ATLANTIC COAST
CONSULTING, INC.

7 E. Congress Street
Suite 801
Savannah, GA 31401
(912) 236-3471
www.atlcc.net

April 6, 2017

Mr. William Cook
Solid Waste Management Program
Georgia Environmental Protection Division
4244 International Parkway, Suite 104
Atlanta, Georgia 30354

RE: R & B Landfill, Inc.
Minor Modification – Coal Combustible Residuals (CCR) Management Plan
Permit Number: 006-009D (MSWL)

Dear William,

Please find enclosed four copies of the revised Plan Sheets 44, 46, and 53 for the above referenced facility. The purpose of this submittal is to modify the current proposed major permit modification to incorporate a CCR Management Plan in accordance with EPD's Solid Waste Management Rule 391-3-4-.07(5) as well as the EPD guidance document issued December 22, 2016. It should be noted that the current approved Design and Operation for the facility addresses most of these issues already. However, below is a summary of the items identified in the guidance documents and how each is addressed by the proposed major modification or revised herein.

CCR Guidance General Requirements

1) *The CCR Management Plan shall be submitted as a request for modification to the facility's Design and Operational (D&O) Plan. Modifications which substantially alter the design of the facility, management practices, the types of wastes being handled, or the method of waste handling, and due to the nature of the changes would likely have an impact on the ability of the facility to adequately protect human health and the environment will require a major modification.*

   <u>Response:</u> The R&B Landfill is currently accepting CCR material in accordance with a permit modification and ash management program approved by EPD April 30, 2015. The changes proposed within this submittal are proposed to be included within the current major permit modification package with the latest drawings revised October 2016.

2) *CCR Management Plans will be approved for a duration of one year. Facilities must submit a sealed professional engineer's Annual CCR Management and Dust Control Review describing activities, issues and any non-compliance*

from the prior year (for more on Fugitive Dust Control requirements, see below). Based on the annual review, Georgia EPD will either issue written approval to continue CCR management under the existing plan or will request the facility to amend their Plan. Amendments to the plan shall include any changes necessitated by the prior year's operations. The facility shall place the written EPD approval in the facility operating record. Facilities requested to amend their CCR Management Plan must obtain an approved amended Plan within 30 days of EPD's request or cease receipt of CCR until such approval is granted.

Revision: Section 13 has been added to the Coal Combustion Residuals (CCR) Disposal Procedures on Sheet 46 to define the annual reporting requirements related to CCR management. Section 20 on the Operational Procedures, Sheet 44, has been revised to address the Dust Control requirements.

The current source of CCR for this facility is defined in Section 14 of the CCR Disposal Procedures on Sheet 46. This section also requires that EPD approval be obtained prior to accepting new types of CCR

3) *Plan sheets should be the same size (24"x30" to 24"x36") and have a standard title block.*

Response: All plan sheets match the size of the current D&O plan and have a standard title block.

4) *A professional engineer registered to practice in Georgia must stamp and sign all sheets*

Response: All modified plan sheets are stamped and signed by a Georgia Registered Professional Engineer.

CCR Management Plan Components

1) *The estimated total amount of CCR to be accepted on annual basis and the daily maximum amount of CCR to be accepted must be listed in the Plan.*

For sites that will dispose of comingled CCR and MSW, the amount of MSW received and the maximum ratio of CCR to MSW for placement in the landfill must be listed in the Plan. The facility must be designed to address Section 4, Design Consistency, for comingling waste up to this maximum ratio. The facility may not dispose of comingled waste at a ratio that exceeds the maximum considered in the design calculations. Dedicated CCR cells that were previously approved for MSW disposal must also be redesigned to address the requirements of section 4. Design Consistency.

<u>Revision:</u> Section 1 of the Operational Procedures on Sheet 44 has been modified to define the estimated annual and maximum daily tonnages to be accepted at the facility. Because the facility only proposes monofilling of CCR, the ratios of MSW to CCR not shown on the revised plans.

The design calculations that are affected by the CCR waste stream are included as attachments to this submittal.

2) *Procedures for waste placement, cover, and recovery*
The CCR Management Plan must include the following:

a. *A description of how the working face will be managed at facilities where CCR and other wastes will be comingled, or identification of proposed CCR monofill cells.*

<u>Revision:</u> The procedures governing the controlled unloading of CCR material at the working face are addressed in the Coal Combustion Residuals (CCR) Disposal Procedures on Sheet 46 and unmodified from the current approved plan. There is no co-mingled CCR with MSW waste proposed for this facility. The CCR monofill cells designated for this facility are cell 11 and potentially any western cell.

b. *Description of waste placement procedures including (but not limited to):*

i. *the initial layer placement of CCR above the liner and leachate collection system,*

<u>Revision:</u> Section 2 in the Coal Combustion Residuals (CCR) Disposal Procedures on Sheet 46 has been modified to state that all leachate collection gravel shall be covered by a minimum of 12-inches of protective cover soil prior to CCR material placement in the initial lift of a newly constructed cell.

ii. *placement and compaction requirements of CCR lifts to maintain stability,*

<u>Response:</u> Section 2 in the Coal Combustion Residuals (CCR) Disposal Procedures on Sheet 46 addresses placement and compaction and unmodified from the current approved plan.

iii. *placement and compaction procedures for comingled wastes.*

<u>Response:</u> R&B will not have comingled MSW and CCR waste cells.

c. *Procedures and criteria for daily cover of comingled CCR and MSW.*

<u>Response:</u> Section 3 in the Coal Combustion Residuals (CCR) Disposal Procedures on Sheet 46 addresses daily cover of CCR and unmodified

from the current approved plan. R&B will not have comingled MSW and CCR cells.

d. *The working face must be maintained at a size that is compatible with the facility's available equipment for spreading and compacting waste, and for suppressing dust. Describe the proposed maximum working face area and the equipment needed to manage a working face of this area.*

<u>Response:</u> Sections 1 and 2 in the Coal Combustion Residuals (CCR) Disposal Procedures on Sheet 46 addresses unloading, spreading and compaction of CCR and unmodified from the current approved plan. R&B will not have comingled MSW and CCR cells.

e. *Operator inspection procedures for maintaining and documenting compliance with the CCR Management Plan must be given.*

<u>Response:</u> Section 1 in the Coal Combustion Residuals (CCR) Disposal Procedures on Sheet 46 addresses operator training related to CCR waste streams and unmodified from the current approved plan.

f. *If applicable, procedures for onsite liquid waste solidification operations using CCR.*

<u>Response:</u> R&B has no solidification operations, therefore this is not applicable.

g. *If applicable, procedures must be given for recovery of previously disposed CCR for beneficial reuse. EPD must be notified prior to disturbing and excavating previously disposed CCR for beneficial reuse*

<u>Response:</u> The D&O plan does not allow recovery of previously disposed CCR material for beneficial re-use.

3) *Fugitive Dust Control*

The CCR Management Plan must include measures that will minimize CCR from becoming airborne at the facility. Potential CCR fugitive dust emissions originating from CCR disposal units, roads, conditioning areas, and other CCR management and material handling activities must be minimized.

a. *Performance Standard: The percent opacity from CCR and any other fugitive dust source listed in Air Quality Rule 391-3-1-.02(2)(n)1 shall not exceed the limits set therein.*

<u>Revision:</u> Section 20 on the Operational Procedures, Sheet 44, has been modified to reference compliance with Air Quality Rule 391-3-1-.02(2)(n)1.

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b. *The Dust Control Plan must describe measures that the owner or operator will use to minimize CCR from becoming airborne, such as the following:*
   i. *locating CCR inside an enclosure/partial enclosure*
   ii. *operating a water spray or fogging system*
   iii. *reducing fall distances at material drop points*
   iv. *using wind barriers, compaction, or vegetative covers*
   v. *establishing vehicle speed limits*
   vi. *paving and sweeping roads*
   vii. *covering trucks transporting CCR*
   viii. *reducing or halting operations during high wind events*
   ix. *applying daily cover or more frequent cover as needed*

Revision: Section 20 on the Operational Procedures, Sheet 44 has been modified to require wetting of CCR disposal areas with a water truck to control dust, if needed. Posi-Shell ® or earth may also be applied if necessary to control dust.

c. *The Dust Control Plan must provide an explanation of how the selected measures are applicable and appropriate for the existing site conditions.*

Response: The use of a water truck to provide dust control was selected as it is equipment currently available at the facility. See Sections 15 and 20 of Sheet 44. Posi-Shell ® or earth may also be applied if necessary to control dust.

d. *The Dust Control Plan must provide procedures to emplace CCR with adequate moisture content or other suppressants added to minimize dust.*

Revision: Section 20 on the Operational Procedures, Sheet 44 has been modified to require wetting of CCR disposal areas with a water truck to control dust, if needed. Posi-Shell ® or earth may also be applied if necessary to control dust.

e. *Citizen Complaints: Procedures to log citizen complaints received by the owner or operator must be described in the Plan.*

Revision: Section 20 of the Operational Procedures on Sheet 44 has been modified to require the use of Waste Management's 1-800 comment system number for documenting citizen CCR concerns.

f. *An "Annual Fugitive Dust Control Report" report will be due 12 months after the approval of the CCR Management Plan, and one year later for each subsequent report. The report shall include a description of the actions taken to control fugitive dust, a record of all citizen complaints, a summary of any corrective measures taken and, if applicable, recommendations to improve the dust control measures in the future.*

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Revision: Section 20 of the Operational Procedures on Sheet 44 has been modified to require preparation and submission of an annual dust control report. Additionally, Section 13 on Sheet 46 was added to allow for the annual fugitive dust report to be included with the annual CCR management plan renewal requirements.

4. *Design Consistency*
   The CCR Management Plan must address the following landfill design considerations:

   a. *A demonstration that the design grades of the landfill are stable (i.e., for short operations and long-term static and seismic conditions).*

      Revision: A revised stability analysis is included as an attachment to demonstrate that the facility's waste mass will remain stable with the potential of any western cell being a monofill cell.

   b. *A demonstration that the liner system is designed to account for chemical exposure to CCR-generated leachate.*

      Revision: CCR are defined by the EPA as a solid waste to be regulated under Subtitle D (EO 12866 CCR 2050-AE81). CCR waste material accepted for disposal at the landfill will not require non-hazardous certification. Additionally, CCR generated leachate will not subject the liner system to additional chemical exposure beyond what it endures from typical MSW.

   c. *The cell floor grading and construction plans shall account for settlement caused by the weight of the CCR or the comingled waste. Cell floor subsidence and leachate collection pipe crushing shall be evaluated, and a demonstration of adequate post-settlement cell floor grades, leachate pipe grades, and resistance to crushing shall be provided in the design calculations.*

      Revision: Revised pipe crushing calculations are included as an attachment to demonstrate the integrity of the facility's leachate collection piping in CCR waste cells. Appropriate revisions to the D&O CQA Plan Sheet 53 are included with this submittal.

   d. *The Leachate Collection and Removal System (LCRS) shall continue to maintain its functionality and limit the head of leachate on the liner system to a maximum of 30 centimeters. Drainage nets, filter fabrics, and other features of the LCRS must be demonstrated to be compatible with CCR. Pipes must be able to support the weight of the CCR without damage.*

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Revision: Revisions to the geocomposite design calculations are included with this submittal. Appropriate revisions to the D&O CQA Plan Sheet 53 are included with this submittal.

e. *The landfill gas collection system design shall account for comingling of MSW and CCR waste.*

Response: R&B will not have comingled MSW and CCR waste cells.

f. *Construction, operation, and maintenance of waste units to be used for CCR disposal shall remain consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR to be disposed.*

Response: The construction, operation, and maintenance of waste units to be used for CCR disposal shall remain consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR to be disposed. No revisions are necessary to the D&O plan's specified construction, operation or maintenance of the waste units other than those issues addressed herein.

g. *The plan must define any events or circumstances that represent a safety emergency, along with a description of the procedures that will be followed to detect a safety emergency in a timely manner.*

Revision: CCR does not present any significant safety concern beyond what is typically experienced at the site on a daily basis. The site has existing onsite safety procedures, contingency plans, and training materials to address routine emergencies. Section 8 of the Operational Procedures on Sheet 44 has been amended to require regular training of facility employees that will enable them to better detect and respond to safety emergencies.

h. *The plan must provide a detailed description of leachate and contact water management that demonstrates surface water contacting MSW or CCR will not be discharged into the stormwater management system. Describe or provide details for any required structures (such as chimney drains) and any management practices such as placement of diversion berms between the working face or exposed CCR and the stormwater collection ditches.*

Response: Section 8 in the Coal Combustion Residuals (CCR) Disposal Procedures on Sheet 46 addresses the handling of CCR leachate. The facility's Storm Water Pollution Prevention Plan developed under the NPDES General Permit No. GAR050000 also details onsite practices in relation to stormwater management.

i. *Design calculations supporting the CCR Management Plan are to be performed by or be done under the direction of a Professional Engineer and shall be submitted as auxiliary materials to the Plan.*

<u>Revision:</u> Design calculations are included with this submittal and are sealed and signed by a Professional Engineer.

j. *CCR shall not be placed in any previously constructed cell, either comingled or as a monofill, without a demonstration that the cell, as constructed, was designed or can be retrofitted (e.g., lowering of final grades) to accommodate CCR disposal.*

<u>Response:</u> CCR has been and will only be place in cells approved by GA EPD for CCR disposal. Cell 11 was previously approved by EPD to accept monofilled CCR. The products used within cell 11 were designed to accommodate CCR disposal per the EPD approved plan dated April 30, 2015.

5. *Waste Compatibility Analysis*
The Plan must show that CCR waste is compatible (non-reactive) with MSW or industrial waste streams received at the facility, and that different CCR waste streams received are compatible with one another. In demonstrating compatibility, the plan shall contain at a minimum the following components:
a. *List of source(s) of CCR waste streams*

<u>Revision:</u> The current source of CCR for this facility is defined in Section 14 of the CCR Disposal Procedures on Sheet 46. This section also requires that EPD approval be obtained prior to accepting new types of CCR.

b. *Chemical analyses of CCR waste streams*

<u>Revision:</u> CCR are defined by the EPA as a solid waste to be regulated under Subtitle D (EO 12866 CCR 2050-AE81). CCR waste material accepted for disposal at the landfill will not require non-hazardous certification. The current list of sources of CCR waste streams and pre-acceptance chemical analysis are detailed in Section 14 in the Coal Combustion Residuals (CCR) Disposal Procedures on Sheet 26.

c. *Documentation of compatibility analyses for use in a solidification process, if applicable*

<u>Response:</u> Not applicable.

