is shown on Drawing 1. This survey is a composite survey as noted on Drawing 1. As noted in the Landfill Disposal Efficiency Report – September 2009, dated March 30, 2010, the shelf (bench) located on the north side of the landfill at elevation 80 has not been constructed. There are two potential options that should be considered to add the shelf. Option 1 would require the shelf be constructed at the current grade. Option 2 would require the shelf to be constructed at elevation 80 as shown on Supplement No. 9. We would like to discuss these options with the County as soon as possible. The addition of the shelf will greatly aid the County establish ground cover during landfill closure. Also, differential settlement in excess of that typically observed is noted for the C&D debris landfill during this period.

3.1 C&D Debris Waste Stream Summary

The landfill tonnage reports for July 1, 2009 through June 30, 2010 and July 1, 2010 through June 30, 2011 are included in Appendix A. The categories of C&D debris, trailers, asbestos, and shingles are disposed into the landfill. The total C&D debris disposed into the landfill is estimated to be 23,272 tons for the period of September 28, 2009 through July 20, 2011.

The total C&D debris received during the fiscal year of July 1, 2009 through June 30, 2010 was 24,825 tons. Of this total, 15,054 tons of C&D debris was disposed into the landfill and 9,771 tons of C&D debris was transferred to Sandlands Landfill. This represents a 37% decrease in C&D debris received at the landfill and a 44% decrease in C&D debris disposed into the landfill from the fiscal year July 1, 2008 through June 30, 2009.

The total C&D debris received during the fiscal year of July 1, 2010 through June 30, 2011 was 18,749 tons. Of this total, 11,272 tons of C&D debris was disposed into the landfill and 7,477 tons of C&D debris was transferred to Sandlands Landfill. This represents a 24% decrease in C&D debris received at the landfill and a 25% decrease in C&D debris disposed into the landfill from the fiscal year July 1, 2009 through June 30, 2010. The decrease in C&D debris received and disposed can likely be attributed to the reported decline in the local building industry and the C&D waste diversion operation.

To determine the amount of airspace used, surfaces were developed using the September 28, 2009 survey and the July 20, 2011 survey. A three-dimensional comparison (Drawing 2) provided the volume of C&D debris and cover placed for the period between the September 28, 2009 survey and the July 20, 2011 survey. The landfill disposal efficiency was calculated using the September 28, 2009 survey and the July 20, 2011 survey.

To determine the remaining volume of the landfill, a surface was developed using the July 20, 2011 survey to compare against the surface developed from the final permitted grades for Phases 6A, 6B, and 6C. A three-dimensional comparison (Drawing 3) provided the remaining airspace in the landfill.

3.2 Occupied Airspace

From the comparison of surfaces from the September 28, 2009 survey and the July 20, 2011 survey, the total occupied airspace was 42,652 cubic yards (cy). This equates to approximately 1,964 cy/month fill rate for the period September 28, 2009 to July 20, 2011. This comparison is shown on Drawing 2.

3.3 Useable Airspace

From the comparison of surfaces of the July 20, 2011 survey and the final permitted grades of Phases 6A, 6B, and 6C 308,088 cy of total airspace remain. This comparison is shown on Drawing 3. The remaining airspace in Phase 6A

and 6B, including the final cap, is approximately 207,223 cy. The remaining airspace in Phase 6C, excluding the final cap, is approximately 100,865 cy.

With the assumptions the final cap for the C&D debris landfill closure will be 3.5 feet deep consisting of intermediate cover, geocomposite liner (GCL), protective cover, and vegetative layer as described in "Supplement No. 9 to the Brunswick County Municipal Solid Waste Landfill Transition Plan" (Supplement No. 9) and the final design surface area is approximately 16 acres for 6A, 6B, and 6C only, the final cap volume for these areas will be approximately 90,740 cy. To determine the useable airspace for these phases, the final cap volume must be subtracted from the available airspace. This equates to 217,348 cy of useable airspace, assuming grades shown in Supplement No. 9 are the final grades. Final grades may have to be adjusted and a revised permit requested to account for any additional volume or other change prior to closure.

Supplement No. 9, states the landfill will reach its ultimate capacity in 2008. However, the County has continued to experience a declining C&D waste stream and has been transferring C&D waste to Sandlands Landfill since 2007 (currently through the MSW Transfer Station by Waste Industries). Assuming a flat rate of growth (25,000 tons/year) and no diversion, it is projected that the landfill will reach its ultimate capacity in 2015. Variables that will affect this capacity date include compaction, additional changes in the volume of the C&D debris stream, and operational changes such as C&D transfer and recycling.

