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NCBC GULFPORT
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FINAL LANDFILL COVER ASSESSMENT REPORT SITE 3 WITH TRANSMITTAL NCBC GULFPORT MS
7/27/2009
TETRA TECH NUS

TtNUS/TAL-09-71/1310-5.0

July 27, 2009

Project Number 01310

Commander, Southeast
Naval Facilities Engineering Command Southeast
Attn: Robert Fisher (Code OPG6)
Remedial Project Manager
NAS Jacksonville
Building 903
Jacksonville, FL 32213-0030

Reference: CLEAN Contract No. N62467-04-D-0055
Contract Task Order No. 0106

Subject: Final Landfill Cover Assessment Report
Site 3 Northwest Landfill
Naval Construction Battalion Center Gulfport
Gulfport, Mississippi

Dear Mr. Fisher:

This Final Landfill Cover Assessment Report has been prepared by Tetra Tech NUS, Inc. (TtNUS), under the Comprehensive Long-Term Environmental Action Navy (CLEAN) IV, Contract No. N62467-04-D-0055 of Naval Facilities Engineering Command Southeast (NAVFAC SE). This report presents the results of the Landfill Cover Assessment at Site 3 Northwest Landfill (Site 3, shown in Figure 1) at Naval Construction Battalion Center (NCBC) Gulfport conducted in 2008 and addresses the comments received from the Navy and Mississippi Department of Environmental Quality (MDEQ). Comments received as well as the responses to comments are included in Appendices A and B.

According to the historical data, the Site 3 landfill was in operation from 1948 to 1966. During this time, nearly all of the solid waste and some of the liquid and chemical waste generated at NCBC Gulfport (an estimated 30,000 tons of solid waste, including some additional liquid wastes), were disposed of in this unlined landfill. The landfill was a trench-and-fill operation with daily burning of wastes. Additional information about the site use and history can be found in the Draft Remedial Investigation Report for Site 3, which was issued in July, 2008.

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RATIONALE FOR ASSESSMENT

According to the United States Environmental Protection Agency (USEPA) (*Presumptive Remedies: Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Landfill Caps*, 1995), containment is chosen as the remedial action in approximately 75 percent of all solid waste landfill sites. This finding lead USEPA to issue guidance to streamline and focus the investigation and remedy selection process, now collectively referred to as the Presumptive Remedy Process (*Conducting Remedial Investigation/Feasibility Studies (RI/FS) for CERCLA Municipal Landfill Sites*, USEPA, 1991). The guidance was revised in 1993 (*Presumptive Remedies: Policies and Procedures*, USEPA, 1993) to increase the consistency in remedy selection and to further streamline the investigation process. Most importantly, in relation to potential remedial actions for Site 3 at NCBC Gulfport, the USEPA expanded this guidance to include military landfills with exceptions noted for military-specific hazardous wastes (e.g. chemical warfare agents, ordnance, and radiological disposal) (*Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills*, USEPA, 1996). This guidance provides the framework for the current RI and FS documents in preparation for Site 3.

However, in 2002 a re-evaluation of previous investigations of the solid waste landfills at NCBC Gulfport determined that the Presumptive Remedy Process was the best course of action for these sites, especially Site 3, based on the characteristics of the materials in the landfill and the low concentrations of the contaminants reported in the surficial aquifer. A containment presumptive remedy, based on a low permeability soil cover, will be tailored to address the remedial action objectives for Site 3, which includes preventing direct exposure to buried waste and minimizing infiltration of surface water into the disposal cells. The preliminary remedial action objectives can be found in the Draft RI (TtNUS, 2008).

The presumptive remedy process as described in the *Presumptive Remedies: CERCLA Landfill Caps RI/FS Data Collection Guide* (USEPA, 1995) identifies six technical areas that are pertinent to landfill cap design typical for most municipal waste disposal sites. The six areas are listed below, including where in the environmental investigation process they are addressed for Site 3:

<u>Waste area delineation:</u>
The delineation of the area where waste was disposed was assessed in the RI for the site.

<u>Slope stability and settlement</u>:
The technical specifications regarding the slope stability and settlement will to be evaluated as part of the remedial design.

<u>Gas generation and migration</u>:
Data regarding the landfill gas survey, conducted in 2008, is presented in this report.

Existing cover assessment:

Data regarding the geotechnical investigation, conducted in 2008, is presented in this report.

Surface water run-off management:

Surface water and storm water runoff will be evaluated as part of the remedial design.

Clay sources:

To be evaluated as part of the remedial design.

Following the evaluation of Presumptive Remedy Guidance, site history, remedial investigation, and the data presented in this report, the primary action will be the modifications made to the current cover to incorporate soil with a lesser permeability than the current cover, non native and unprocessed as required by *Regulation SW-2: Solid Waste Management and Criteria (*MCEQ, 2005).

LANDFILL GAS EVALUATION

The landfill gas survey was conducted in 2008 to detect generation of landfill gases to determine if the final cover would need to include a gas collection/venting system. The evaluation included the collection and field analysis of vadose zone gas samples from five locations at Site 3 (Figure 2). Locations were evenly spaced over the disposal area, including the area where the chlorinated volatile organic compound (CVOC) plume was delineated during the RI.

The vadose zone sampling was conducted with an expendable probe system because of potential for the water table to be very close to the ground surface. The sampling probe tip was attached to a length of teflon tubing and was driven with a slide hammer to a depth of 1 foot (2 feet at 03LG02 due to the softness of the soil), and the surface annular space was sealed with clay. A GEM 2000 landfill gas monitor was attached to the tubing and was used to purge the system. The GEM 2000 was used to monitor concentrations of methane (% CH_4), oxygen (% O_2) and carbon dioxide (% CO_2). Readings were recorded at two time intervals (at 5 and 10 minutes elapsed time) and compared, as shown in Table 1. At each sampling location, the readings showed that the vadose zone gas concentrations had stabilized. Then a Multi-Rae multi-gas meter was attached to the tubing and readings were recorded for oxygen (%O_2), methane lower explosive limit (% LEL), volatile organic compounds (photoionization detector [PID] in parts per million [ppm]), carbon monoxide (ppm CO), and hydrogen sulfide (ppm H_2S).

Based on guidance from the USEPA (*Data Requirements for Selecting Remedial Action Technology*, USEPA, 1987), active gas collection/venting is generally required when vadose zone methane concentrations exceed either:

- 5% methane at the property line or cap edge, or
- 25% lower explosive limit (LEL) in or at onsite structures.

The methane concentrations at the five vadose zone sampling locations at Site 3 were less than the instrument detection levels for both methane concentration (% CH_4) and LEL.

EXISTING COVER ASSESSMENT

The existing cover assessment included evaluation of field logs from RI sampling to describe the type, horizontal extent, and thickness of cover material currently at Site 3 and the collection and analysis of geotechnical samples for vertical hydraulic conductivity and grain size analysis. A work plan for geotechnical sample collection was submitted on September 4, 2008, and further information regarding the soil logs can be found in the RI (TtNUS, July 2008).

Description of Existing Cover Material

Soil logs were prepared during the RI sampling events for ten surface soil sample locations - 03SS01 to 03SS10, and eleven soil boring locations - 03SB01 to 03SB08 and 03SB11 to 03SB13 (Figure 3). The lithologic descriptions in these logs were evaluated to determine the nature and thickness of fill material at Site 3. The soil logs are included as Appendix C.

The surface soil samples (0-1 foot in depth) were collected from within the waste disposal area identified by the geophysical survey to determine if contaminants were present in the existing soil cover. The soil boring locations were selected to coincide with the margins of the waste area and provide a cross-sectional characterization of the shallow subsurface across the site. Three of the soil borings, 03SB01, 03SB02, and 03SB03, were located to verify whether the waste types observed in the disposal area correspond with the reported operating history and the municipal waste definition. A lithology summary is presented as Table 2 to summarize the evaluation of the soil logs.

Figure 3 shows the observed thickness of the cover at each of the sample locations, as well as the location of topographic features on the Golf Course that indicate additional cover material.

At three locations southeast of the golf cart path, the existing cover was 1 ft (03SB02) or less (03SS07 and 03SS09) in thickness, with landfill material observed in the samples.

At the majority of the sampling locations on the golf course northwest of the cart path, at least one foot of fill material was reported overlying native soil. This fill material was typically brown or orange-tan silty sand.

At the three soil boring locations at the southern edge of the site adjacent to 8th Street (03SB11, 03SB12, and 03SB13), native soil material was present at all horizons.

At the west and east ends of the disposal area, elevated areas of the golf course result in increased cover thickness. These areas were mapped in the topographic survey and the relief above the adjacent areas is shown in feet. Two additional areas of increased cover thickness north of 8th Street are also shown. The soil pile and gravel pile shown were not surveyed because they are assumed to be temporary, rather than a permanent part of the golf course design.

Geotechnical Sampling and Analysis

The geotechnical investigation was conducted in 2008 to determine if the current surface soil could be integrated into a final cover. At total of five surface soil samples (0-2 feet deep) were collected using Shelby tubes (as shown in figure 2). The Shelby tube samples allow collection of in-situ soil horizons to aid in an accurate determination of vertical hydraulic conductivity (K) in a controlled environment. Upon completion of hydraulic conductivity measurements, the soils in the Shelby tube samples were extracted and used in a grain size analysis to aid in the engineering evaluation. One sample was taken from the waste disposal area (03GT001), to evaluate the current cover material, two samples were taken from nearby the disposal areas (03GT004 and 03GT005) and two were taken from undisturbed soils (03GT002 and 03GT003) to gather information regarding the native soils. The results of the geotechnical analyses are summarized in Table 3. Additionally, the geotechnical laboratory report is included as Appendix D.

The vertical hydraulic conductivity values in the Site 3 samples ranged from 1.9×10^{-4} centimeter per second (cm/sec) to 4.8×10^{-6} cm/sec, with a geometric mean of 4.6×10^{-5} cm/sec and an average of 8.9×10^{-5} cm/sec. Three of the samples, 03GT001, 03GT003, and 03GT004, had K values in the 10^{-5} cm/sec range. The highest K value, 1.9×10^{-4} cm/sec, was from 03GT002, which was collected from the least disturbed area of the site and could be attributed to native soil.

Grain size samples of the current cover were evaluated to determine how much the current soil would have to be amended to meet the ideal grain size curve for the low permeability layer. Other than sample 03GT004, which had the lowest K (4.8×10^{-6} cm/sec) and the highest percentages of silt and clay (43% + 5%) and the lowest percentage of sand (51%), there was no direct correlation between K and grain size in the geotechnical samples. Sample 02GT002 had the second highest silt and clay percentages (21% + 14%) but also the highest K value.

CONCLUSIONS AND RECOMMENDATIONS

The landfill gas evaluation indicates that little or no gas generation is occurring at Site 3. Given the age and relatively small size of the landfill, the results were as expected. Based on the findings of this assessment, it is unlikely that venting or gas collection will be required. The final determination of the need for further sample collection or landfill gas treatment will be addressed in the FS and remedial design and will be contingent on the final cover design.

Soil descriptions logged during the collection of surface soil samples and soil borings indicate that at least 1 foot of clean fill is present over most of the waste disposal area.

Solid waste (40 CFR) guidelines for a low permeability soil cover, the major component of the waste containment strategy at Site 3, specify cover criteria for landfill closure of non permitted landfills. The landfill cover should be less permeable than the liner (whether natural or man made) with a maximum permeability of 1×10^{-5} cm/sec for landfills containing a liner of unknown permeability.

The existing cover assessment indicates that some parts of the existing cover have permeabilities less than 1×10^{-5} cm/sec, although permeability values range over two orders of magnitude.