The chemical analyses may be submitted as auxiliary materials to the Plan. If a new type of CCR is proposed for disposal a plan modification application must be submitted if, based on the above analyses, acceptance of the new CCR material necessitates changes to the facility's design or operations.

Revision: The current source of CCR for this facility is defined in Section 14 of the CCR Disposal Procedures on Sheet 46. This section also requires that EPD approval be obtained prior to accepting new types of CCR.

6. *Closure and Post-Closure Care Impacts*
The CCR Management Plan shall evaluate impacts to the landfill's closure and post-closure care cost estimates. If CCR management changes either or both of these estimates, these plan sections must be revised to comply with 391-3-4-.11 or 391-3-4-.12. Groundwater monitoring costs should be updated to reflect the additional constituents monitored for landfills that have accepted CCR. If the largest open waste-accepting area increases due to CCR acceptance, closure cost estimates must be updated accordingly.

Response: The Closure/Post Closure Care Plan was previously revised in the pending major modification to address the additional groundwater monitoring costs during post closure care. The closure costs and largest waste accepting area open are unaffected by the CCR management plan.

7. *Groundwater Monitoring*
Appendix III and IV constituents (including boron) must be incorporated into the facility's groundwater monitoring plan in accordance with 391-3-4-.14(21)(c) and 391-3-4-.14(25).

Response: The Groundwater Monitoring Plan was previously revised in the pending major modification address the additional groundwater monitoring requirements related to acceptance of CCR wastes.

8. *Modification Procedures*
The CCR Management Plan must be modified and submitted for EPD's approval if changes in either operating procedures or the facility design are necessary to comply with the requirements for CCR management.

Revision: Section 13 has been added to the Coal Combustion Residuals (CCR) Disposal Procedures on Sheet 46 to require submittal of revised plans if operating procedures or facility design are necessary due to changes in the CCR waste stream.

9. *Documentation of Notification to Local Governments*
The owner or operator shall notify the local governing authorities of the county, and any city within the county, in which the landfill is located upon the initial submittal of a CCR Management Plan or upon submittal of an amended Plan to EPD. Copies of the correspondence to local governing authorities must be provided to EPD with the Plan submittal.

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APR 20 2017

SOLID WASTE
MANAGEMENT PROGRAM

April 18, 2017

Mr. William Cook
Solid Waste Management Program
Georgia Environmental Protection Division
4244 International Parkway, Suite 104
Atlanta, Georgia 30354

RE: R & B Landfill, Inc.
Coal Combustible Residuals (CCR) Management Plan
Permit Number: 006-009D (MSWL)

Dear Mr. Cook,

Please find the enclosed copies, as well as documentation of deliveries to each entity, of the notification of the initial submittal of a proposed Coal Combustion Residuals (CCR) Management Plan for R&B Landfill sent to the local governing authorities within Banks County, Georgia.

Please let me know if you have any questions.

Sincerely,

ATLANTIC COAST CONSULTING, INC.

Beth H

Beth Headrick, P.E.
Project Engineer

cc: John Workman, WM
Shawn Carroll, WM

ATLANTIC COAST
CONSULTING, INC.

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APR 20 2017

SOLID WASTE
MANAGEMENT PROGRAM

April 12, 2017

Honorable Audrey Turner
Mayor
City of Alto
162 S. Grant St.
Alto, Georgia 30510-0215

RE: Notification of Submittal of a Coal Combustion Residuals (CCR) Management Plan
R&B Landfill, Inc. – R&B Landfill
Banks County, Georgia

Dear Mayor Turner,

Rules and regulations of the State of Georgia (391-3-4-.07(5)) require that you be notified of the initial submittal of a proposed Coal Combustion Residuals (CCR) Management Plan for solid waste disposal facilities permitted by the Georgia Department of Natural Resources Environmental Protection Division (EPD). On April 7, 2017, an Application for R&B Landfill was submitted to EPD. On behalf of R&B Landfill, Inc., this letter is to provide such notice. You will also be notified if an amended CCR Management Plan is submitted to EPD.

Sincerely,

ATLANTIC COAST CONSULTING, INC.

Beth H

Beth Headrick, P.E.
Project Engineer

cc: Mr. John Workman, WM
Mr. Shawn Carroll, WM
Mr. William Cook, GA EPD

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APR 20 2017
SOLID WASTE
MANAGEMENT PROGRAM

April 12, 2017

Honorable Jerry Neace
Mayor
City of Baldwin
186 US HWY 441
Baldwin, Georgia 30511-0247

RE: Notification of Submittal of a Coal Combustion Residuals (CCR) Management Plan
R&B Landfill, Inc. – R&B Landfill
Banks County, Georgia

Dear Mayor Neace,

Rules and regulations of the State of Georgia (391-3-4-.07(5)) require that you be notified of the initial submittal of a proposed Coal Combustion Residuals (CCR) Management Plan for solid waste disposal facilities permitted by the Georgia Department of Natural Resources Environmental Protection Division (EPD). On April 7, 2017, an Application for R&B Landfill was submitted to EPD. On behalf of R&B Landfill, Inc., this letter is to provide such notice. You will also be notified if an amended CCR Management Plan is submitted to EPD.

Sincerely,

ATLANTIC COAST CONSULTING, INC.

Beth H

Beth Headrick, P.E.
Project Engineer

cc: Mr. John Workman, WM
Mr. Shawn Carroll, WM
Mr. William Cook, GA EPD

ATLANTIC COAST
CONSULTING, INC.

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Suite 801
Savannah, GA 31401
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APR 20 2017

SOLID WASTE
MANAGEMENT PROGRAM

April 12, 2017

Honorable Larry Poole
Mayor
City of Gillsville
6288 Highway 52
Gillsville, Georgia 30543-0025

RE: Notification of Submittal of a Coal Combustion Residuals (CCR) Management Plan
R&B Landfill, Inc. - R&B Landfill
Banks County, Georgia

Dear Mayor Poole,

Rules and regulations of the State of Georgia (391-3-4-.07(5)) require that you be notified of the initial submittal of a proposed Coal Combustion Residuals (CCR) Management Plan for solid waste disposal facilities permitted by the Georgia Department of Natural Resources Environmental Protection Division (EPD). On April 7, 2017, an Application for R&B Landfill was submitted to EPD. On behalf of R&B Landfill, Inc., this letter is to provide such notice. You will also be notified if an amended CCR Management Plan is submitted to EPD.

Sincerely,

ATLANTIC COAST CONSULTING, INC.

Beth Headrick, P.E.
Project Engineer

cc: Mr. John Workman, WM
Mr. Shawn Carroll, WM
Mr. William Cook, GA EPD

ATLANTIC COAST
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APR 20 2017
SOLID WASTE
MANAGEMENT PROGRAM

April 12, 2017

Chairman Jimmy Hooper
Banks County Board of Commissioners
150 Hudson Ridge, Suite 1
Homer, Georgia 30547

RE: Notification of Submittal of a Coal Combustion Residuals (CCR) Management Plan
R&B Landfill, Inc. - R&B Landfill
Banks County, Georgia

Dear Mr. Hooper,

Rules and regulations of the State of Georgia (391-3-4-.07(5)) require that you be notified of the initial submittal of a proposed Coal Combustion Residuals (CCR) Management Plan for solid waste disposal facilities permitted by the Georgia Department of Natural Resources Environmental Protection Division (EPD). On April 7, 2017, an Application for R&B Landfill was submitted to EPD. On behalf of R&B Landfill, Inc., this letter is to provide such notice. You will also be notified if an amended CCR Management Plan is submitted to EPD.

Sincerely,

ATLANTIC COAST CONSULTING, INC.

Beth H

Beth Headrick, P.E.
Project Engineer

cc: Mr. John Workman, WM
Mr. Shawn Carroll, WM
Mr. William Cook, GA EPD

ATLANTIC COAST
CONSULTING, INC.

7 E. Congress Street
Suite 801
Savannah, GA 31401
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APR 20 2017

SOLID WASTE
MANAGEMENT PROGRAM

April 12, 2017

Honorable Doug Cheek
Mayor
City of Homer
943 Historic Homer Hwy
Homer, Georgia 30547

RE: Notification of Submittal of a Coal Combustion Residuals (CCR) Management Plan
R&B Landfill, Inc. – R&B Landfill
Banks County, Georgia

Dear Mayor Cheek,

Rules and regulations of the State of Georgia (391-3-4-.07(5)) require that you be notified of the initial submittal of a proposed Coal Combustion Residuals (CCR) Management Plan for solid waste disposal facilities permitted by the Georgia Department of Natural Resources Environmental Protection Division (EPD). On April 7, 2017, an Application for R&B Landfill was submitted to EPD. On behalf of R&B Landfill, Inc., this letter is to provide such notice. You will also be notified if an amended CCR Management Plan is submitted to EPD.

Sincerely,

ATLANTIC COAST CONSULTING, INC.

Beth H

Beth Headrick, P.E.
Project Engineer

cc: Mr. John Workman, WM
Mr. Shawn Carroll, WM
Mr. William Cook, GA EPD

ATLANTIC COAST CONSULTING, INC.

7 E. Congress Street
Suite 801
Savannah, GA 31401
(912) 236-3471
www.atlcc.net

April 12, 2017

Honorable Milton Turner
Mayor
City of Lula
6055 Main St.
Lula, Georgia 30554

RE: Notification of Submittal of a Coal Combustion Residuals (CCR) Management Plan
R&B Landfill, Inc. – R&B Landfill
Banks County, Georgia

Dear Mayor Turner,

Rules and regulations of the State of Georgia (391-3-4-.07(5)) require that you be notified of the initial submittal of a proposed Coal Combustion Residuals (CCR) Management Plan for solid waste disposal facilities permitted by the Georgia Department of Natural Resources Environmental Protection Division (EPD). On April 7, 2017, an Application for R&B Landfill was submitted to EPD. On behalf of R&B Landfill, Inc., this letter is to provide such notice. You will also be notified if an amended CCR Management Plan is submitted to EPD.

Sincerely,

ATLANTIC COAST CONSULTING, INC.

Beth H

Beth Headrick, P.E.
Project Engineer

cc: Mr. John Workman, WM
Mr. Shawn Carroll, WM
Mr. William Cook, GA EPD

ATLANTIC COAST
CONSULTING, INC.

7 E. Congress Street
Suite 801
Savannah, GA 31401
(912) 236-3471
www.atlcc.net

April 12, 2017

Honorable Richard Pressley
Mayor
City of Maysville
226 South Main St.
Maysville, Georgia 30558

RE: Notification of Submittal of a Coal Combustion Residuals (CCR) Management Plan
R&B Landfill, Inc. – R&B Landfill
Banks County, Georgia

Dear Mayor Pressley,

Rules and regulations of the State of Georgia (391-3-4-.07(5)) require that you be notified of the initial submittal of a proposed Coal Combustion Residuals (CCR) Management Plan for solid waste disposal facilities permitted by the Georgia Department of Natural Resources Environmental Protection Division (EPD). On April 7, 2017, an Application for R&B Landfill was submitted to EPD. On behalf of R&B Landfill, Inc., this letter is to provide such notice. You will also be notified if an amended CCR Management Plan is submitted to EPD.

Sincerely,

ATLANTIC COAST CONSULTING, INC.

Beth H

Beth Headrick, P.E.
Project Engineer

cc: Mr. John Workman, WM
Mr. Shawn Carroll, WM
Mr. William Cook, GA EPD

Attachment 1:
Minor Modification Form

FACILITY R&B Landfill PERMIT NO. 006-009D(MSWL)

Pursuant to the requirements of the Georgia Comprehensive Solid Waste Management Act, O.C.G.A 12-8-20, et seq. and the Rules of the Georgia Department of Natural Resources, Chapter 391-3-4-.02(4), Solid Waste Management, both as amended, the undersigned hereby:

1 Requests a minor modification as represented in the attached modified D&O Plan, and/or supporting documents;

2 Certifies that the Permittee is the rightful owner of the facility and can verify that this proposed modification shall conform to all local zoning/land use ordinances; and

3 Certifies that the information provided in or submitted by the facility Permittee as part of this request form and modified D&O Plan is true and correct, and if approved, the facility Permittee agrees to comply with provisions of this minor modification to the D&O Plan, provisions of the Act Rules, and conditions of the Permit.

I PERMITTEE R & B Landfill, Inc.

ADDRESS 610 Frank Bennett Road PHONE (706) 677-2650

CITY Homer STATE Georgia ZIP 30547

AUTHORIZED OFFICIAL Tim Bassett

SIGNATURE [signature] DATE 3-24-17

TITLE Environmental Protection Manager

MAILING ADDRESS 610 Frank Bennett Road

CITY Homer STATE Georgia ZIP 30547

II Briefly describe the exact changes to be made to the permit conditions and explain why the change is needed.

Revision of the Facilities Design & Operations Plan to incorporate Coal Combustion Residual Management Plan and Procedures.

III Attached documents include:

Revised Design & Operations Plan Sheets

DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

REQUEST FOR MINOR MODIFICATION TO
SOLID WASTE HANDLING PERMIT

Instructions This form must accompany all requests by the Permittee requiring a minor modification for the subject facility. Attached modifications of the Design and Operation (D&O) Plan must be factual and complete. This form and supporting documents must be submitted directly to the EPD Regional office to which the facility is assigned. For modifying a D&O Plan, please include three (3) copies of all pertinent sheets. **Follow-up submittals require the Permittee to submit a new request form.**

APPLICANT TO COMPLETE THE REVERSE SIDE

FOR EPD USE ONLY

Official Facility Name ______________________________

Permit No. ______________ Modification Type ______________

Review Deadline Date ______________________________

Received By ______________ Date ______________ Comments* ______________

Reviewed By ______________ Date ______________ Comments* ______________

Action By ______________ Date ______________ Comments* ______________

*Disposition: Approved/Denied/Incomplete

Reply to Appropriate EPD District Office

1 Georgia EPD Mountain District
P.O. Box 3250
Cartersville, Georgia 30120
(770) 387-4900
ATTN: Mr. James Cooley, Mgr.

2 Georgia EPD West Central District
2640 Shurling Drive
Macon, Georgia 31202
(478) 751-6612
ATTN: Mr. Todd Bethune, Mgr.

3 Georgia EPD Northeast District
745 Gaines School Road
Athens, Georgia 30605
(706) 369-6376
ATTN: Mr. Derrick Williams, Mgr.