3.4 Landfill Disposal Efficiency

The compaction rate for the period between September 28, 2009 and July 20, 2011 is determined by approximating the weight (pounds) of C&D debris per volume (cubic yards) of airspace occupied by C&D debris and daily cover. For the period between September 28, 2009 and July 20, 2011 a prorated weight of 23,272 tons of C&D debris disposed into the landfill will be used. From the comparison of the September 28, 2009 and July 20, 2011 surveys, it was determined 42,652 cy of airspace has been used.

The compaction rate for the period between September 28, 2009 and July 20, 2011 can then be determined as follows:

$$\text{Compaction Rate} = (23,722 \text{ tons} / 42,652 \text{ cy}) * 2,000 \text{ lbs/ton} = 1,091 \text{ lbs/cy}$$

The efficiency study analysis providing data used and assumptions made is included in Appendix B.

3.5 Remaining Landfill Life

Figure 1 is a plot of total C&D debris received at the C&D debris landfill and the total C&D debris disposed into the C&D debris landfill by time period. The amount of C&D debris received and disposed increased roughly 20% each year between 2001-2002 and 2005-2006. However, for 2006-2007 the amount of C&D debris received and disposed remained almost constant. The amount of C&D debris received and disposed has declined significantly since 2006-2007. The decline in C&D debris received and disposed is probably attributed to the reported decline in the local building industry and the C&D waste diversion operation. The decline in the C&D debris waste stream is allowing the landfill to remain open for a much longer period than predicted several years ago.