The data evaluated in this study will be incorporated into the FS and Remedial Design for Site 3. To achieve the goals of preventing direct exposure to buried waste and minimizing infiltration of surface water into the disposal cells, the final cover will have a lower permeability than the current cover and will be applied uniformly to achieve the designed final surface grade. However, the design requirements may be altered based on regulatory agency comments/approval.

If you have any questions regarding the information presented in this final letter report, please contact me by phone at (850) 385-9899 or via e-mail at Yarissa.Martinez@tetratech.com.

Cordially,

Yarissa Martinez, P.E.
Acting Task Order Manager

Attachments: REFERENCES
FIGURES
TABLES
APPENDIX A – COMMENTS AND RESPONSE TO COMMENTS FROM MDEQ
APPENDIX B – COMMENTS AND RESPONSE TO COMMENTS FROM THE NAVY
APPENDIX C – SOIL LOGS
APPENDIX D – GEOTECHNICAL LABORATORY DATA

c: Gordon Crane, NCBC Gulfport
Bob Merrill, MDEQ
Debbie Humbert (Cover Letter Only)
Mark Perry/File (Unbound)

REFERENCES

REFERENCES

MCEQ, 2005. *Regulation SW-2: Solid Waste Management and Criteria.* Mississippi Commission on Environmental Quality, April 2005.

TtNUS, 2008. Remedial Investigation Site 3. Tetra Tech NUS, Inc. July 2008.

USEPA, 1987. *Data Requirements for Selecting Remedial Action Technology*. U.S. Environmental Protection Agency. EPA/600/2-87/001.

USEPA, 1991. *Conducting RI/FS for CERCLA Municipal Landfill Sites.* EPA/540/P-91/001.

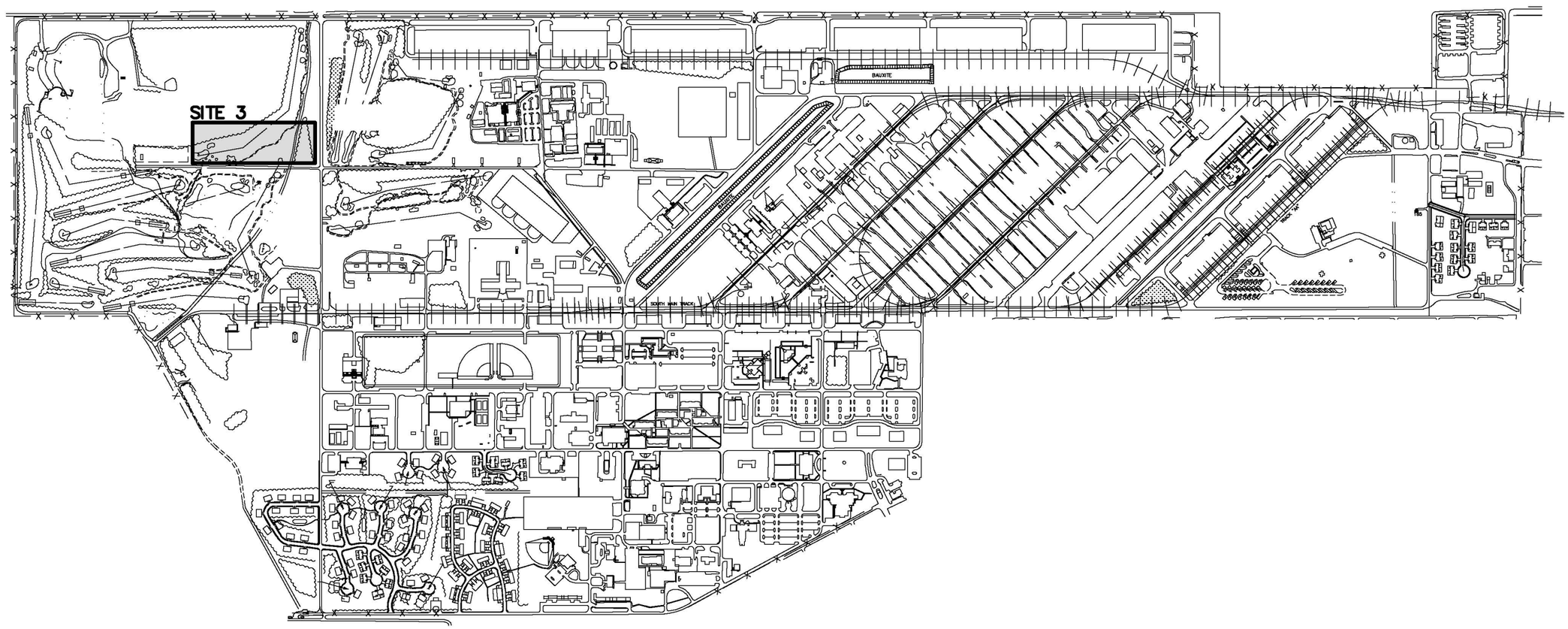
USEPA, 1993. *Presumptive Remedies: Policies and Procedures*, EPA/540/F-93/047.

USEPA, 1995. *Presumptive Remedies: CERCLA Landfill Caps RI/FS, Data Collection Guide.* EPA/540/F-95/009.

USEPA, 1996. *Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills*. EPA/540/F-96/020.

FIGURES

ACAD: 0464QM01.dwg 02/19/09 CK PIT



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SCALE IN FEET

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CHECKED BY DATE			OWNER NO.
REVISED BY DATE			APPROVED BY DATE
SCALE AS NOTED	NAVFAC		DRAWING NO. FIGURE 1 / REV. 0

FORM CADD NO. SDIV-BH.DWG - REV 1 - 9/10/98

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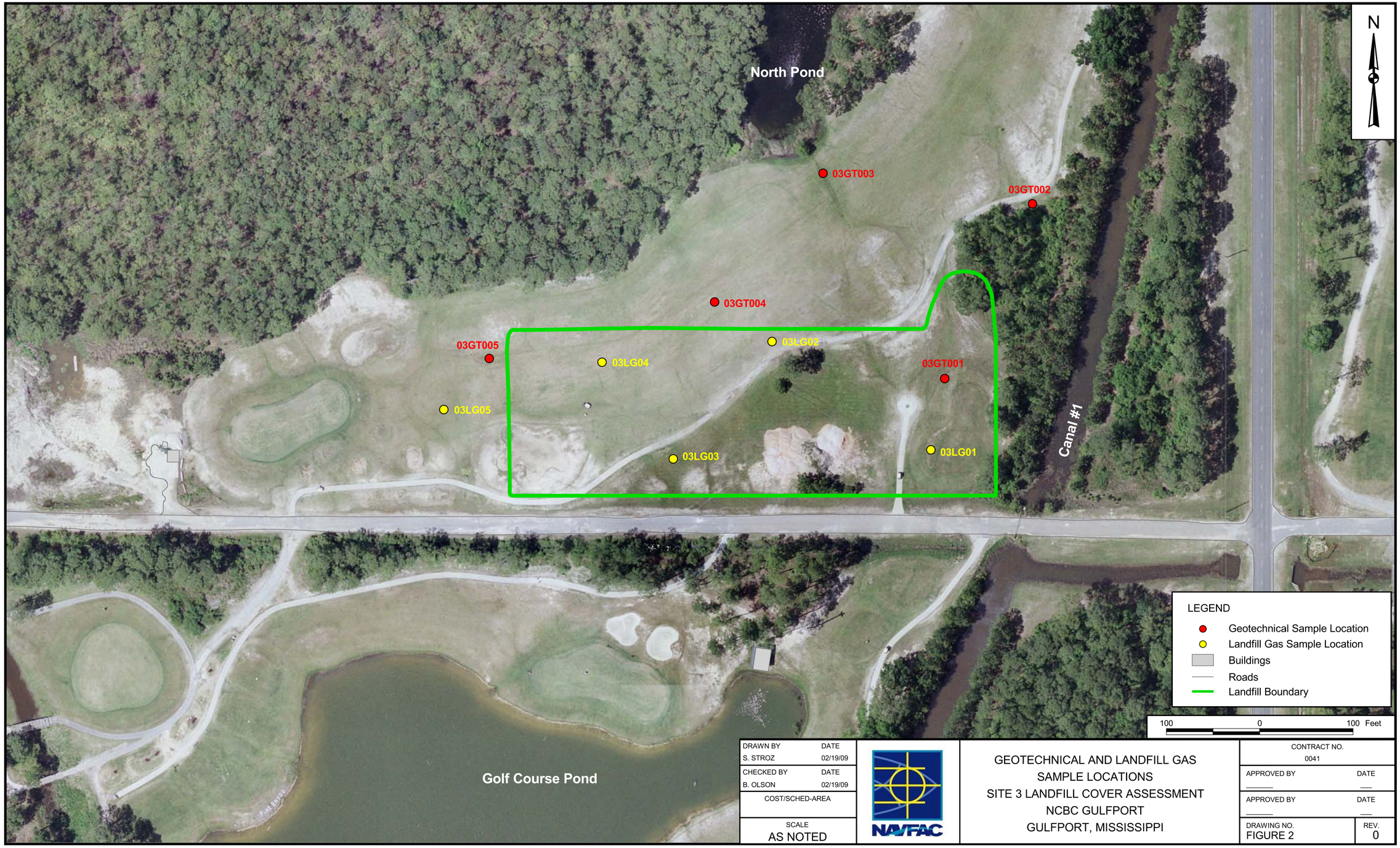

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S. STROZ	02/19/09
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B. OLSON	02/19/09
COST/SCHED-AREA	
SCALE	
AS NOTED	