4 Georgia EPD East Central District
3524 Walton Way Ext.
Augusta, GA 30909
(706) 667-4343
ATTN: Mr. Jeff Darley, Mgr.

5 Georgia EPD Coastal District
400 Commerce Center Drive
Brunswick, Georgia 31523-8251
(912) 264-7284
ATTN: Mr. Bruce Foisy, Mgr.

6 Georgia EPD Southwest District
2024 Newton Road
Albany, Georgia 31708
(229) 430-4144
ATTN: Ms. Lisa Myler, Mgr.

NOTE: All minor modifications for private industrial facilities except for those facilities located in the Coastal District should be directed to:
Georgia Environmental Protection Division
Solid Waste Management Program
4244 International Parkway, Suite 104
Atlanta, Georgia 30354
(404) 362-2692
ATTN: Solid Waste Management Program

Attachment 2:
Help Model Analysis

Liner System Analysis

HELP Model Analysis

ATLANTIC COAST CONSULTING, INC.

GEORGIA
REGISTERED
No. 27863
PROFESSIONAL
ENGINEER
JONI ELIZABETH HEADRICK

5-5-17

TABLE 3-2

HELP Model Analysis - Summary CCR Cells

File Name	Scenario	Description: Base Liner Option	Description: Final Cover Option	Description: Waste Depth (ft)	Description: Runoff (%)	Description: Recirculation (%)	Description: Simulation Term (yrs)	Maximum Base Liner Head per Peak Daily Value (inches)	Drainage Collected From LCS Peak Daily Value (inches)	Annual Average Leachate Generation Rate (CF/Ac/Yr)	Annual Average Leachate Generation Rate (Gal/Ac/Day)	Recirculated Leachate (CF/Ac/Yr)	Recirculated Leachate (Gal/Ac/Day)	Peak Daily Leachate Generation Rate (CF/Ac/Day)	Geonet Core Thickness Modeled (inches)
rbbrA.out	9	1	-	10	0	-	1	0.050	0.138	59,307	1,215	-	-	501	0.30
rbb22A.out	10	1	-	50	25	-	10	0.052	0.070	27,220	558	-	-	254	0.30
rbb2A.out	11	1	-	50	100	-	10	0.040	0.055	20,444	419	-	-	200	0.30
rbb555.out	12	1	-	130	25	-	50	0.195	0.080	31,788	651	-	-	291	0.27
rbb5555.out	13	1	-	130	100	-	50	0.195	0.080	31,788	651	-	-	291	0.27
rbb55A.out	14	1	-	210	25	-	50	0.210	0.071	24,205	496	-	-	258	0.27
rbb5A.out	15	1	-	210	100	-	50	0.210	0.071	26,478	543	-	-	257	0.27
rbb44A.out	16	1	-	270	25	-	50	0.276	0.066	18,520	380	-	-	241	0.30
rbb4A.out	17	1	-	270	100	-	50	0.235	0.056	13,938	286	-	-	205	0.30
Alternate HELP Run with Protective Cover having a hydraulic conductivity of 1.0E-6 cm/S.															
rbb44A*.out	16*	1	-	270	25	-	50	0.143	0.034	18,154	372	-	-	123	0.30

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************


PRECIPITATION DATA FILE:    C:\help\DATA4.D4
TEMPERATURE DATA FILE:      C:\help\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\help\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\help\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\help\rbb44a*.D10
OUTPUT DATA FILE:           C:\help\rbb44a*.OUT


TIME:  17:40     DATE:   5/ 4/2017


******************************************************************************

     TITLE:  R&B Site 2 MSW Landfill Horizontal Exp - Just Before Closed

******************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                  LAYER  1
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                   =     12.00   INCHES
           POROSITY                    =      0.3980 VOL/VOL
           FIELD CAPACITY              =      0.2440 VOL/VOL
           WILTING POINT               =      0.1360 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.2371 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.116000003000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 31

THICKNESS	=	3240.00 INCHES
POROSITY	=	0.5780 VOL/VOL
FIELD CAPACITY	=	0.0760 VOL/VOL
WILTING POINT	=	0.0250 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0801 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.410000002000E-02 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00 INCHES
POROSITY	=	0.3980 VOL/VOL
FIELD CAPACITY	=	0.2440 VOL/VOL
WILTING POINT	=	0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999997000E-06 CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.30 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	2.14000010000 CM/SEC
SLOPE	=	2.00 PERCENT
DRAINAGE LENGTH	=	510.0 FEET

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER

MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06 INCHES
POROSITY	=	0.0000 VOL/VOL
FIELD CAPACITY	=	0.0000 VOL/VOL
WILTING POINT	=	0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.25	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 3.% AND A SLOPE LENGTH OF 510. FEET.

SCS RUNOFF CURVE NUMBER	=	94.40	
FRACTION OF AREA ALLOWING RUNOFF	=	25.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	4.817	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	10.556	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.882	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	268.374	INCHES
TOTAL INITIAL WATER	=	268.374	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM WATKINSVILLE GEORGIA

STATION LATITUDE	=	33.90	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	78	
END OF GROWING SEASON (JULIAN DATE)	=	314	
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.50	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	67.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	70.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	71.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR ATLANTA GEORGIA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.91	4.43	5.46	4.43	4.02	3.41
4.73	3.41	3.17	2.53	3.43	4.23

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR WATKINSVILLE GEORGIA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
45.00	47.00	52.00	61.00	70.00	77.00
79.00	78.00	73.00	63.00	51.00	44.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR WATKINSVILLE GEORGIA AND STATION LATITUDE = 33.90 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 50

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.38	4.40	5.65	4.55	4.21	3.57
	5.06	3.32	3.57	2.47	3.31	3.85
STD. DEVIATIONS	2.22	1.97	2.41	2.29	2.20	1.65
	2.50	1.79	2.19	1.39	1.75	2.14
RUNOFF						
TOTALS	0.340	0.332	0.473	0.334	0.306	0.151
	0.354	0.188	0.260	0.137	0.234	0.252
STD. DEVIATIONS	0.305	0.312	0.349	0.276	0.263	0.115
	0.416	0.179	0.271	0.149	0.224	0.290
EVAPOTRANSPIRATION						

TOTALS	2.033	2.293	3.456	3.626	3.433	3.227
	3.917	3.062	2.588	2.094	1.802	1.588
STD. DEVIATIONS	0.233	0.286	0.405	0.824	1.055	1.295
	1.281	1.200	1.178	0.763	0.399	0.271

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.4636	0.3810	0.3708	0.3221	0.3133	0.3580
	0.3821	0.4842	0.4702	0.5025	0.4631	0.4903
STD. DEVIATIONS	0.4490	0.3871	0.3977	0.3687	0.3830	0.4095
	0.4267	0.4712	0.4469	0.4847	0.4532	0.4605

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0314	0.0284	0.0252	0.0226	0.0212	0.0251
	0.0259	0.0328	0.0330	0.0341	0.0325	0.0333
STD. DEVIATIONS	0.0305	0.0288	0.0270	0.0258	0.0260	0.0287
	0.0289	0.0320	0.0313	0.0329	0.0318	0.0312

****

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 50

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.36 (6.768)	175541.0	100.00
RUNOFF	3.362 (0.9248)	12205.26	6.953
EVAPOTRANSPIRATION	33.121 (3.3010)	120228.59	68.490
LATERAL DRAINAGE COLLECTED FROM LAYER 4	5.00121 (4.87522)	18154.402	10.34197
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.012	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.029 (0.028)		
CHANGE IN WATER STORAGE	6.874 (6.8371)	24952.81	14.215

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 50

	(INCHES)	(CU. FT.)
PRECIPITATION	7.44	27007.201
RUNOFF	2.067	7502.7148
DRAINAGE COLLECTED FROM LAYER 4	0.03402	123.47513
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00005
AVERAGE HEAD ON TOP OF LAYER 5	0.072	
MAXIMUM HEAD ON TOP OF LAYER 5	0.143	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	1.6 FEET	
SNOW WATER	3.05	11065.9375
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3707	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0976	

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 50

LAYER	(INCHES)	(VOL/VOL)
1	3.3829	0.2819
2	598.4885	0.1847
3	9.5437	0.3977
4	0.0631	0.2103
5	0.0000	0.0000
6	0.1875	0.7500
SNOW WATER	0.410	

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Attachment 3:
Leachate Pipe Design

Leachate Collection & Conveyance Design

Leachate Pipe Design

ATLANTIC COAST CONSULTING, INC.

GEORGIA
REGISTERED
No. 27863
PROFESSIONAL
ENGINEER
JOY ELIZABETH HEADRICK

5-5-17

Project #:	I002-415			
Project Name:	R&B Minor Modification CCR Management	By: BFH	Date	3/30/2015
Subject:	Leachate Pipe Design CELL 11	Checked: BH	Date	4/1/2015

Leachate Collection Pipe Design SDR 11

Determine the thickness of the HDPE leachate pipes (from ISCO Product Catalog)
Pipes are to be placed in the center of the low point of each lined cell. The 6" perforated pipe will be placed in 2 feet of gravel (see detail).

SDR=	**11**				
PE Pipe Material Code	PE 4710				
compressive yield, σ_y =	1150	psi	165600	psf	(See Appendix C, Chapter 3, 2nd Edition Handbook of PE Pipe by PPI)
Normal outer Diameter, Bc=	6.625	inches			
minimum wall thickness, t=	0.602	inches			
Average Inner Diameter, Bi=	5.348	inches			
mean radius, r= (Bi+2t)/2 =	3.28	inches			
Liner System (gravel)	120	lb/ft^3			
Final Cover System	120	lb/ft^3			
CCR Waste	115	lb/ft^3			

Total External Pressure

$P_T = P_S + P_L + P_I$

P_T = total pressure
P_S = total Static Pressure
P_L = total Dynamic pressure
P_I= total Internal Pressure

Static Load, Post Closure: $P_S = P_{LS} + P_{FC} + P_{SW} = \rho_{LS} * D_{DE} + \rho_{FC} * Dwe + \rho_{SW} * Dsw$

P_{LS} = Pressure from Liner System =	Liner System unit weight,	120	(lb/ft^3) * Depth of Liner System,	2	ft =	240 lb/ft^2
P_{FC} = Pressure from Final Cover =	Final Cover unit weight,	120	(lb/ft^3) * Depth of Final Cover,	3	ft =	360 lb/ft2
P_{CCR} = Pressure from Wastes =	Landfill CCR unit weight,	115	(lb/ft^3) * Depth of Stacked waste,	106	ft =	12190 lb/ft2

P_s = 12790 psf **For Full Cell, P_T= 12790 psf (PL and PI = 0)**
= 88.8 psi

Dynamic Load, Active Operation: $P_L = 3I_fW_wH^3/(2¶r^5)$ (psf) (Boussinesq Equation - page 203, Chapter 6, 2nd Edition Handbook of PE Pipe by PPI)

P_L = vertical soil pressure due to live load, psf
W_w = Wheel Load (lbs)
H = vertical depth to pipe crown, ft
I_f = impact factor = 2.0 since load is traveling
r = distance from point of load application to pipe crown, ft
$r=(X^2 + H^2)^{1/2}$ (See Figure 3-4)
For empty cell max stess: (Directly beneath one wheel as vehicle travels over pipe)

W =	24,000	lbs	Half of axle load of 24 tons
X_1 =	0	ft	For wheel load above point on pipe
X_2 =	6	ft	For wheel load at other end of the axle
H =	2	ft	
r_1 =	2.00	ft	
r_2 =	6.32	ft	
P_{L1} =	5,730	psf	Due to wheel load directly above point on pipe
P_{L2} =	18	psf	Due to wheel at the other end of the axle
P_L=	5,748	psf	

Internal Pressure due to Vacuum
P_I= 0 psf

For an empty cell, PT = PS + PL + PI = 5,988 psf, or
41.6 psi

Design for Compressive Ring Thrust Stress:

At greater than 50' of burial depth, the use of Spangler's modified Iowa formula is impractical because it ignores arching effect.
Due to full landfill development depth, CRT should include vertical arching factor per McGrath's modification of the Burns and Richard's equations
(See pages 226 and 227, Chapter 6, 2nd Edition Handbook of PE Pipe by PPI)

$$VAF = 0.88 - 0.71\frac{S_A - 1}{S_A + 2.5}$$

VAF= Vertical Arching Factor
S_A= Hoop Thrust Stiffness Ratio

$$S_A = \frac{1.43 M_S r_{CENT}}{EA}$$

r_{CENT}= radius to centroidal axis of pipe, in — r_{CENT}= 3.28
M_S= one-dimensional modulus of soil, psi — M_S= 4,000 (Table 3-12, 90%, extrapolated to static load)
E= apparent modulus of elasticity of pipe material, psi — E= 22,960 (Table B1.1 & B1.2, 100 yrs, PE4710, 90°F)
A= profile wall average cross sectional area, in^2/in — A= 0.602

S_A= 1.36
VAF= 0.81

$$P_{RD} = (VAF)wH$$ Equation 3-23

P_{RD}= radial directed earth pressure, psf
w= unit weight of cover, pcf
H= depth of cover, ft
wH= P_s for post closure condition

P_{RD}= 10,417 psf

$$S = (P_{RD} * D_O)/(288*A)$$

S= pipe wall compressive stress (psi)
D_O= pipe outside diameter (in.)
A= pipe wall thickness (in.)

S=	398.1 psi	57321.7 psf
Allowable Compressive Stress=	1150 psi	165,600 psf

Since 398.1 psi is < 1150 psi; design OK
Since 57321.7 psf is < 165600 psf; design OK

Design for Wall Crushing (see page 219, Chapter 6, 2nd Edition Handbook of PE Pipe by PPI)

$$S = \frac{P_t * Bc}{288 * t}$$

S= pipe wall compressive stress (psi)
Pt= vertical load applied to the pipe (psf)
Bc= pipe outside diameter (in.)
t= pipe wall thickness (in.)