**Figure 1.
Construction and Demolition Debris Tonnage**

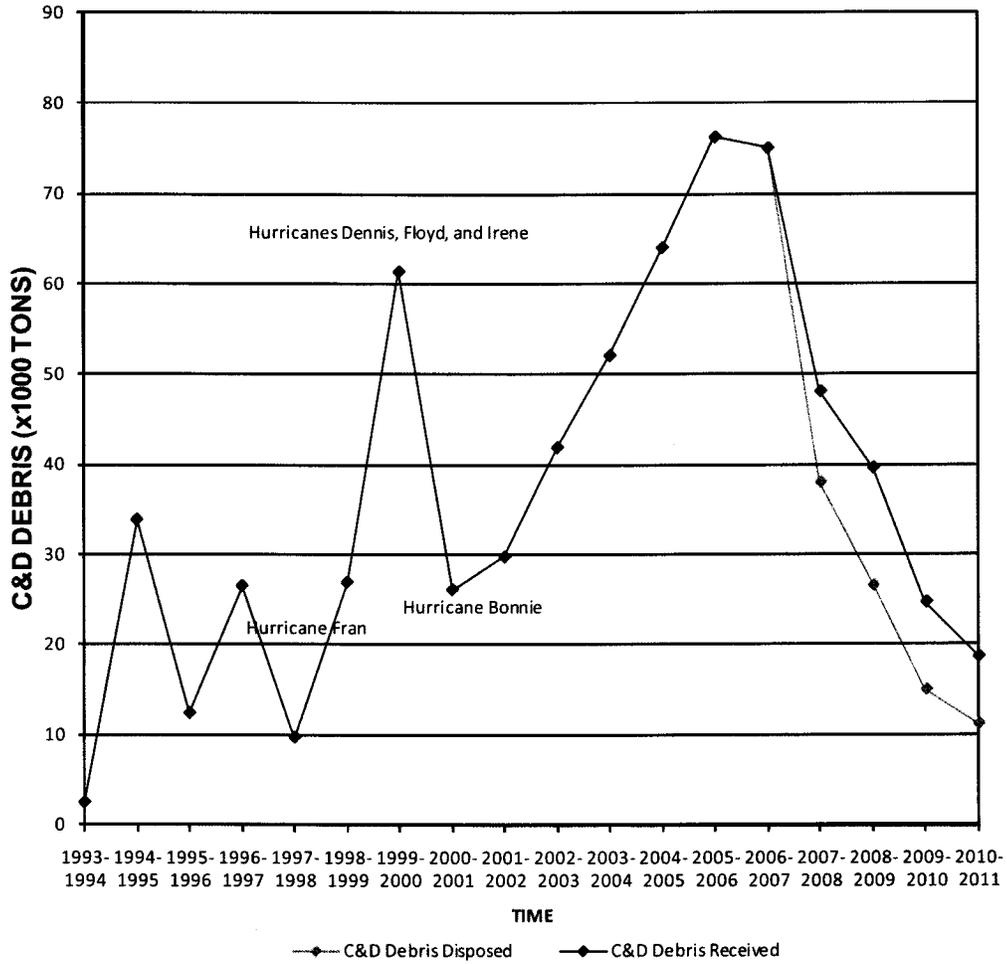


Table 1 provides three different scenarios for C&D debris disposal and a projection of the remaining capacity in the C&D Debris Landfill. A compaction rate of 1,100 lbs/cy and C&D debris disposal of approximately 25,000 tons/year being landfilled (45,500 cy/year) has been assumed.

**Table 1.
Projection of Remaining Capacity in C&D Debris Landfill**

Fiscal Year*	No Waste Stream Diversion (cy)	25% Waste Stream Diversion (cy)	50% Waste Stream Diversion (cy)
2011-2012	172,300	172,300	172,300
2012-2013	126,800	138,200	149,600
2013-2014	81,300	104,100	126,900
2014-2015	35,800	70,000	104,200
2015-2016		35,900	81,500

Fiscal Year*	No Waste Stream Diversion (cy)	25% Waste Stream Diversion (cy)	50% Waste Stream Diversion (cy)
2016-2017		1,800	58,800
2017-2018			36,100
2018-2019			13,400

* All projections assume no growth in the C&D waste stream.

The remaining useable airspace in the landfill is approximately 217,348 cy. It is estimated that landfill will reach its ultimate capacity sometime in 2014 if the C&D debris waste stream growth remains flat and no C&D debris is transferred. The County currently has an operation to divert and recycle a portion of the C&D debris waste stream. If 25% of the C&D debris waste stream is diverted and growth remains flat, the landfill will reach its ultimate capacity in 2016. If as much as 50% of the C&D debris waste stream can be diverted and growth remains flat, the landfill will reach its ultimate capacity in 2019.

Brunswick County has amended its C&D debris landfill permit to prohibit sources from outside the County from placing waste in the C&D Debris Landfill. The current facility is permitted through March 28, 2014. The current permit includes the operation of the C&D Debris Landfill, temporary transfer of C&D debris, and the C&D recycling pad. The County has not yet constructed the C&D recycling pad. The County will have to submit an application for a permit renewal no later than September 30, 2013.

4. APPENDICES

APPENDIX A – C&D Debris Tonnage Reports
APPENDIX B – Efficiency Study Analysis

APPENDIX A

Appendix A

C&D Tonnage Report for July 1, 2009 - June 30, 2010

MATERIAL	TICKETS	POUNDS	TONS
TRAILERS N	22	0	108
TRAILER AC	1	0	2
C & D	9,143	44,458,298	22,229
C&D HAULED	776	19,543,120	9,772
ASBESTOS	20	100,100	50
SHINGLES	1,154	4,871,700	2,436

Total C&D Debris Received	24,825
Total C&D Debris Hauled	9,772
Total C&D Debris Landfilled	15,054

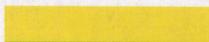
 Denotes total C&D debris waste stream
 Denotes C&D debris waste stream hauled

Appendix A

C&D Tonnage Report for July 1, 2010 - June 30, 2011

MATERIAL	TICKETS	POUNDS	TONS
TRAILERS N	13	0	63
TRAILERS AC	1	0	1
C&D	7,644	31,962,320	15,981
C&D HAULED	707	14,954,900	7,477
ASBESTOS	14	36,700	18
SHINGLES	1,276	5,369,100	2,685

Total C&D Debris Received	18,749
Total C&D Debris Hauled	7,477
Total C&D Debris Landfilled	11,271

 Denotes total C&D debris waste stream
 Denotes C&D debris waste stream hauled

APPENDIX B

Appendix B
Brunswick County Landfill Disposal Efficiency Report
Construction and Demolition Debris
Period: September 28, 2009 - July 20, 2011
Efficiency Study Analysis

	Total Received (Tons)	Hauled (Tons)	Total Landfilled (Tons)	Tons Landfilled per Month	% Hauled
FY 09-10	24,825	9,771	15,054	1,255	39%
FY 10-11	18,749	7,477	11,272	939	40%
Total	43,574	17,248	26,326		

September 28, 2009 - July 20, 2011 (Time evaluated for Efficiency Study)