NAVFAC

GEOTECHNICAL AND LANDFILL GAS
SAMPLE LOCATIONS
SITE 3 LANDFILL COVER ASSESSMENT
NCBC GULFPORT
GULFPORT, MISSISSIPPI

CONTRACT NO.	
0041	
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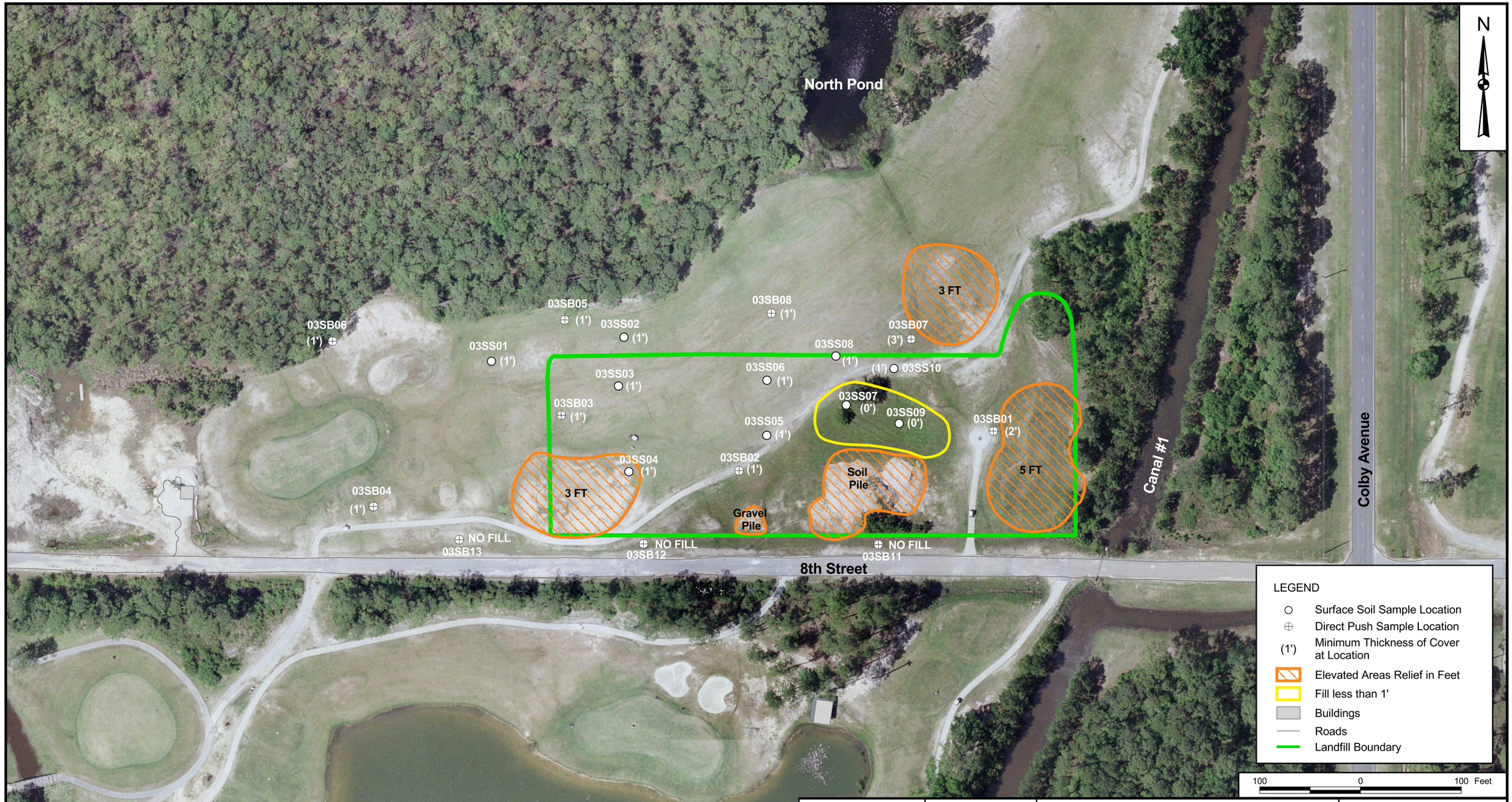

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S. STROZ	07/09/09
CHECKED BY	DATE
B. OLSON	07/10/09
COST/SCHED-AREA	
SCALE	
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NAVFAC

EXISTING COVER THICKNESS
SITE 3 LANDFILL COVER ASSESSMENT
NCBC GULFPORT
GULFPORT, MISSISSIPPI

CONTRACT NO.	
0041	
APPROVED BY	DATE
APPROVED BY	DATE
DRAWING NO. FIGURE 3	REV. 0

TABLES

TABLE 1

LANDFILL GAS MONITORING DATA
SITE 3 LANDFILL COVER ASSESSMENT REPORT
NCBC GULFPORT
GULFPORT, MISSISSIPPI

SAMPLE LOCATION	PROBE DEPTH	ELAPSED TIME	GEM 2000			Multi RAE				
			CH_4 (%)	CO_2 (%)	O_2 (%)	O_2 (%)	CO (PPM)	PID (PPM)	LEL (%)	H_2S (PPM)
03LG01	1 FT	5 min	00.0	0.8	19.4					
		10 min	00.0	0.8	19.4	19.8	10	0.0	0	0
03LG02	2 FT	5 min	00.0	4.3	16.8					
		10 min	00.0	4.2	17.0	17.5	0	0.0	0	0
03LG03	1 FT	5 min	00.0	0.4	19.4					
		10 min	00.0	0.4	19.2	20.3	41	0.0	0	0
03LG04	1 FT	5 min	00.0	1.9	17.6					
		10 min	00.0	1.6	17.7	19.3	0	0.0	0	0
03LG05	1 FT	5 min	00.0	2.5	16.9					
		10 min	00.0	2.5	16.8	19.0	0	0.0	0	0

Notes:

FT = Feet below land surface
min = Minutes
% = Percent concentration
PPM = Parts per million
CH_4 = Methane
CO_2 = Carbon Dioxide
O_2 = Oxygen
CO = Carbon Monoxide
PID = Photoionization Detector (Volatile Organics)
LEL = Lower Explosive Limit (of methane)
H_2S = Hydrogen Sulfide

TABLE 2

LITHOLOGY SUMMARY
SITE 3 LANDFILL COVER ASSESSMENT REPORT
NCBC GULFPORT
GULFPORT, MISSISSIPPI

SAMPLE LOCATION	DEPTH INTERVAL	COLOR	TEXTURE	COMMENTS
03SS01	0-12"	Brown	Clayey Sand	
03SS02	0-12"	Gray	Sand	
03SS03	0-12"	Orange/Tan	Clayey Sand	
03SS04	0-12"	Orange/Tan	Silty Sand	
03SS05	0-12"	Orange/Tan	Silty Sand	
03SS06	0-12"	Tan/Orange	Silty Sand	
03SS07	0-12"	Brown	Clayey Sand with Gravel	
03SS08	0-12"	Tan/Orange	Silty Sand with Clay	
03SS09	0-12"	Brown/Black	Sandy Clay with Pea Gravel	Metal bits and textile observed
03SS10	0-12"	Tan/Orange	Silty Sand	
03SB01	0-2'	Brown	Silty Sand	
	2-3'	Gray	Fine Sand	
03SB02	0-1'	Brown	Silty Sand	
	1-2'	Black	Asphalt/burned plastic	
	2-4'	White	Fine Sand	Clay Stringers/Glass
03SB03	0-1'	Brown	Silty Sand	
	1-3'	Tan	Clayey Silt	Organic Material
	3-4'	Tan	Clay	
03SB04	0-1'	Brown	Silty Sand	
	1-1.5'	Black	Silty Fine Sand	Wood Debris
	1.5-4'	White	Silty Fine Sand	
03SB05	0-1'	Brown	Silty Sand	
	1-3'	Orange	Clay	
	3-6'	Gray	Silty Fine Sand	
03SB06	0-2'	Brown	Silty Sand	
	2-5'	Gray	Fine Sand and Silty Fine Sand	
03SB07	0-3'		Sandy Fill	
	3-4'	Tan	Sandy Clay	
03SB08	0-1'	Brown	Silty Fine Sand	
	1-4'	Gray	Silty Fine Sand	Black Staining/Rock Fragments
	4-6'	Tan	Fine Sand and Silt	
03SB11	0-2'	Tan	Fine Sand	Mottled with brown
	2-3'	Brown	Silty Sand	
	3-6'	White	Fine Sand	
03SB12	0-2'	Gray/Brown	Fine Sand	Organic Material
	2-4'	Gray	Fine Sand	
03SB13	0-2'	Gray/Black	Silty Fine Sand	
	2-3'	Brown	Silty Sand	
	3-4'	Gray	Fine Sand	

TABLE 3

GEOTECHNICAL ANALYTICAL DATA SUMMARY
SITE 3 LANDFILL COVER ASSESSMENT REPORT
NCBC GULFPORT
GULFPORT, MISSISSIPPI

SAMPLE ID	AVERAGE HYDRAULIC CONDUCTIVITY (cm/sec)	MOISTURE CONTENT	GRAIN SIZE			
		%	Gravel %	Sand %	Silt %	Clay %
03GT001	5.5E-05	8.9	1	77	15	7
03GT002	1.9E-04	8.9	0	65	21	14
03GT003	2.5E-05	16.1	0	72	19	9
03GT004	4.8E-06	16.4	1	51	43	5
03GT005	1.7E-04	12.2	3	79	10	8

(cm/sec) = Centimeters per second

% = Percent by weight

APPENDIX A:

COMMENTS AND RESPONSES TO COMMENTS FROM MDEQ

STATE OF MISSISSIPPI
HALEY BARBOUR
GOVERNOR
MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY
TRUDY D. FISHER, EXECUTIVE DIRECTOR

30 March 2009

Robert Fisher
NAVFAC SE (OPG6)
PO Box 30, Bldg 903
NAS Jacksonville, FL 32212-0030

Re: Landfill Cover Assessment Report, Site 3 Northwest Landfill, Naval Construction Battalion Center Gulfport, MS, draft, March 2009.

The Mississippi Office of Pollution Control has reviewed the above referenced document. The following concerns were noted during document review.

1. The study did not address the existing landfill cover thickness.

2. The text (page 4, paragraph 2) states that the guidelines for a low permeability soil cover require K (hydraulic conductivity values) in the 1 E -5 cm/sec range to be considered effective. The guidelines used for this evaluation are not identified. The text does not specify whether this refers to vertical or horizontal hydraulic conductivity. Vertical hydraulic conductivity tests should be performed on undisturbed samples taken from representative liner material.

   In the absence of guidelines for liners and covers for non permitted landfills, solid waste or hazardous waste landfill guidelines are frequently used in order to identify acceptable construction materials. Solid waste (40 CFR) guidelines generally describe solid waste landfill liner and cover criteria for landfill closure of non permitted landfills or those that do not comply with 40 CFR Solid Waste Regulations. The landfill cover should be less permeable (lower vertical hydraulic conductivity or Kv) than the liner (whether natural or man made) with a maximum permeability (Kv value) of 1 E -5 cm/sec for landfills containing a liner of unknown permeability.

   A vertical hydraulic conductivity value of 1 E -5 is considered to be marginally suitable for landfill cover material, however a less permeable (ex.1 E -6 cm/sec) material would be more protective, allowing less infiltration for leachate production.

3. The text (page 2, paragraph 2 and page 4, paragraph 5) states that the proposed cover will be composed of soil (non native and unprocessed) with a lesser permeability than the current cover. OPC concurs with this recommendation. It is noted that Kv values ranged over two orders of magnitude (1.9 E -4 cm/sec to 4.8 E -6 cm/sec) all of which were above the 1 E -6 recommended cover material for permitted solid waste (non hazardous) landfills.

4. It is noted that the landfill gas survey indicated that little or no gas generation is occurring at Site 3 and that a gas venting system will not be necessary. Confirmation of this should be included in the evaluation of the chosen cover material, as this conclusion is based on a limited number of samples (4 within and one outside of site boundaries).

Please feel free to contact me if I can be of further assistance.

Sincerely,

Bob Merrill

Bob Merrill

cc. Bart Reedy, USEPA

RESPONSE TO MDEQ COMMENTS

Responses to MDEQ comments, dated March 30, 2009, on the Draft Landfill Cover Assessment for the Site 3 Northwest Landfill.

COMMENT 1:

The study did not address the existing landfill cover thickness.

RESPONSE TO COMMENT 1:

Text, figures, and RI field data have been added to the report to describe the lithology and thickness of the existing landfill cover as encountered at soil sample locations from the RI.

COMMENT 2:

The text (page 4, paragraph 2) states that the guidelines for a low permeability soil cover require K (hydraulic conductivity values) in the 1 E-5 cm/sec range to be considered effective. The guidelines used for this evaluation are not identified. The text does not specify whether this refers to vertical or horizontal hydraulic conductivity. Vertical hydraulic conductivity tests should be performed on undisturbed samples taken from representative liner material.

In the absence of guidelines for liners and covers for non permitted landfills, solid waste or hazardous waste landfill guidelines are frequently used in order to identify acceptable construction materials. Solid waste (40 CFR) guidelines generally describe solid waste landfill liner and cover criteria for landfill closure of non permitted landfills or those that do not comply with 40 CFR Solid Waste Regulations. The landfill cover should be less permeable (lower vertical hydraulic conductivity or Kv) than the liner (whether natural or man made) with a maximum permeability (Kv value) of 1 E-5 cm/sec for landfills containing a liner of unknown permeability.