S= 488.7 psi — **Since 488.7 psi is < 1150 psi; design OK**
70376.87 psf — **Since 70376.9 psf is < 165600 psf; design OK**

$$FS = \frac{\sigma_y}{S}$$

σ_y = compressive yield (psf)
S= pipe wall compressive stress (psf)

FS= 2.4

Design for Ring Deflection

Use Watkins-Gaube Method per pages 229-231 of Chapter 6, 2nd Edition Handbook of PE Pipe by PPI

R_F= Rigidity Factor

$$R_F = (12 * E_S (SDR-1)^3)/E$$

E= Modulus of elasticity of the pipe material, (psi) — E= (Table B1.1 & B1.2, 100 yrs, PE4710, 90°F)

E_S= Secant modulus of soil , (psi) — E= 22,960

SDR= standard dimension ratio — SDR= 11

$$E_S = M_S*(1+\mu)(1-2\mu)/(1-\mu)$$

μ= Poisson's Ratio — μ= 0.2 (Table 3-13)

M_S= one-dimensional modulus of soil, psi — M_S= (Table 3-12, 90%, extrapolated to static load)

E_S= 3,600 psi — M_s= 4,000

$$\varepsilon_S = wH/144E_S$$

ε_S = soil strain

w= unit weight of cover, pcf

H= depth of cover, ft

wH= P_s for post closure condition — wH= 12,790 psf

ε_S = 2.5 percent

R_F= 1,882

D_F= Deformation Factor

D_F= 1.4 (From Figure 3-6: Watkins-Gaube Graph)

$$(\Delta X/D_M)*100 = D_F*\varepsilon_S$$

ΔX= horizontal deflection or change in diameter, (in)

D_M= outside pipe Diameter, (in)

$\Delta X/D_M$= 3.45 Percent Since 3.45 is < 7.5 OK

$$FS = \frac{7.5}{\Delta X/D_M}$$ **FS= 2.2**

<u>Design for Constrained Pipe Wall Buckling</u>

Use Luscher's equation to determine allowable constrained buckling pressure

$$P_{wc} = 5.65/SF\ \sqrt{(R*B'*E'*E/12(SDR-1)^{3})}$$

(Equation 3-15, page 221, Chapter 6, 2nd Edition Handbook of PE Pipe by PPI)

P_{wc}=	Allowable constrained wall buckling pressure (psi)	H_w=	1 ft
SF=	Safety Factor; 2	H=	106 ft
R=	Buoyancy reduction factor; $R=1-(0.33*H_w/H)$	R=	1.0
H_w=	groundwater height above pipe (ft);	B'=	1.0
H=	Cover above pipe (ft)	E'=	3500 psi
B'=	elastic support factor; $B'=1/(1+4e^{-0.065H})$	E=	22,960 psi
E'=	modulus of soil reaction for pipe bedding (psi);	SDR=	11
E=	long-term modulus of elasticity of the pipe material (psi);		
SDR=	standard dimension ratio of the pipe		

P_{wc}= 231.2 psi ≥ 88.8 psi so OK

33290 psf ≥ 12790 psf so OK

FS= 1.7

Attachment 4:
Leachate Comparison

October 2016 Leachate Sample Results
R&B Site 2 Landfill

	Parameter	CCR Leachate	MSW Leachate	Units
General Chemistry/Water Quality	Alkalinity, Total	87.8	3000	mg/L
	Chemical Oxygen Demand	17.2	1190	mg/L
	Field pH	5.78	6.95	SU
	Field Turbidity	2.4	44.1	NTU
	Specific Conductance	1020	10600	uS/cm
	Sulfate	378	1.5	mg/L
	Temperature	23.8	28.8	Celsius
	Total Dissolved Solids	711	4330	mg/L
Metals	Antimony	ND	0.013	mg/L
	Arsenic	ND	0.072	mg/L
	Barium	0.048	1.4	mg/L
	Beryllium	ND	ND	mg/L
	Boron	0.21	NR	mg/L
	Calcium	59.7	14.9	mg/L
	Chloride	22.2	1710	mg/L
	Chromium	ND	0.029	mg/L
	Cobalt	0.62	0.03	mg/L
	Copper	ND	ND	mg/L
	Fluoride	0.34	NR	mg/L
	Lead	ND	ND	mg/L
	Nickel	0.09	0.2	mg/L
	Selenium	ND	0.01	mg/L
	Silver	ND	ND	mg/L
	Thallium	ND	ND	mg/L
	Vanadium	ND	0.042	mg/L
	Zinc	ND	0.0058	mg/L

Notes:
ND = Not detected
NR = Not required
mg/L = milligrams per liter
uS/cm = milliSiemens per centimeter
SU = Standard Units
NTU = nephelometric turbidity units

Attachment 5:

Base Grade Settlement Analysis

Base Grade Settlement Analysis

Atlantic Coast Consulting, Inc.

GEORGIA
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No. 27863
PROFESSIONAL
ENGINEER
JOAN ELIZABETH HEADRICK

5-5-17

OBJECTIVE: Evaluate the base grade settlement as a result of the change in stress in the subgrade soils due to placement of CCR waste in the landfill. Determine effects of the estimated settlement (overall and differential) on the proposed waste containment systems.

METHOD: The compression of the subgrade soils as a result of placement of waste in the landfill and the resulting impact on the landfill liner system was evaluated. The overall settlement is a sum of the primary and secondary settlements of the subgrade. The first step in the evaluation was to review the geometry and soils and waste mass and the physical properties of the soils and waste at discreet points along a selected cross section and perform a one-dimensional settlement analysis at critical analysis locations. This allows for an estimation of post settlement base grades and the resulting tensile stresses in the liner system.

Primary Settlement (Sc)

The following equation is used to estimate the *primary settlement* in normally consolidated clays or loose granular materials:

$$S_c = \left(\frac{C_c}{1+e_0}\right)\cdot H\cdot\log\left(\frac{\sigma_0' + \Delta\sigma_0'}{\sigma_0'}\right) \qquad (6.1)$$

where
- H = thickness of the layer after excavation to be evaluated,
- C_c = primary compression index,
- e_o = initial void ratio,
- σ_o' = effective vertical stress at the middle of the layer after excavation, but before loading, and
- $\Delta\sigma_o'$ = increase or change in effective vertical stress due to loading.

The following equation is used to estimate the consolidation settlement in overconsolidated clays. Dense cohesionless materials do not settle significantly and thus, do not have to be evaluated using this equation.

$$S_c = \left(\frac{C_r}{1+e_0}\right)\cdot H\cdot\log\left(\frac{\sigma_0' + \Delta\sigma_0'}{\sigma_0'}\right) \qquad (6.2)$$

where C_r = recompressive index.

If the increase in vertical stress at the middle of the consolidation layer is such that ($\sigma_o' + \Delta\sigma_o'$) exceeds the preconsolidation pressure (σ_p') of the consolidating layer, the following equation should be used:

$$S_c = \left[\left(\frac{C_r}{1+e_0}\right)\cdot H\cdot\log\left(\frac{\sigma_p'}{\sigma_0'}\right)\right] + \left[\left(\frac{C_c}{1+e_0}\right)\cdot H\cdot\log\left(\frac{\sigma_0' + \Delta\sigma_0'}{\sigma_p'}\right)\right] \qquad (6.3)$$

Secondary Settlement (S_s)

Secondary settlement can be calculated using the following equation:

$$S_s = \frac{C_\alpha}{1+e_p} \cdot H \cdot \log\left(\frac{t_s}{t_{pf}}\right) \qquad (6.4)$$

where C_a = *secondary compression* index of the *compressible layer*,
H = thickness of the layer to be evaluated after excavation, but before loading
t_s = time over which *secondary compression* is to be calculated (use 100 years plus the maximum time it will take to complete *primary consolidation* under the facility unless some other time frame is acceptable to Ohio EPA for a specific facility), and
t_{pf} = time to complete *primary consolidation* in the consolidating layer in the field, and
e_p = the void ratio at the time of complete *primary consolidation* in the test specimen of the *compressible layer*.

Both t_s and t_{pf} must be expressed in the same units (e.g., days, months, years).

DATA: Design drawings of the liner system and final cover grades of the landfill were used to identify a representative cross section for settlement analysis. The critical section was chosen to coincide with a leachate collection line along Cell 18 in the Western Disposal Area, which includes the designed highest waste fill grades and the cells sump area. The selected cross section location is shown in Figure 7-1. The results of a previously subsurface exploration outlined in the report "Application for Site Acceptability R&B Landfill by GZA Geoenvironmental, Inc., dated May 29, 1996 were used to characterize the subsurface stratigraphy used in this analysis. The geometry of the landfill and subsurface soils along the analyzed cross section is shown in Figure 7-2.

Soil Layer Data:

The subgrade soil at the site consists of a few separate soil types as discussed in the cited report. The compressible layer is generally a silty sand between the landfill base grades and the bedrock. These calculations assume that the bedrock layer as well as the layers beneath it are not affected by the landfill loading. The following subgrade soil material properties were used based on experience and the references cited.

Layer 1 – Silty Sand

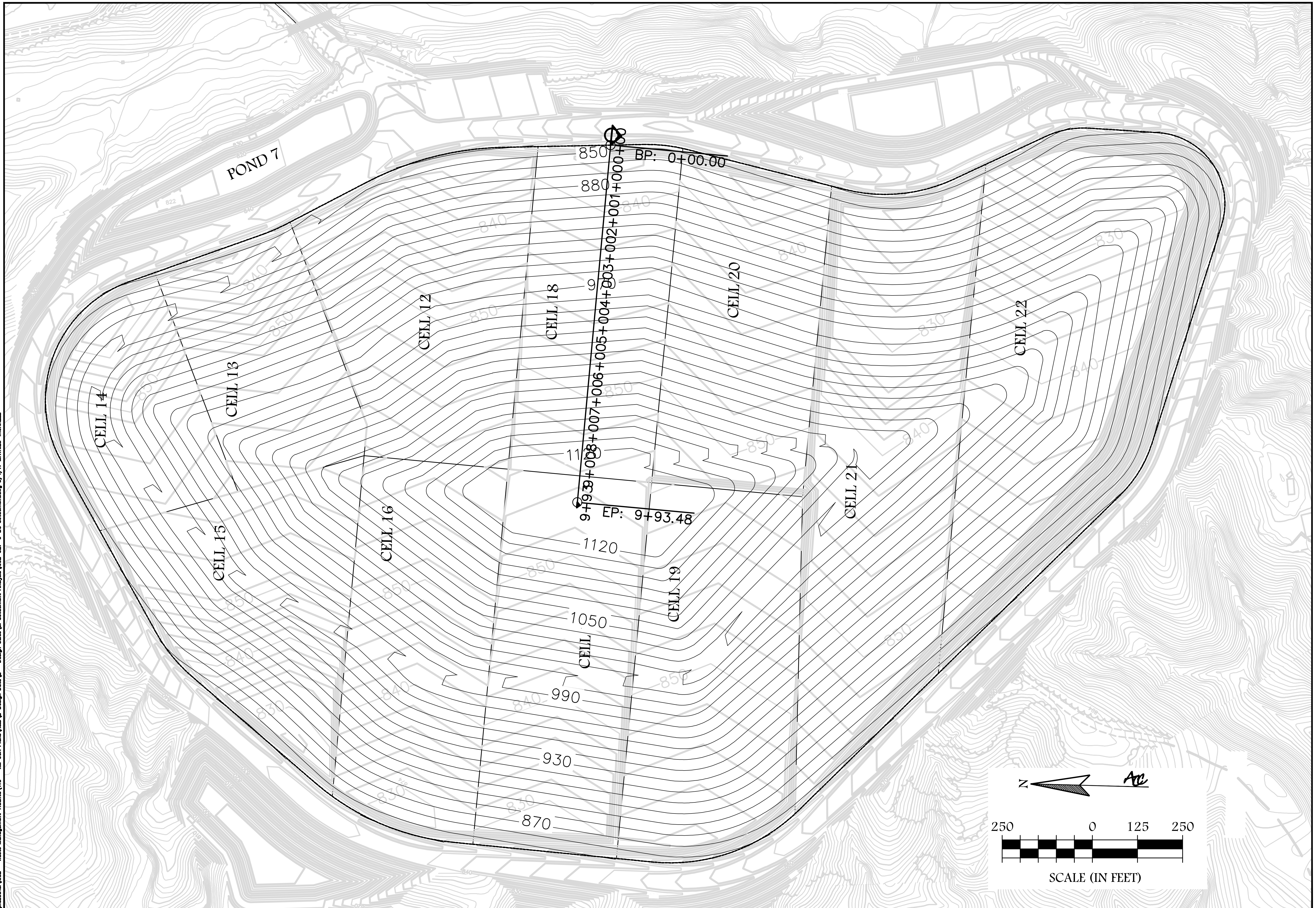
The void ratio was as reported in the undisturbed samples (see attached). The Re-Compression Index was calculated based on the equation from Nagaraj and Murthy (1985) as shown on the attached. The primary compression index was calculated based on Hough (see attached). The layer was assumed to have a total unit weight of 110 pcf as averaged from the GZA data.

The placement of liner soil (unit weight 120 pcf), CCR waste (unit weight 115 pcf), and the final cover soil (unit weight 110 psf) were assumed to result in an increase in stress in the underlying layers. The change in stress was estimated at the midpoint of each layer, and the resulting change in layer thickness was estimated using either elastic or consolidation properties. The total change in stress for all underlying layers was computed at the settlement at the landfill subgrade level. The difference in settlement between two adjacent points was used to compute the change is slope and, any induced tensile stresses.

RESULTS: The output for the spreadsheet computation of the base grade settlement analysis is attached. As indicated, the estimated settlement ranges from 0.60 to 3.40 ft under the landfill liner. Based on this computed settlement, the maximum tensile stress in the liner system is anticipated to be 0% (which is less than the typically acceptable value of 5%), while the overall landfill Leachate Collection System slope towards the sump is maintained.

CONCLUSION: The analysis indicates that the proposed landfill geometry is adequately designed to accommodate the anticipated base grade settlements.