0.07 Percentage of September 2009 Waste Considered for Efficiency Study

0.67 Percentage of July 2011 Waste Considered for Efficiency Study

21.72 Number of Months Considered for Efficiency Study

FY 09-10 (Sept. 28 - June 30)	18,757 Tons Received during Efficiency Study Period (September 28, 2009 - July 20, 2011)
FY 10-11	18,749 Tons Received during FY 10-11
FY 11-12 (July 1 - July 20)	1,042 Total Received from July 1, 2011 - July 20, 2011 (Prorated based on FY 10-11 data)

38,547 Total Tons Received during Efficiency Study Period

FY 09-10 (Sept. 28 - June 30)	7,383 Tons Hauled during Efficiency Study Period (September 28, 2009 - July 20, 2011)
FY 10-11	7,477 Tons Hauled during FY 10-11
FY 11-12 (July 1 - July 20)	415 Total Hauled from July 1, 2011 - July 20, 2011 (Prorated based on FY 10-11 data)

15,275 Total Tons Hauled during Efficiency Study Period

FY 09-10 (Sept. 28 - June 30)	11,374 Tons Landfilled during Efficiency Study Period (September 28, 2009 - July 20, 2011)
FY 10-11	11,272 Tons Landfilled during FY 10-11
FY 11-12 (July 1 - July 20)	626 Total Landfilled from July 1, 2011 - July 20, 2011 (Prorated based on FY 10-11 data)

23,272 Total Tons Landfilled during Efficiency Study Period

42,652 Total CY Landfilled during Efficiency Study Period (from volume calculations)