A vertical hydraulic conductivity value of 1 E-5 is considered to be marginally suitable for landfill cover material, however a less permeable material (ex. 1 E-6 cm/sec) material would be more protective, allowing less infiltration for leachate production.

RESPONSE TO COMMENT 2:

The text will be revised to clearly identify the guidelines that were used to evaluate the K data from Site 3. Also, the text will specify that the K values presented are vertical K values.

Currently, there is no documentation available that would indicate that the disposal trenches were lined. Therefore, there is no evidence to suggest that the permeability of the bottom of the disposal cells is less than that of the typical native soil.

COMMENT 3:

The text (page 2, paragraph 2 and page 4, paragraph 5) states that the proposed cover will be composed of soil (non native and unprocessed) with a lesser permeability than the current cover. OPC concurs with this recommendation. It is noted that Kv values ranged over two orders of magnitude (1.9 E-4 cm/sec to 4.8 E-6 cm/sec) all of which were above the 1 E-6 recommended cover material for permitted solid waste (non hazardous) landfills.

RESPONSE TO COMMENT 3:

The remedial design will specify the process for identifying and testing a source material with suitable hydraulic properties to ensure acceptance of the final cover.

COMMENT 4:

It is noted that the landfill gas survey indicated that little or no gas generation is occurring at Site 3 and that a gas venting system will not be necessary. Confirmation of this should be included in the evaluation of the chosen cover material, as this conclusion is based on a limited number of samples (4 within and one outside of site boundaries).

RESPONSE TO COMMENT 4:

The report states that under current conditions landfill gas concentrations do not exceed criteria that would require landfill gas treatment. However, the final determination of the need for further sample collection or landfill gas treatment will be addressed in the FS and remedial design and will be contingent on the final cover design.

APPENDIX B:

COMMENTS AND RESPONSE TO COMMENTS FROM THE NAVY

DEPARTMENT OF THE NAVY
Naval Facilities Engineering Command Southeast
Jacksonville, FL 32212-0030

April 14, 2009

Yarissa Martinez
Task Order Manager
Tetra Tech NUS
Tallahassee, FL 32308

RE: **Draft Landfill Cover Assessment for Site 3**, NCBC Gulfport, MS

I have reviewed the report and have the following comments.

1. Rationale for Assessment. The Presumptive Remedy Guidance states that, "in the absence of Federal Closure Guidelines, State Subtitle D closure requirements have generally applied…" MDEQ has noted that a vertical hydraulic conductivity cover of 1 E -5 cm/sec is the minimum acceptable cover for unregulated landfills with unknown liners.

2. Rationale for Assessment. Please note that the cover performs two functions: (1) to prevent direct contact with landfill contents, and (2) to minimize infiltration/leaching of potential contaminants to groundwater. Please also note that the contents (disposal cells) are repeatedly below groundwater during the frequent wet periods. Therefore, lowering the vertical hydraulic conductivity of the cover will not significantly alter the generation or movement of leachate/contaminants in the shallow aquifer and could result in the unwanted capture and movement of landfill gases. I recommend that surface soil amendments or fill material not greatly exceed state requirements.

3. General Comment. Please add a brief section on "Data Sources/Field Methods." Please also include the soil descriptions from a representative number of borings across the site conducted during the RI. Ten to fifteen locations would give a better picture of the vertical and horizontal extent of the existing cover.

4. Existing Cover Assessment. Discuss the current cover in terms of thickness and extent using boring data from the RI. As stated above, 10 to 15 locations would be enough. Discuss the depth to the disposal cells and their relation to seasonal groundwater fluctuations.

5. Existing Cover Assessment. Please add descriptive boring locations to site figure.

6. Conclusions and Recommendations. Please note that the current cover already meets one of the presumptive remedy cover requirements: preventing direct exposure to landfill contents.

7. Conclusions and Recommendations. Add a recommendation for identifying and testing a source material in the remedial design process to ensure acceptance of the final cover.

Sincerely,

Robert Fisher, P.G.
Task Order Manager

cc. Bob Merrill
Helen Lockard
Gordon Crane

RESPONSE TO NAVY COMMENTS

Responses to Navy comments, dated April 14, 2009, on the Draft Landfill Cover Assessment for the Site 3 Northwest Landfill.

COMMENT 1:

Rationale for Assessment. The Presumptive Remedy Guidance states that, "in the absence of Federal Closure Guidelines, State Subtitle D closure requirements have generally applied…" MDEQ has noted that a vertical hydraulic conductivity cover of 1 E -5 cm/sec is the minimum acceptable cover for unregulated landfills with unknown liners.

RESPONSE TO COMMENT 1:

The text will be revised to clarify the guidelines that are applicable to Site 3.

COMMENT 2:

Rationale for Assessment. Please note that the cover performs two functions: (1) to prevent direct contact with landfill contents, and (2) to minimize infiltration/leaching of potential contaminants to groundwater. Please also note that the contents (disposal cells) are repeatedly below groundwater during the frequent wet periods. Therefore, lowering the vertical hydraulic conductivity of the cover will not significantly alter the generation or movement of leachate/contaminants in the shallow aquifer and could result in the unwanted capture and movement of landfill gases. I recommend that surface soil amendments or fill material not greatly exceed state requirements.

RESPONSE TO COMMENT 2:

The text will be revised to more fully define the two functions of the landfill cover under the presumptive remedy strategy. Additional discussion will be added that describes the interaction of groundwater with the disposal cells at Site 3. Further description and evaluation will be provided in the Feasibility Study.

COMMENT 3:

General Comment. Please add a brief section on "Data Sources/Field Methods." Please also include the soil descriptions from a representative number of borings across the site conducted during the RI. Ten to fifteen locations would give a better picture of the vertical and horizontal extent of the existing cover.

RESPONSE TO COMMENT 3:

The data sources/data collection methodology will be summarized to describe the types of data used in the evaluation. RI field data have been added to the report to describe the lithology and thickness of the existing landfill cover as encountered at soil sample locations from the RI.

COMMENT 4:

Existing Cover Assessment. Discuss the current cover in terms of thickness and extent using boring data from the RI. As stated above, 10 to 15 locations would be enough. Discuss the depth to the disposal cells and their relation to seasonal groundwater fluctuations.

RESPONSE TO COMMENT 4:

Text, figures, and RI field data have been added to the report to describe the lithology and thickness of the existing landfill cover as encountered at soil sample locations from the RI.

COMMENT 5:

Existing Cover Assessment. Please add descriptive boring locations to site figure.

RESPONSE TO COMMENT 5:

A figure has been added that shows the thickness of fill material at soil boring locations, based on information gathered during the RI.

COMMENT 6:

Conclusions and Recommendations. Please note that the current cover already meets one of the presumptive remedy cover requirements: preventing direct exposure to landfill contents.

RESPONSE TO COMMENT 6:

The text will be revised to indicate that the disposal area has a soil cover that currently prevents direct exposure to the landfill material.

COMMENT 7:

Conclusions and Recommendations. Add a recommendation for identifying and testing a source material in the remedial design process to ensure acceptance of the final cover.

RESPONSE TO COMMENT 7:

The text will be revised to indicate that the remedial design process should specify the testing requirements to meet the requirements of the final cover.

APPENDIX C:
SOIL LOGS

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: GPT 3 R1
PROJECT NUMBER: 112G00464
DRILLING COMPANY: MTW
DRILLING RIG: DPT

BORING NUMBER: 035B11
DATE: 10-14/06
GEOLOGIST: W.A. Olson
DRILLER: D. Duncan

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks PID/ppm	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							TAN FS mottled w/brown		4.8				
							Brn silty sand		5.8				
							wht FS		wet @4'				
5									5.6				
							TAN FS w/org mottling		5.5				
									3.7				
10							orange FS						
							white FS		5.2				
									4.0				
15									4.1				
							orange + gray FS		7.2				
							gray sandy clay		8.8				
20									5.5				
									6.7				
25									4.7				

5-7

10-12

03LP110
15-17
1010

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: _____

Drilling Area Background (ppm): _____

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME:
PROJECT NUMBER:
DRILLING COMPANY:
DRILLING RIG:

BORING NUMBER: 03SB11
DATE:
GEOLOGIST:
DRILLER:

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks PID/PPm	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
25							Grey Sandy Clay						
							and Clayey Sand		4.9				
									5.2				
30							Grey Sandy		4.9				
							clay						
							1" Sand stringer		4.7				
						Grey	FS						
35						Grey	clayey Sand		7.2				
					Sand								
40													
					green	clay	, stiff						
				TD									

03GP1104
38.40
0955

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes ____ No ____ Well I.D. #:

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: Site 3 RI
PROJECT NUMBER: 112G00464
DRILLING COMPANY: M&W
DRILLING RIG: DPT
BORING NUMBER: 03SB12
DATE: 10-14-06
GEOLOGIST:
DRILLER: D. Duncan

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks: PID PPM	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							Lt Grey-Lt Brown						
							Fine-Med Fine Sand	0-2	3.2				
							w/Biotites		~~0.5~~ 5.2				
							Lt Grey Fine-Med Fine	2-4					
5							Rusty CISA-SACI	4-5	3.8				
							White-Lt Grey		2.2				
							Med Fine-Med QTZ						
							Sand, H_2O Staining		3.3				
10													
							Same as above		5.2				
									4.8				
15									2.7				
							1 ft Same as Above		Liner Stuck in Casing				
							16 ft + Dk grey-Blk		4.8				
							Clay - Clay SACI						
							Btm 1 ft green tint		4.3				
20							Same as above						
							20-24 Dk grey-Blk		3.5				
							w/green tint clay						
							Massive		5.0				
							24 ft Dk grey-Blk						
25							SACI-Clay		4.5				

6-8 - WS - H_2O - 03GP1201

- H_2O

13-15 - WS - 03GP1202

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks:

Converted to Well: Yes ____ No ____ Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME:
PROJECT NUMBER:
DRILLING COMPANY:
DRILLING RIG:

BORING NUMBER: 03SB12
DATE:
GEOLOGIST:
DRILLER:

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**	
25							grey-DKgrey SACl		4.5					
							-CISA		↑					
									5.4					
									↓					
									↑					
									6.4					
30									↓					
							Same as above		4.7					
									↓					
									6.3					
									↓					
35							34'+ Med ~~SA~~ Grey Sand		-734-35=6.6					34-36 -WS ©3GP1203
							Push through		flowing					
							To Bridge flowing		Sand					
							Sand layer		17'up					
									casing					
							↓							
40							Sand filled 2nd Attempted							-38-41 -WS ©3GP1204
							Pushed through - 45ft							
							↓							
45							green clay							
50														

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes ____ No ____ Well I.D. #:

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME:
PROJECT NUMBER:
DRILLING COMPANY:
DRILLING RIG:

BORING NUMBER: 035B13
DATE: 10-15/06
GEOLOGIST: W.D. OLSON
DRILLER: D. Duncan

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							gray/black Silty FS		2.7				
							Brown Silty sand		5.1				
							gray FS						
							Orange Clayey sand		5.8				
5							gray Clayey sand		wet @ 6'				
									6.3				
							white/gray FS						
									6.1				
10													
									6.2				
									5.1				
							gray sandy clay		4.9				
15													
									11.0				
									5.1				
20									9.7				
									10.0				
							1" sand lens		9.0				
25													

B-10

12-14 ~~14-16~~ 036-P1302 1145

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes ____ No ____ Well I.D. #:

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: _____ BORING NUMBER: 03SB13
PROJECT NUMBER: _____ DATE: _____
DRILLING COMPANY: _____ GEOLOGIST: _____
DRILLING RIG: _____ DRILLER: _____