Point No.	A	B
Horizontal Distance	0.00	835
Top of Final Cover Elevation (ft MSL)	1124.00	856.00
Top of Waste Elevation (ft MSL)	1121.00	853.00
Top of Liner Elevation (ft MSL)	854.50	838.00
Subgrade Elevation (ft MSL)	852.50	836.00
Existing Ground Elevation (ft MSL)	850.00	843.00
Groundwater Elevation (ft MSL)	838.50	824.00
Cut (ft)	0.00	7.00
Fill (ft)	2.50	0.00
Soil Density (pcf)	110	110
Liner Soil Thickness (ft)	2.00	2.00
Liner Soil Density (pcf)	120	120
Cover Soil Thickness (ft)	3.00	3.00
Cover Soil Density (pcf)	110	110
Waste Thickness (ft)	266.50	15.00
CCR Waste Density (pcf)	115	115
Change in Stress (psf)	31492.50	1525.00
Primary Settlement		
Layer 1 (Silty Sand)		
Top Elevation (ft MSL)	852.50	836.00
Bottom Elevation (ft MSL)	830.00	820.00
Mid Point Elevation (ft MSL)	841.25	828.00
Soil Density (pcf)	110	110
Layer Thickness (ft)	22.50	16.00
Preconsolidation pressure (psf)	1100.00	1265.00
Effective Initial Stress before loading(psf)	1237.50	880.00
Initial Void Ratio	0.9	0.9
Liquid Limit	36	36
Primary compression Index	0.19	0.19
Re-compression Index	0.05	0.05
Primary Layer Settlement (ft)	3.271	0.504
Secondary Settlement		
Layer 1 (Silty Sand)		
Top Elevation (ft MSL)	852.50	836.00
Bottom Elevation (ft MSL)	830.00	820.00
Mid Point Elevation (ft MSL)	841.25	828.00
Soil Density (pcf)	110.0	110.0
Layer Thickness (ft)	22.50	16.00
Time for secondary compression (years)	200.00	200.00
Time for primary compression (years)	100.00	100.00
Void Ratio after primary consolidation	0.18	0.18
Secondary compression Index	0.02	0.02
Secondary Settlement (ft)	0.129	0.092
Total Settlement (ft)	3.40	0.60
Initial Length of Liner Segment (ft)		835.16
Final Length of Liner Segment (ft)		835.09
Strain (%, Tensile Negative)		0.01
Initial Liner Slope (ft/f)		2%
Final Liner Slope (ft/ft)		2%



ATLANTIC COAST CONSULTING, INC.
630 Colonial Park Dr.
Suite 110
Roswell, Ga 30075
p.770-594-5998
f.770-594-5967
www.atlcc.net

WASTE MANAGEMENT
610 BENNETT ROAD
HOMER, GEORGIA
30547

PROJECT:
R&B LANDFILL
HORIZONTAL
EXPANSION

BANKS, COUNTY GA

REVISIONS

Drawn by: BFH

Checked by:

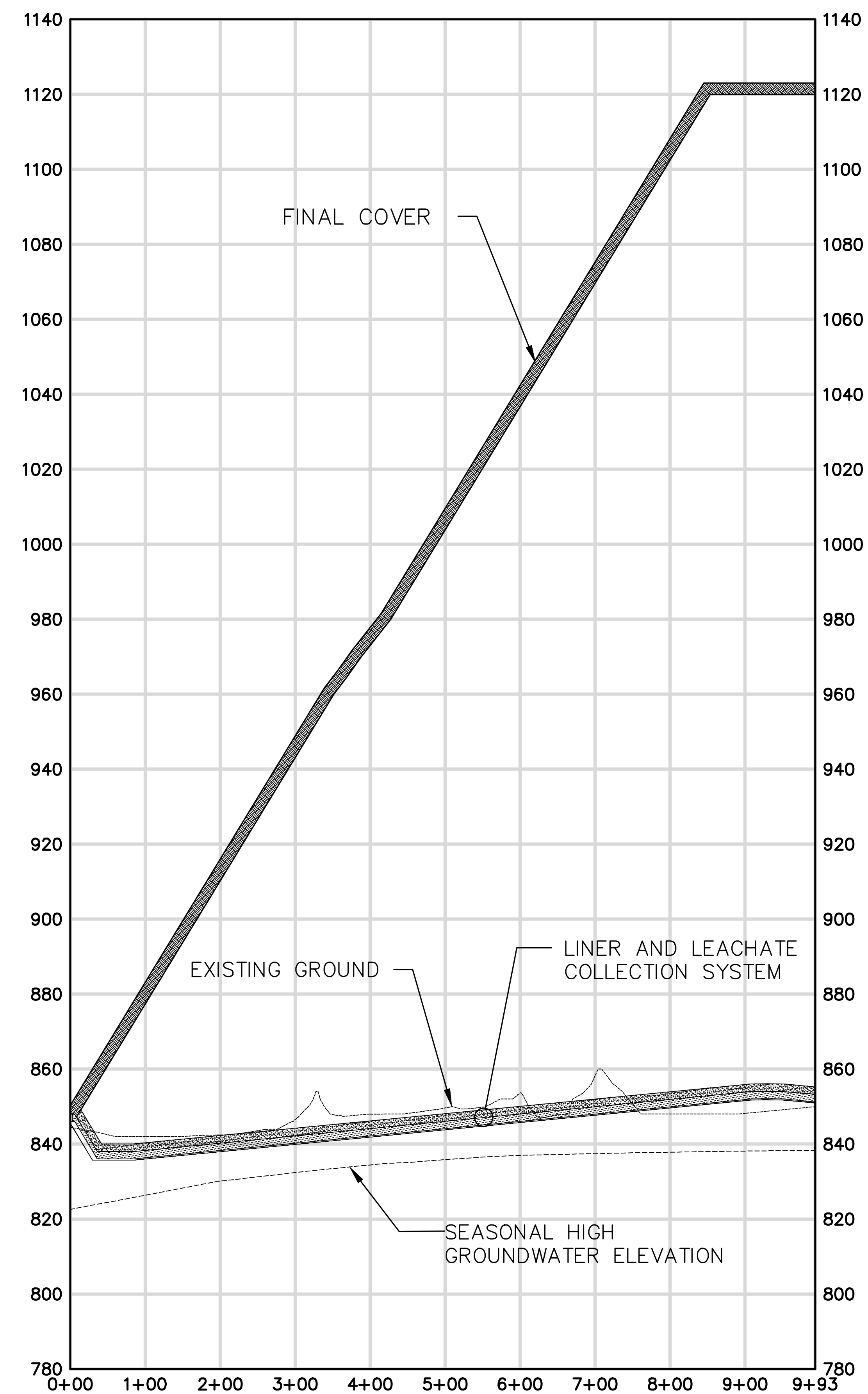
PROJECT NUMBER:
I002-327

April 2017

BASE GRADE
SETTLEMENT
ANALYSIS

SECTION PLAN

FIGURE 7-1



SCALE
1"=200' HORIZONTAL
1"=40' VERTICAL

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EXPANSION

BANKS, COUNTY GA

REVISIONS

Drawn by:	Checked by:
BFH	

PROJECT NUMBER:
I002-327

April 2017

BASE GRADE
SETTLEMENT
ANALYSIS

SECTION PROFILE

FIGURE 7-2

LABORATORY TES —NG DATA SUMMARY

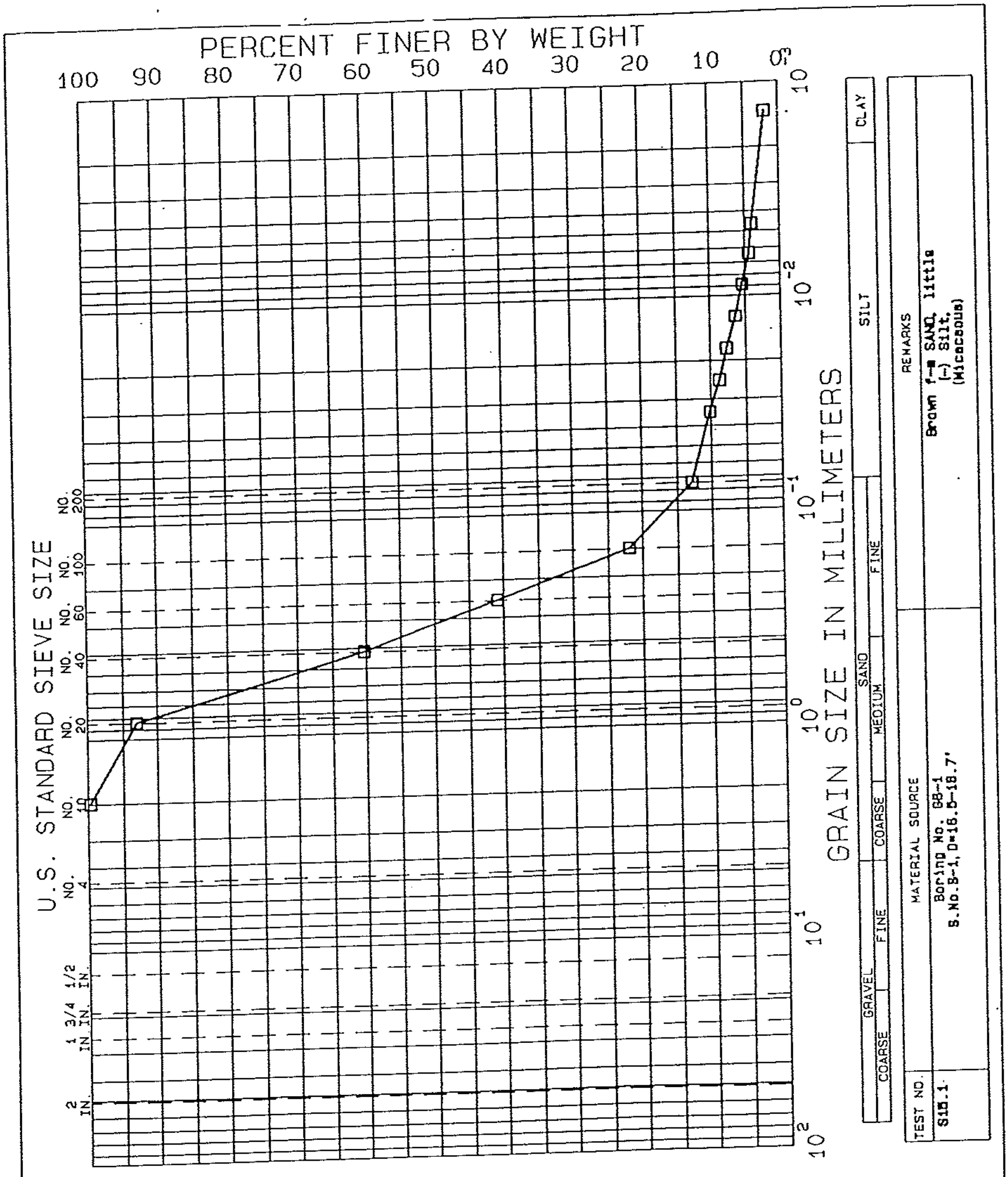
Project Name .S COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Reviewed by ______
Date ______
Required ______

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned MAR. 96

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS: Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	DENSITY: γ_d MAX (pcf) / W_{opt} (%)	Permeability cm/sec	STRENGTH TESTS: Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	CONSOL.: $\frac{C_c}{1 + e_0}$	Laboratory Log and Soil Description
GB-1	S-1	15-17	15		Average Total Unit Weight (15.0-17.0') = 93.7 Pcf															Brown f-m SAND, little (-) Silt, (Micaceous)
		15.4		21.0																
		15.4-15.7		Save																
		15.7		20.9																
		16.2		20.7																
		16.2-16.5		23.5							87.4		1.8 X EE-04	K	720	Triaxial Permeability Test				
		16.5		20.6																
		16.5-16.7		20.6		non-plastic	13	3												

GZA GEOENVIRONMENTAL, INC.
ENGINEERS AND SCIENTISTS



BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. GB-1
SAMPLE S-1
DEPTH 16.5-16.7'
TECH. MST
REVIEWER DAB

TEST SERIES
NO. 15
DATE Feb. 98

FILE 170027.0

LABORATORY TES⁻⁻NG DATA SUMMARY

Project Name KS COUNTY ROAD B CHAMBERS, ..A WASTE, BANKS COUNTY GA.

Reviewed by ______
Date ______
Required ______

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned MAR. 96

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS								DENSITY		STRENGTH TESTS					CONSOL.	Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	γ_d MAX (pcf) / W_{opt} (%)	Perme-ability cm/sec	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	$\frac{C_c}{1 + e_0}$	
GB-1	S-2	33-35	16	Average Total Unit Weight (33.0-35.0') = 98.7 Pcf																Brown f-m SAND, little (-) Silt, trace (+) Gravel (Micaceous)
		33.4		17.1																
		33.4-33.7		Save																
		33.7		18.5																
		34.4		16.0																
		34.4-34.7		24.7							88.0		2.5 X EE-05	K	720	Triaxial Permeability Test				
		34.7		17.9																
		34.7-34.9		18.1	non-plastic		13	2												