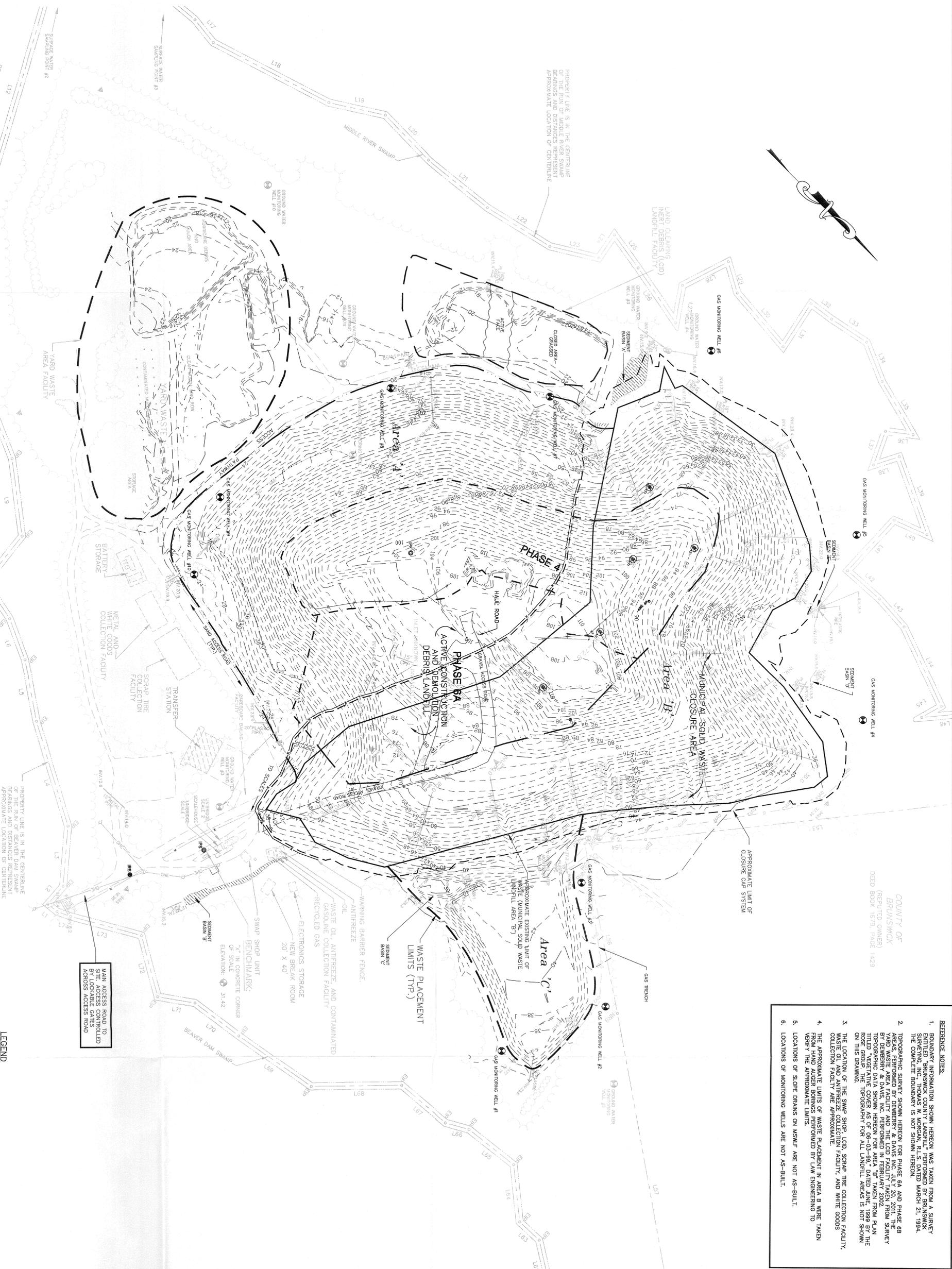
1,964 cy/month fill rate

1,091 lbs/cy - LANDFILL DISPOSAL EFFICIENCY

**BRUNSWICK COUNTY
CONSTRUCTION AND DEMOLITION
DEBRIS LANDFILL**
2012 LANDFILL
DISPOSAL EFFICIENCY REPORT

179 MARCH 9, 1764 DRIVE NE
BOLIVIA, NORTH CAROLINA 28422

- REFERENCE NOTES:**
- BOUNDARY INFORMATION SHOWN HEREON WAS TAKEN FROM A SURVEY PERFORMED BY THOMAS W. MORGAN, R.L.S. DATED MARCH 21, 1994. THE COMPLETE BOUNDARY IS NOT SHOWN HEREON.
 - TOPOGRAPHIC SURVEY SHOWN HEREON FOR PHASE 8A AND PHASE 8B WASTE AREA FACILITY AND THE LOD FACILITY TAKEN FROM SURVEY BY DEWBERRY & DAVIS, INC. PERFORMED IN FEBRUARY 2002. TITLED "VEGETATIVE COVER AS OF 06-03-97" DATED FROM PLAN THE ROSE GROUP. THE TOPOGRAPHY FOR ALL LANDFILL AREAS IS NOT SHOWN ON THIS DRAWING.
 - THE LOCATION OF THE SWAP SHOP, LOD, SCRAP TIRE COLLECTION FACILITY, WASTE OIL AND ANTI-FREEZE COLLECTION FACILITY AND WHITE GOODS COLLECTION FACILITY ARE APPROXIMATE.
 - THE APPROXIMATE LIMITS OF WASTE PLACEMENT IN AREA B WERE TAKEN FROM HAND AUGER BORINGS PERFORMED BY LAW ENGINEERING TO VERIFY THE APPROXIMATE LIMITS.
 - LOCATIONS OF SLOPE DRAINS ON MSWLF ARE NOT AS-BUILT.
 - LOCATIONS OF MONITORING WELLS ARE NOT AS-BUILT.



LEGEND
--- PROPERTY LINE IS IN THE CENTERLINE OF THE RUN OF BEAVER DAM SWAMP BEARINGS AND DISTANCES REPRESENT APPROXIMATE LOCATION OF CENTERLINE
--- MAJOR CONTOURS FROM JULY 20, 2011 SURVEY
--- MINOR CONTOURS FROM JULY 20, 2011 SURVEY

REVISIONS

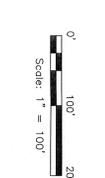
No.	DATE	BY	Description

DRAWN BY: CRC
APPROVED BY: MBW
CHECKED BY: MBW
DATE: JUNE 2012

TITLE
TOPOGRAPHIC
SURVEY
PERFORMED
JULY 20, 2011

PROJECT NO.: 50046799

SHEET NO.