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
25													
									11.0				
							wood F pong						
							green clay		12.2				
30							gray FS w/ clay						
							gray clay 45		10.9				
									X				
							sand stringer						
35									10.7				
							gray FS						
									11.2				
									12.2				
40													
							green stiff clay						
45													

03GP13C
36-40
1100

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: _____

Drilling Area Background (ppm): _____

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: GPT 3R1
PROJECT NUMBER: 112G00464
DRILLING COMPANY: MW
DRILLING RIG: DPT

BORING NUMBER: 03SB01
DATE: 10-10-04
GEOLOGIST: W.D. Olson
DRILLER: D. Duncan

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks PID/ppm	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
						Brn	Silty Sand			0.2			
						Gry	FS			1.2			
						W	FS		wet @ 4'				
										0.9			
5													
										1.0			04GP0101 1225 6-8
						W	FS			0.3			
							Orange mottles						
10										1.1			
										1.6			04GP0107 1246 12-16
15										1.1			
										0.9			
						W	FS			2.4			
20										3.0			04GP0103 20-24 1312
										3.5			
						Gray	Sandy Clay			2.6			
25													

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm):

Converted to Well: Yes _____ No _____ Well I.D. #: _____

4-9
12-16
19-23

4-23
19

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: _____ BORING NUMBER: 035B01
PROJECT NUMBER: _____ DATE: _____
DRILLING COMPANY: _____ GEOLOGIST: _____
DRILLING RIG: _____ DRILLER: _____

	Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
25								Gray ~~clay sand~~						
								Clay w/sand		4.4				
										3.5				
								Gray Sandy Clay						
30														
										4.6				
								Gray Clayey Sand		4.7				
35														
								Grn/gray clay						
								trace sand						
40														
45														
					TD									

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: _____

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: GRT 3 RI
PROJECT NUMBER: 112G00416
DRILLING COMPANY: MPW
DRILLING RIG: DPT

BORING NUMBER: 03SB02
DATE: 10/10/06
GEOLOGIST: W.D. Olson
DRILLER: D. Duncan

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks PID/PPM	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							BRN silty sand			0.0			
							black asphalt / buar plastic clayey						
							wht FS			0.0			
							w/clay stringers/glass						
							w FS		wet @ 4' 0.0				
5							trace silt						
									0.2				
									0.4				
							Lt TN FS						
10							wht FS		1.1				
							TAN FS, some clay stringers		1.1				
15									0.6				
									1.2				
							orange FS		0.4				
20							gray clayey sand						
							gray clayey sand and clay		0.0				
									0.0				
							gray sandy clay						
25									0.0				

03GP020 6-10

CO=50

CO=51
03GP020
CO=83
14-1
0900
CO=22

* When rock coring, enter rock brokeness.
** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: _____

Drilling Area Background (ppm): 0.0

Converted to Well: Yes _____ No _____ Well I.D. #: _____

~~6-8~~
~~10-12~~

42 38 14-18

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME:
PROJECT NUMBER:
DRILLING COMPANY:
DRILLING RIG:

BORING NUMBER: 03SB02
DATE:
GEOLOGIST:
DRILLER:

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks PID/PPM	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
25							Sand		0.0				
									0.0				
									0.0				
30							Sandier						
							gray Sandy clay		0.0				
									0.0				
35													036P0203
							gray med sand		0.0				
							qtz, subrounded						08445
									0.0				38
40									0.0				
													42
													43
45							green/gray plastic clay						
50				TD @ 50									

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes ____ No ____ Well I.D. #:

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: GPT 3 RT
PROJECT NUMBER: 112G00244
DRILLING COMPANY: MPW
DRILLING RIG: DPT

BORING NUMBER: 03SB03
DATE: 10-11-06
GEOLOGIST: W. D. Olsen
DRILLER: D. Duncan

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks: PID/ppm	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**	
							Brn silty sand							
							Tan clayey silt		1.1					
							w/org matt							
							Tan clay		1.5					
							gray clayey silt							
5									wet @ 6' 1.4					
							clayey							
							gray clayey sand		1.2					
							w/orange silt							
							gray silty sand		4.2					
10							w/trace FS							
									4.6					X 03GP0301
														X
									4.5					X
														X
									4.3					
15														
									1.9					X 03GP0302
														X 1110
									1.9					
														X
20														
					gray clay				1.5					
									1.[illegible]					
					gray sandy clay				1.4					
					and clay w/sand									
25									1.1					

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm):

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: GPT 3 R1
PROJECT NUMBER: 112G00464
DRILLING COMPANY: MPW
DRILLING RIG: DPT

BORING NUMBER: 03SB03
DATE: 10/11/06
GEOLOGIST: W.A. Olsen
DRILLER: D. Duncan

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
25									1.1				
							gray sandy clay		1.1				
							gray/TAN clayey sand		1.0				
30									1.0				
									1.2				
							1" Fine sand lens @ 33 1/2						
35									1.0				
									1.2				
									1.1				
							grey Fine to med sand						
40													
45							green plastic stiff clay						
50				TD									

03GP0303
40-42
1515

* When rock coring, enter rock brokeness.
** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm):

Converted to Well: Yes No Well I.D. #:

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: GPT 3 R1
PROJECT NUMBER: 112G00464
DRILLING COMPANY: MPW
DRILLING RIG: DPT
BORING NUMBER: 03SB04
DATE: 10-11/06
GEOLOGIST: W.A. Olson
DRILLER: D. Duncan

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						Brn	silty gr						
					blk	silty FS w/ wood debris			0.9				
									5.9				
					white	silty FS							
5					Brn	silty FS			5.7				
					white	FS w/clay			1.2				
									wet @ 7'				
									0.6				
10					Lt gray	FS			0.8				
									0.8				
									0.5				
15						increased clay			1.0				
						gray clay			1.0				
20					gray	sandy clay			0.9				
									0.8				
									1.0				

04G-P0401 9-11 No sample

03G-P0402 14-16 17:35

* When rock coring, enter rock brokeness.
** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm):

Converted to Well: Yes ____ No ____ Well I.D. #: ____

8-10
14-16
41-43

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: _____ BORING NUMBER: 035B04
PROJECT NUMBER: _____ DATE: _____
DRILLING COMPANY: _____ GEOLOGIST: _____
DRILLING RIG: _____ DRILLER: _____

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
25							Gray Sandy Clay		1.0				
							Gray Clayey Sand		0.7				
30				X			~~Brown wood debris~~		0.8				
				X			Gray sandy clay		0.9				
35							Brown wood Fruss intact		0.7				
							Lt gray / white Sandy Clay		0.5				
									0.9				
40							White FS		0.7				
									0.5				
45							Green clay 6"		0.7				
				TD 45									

036P040: 42-44 1715

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: _____

Drilling Area Background (ppm): _____

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: GPT 3 RI
PROJECT NUMBER: 112G00464
DRILLING COMPANY: M+W
DRILLING RIG: DPT

BORING NUMBER: 03SB05
DATE: 10-12/06
GEOLOGIST: W.D. Olson
DRILLER: D. Duncan

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks PID/ppm	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						Brown silty Sand			0.9				
						Orange clay			→				
						brown @ contact			1.4				
						gray silty FS			wet 4'				
5									1.1				
						Brown clayey silt			1.1				
						~~wet FS~~			H_2S odor 2.4				
						white FS							
10									1.9				03GP0501 10-12 1328
									2.5				
15									1.2				
							grades to lt. gray		0.8				03GP0502 16-18' 1320
						BRN FS			0.9				
20						sandy sandy clay			0.9				
									0.9				
25									0.8				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #:

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: _____ BORING NUMBER: 03SB05
PROJECT NUMBER: _____ DATE: _____
DRILLING COMPANY: _____ GEOLOGIST: _____
DRILLING RIG: _____ DRILLER: _____

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks PID/PPM	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
25							gray sandy clay some int. sandier, some clayier		0.9				
									1.1				
30									0.8				
							gray sandy clay wood frags @ 34'		0.7				
									1.0				
35							gray sandy clay		0.6				
									0.5				
									0.6				
40							clayey gray FS @ 39.5 grades to fine to med qtz sand, gray						
45													
				?	green		Plastic clay						
50													

03GP05 43-45 1300

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: _____

Drilling Area Background (ppm): _____

Converted to Well: Yes _____ No _____ Well I.D. #: _____

50-55 - green plastic clay

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: GPT 3 RI
PROJECT NUMBER: 112G00464
DRILLING COMPANY: M+W
DRILLING RIG: DPT

BORING NUMBER: 03SB06
DATE: 10-12/06
GEOLOGIST: W.D. Olson
DRILLER: D. Duncan

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks PID/ppm	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
									0.7				
							Brn Silty Sand						
							gray FS		1.2				
							+ silty FS		wet@4'				
5									0.5				
							wht FS						
									0.5				
							Brown Peat		0.4				
10							Gray FS some						
							Peat Frags		0.5				
							gray FS						
									0.4				
15									0.3				
									0.4				
							gray Sandy clay						
									0.5				
20									0.4				
									0.4				
25									0.4				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: _____

Drilling Area Background (ppm): _____

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME:
PROJECT NUMBER:
DRILLING COMPANY:
DRILLING RIG:

BORING NUMBER: 03SB06
DATE:
GEOLOGIST:
DRILLER:

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
25							Grey silty clay						
							sandier close		0.3				
							to 30'						
									0.4				
30													
									0.6				
									0.5				
35									0.5				
							1" sand lens						
							@ 37'		0.4				
				X			grey clayey FS						
									0.5				
40							to FS						
45							green stiff clay						

PBG-P0B01
40-42
1637

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes ____ No ____ Well I.D. #:

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: GPT 3 RI
PROJECT NUMBER: 112600464
DRILLING COMPANY: MPW
DRILLING RIG: DPT

BORING NUMBER: 03SB07
DATE: 10-13/06
GEOLOGIST: W.D. Olson
DRILLER: D. Duncan

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks PID/ppm	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
									0.1				
							Sandy Fill from Lore		1.1				
							Tan Sandy clay		moist@4'				
5							Gray Silty sand to white FS		4.0				
									wet@6'				
									5.9				
							TAN FS@9'		6.5				
10							White FS		6.7				
									4.6				
15									6.1				
20													
							Gray sand/dark clay		5.8				
							Gray sandy clay		4.7				
25													

03GP070 1120 7-9
~~6-10~~ ~~8-10~~
~~7-11~~
~~WA~~
~~11-13~~ 11-13
03GP070
~~14-18~~
16-20
~~18-21~~
15-17
03GP070 1056

* When rock coring, enter rock brokeness.
** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: _____

Drilling Area Background (ppm): _____

Converted to Well: Yes _____ No _____ Well I.D.#: _____

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME:
PROJECT NUMBER:
DRILLING COMPANY:
DRILLING RIG:

BORING NUMBER: 03SB07
DATE: 10-13/06
GEOLOGIST:
DRILLER:

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
25													
							Brown sandy clay		5.8				
							Green gray clayey sand some wood frags		5.6				
30													
							Gray clayey sand		4.1				
									4.7				
35									4.8				
							green clay 1" sand lens @ 37½						
40													
				TD									

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm):

Converted to Well: Yes ____ No ____ Well I.D. #:

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: GPT 3 R1
PROJECT NUMBER: 112G00464
DRILLING COMPANY: M+W
DRILLING RIG: DPT