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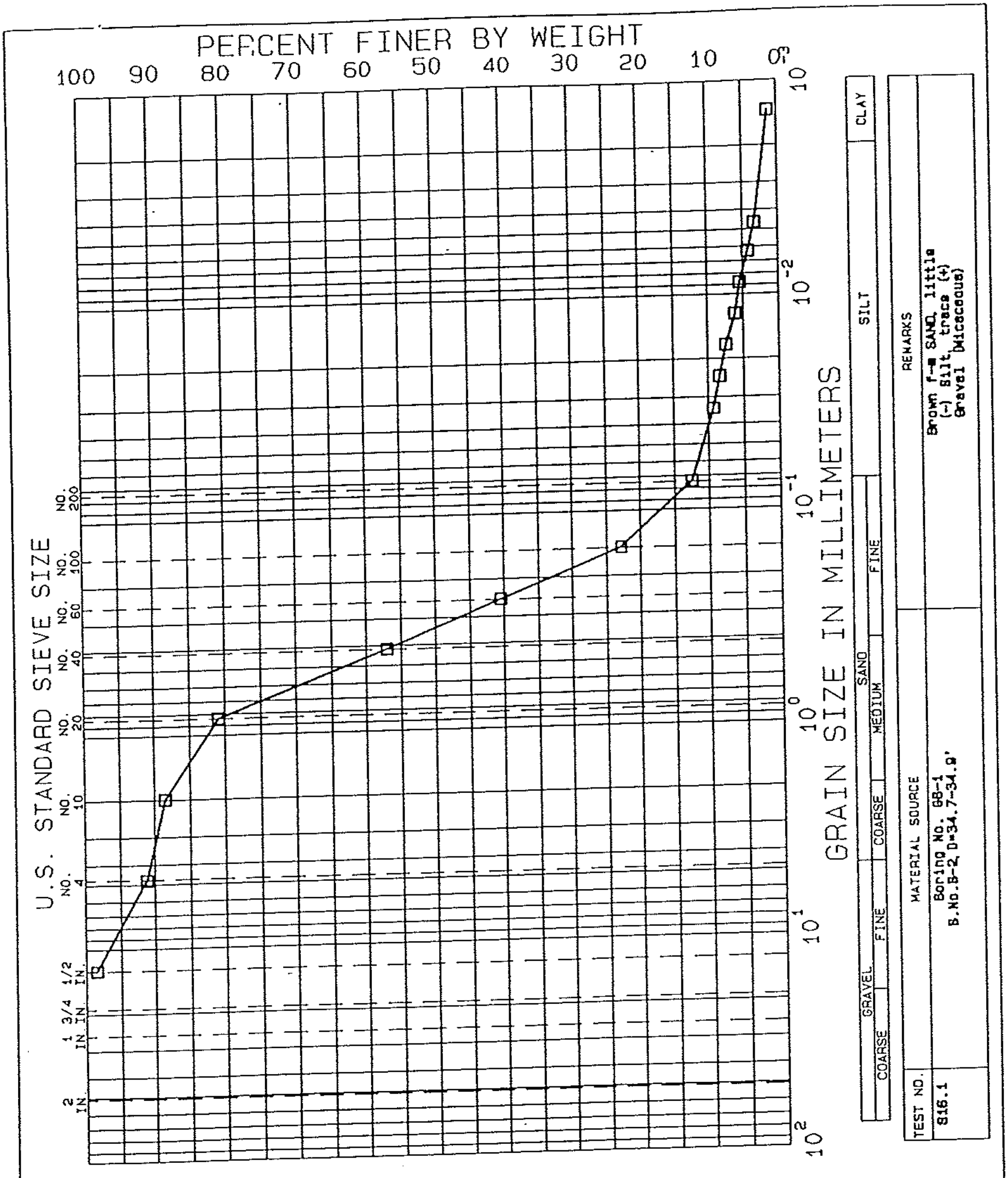

BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. 98-1
SAMPLE S-2
DEPTH 34.7-34.9'
TECH. MST
REVIEWER DAS

TEST SERIES
NO. 16
DATE Feb. 98

FILE 170027.0

LABORATORY TES' ·G DATA SUMMARY

Project Name ..S COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Reviewed by ____________
Date ____________
Required ____________

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned FEB. 96

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS								DENSITY		STRENGTH TESTS					CONSOL.	Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	γ_d MAX (pcf) / W_{opt} (%)	Permeability cm/sec	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	$\frac{C_c}{1 + e_0}$	
GB-2	S-1	12-14	11		Average Total Unit Weight (12.0-14.0') = 94.2 Pcf															Brown f-m SAND, little (+) Silt, (Micaceous)
		12.5		15.6																
		12.5-12.9		Save																
		12.9		15.6																
		13.1-13.2			non-plastic															
		13.3		15.6																
		13.3-13.5		14.4							83.8		2.6 X EE-04	K	720	Triaxial Permeability Test				
		13.5		15.5																
		13.5-13.7					20	4												

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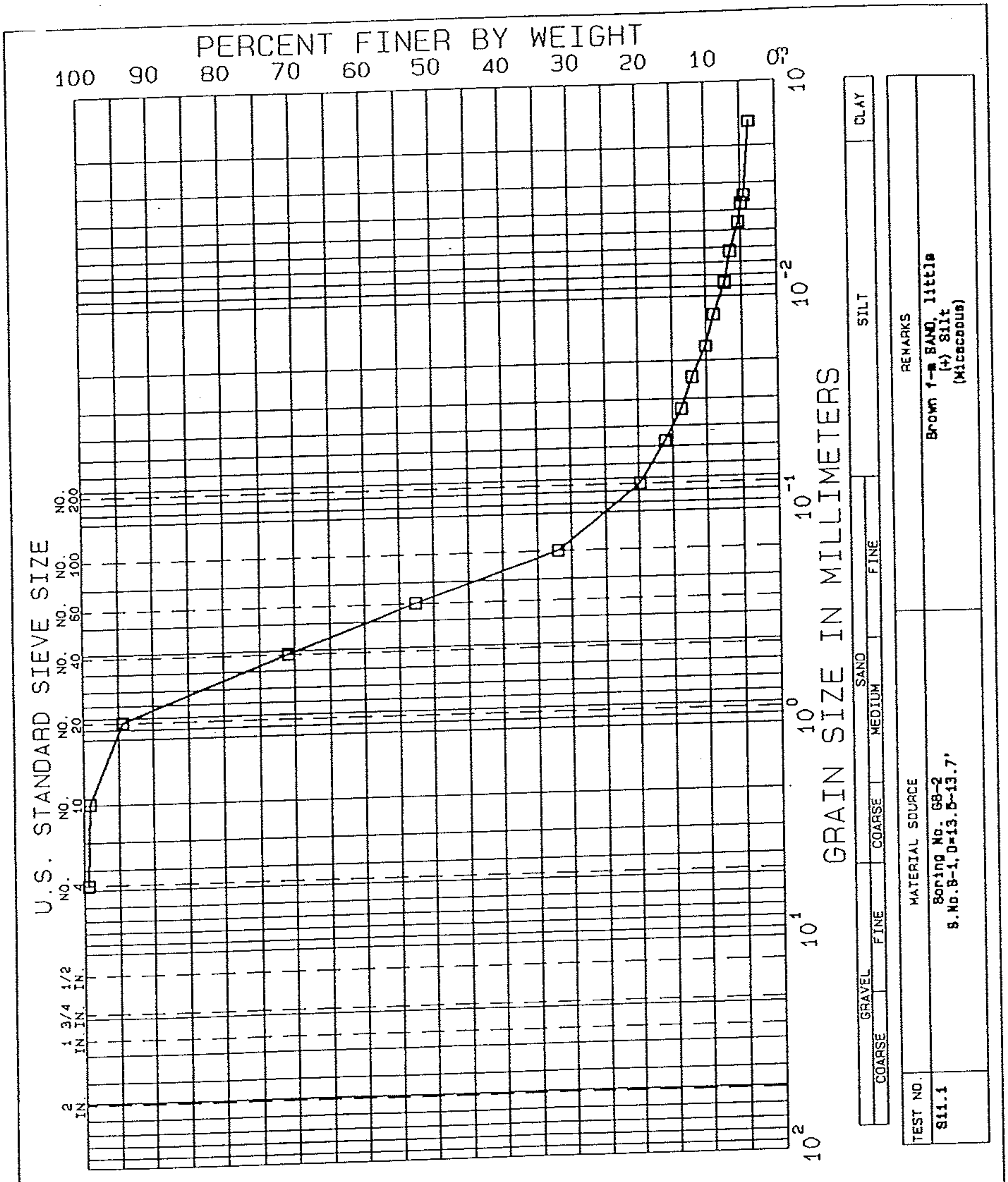

BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. GB-2
SAMPLE S-1
DEPTH 13.5-13.7'
TECH. MST
REVIEWER DAB

TEST SERIES
NO. 11
DATE Feb. 96

FILE 170027.0

LABORATORY TES' IG DATA SUMMARY

Project Name _ .KS COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Reviewed by ______
Date ______
Required ______

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned FEB. 96

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS								DENSITY		STRENGTH TESTS					CONSOL.	Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	γ_d MAX (pcf) / W_{opt} (%)	Perme-ability cm/sec	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	$\frac{C_c}{1 + e_0}$	
GB-2	S-2	22-24	12		Average Total Unit Weight (22.0-23.0') = 99.6 Pcf															Brown f-m SAND, some (-) Silt, (Micaceous)
		22.0		27.0																
		22.0-22.3		Save																
		22.3		27.2																
		22.3-22.5			non-plastic															
		22.5		27.2																
		22.5-22.8		30.0							75.2		3.6 X EE-04	K	720	Triaxial Permeability Test				
		22.8		27.0																
		22.8-22.9					20	2												

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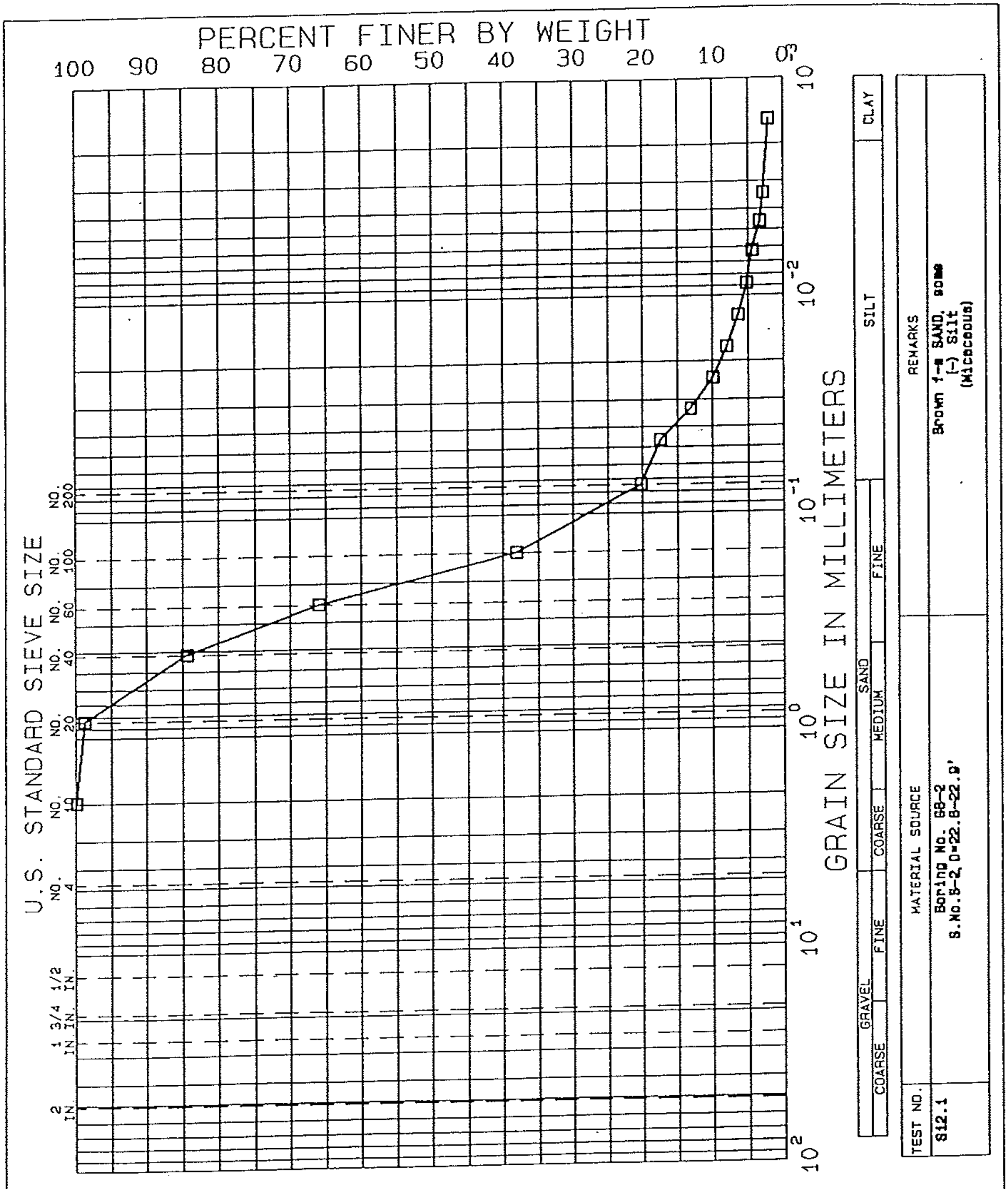

BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. 98-2
SAMPLE S-2
DEPTH 22.8-22.9'
TECH. MST
REVIEWER DAS

TEST SERIES
NO. 12
DATE Feb. 98

FILE 170027.0

LABORATORY TES' G DATA SUMMARY

Project Name BANKS COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned MAR. 96

Reviewed by ______
Date ______
Required ______

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS								DENSITY		STRENGTH TESTS					CONSOL.	Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	γ_d MAX (pcf) / W_{opt} (%)	Perme-ability cm/sec	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	$\frac{C_c}{1 + e_0}$	
GB-4	S-1	15-17	13		Average Total Unit Weight (15.0-16.4') = 111.2 Pcf															Brown f-m SAND, some (-) Silt (Micaceous)
		15.2		20.8																
		15.2-15.5		Save																
		15.6		21.9																
		15.7-16.0		21.5	non-plastic		22	3												
		16.0		21.4																
		16.0-16.3		30.0							73.4		8.0 X EE-05	K	720	Triaxial Permeability Test				
		16.4		21.9																