DRAWING 1

**BRUNSWICK COUNTY
 CONSTRUCTION AND DEMOLITION
 DEBRIS LANDFILL**

**2012 LANDFILL
 DISPOSAL EFFICIENCY REPORT**

179 MARCH 9, 1764 DRIVE NE
 BOLIVIA, NORTH CAROLINA 28422

SCALE



KEY PLAN

No.	DATE	BY	Description

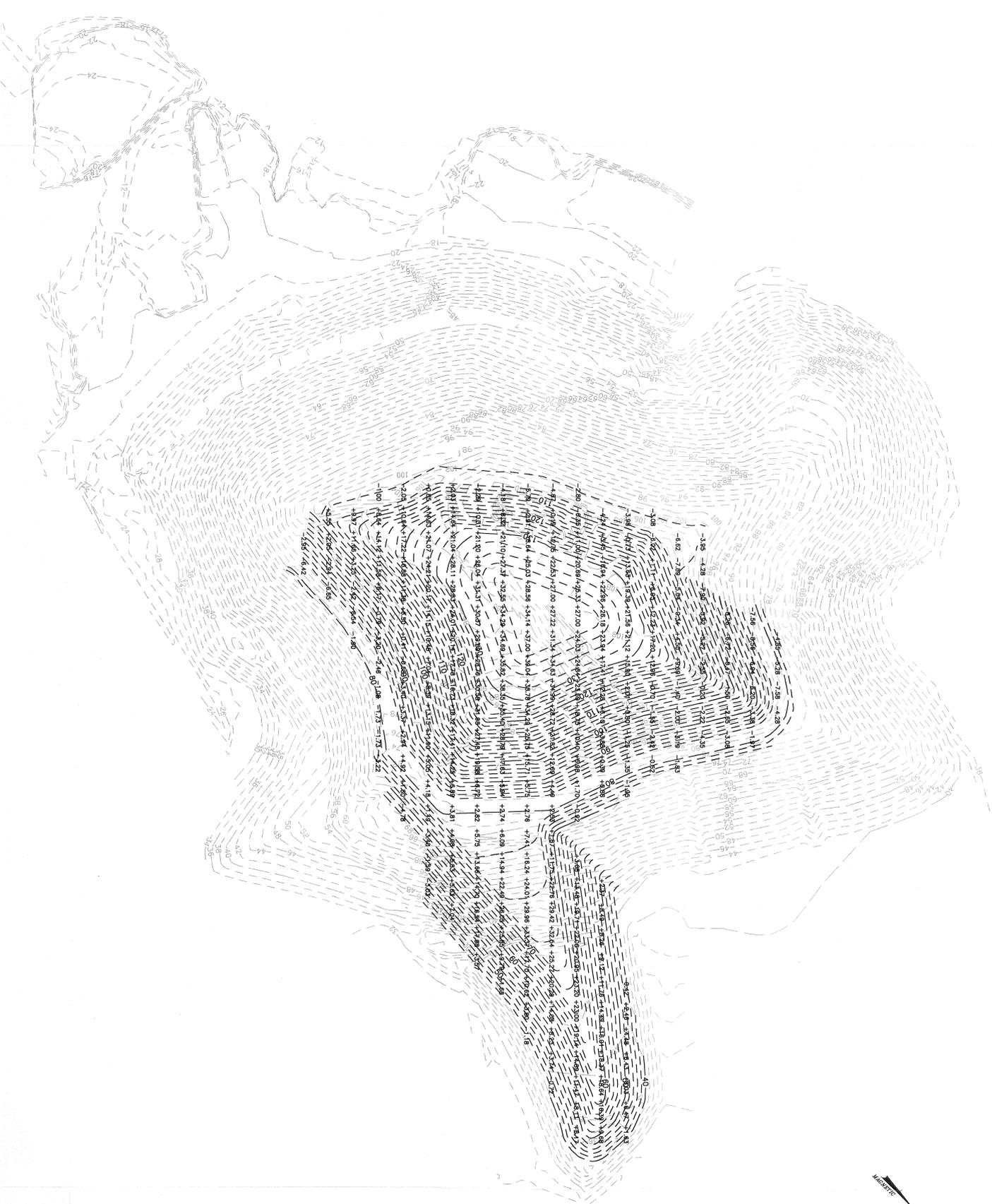
DRAWN BY: CRG
 APPROVED BY: MHW
 CHECKED BY: MHW
 DATE: JUNE 2012

TITLE
**COMPARISON OF
 JULY 20, 2011 SURVEY TO
 PROPOSED FINAL GRADES
 (PHASE 6A, 6B, AND 6C)**

PROJECT NO. 50046799

DRAWING 3

SHEET NO.



LEGEND

--- CONTOURS FROM JULY 20, 2011 SURVEY
 - - - PROPOSED FINAL CONTOURS
 +17.86 DIFFERENCE IN ELEVATION
 NOTE: VALUE CALCULATIONS BASED ON 10'-14" GRID AREA. GRID LABELS SHOWN ON THIS DRAWING ARE BASED ON 50'-50" GRID AREA FOR CLARITY PURPOSES ONLY.