BORING NUMBER: 035B08
DATE: 10-13/06
GEOLOGIST: W.D. Olson
DRILLER: D. Duncan

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							Brown silty FS		5.3				
							grey silty FS						
							some black stuff,		6.8				
							rock frags						
							Tan FS + silt		5.4				
5							grades to						
							white FS		wet @ 6' 5.0				
									5.4				
													8-10
10									3.9				
									5.5				
													13-15 1412
15									5.6				
							grades to tan/						
							and orange		5.8				
							FS						
									6.7				035B08 18-20 1400
							grey FS						
20							grey sandy clay		7.3				
									6.3				
25									6.5				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm):

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME:
PROJECT NUMBER:
DRILLING COMPANY:
DRILLING RIG:

BORING NUMBER: 035B08
DATE:
GEOLOGIST:
DRILLER:

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks PID/PPM	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
25							Grey Sandy clay						
									6.8				
									6.6				
30													
									6.2				
									5.3				
35									4.4				
									5.5				
							Brown FS						
							Grey FS wood debris		4.3				
40													
							Green stiff clay						
45				TD 45									

036-P0804
38-40
1340

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes _____ No _____ Well I.D. #:

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: 03550101
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8/28/07 Time: 1105 Method: hand auger Monitor Reading (ppm): 0	0-12"	brown	clayey sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle If Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: 03550201
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8/28/07	0-12"	Gray	Sand
Time: 1143			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NCBC Gulfport
Project No.: 112G00464

Sample ID No.: 03550301
Sample Location: Site 3
Sampled By: JB
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [ ] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8/28/07 Time: 1350 Method: hand auger Monitor Reading (ppm): 0	0-12	Orange/tan	clayey sand

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
VOC			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: 03550401
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8/28/07	0-12"	orange/tan	silty sand
Time: 1405			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: 03SS0501
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 08/20/07	0-12"	orange/tan	silty sand
Time: 1415			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: 03SS0601
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8/28/07 Time: 1430 Method: Monitor Reading (ppm):	0-12	tan/orange	silty sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:
Project No.:

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 03550701
Sample Location:
Sampled By:
C.O.C. No.:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 09/28/07	0-12	brown	Clayey Sand w/ pea gravel
Time: 1450			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: 03550801
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8/28/07 Time: 1500 Method: Monitor Reading (ppm):	0-12"	tan/orange	silty sand w/clay balls

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: 03SS0901
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8/28/07 Time: 1515 Method: Monitor Reading (ppm):	0-12"	brown black	sandy clay organic material w/ pea gravel

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

* auger bucket ~~retrieved~~
retrieved
bits of metal & textile
- possible landfill material

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: 03SS1001
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8/28/07	0-12"	tan/orange	silty sand
Time: 1525			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

03SS1001D
03SS1001MS
03SS1001MSD

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

APPENDIX D:

GEOTECHNICAL LABORATORY DATA

BEAVER ENGINEERING, INC.

7378 COCKRILL BEND BLVD
NASHVILLE, TN 37209
615-350-8124
e-mail: DATA@BEAVERENGINEERING.COM

CLIENT	TETRA TECH NUS INC.	PROJ. NO.	06-5284
PROJECT	NCBC GULFPORT CTO 0106, SITE 3	DATE	01/02/09
CONTRACT TASK ORDER:	CTO 0106		
SITE NAME;	NCBC GULFPORT		
SAMPLE ID:	NCBC GULFPORT CTO 68 GEOTECHNICAL ANALYSIS		

TEST DESCRIPTION: MOISTURE CONTENT		
LOCATION	03GT001 (ST 3076)	
MOISTURE AS PERCENT OF OVEN DRIED MASS		8.9%
LOCATION	03GT002 (ST 3077)	
MOISTURE AS PERCENT OF OVEN DRIED MASS		8.9%
LOCATION	03GT003 (ST 3078)	
MOISTURE AS PERCENT OF OVEN DRIED MASS		16.1%
LOCATION	03GT004 (ST 3079)	
MOISTURE AS PERCENT OF OVEN DRIED MASS		16.4%
LOCATION	03GT005 (ST 3080)	
MOISTURE AS PERCENT OF OVEN DRIED MASS		12.2%

BEAVER ENGINEERING, INC.

7378 COCKRILL BEND BLVD.
NASHVILLE, TENNESSEE 37209
615-350-8124

CLIENT	TETRA TECH NUS, INC.		
PROJECT	NCBC GULFPORT CTO 0106, SITE 3	PROJ. NO.	08-5856
CONTRACT TASK ORDER	CTO 0106		
SITE NAME:	NCBC GULFPORT		
SAMPLE ID:	NCBC GULFPORT CTO 68 GEOTECHNICAL ANALYSIS		

SATURATED HYDRAULIC CONDUCTIVITY

TEST DESCRIPTION:
EPA 9100, SECTION 2.8, TRIAXIAL CELL METHOD WITH BACKPRESSURE
ASTM D5084 - 90, MEASUREMENT OF HYDRAULIC CONDUCTIVITY

LOCATION	**03GT001** ST 3076		
DESCRIPTION	SAND, YELLOWISH BROWN		
TYPE SAMPLE	SHELBY TUBE		
SAMPLE INFORMATION:		TEST INFORMATION:	
LENGTH	6.2 cm	TEST DATE	12/28/2009
WEIGHT	524.2 grams	TOTAL BACKPRESSURE	80 psi
CROSS SECTIONAL AREA	41.76 cmsq	CELL PRESSURE	85 psi
MOISTURE OF SAMPLE	8.9%	HEAD PRESSURE	83 psi
DENSITY	116.1 pcf	CONSOLIDATION STRESS:	
	1.86 g/cu cm	MAXIMUM	5 psi
PERMEANT:	WATER	MINIMUM	2 psi

		READING 1	READING 2	READING 3	READING 4
LAPSED TIME(in seconds)	T=	307	314	303	310
INITIAL READING,influent liquid		6.0	6.0	6.0	6.0
INITIAL READING,effluent liquid		29.5	29.5	29.5	29.5
END READING, influent liquid		30.0	30.0	30.0	30.0
END READING, effluent liquid		5.5	5.5	5.5	5.5
TOTAL CUBIC CENTIMETERS	Q=	24.0	24.0	24.0	24.0
LENGTH OF SAMPLE	L=	6.2	6.2	6.2	6.2
LOSS OF HEAD	H=	210.4	210.4	210.4	210.4
CROSS SECTIONAL AREA	A=	41.76	41.76	41.76	41.76
EQUATION, K = QL/AHT	K=	**5.5E-05**	**5.4E-05**	**5.6E-05**	**5.5E-05**

5.5E-05 AVERAGE CENTIMETERS PER SECOND

BEAVER ENGINEERING, INC.

7378 COCKRILL BEND BLVD.
NASHVILLE, TENNESSEE 37209
615-350-8124

CLIENT	TETRA TECH NUS, INC.		
PROJECT	NCBC GULFPORT CTO 0106, SITE 3	PROJ. NO.	08-5856
CONTRACT TASK ORDER	CTO 0106		
SITE NAME:	NCBC GULFPORT		
SAMPLE ID:	NCBC GULFPORT CTO 68 GEOTECHNICAL ANALYSIS		

SATURATED HYDRAULIC CONDUCTIVITY

TEST DESCRIPTION:
EPA 9100, SECTION 2.8, TRIAXIAL CELL METHOD WITH BACKPRESSURE
ASTM D5084 - 90, MEASUREMENT OF HYDRAULIC CONDUCTIVITY

LOCATION	**03GT002** ST 3077		
DESCRIPTION	SAND, YELLOWISH BROWN		
TYPE SAMPLE	SHELBY TUBE		
SAMPLE INFORMATION:		TEST INFORMATION:	
LENGTH	6.2 cm	TEST DATE	12/19/2009
WEIGHT	498.1 grams	TOTAL BACKPRESSURE	80 psi
CROSS SECTIONAL AREA	41.56 cmsq	CELL PRESSURE	85 psi
MOISTURE OF SAMPLE	8.9%	HEAD PRESSURE	83 psi
DENSITY	110.5 pcf	CONSOLIDATION STRESS:	
	1.77 g/cu cm	MAXIMUM	5 psi
PERMEANT:	WATER	MINIMUM	2 psi

		READING 1	READING 2	READING 3	READING 4
LAPSED TIME(in seconds)	T =	60	60	60	60
INITIAL READING,influent liquid		14.0	14.0	14.0	14.0
INITIAL READING,effluent liquid		30.0	30.0	30.0	30.0
END READING, influent liquid		30.5	30.3	30.3	30.3
END READING, effluent liquid		13.5	13.8	13.7	13.7
TOTAL CUBIC CENTIMETERS	Q =	16.5	16.3	16.3	16.3
LENGTH OF SAMPLE	L =	6.2	6.2	6.2	6.2
LOSS OF HEAD	H =	210.4	210.7	210.6	210.6
CROSS SECTIONAL AREA	A =	41.56	41.56	41.56	41.56
EQUATION, K = QL/AHT	K =	**2.0E-04**	**1.9E-04**	**1.9E-04**	**1.9E-04**

1.9E-04 AVERAGE CENTIMETERS PER SECOND

BEAVER ENGINEERING, INC.

7378 COCKRILL BEND BLVD.
NASHVILLE, TENNESSEE 37209
615-350-8124

CLIENT	TETRA TECH NUS, INC.		
PROJECT	NCBC GULFPORT CTO 0106, SITE 3	PROJ. NO.	08-5856
CONTRACT TASK ORDER	CTO 0106		
SITE NAME:	NCBC GULFPORT		
SAMPLE ID:	NCBC GULFPORT CTO 68 GEOTECHNICAL ANALYSIS		

SATURATED HYDRAULIC CONDUCTIVITY

TEST DESCRIPTION:
EPA 9100, SECTION 2.8, TRIAXIAL CELL METHOD WITH BACKPRESSURE
ASTM D5084 - 90, MEASUREMENT OF HYDRAULIC CONDUCTIVITY

LOCATION	**03GT003** ST 3078		
DESCRIPTION	SAND, dark YELLOWISH BROWN		
TYPE SAMPLE	SHELBY TUBE		
SAMPLE INFORMATION:		TEST INFORMATION:	
LENGTH	6.1 cm	TEST DATE	12/19/2009
WEIGHT	534.7 grams	TOTAL BACKPRESSURE	80 psi
CROSS SECTIONAL AREA	41.41 cmsq	CELL PRESSURE	85 psi
MOISTURE OF SAMPLE	16.1%	HEAD PRESSURE	83 psi
DENSITY	114.2 pcf	CONSOLIDATION STRESS:	
	1.83 g/cu cm	MAXIMUM	5 psi
PERMEANT:	WATER	MINIMUM	2 psi

		READING 1	READING 2	READING 3	READING 4
LAPSED TIME(in seconds)	T =	120	120	120	120
INITIAL READING,influent liquid		3.0	3.0	3.0	3.0
INITIAL READING,effluent liquid		32.6	32.8	33.0	32.3
END READING, influent liquid		7.8	7.9	7.8	7.8
END READING, effluent liquid		27.8	28.0	28.5	28.3
TOTAL CUBIC CENTIMETERS	Q =	4.8	4.9	4.8	4.8
LENGTH OF SAMPLE	L =	6.1	6.1	6.1	6.1
LOSS OF HEAD	H =	235.7	235.9	236.4	236.2
CROSS SECTIONAL AREA	A =	41.41	41.41	41.41	41.41
EQUATION, K = QL/AHT	K =	**2.5E-05**	**2.5E-05**	**2.5E-05**	**2.5E-05**

2.5E-05 AVERAGE CENTIMETERS PER SECOND

BEAVER ENGINEERING, INC.