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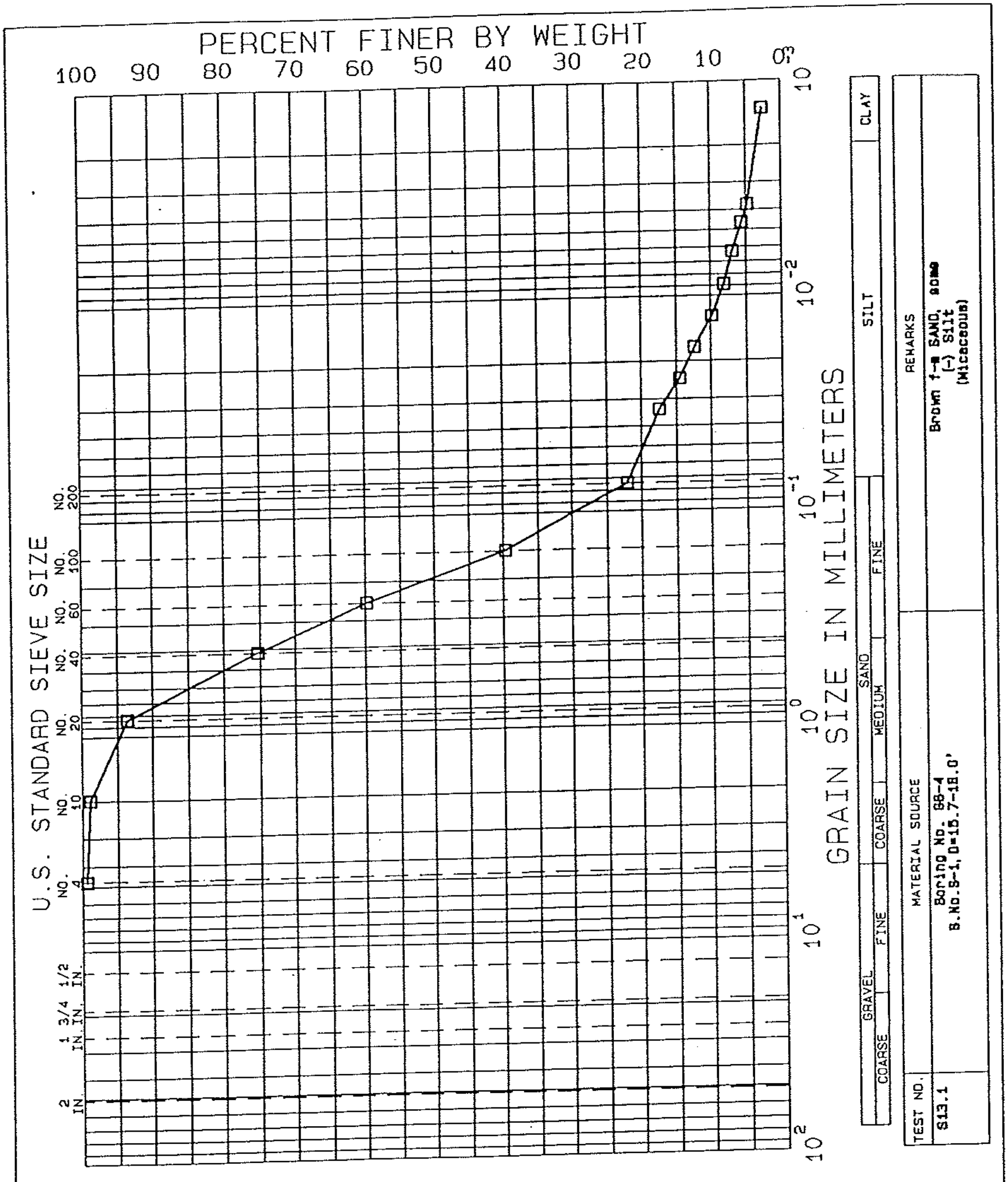

BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. 88-4
SAMPLE S-1
DEPTH 15.7-18.0'
TECH. MST
REVIEWER DAB

TEST SERIES
NO. 13
DATE Feb. 96

FILE 170027.0

LABORATORY TE. ING DATA SUMMARY

Project Name BANKS COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned FEB. 96

Reviewed by ______
Date Required ______

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS: Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	DENSITY: γ_d MAX (pcf) / W_{opt} (%)	Permeability cm/sec	STRENGTH TESTS: Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	CONSOL.: $\frac{C_c}{1 + e_0}$	Laboratory Log and Soil Description
GB-6	S-1	15-17	7	Average Total Unit Weight (15.0-16.7') = 118.0 Pcf																
		15.3		27.8																From 15.0-16.1' Depth - Red-Brown CLAY & SILT of medium plasticity
		15.3-15.8		Save																From 16.1-16.7' Depth - Red-Brown fine SAND and SILT, (Micaceous)
		15.8		27.9																
		16.1		19.0																
		16.1-16.2		18.9	29	28														
		16.2-16.6		15.9							94.8		6.5 X EE-05	K	720	Triaxial Permeability Test				
		16.6		19.2																
		16.6-16.7					37	7												

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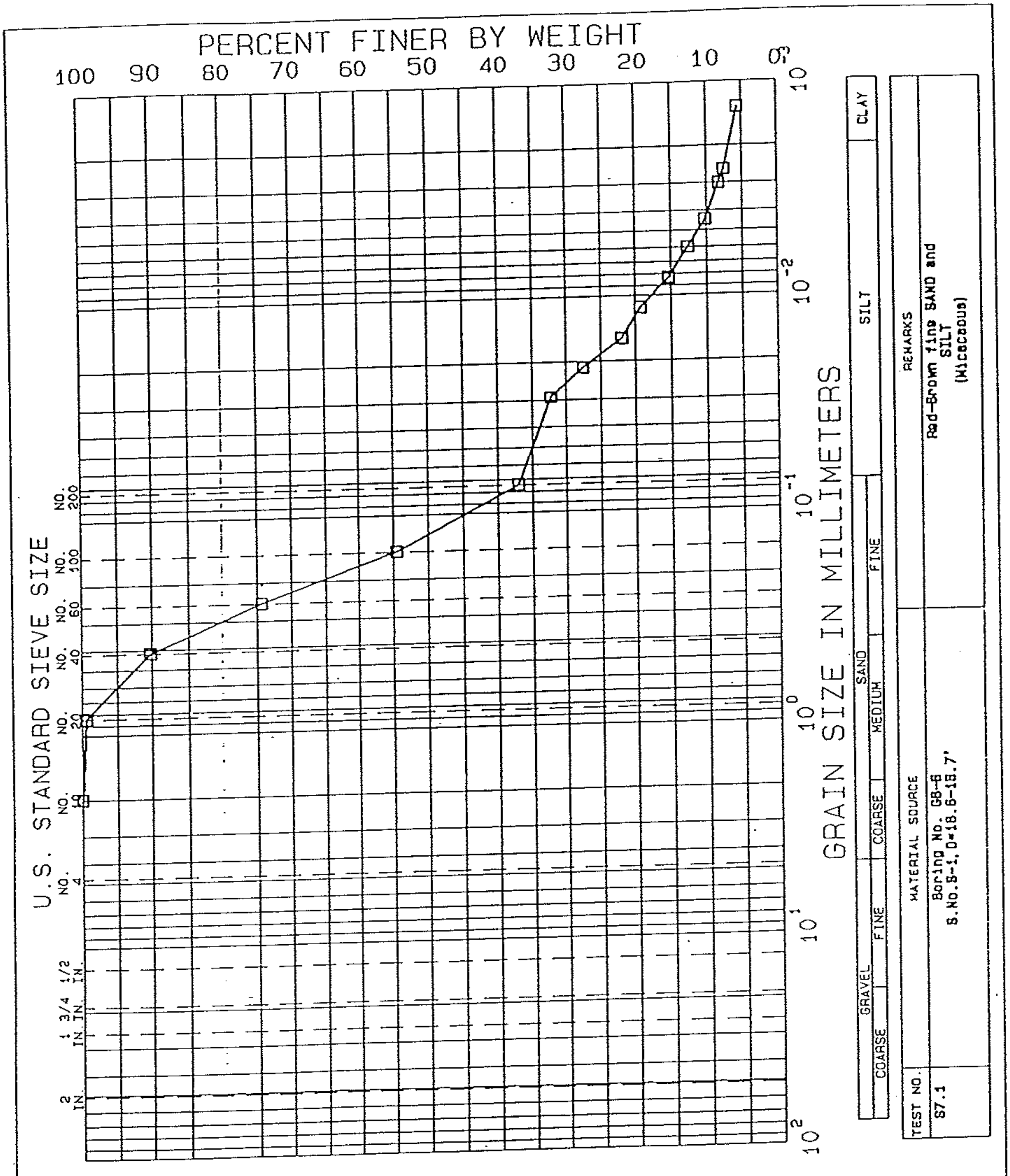


BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. GB-6
SAMPLE S-1
DEPTH 16.6-16.7'
TECH. MST
REVIEWER DAS

TEST SERIES
NO. 7
DATE Feb. 96

FILE Y70027.0

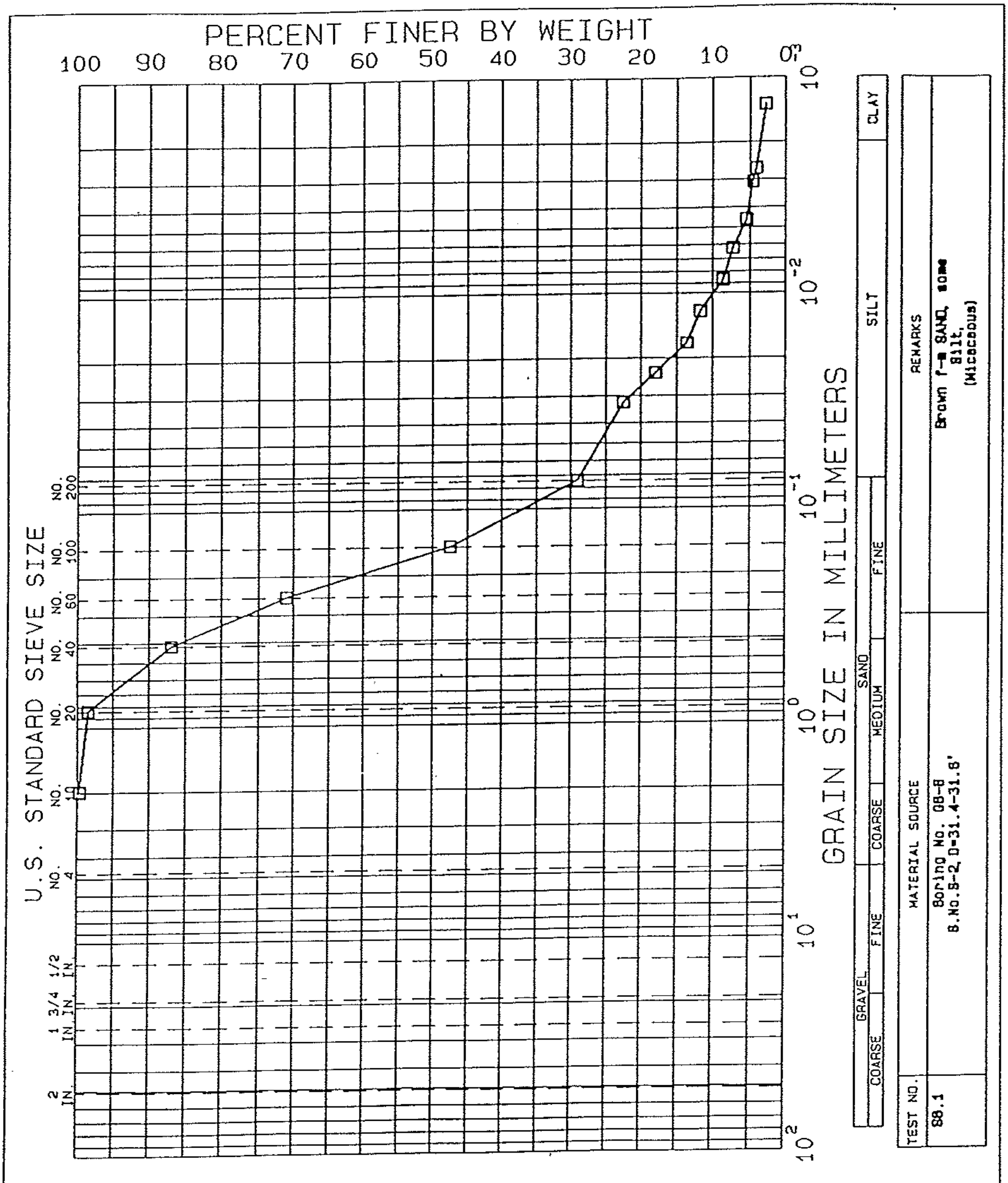
LABORATORY TE. .NG DATA SUMMARY

Project Name BANKS COUNTY ROAD B CHAMBERS, USA WASTE, BANK COUNTY GA.

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned FEB. 96

Reviewed by ______
Date ______
Required ______

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS: Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	DENSITY: γ_d MAX (pcf) / W_{opt} (%)	Perme-ability cm/sec	STRENGTH TESTS: Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	CONSOL.: $\frac{C_c}{1 + e_0}$	Laboratory Log and Soil Description
GB-6	S-2	30-32	8		Average Total Unit Weight (30.0-31.9') = 108.7 Pcf															Brown f-m SAND, some Silt (Micaceous)
		30.1		20.8																
		30.1-30.6		Save																
		30.6		21.2																
		30.9-31.0		21.0	non-plastic															
		31.1		20.6																
		31.1-31.4		18.0							98.4		2.8 X EE-05	K	720	Triaxial Permeability Test				
		31.4		21.2																
		31.4-31.6					29	3												



BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. GB-8
SAMPLE S-2
DEPTH 31.4-31.6'
TECH. MST
REVIEWER DAB