7378 COCKRILL BEND BLVD.
NASHVILLE, TENNESSEE 37209
615-350-8124

CLIENT	TETRA TECH NUS, INC.		
PROJECT	NCBC GULFPORT CTO 0106, SITE 3	PROJ. NO.	08-5856
CONTRACT TASK ORDER	CTO 0106		
SITE NAME:	NCBC GULFPORT		
SAMPLE ID:	NCBC GULFPORT CTO 68 GEOTECHNICAL ANALYSIS		

SATURATED HYDRAULIC CONDUCTIVITY

TEST DESCRIPTION:
EPA 9100, SECTION 2.8, TRIAXIAL CELL METHOD WITH BACKPRESSURE
ASTM D5084 - 90, MEASUREMENT OF HYDRAULIC CONDUCTIVITY

LOCATION	**03GT004** ST 3079		
DESCRIPTION	SAND, SILTY, DARK YELLOWISH BROWN		
TYPE SAMPLE	SHELBY TUBE		
SAMPLE INFORMATION:		TEST INFORMATION:	
LENGTH	5.7 cm	TEST DATE	12/22/2009
WEIGHT	485.9 grams	TOTAL BACKPRESSURE	80 psi
CROSS SECTIONAL AREA	42.07 cmsq	CELL PRESSURE	85 psi
MOISTURE OF SAMPLE	16.4%	HEAD PRESSURE	83 psi
DENSITY	108.7 pcf	CONSOLIDATION STRESS:	
	1.74 g/cu cm	MAXIMUM	5 psi
PERMEANT:	WATER	MINIMUM	2 psi

		READING 1	READING 2	READING 3	READING 4
LAPSED TIME(in seconds)	T=	60	60	60	60
INITIAL READING,influent liquid		7.8	8.3	8.8	9.3
INITIAL READING,effluent liquid		36.1	35.6	35.1	34.6
END READING, influent liquid		8.3	8.8	9.3	9.8
END READING, effluent liquid		35.6	35.1	34.6	34.1
TOTAL CUBIC CENTIMETERS	Q=	0.5	0.5	0.5	0.5
LENGTH OF SAMPLE	L=	5.7	5.7	5.7	5.7
LOSS OF HEAD	H=	238.7	237.7	236.7	235.7
CROSS SECTIONAL AREA	A=	42.07	42.07	42.07	42.07
EQUATION, K = QL/AHT	K=	**4.7E-06**	**4.7E-06**	**4.8E-06**	**4.8E-06**

4.8E-06 AVERAGE CENTIMETERS PER SECOND

BEAVER ENGINEERING, INC.

7378 COCKRILL BEND BLVD.
NASHVILLE, TENNESSEE 37209
615-350-8124

CLIENT	TETRA TECH NUS, INC.		
PROJECT	NCBC GULFPORT CTO 0106, SITE 3	PROJ. NO.	08-5856
CONTRACT TASK ORDER	CTO 0106		
SITE NAME:	NCBC GULFPORT		
SAMPLE ID:	NCBC GULFPORT CTO 68 GEOTECHNICAL ANALYSIS		

SATURATED HYDRAULIC CONDUCTIVITY

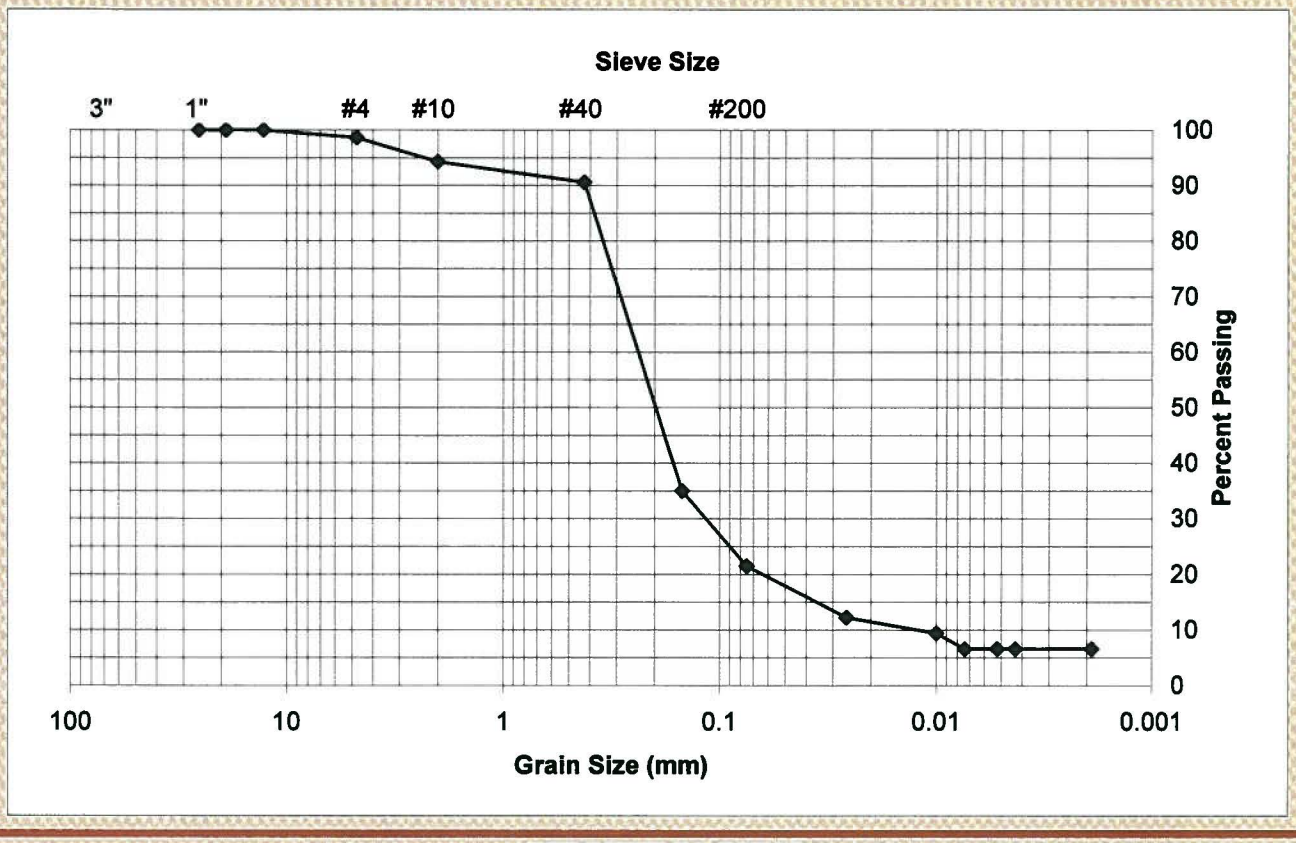
TEST DESCRIPTION:
EPA 9100, SECTION 2.8, TRIAXIAL CELL METHOD WITH BACKPRESSURE
ASTM D5084 - 90, MEASUREMENT OF HYDRAULIC CONDUCTIVITY

LOCATION	**03GT005** ST 3080		
DESCRIPTION	SILTY SAND, MOTTLED YELLOWISH BROWN TO DARK BROWN		
TYPE SAMPLE	SHELBY TUBE		
SAMPLE INFORMATION:		TEST INFORMATION:	
LENGTH	6.2 cm	TEST DATE	12/22/2009
WEIGHT	527.5 grams	TOTAL BACKPRESSURE	80 psi
CROSS SECTIONAL AREA	42.30 cmsq	CELL PRESSURE	85 psi
MOISTURE OF SAMPLE	12.2%	HEAD PRESSURE	83 psi
DENSITY	111.9 pcf	CONSOLIDATION STRESS:	
	1.79 g/cu cm	MAXIMUM	5 psi
PERMEANT:	WATER	MINIMUM	2 psi

		READING 1	READING 2	READING 3	READING 4
LAPSED TIME(in seconds)	T =	10	10	10	10
INITIAL READING,influent liquid		21.5	23.8	26.2	28.4
INITIAL READING,effluent liquid		20.0	17.7	15.3	13.1
END READING, influent liquid		23.8	26.2	28.4	30.6
END READING, effluent liquid		17.7	15.3	13.1	10.8
TOTAL CUBIC CENTIMETERS	Q =	2.3	2.4	2.2	2.2
LENGTH OF SAMPLE	L =	6.2	6.2	6.2	6.2
LOSS OF HEAD	H =	207.1	202.4	197.8	193.3
CROSS SECTIONAL AREA	A =	42.30	42.30	42.30	42.30
EQUATION, K = QL/AHT	K =	**1.6E-04**	**1.7E-04**	**1.6E-04**	**1.7E-04**

1.7E-04 AVERAGE CENTIMETERS PER SECOND

GRAIN SIZE DISTRIBUTION REPORT
ASTM D 422



PERCENT PASSING

SAMPLE ID	Selve Sizes for Mechanical Analysis								Diameters for Hydrometer Analysis (mm)					
	1.0(in)	0.75(in)	0.50(in)	#4	#10	#40	#100	#200	0.026	0.01	0.007	0.0052	0.004	0.002
03GT001	100	100	100	99	94	91	35	21	12	9	7	7	7	7
	1%			77%					15%			7%		
LAB ID ST 3076	GRAVEL			SAND					SILT			CLAY		

BEAVER ENGINEERING

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NCBC GULPORT CTO 0106, SITE 3

PROJECT NUMBER: 08-5856

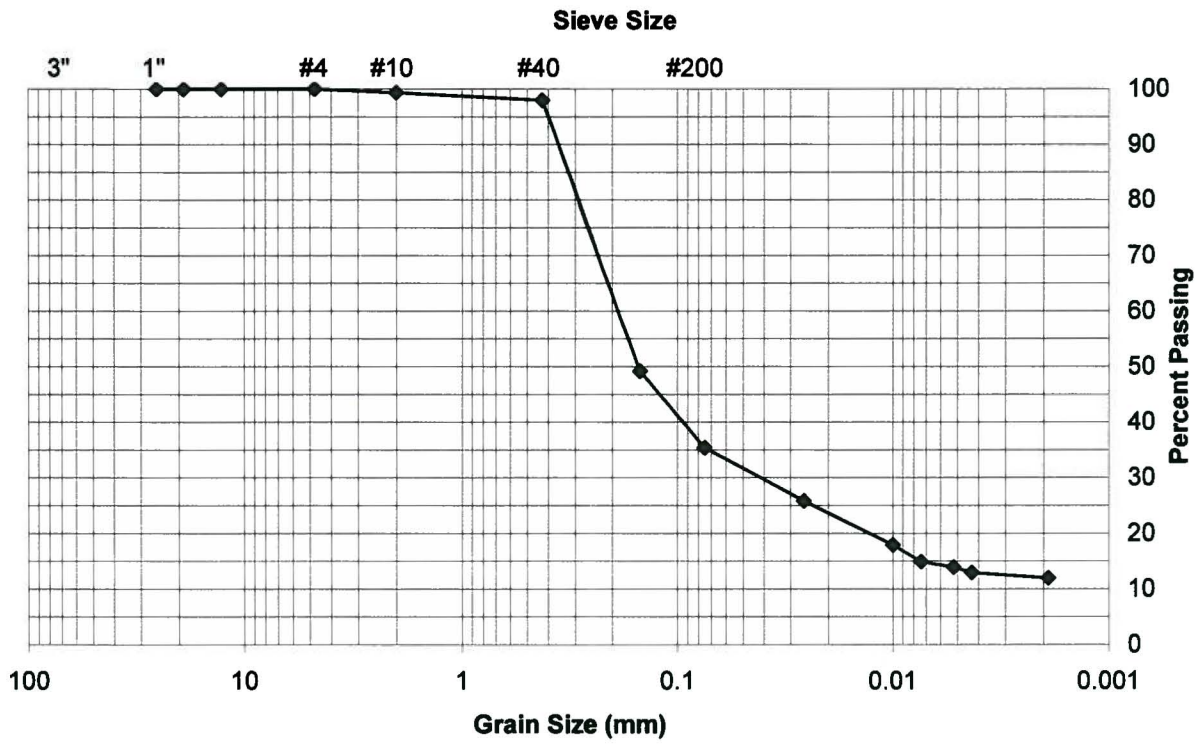
DATE: JANUARY 2, 2009

CONTRACT TASK ORDER - CTO 0106

SITE NAME: NCBC GULFPORT

SAMPLE ID: NCBC GULFPORT CTO 68 GEOTECHNICAL ANALYSIS

GRAIN SIZE DISTRIBUTION REPORT
ASTM D 422



PERCENT PASSING

SAMPLE ID	Seive Sizes for Mechanical Analysis								Diameters for Hydrometer Analysis (mm)					
	1.0(in)	0.75(in)	0.50(in)	#4	#10	#40	#100	#200	0.026	0.01	0.007	0.0052	0.004	0.002
03GT002	100	100	100	100	99	98	49	35	26	18	15	14	13	12
LAB ID ST 3077	0%			65%					21%			14%		
	GRAVEL			SAND					SILT			CLAY		

BEAVER ENGINEERING

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SITE NAME: NCBC GULFPORT

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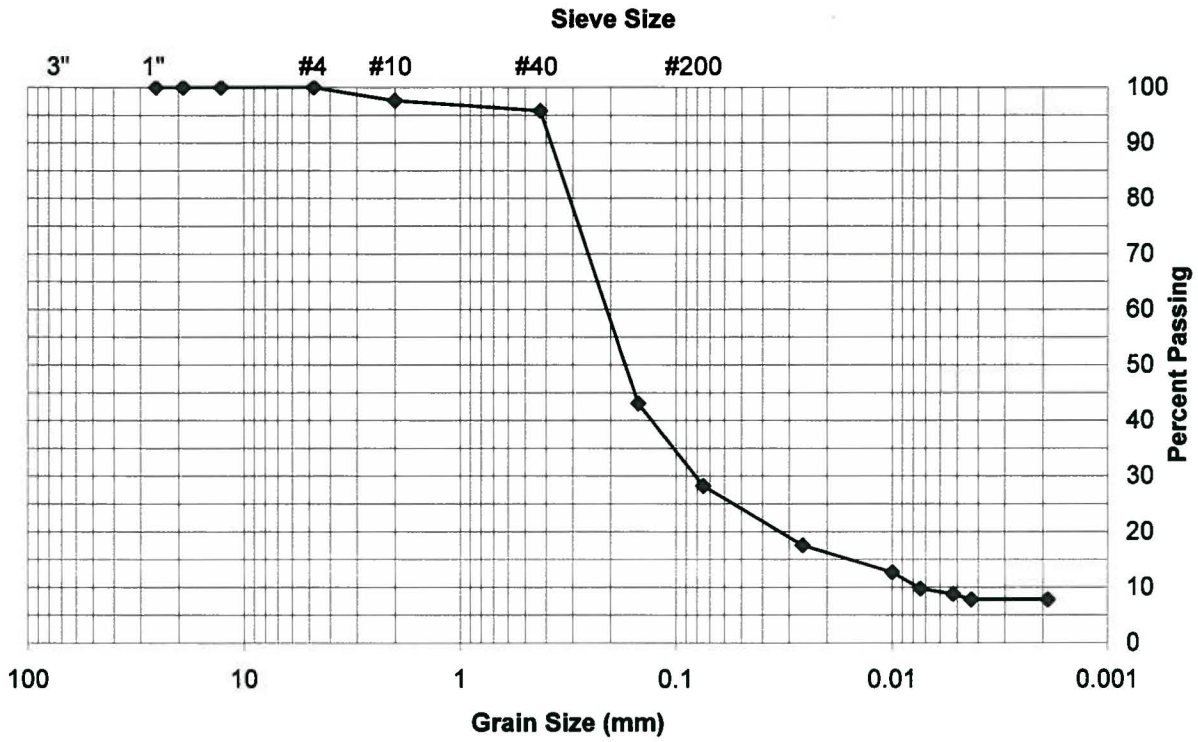
GRAIN SIZE DISTRIBUTION REPORT
ASTM D 422



PERCENT PASSING

SAMPLE ID	Seive Sizes for Mechanical Analysis								Diameters for Hydrometer Analysis (mm)					
	1.0(in)	0.75(in)	0.50(in)	#4	#10	#40	#100	#200	0.026	0.01	0.007	0.0052	0.004	0.002
03GT003	100	100	100	100	98	96	43	28	18	13	10	9	8	8
LAB ID ST 3078	0%			72%				19%				9%		
	GRAVEL			SAND				SILT				CLAY		

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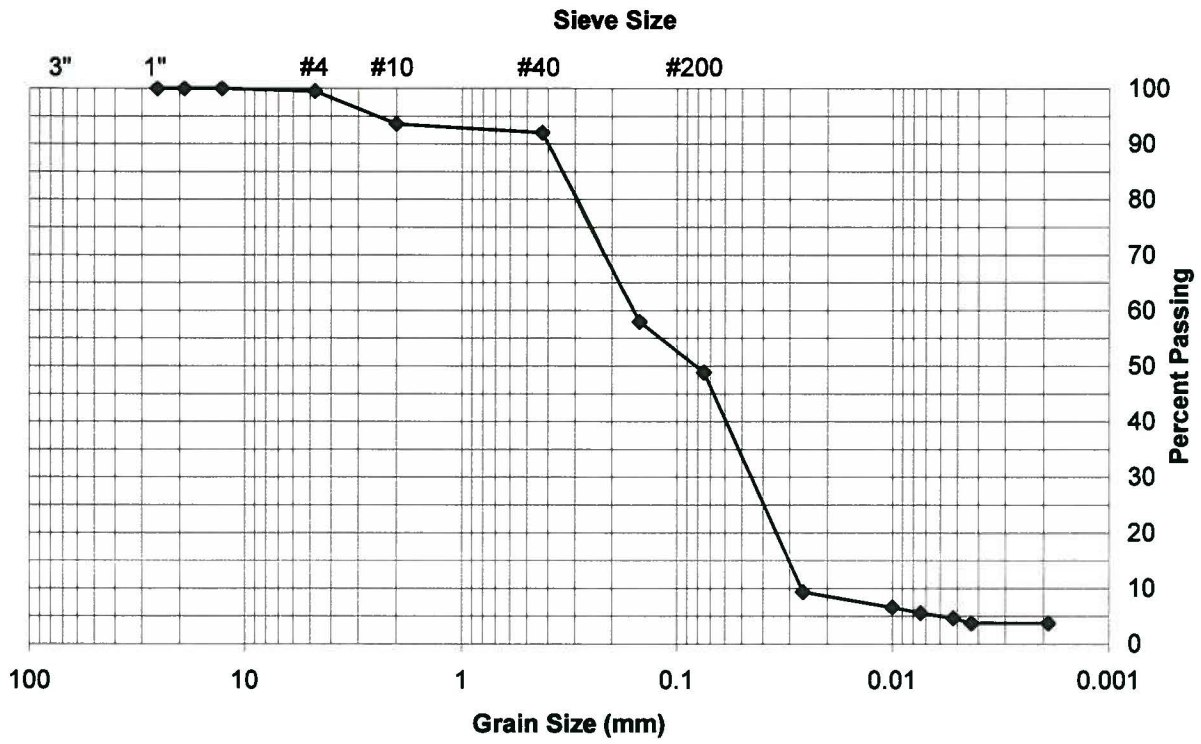
GRAIN SIZE DISTRIBUTION REPORT
ASTM D 422



PERCENT PASSING

SAMPLE ID	Seive Sizes for Mechanical Analysis								Diameters for Hydrometer Analysis (mm)					
	1.0(in)	0.75(in)	0.50(in)	#4	#10	#40	#100	#200	0.026	0.01	0.007	0.0052	0.004	0.002
03GT004	100	100	100	99	94	92	58	49	9	7	6	5	4	4
LAB ID ST 3079	1%			51%				43%				5%		
	GRAVEL			SAND				SILT				CLAY		

BEAVER ENGINEERING

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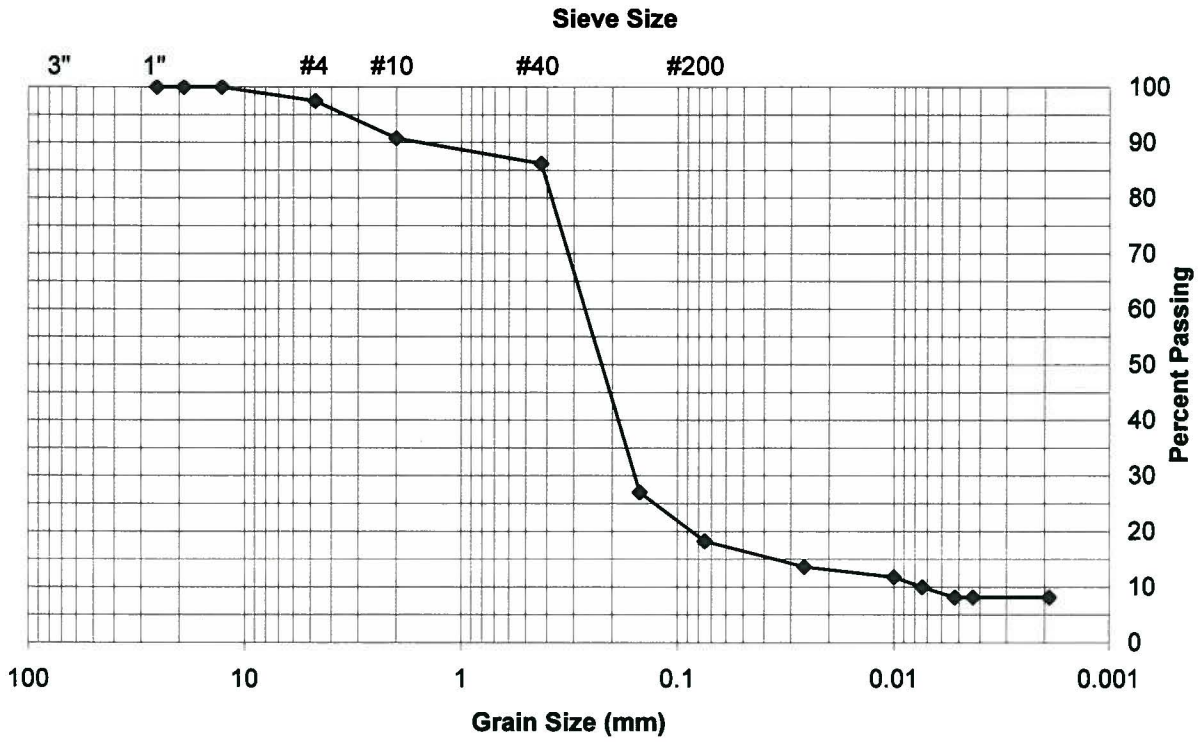
GRAIN SIZE DISTRIBUTION REPORT
ASTM D 422



PERCENT PASSING

SAMPLE ID	Seive Sizes for Mechanical Analysis								Diameters for Hydrometer Analysis (mm)					
	1.0(in)	0.75(in)	0.50(in)	#4	#10	#40	#100	#200	0.026	0.01	0.007	0.0052	0.004	0.002
03GT005	100	100	100	97	91	86	27	18	14	12	10	8	8	8
LAB ID ST 3080	3%			79%					10%			8%		
	GRAVEL			SAND					SILT			CLAY		

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