TEST SERIES
NO. 8
DATE Feb. 98

FILE 170027.0

LABORATORY TE :NG DATA SUMMARY

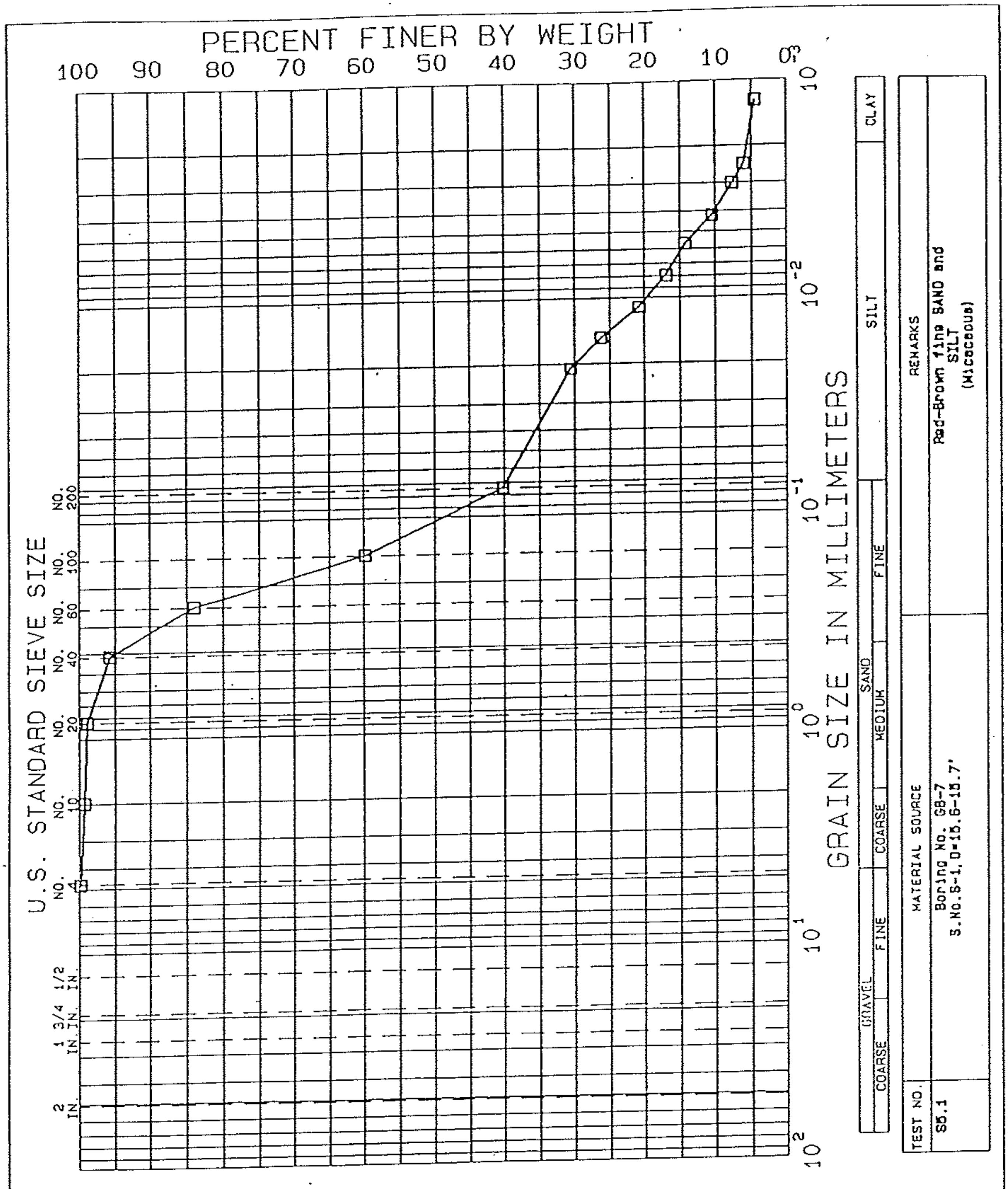
Project Name BANKS COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned FEB. 96

Reviewed by ______
Date ______
Required ______

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS: Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	DENSITY: γ_d MAX (pcf) / W_{opt} (%)	Perme-ability cm/sec	STRENGTH TESTS: Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	CONSOL. $\frac{C_c}{1+e_0}$	Laboratory Log and Soil Description
GB-7	S-1	14-16	5	Average Total Unit Weight (14.0-15.7') = 110.5 Pcf																
		14.7		20.4																From 14.0-15.3' Depth-Red-Brown CLAY & SILT of medium plasticity,
		14.7-15.0		Save																
		15.1		25.9																From 15.3-15.7' Depth-Red-Brown fine SAND and SILT (Micaceous)
		15.3-15.4		35.9	54	53														
		15.4		35.9																
		15.4-15.6		39.2							70.3		8.7 X EE-05	K	720	Triaxial Permeability Test				
		15.6		36.0																
		15.6-15.7					40	6												

GZA GEOENVIRONMENTAL, INC.
ENGINEERS AND SCIENTISTS



BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. GB-7
SAMPLE S-1
DEPTH 15.6-15.7'
TECH. MST
REVIEWER DAS

TEST SERIES
NO. 5
DATE Feb. 96

FILE 170027.0

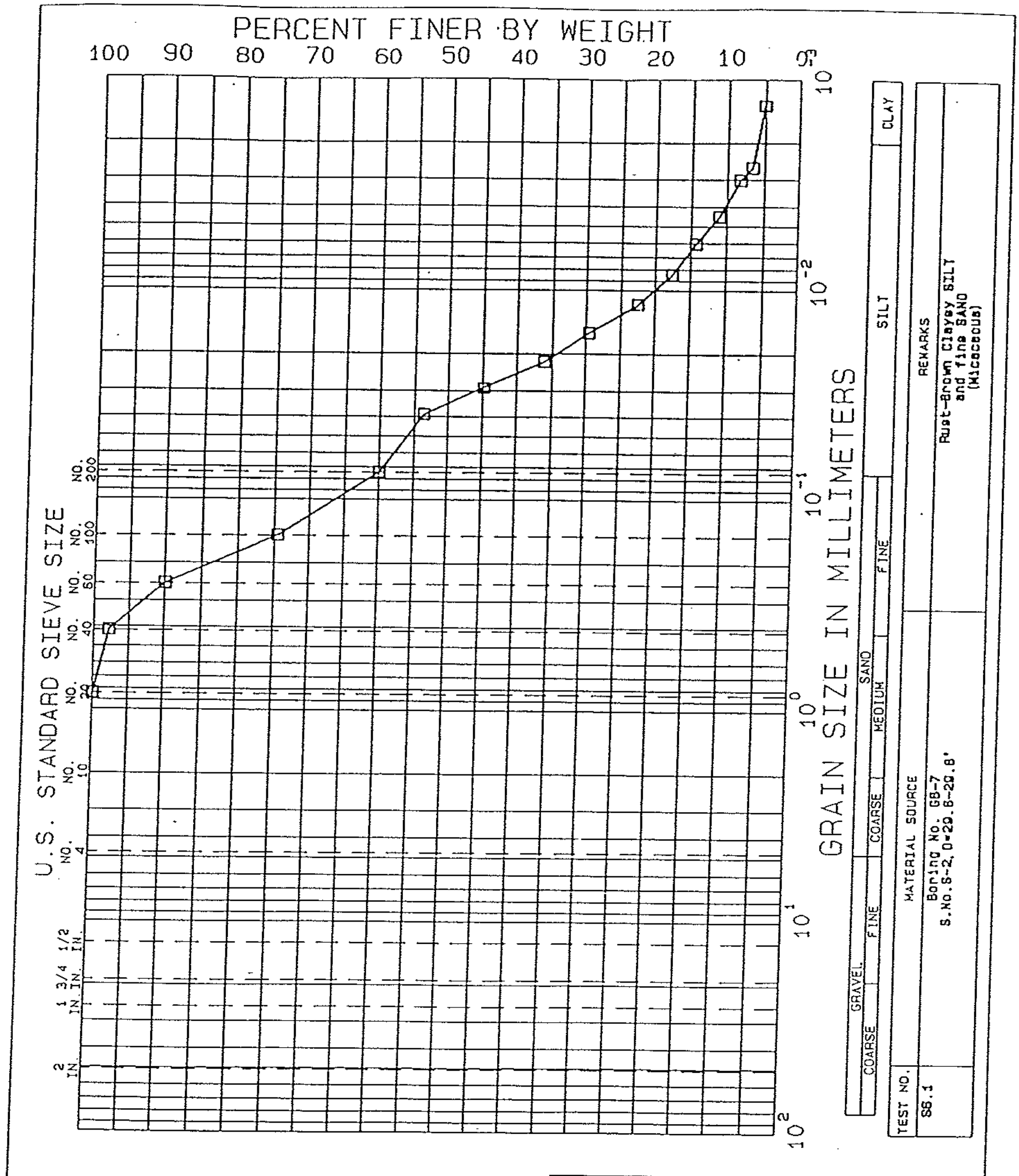
LABORATORY TE NG DATA SUMMARY

Project Name BANKS COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned FEB. 96

Reviewed by ____
Date ____
Required ____

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS: Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	DENSITY: γ_d MAX (pcf) / W_{opt} (%)	Permeability cm/sec	STRENGTH TESTS: Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	CONSOL.: $\frac{C_c}{1 + e_0}$	Laboratory Log and Soil Description
GB-7	S-2	28-30	6		Average Total Unit Weight (28.0-29.9') = 103.9 Pcf															
		28.3		49.4																Rust-Brown Clayey SILT of slight plasticity, and fine SAND, (Micaceous)
		28.8		47.6																
		28.8-29.3		Save																
		29.3		45.1																
		29.3-29.6		49.4							64.6		1.3 X EE-04	X	720	Triaxial Permeability Test				
		29.6		53.7																
		29.6-29.8		48.9	55	51	60	6												



BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. GB-7
SAMPLE S-2
DEPTH 29.6-29.8'
TECH. WST
REVIEWER DAS

TEST SERIES
NO. 6
DATE Feb. 96

FILE Y70027.0

LABORATORY TEST 'G DATA SUMMARY

Project Name: KS COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned MAR. 96

Reviewed by ______
Date ______
Required ______

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS: Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	DENSITY: γ_d MAX (pcf) / W_{opt} (%)	Permeability cm/sec	STRENGTH TESTS: Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	CONSOL.: $\frac{C_c}{1 + e_0}$	Laboratory Log and Soil Description
GB-9	S-1	12-14	17	Average Total Unit Weight (12.0-13.0') = 119.0 Pcf																
		12.1		30.8																From 12.0-12.4' Depth - Brown Silty CLAY
		12.1-12.4		Save																
		12.4		26.3																From 12.4-13.0' Depth - Brown f-m SAND, some Silt (Micaceous)
		12.5-12.7			non-plastic		26	3												
		12.7		28.6																
		12.7 12.9		25.3							88.0		1.2 X EE-04	K	720	Triaxial Permeability Test				
		12.9		28.5																

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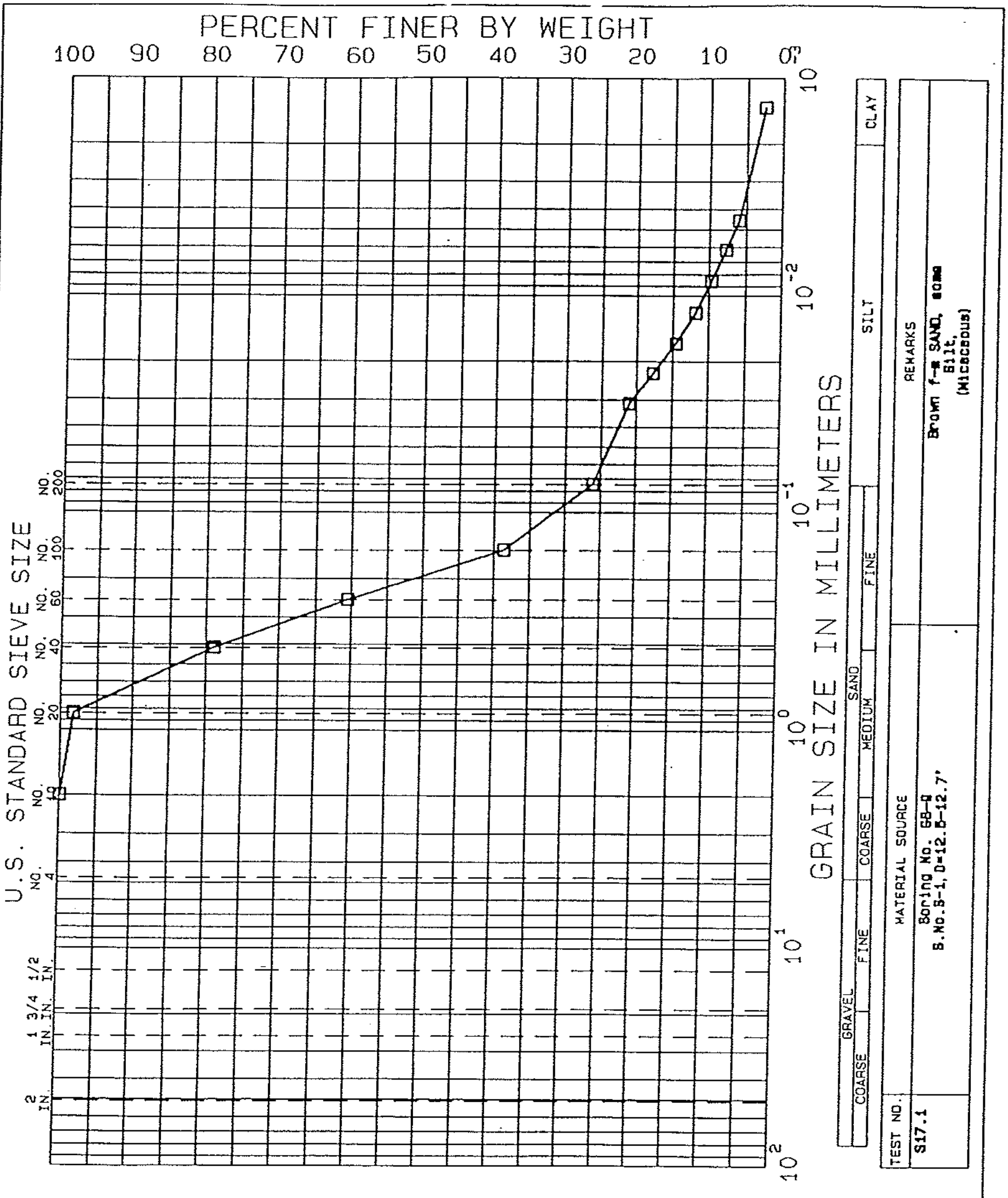
ENGINEERS AND SCIENTISTS



BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.
GRADATION TESTS

BORING NO.	GB-9	TEST SERIES	
SAMPLE	S-1	NO.	17
DEPTH	12.5-12.7'	DATE	Feb. 96
TECH.	MGT		
REVIEWER	DAB	FILE	170027.0

LABORATORY TES[illegible] DATA SUMMARY

Project Name [illegible]S COUNTY ROAD 8 CHAMBERS, USA WASTE, BANKS COUNTY GA.

Reviewed by ______

Date Required ______

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned FEB. 96

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS								DENSITY		STRENGTH TESTS					CONSOL.	Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	γ_d MAX (pcf) / W_{opt} (%)	Perme-ability cm/sec	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	$\frac{C_c}{1 + e_0}$	
GB-12	S-1	10-12	3		Average Total Unit Weight (10.0-11.8') = 95.2 Pcf															Red-Brown f-m SAND and SILT (Highly Micaceous)
		10.1		28.6																
		10.1-10.5		Save																
		10.6		33.1																
		10.6-10.8		30.3							79.7		6.5 X EE-05	K	720	Triaxial Permeability Test				
		10.8-11.0		24.4	non-plastic		38	7												
		11.0		40.7																
		11.5		16.6																

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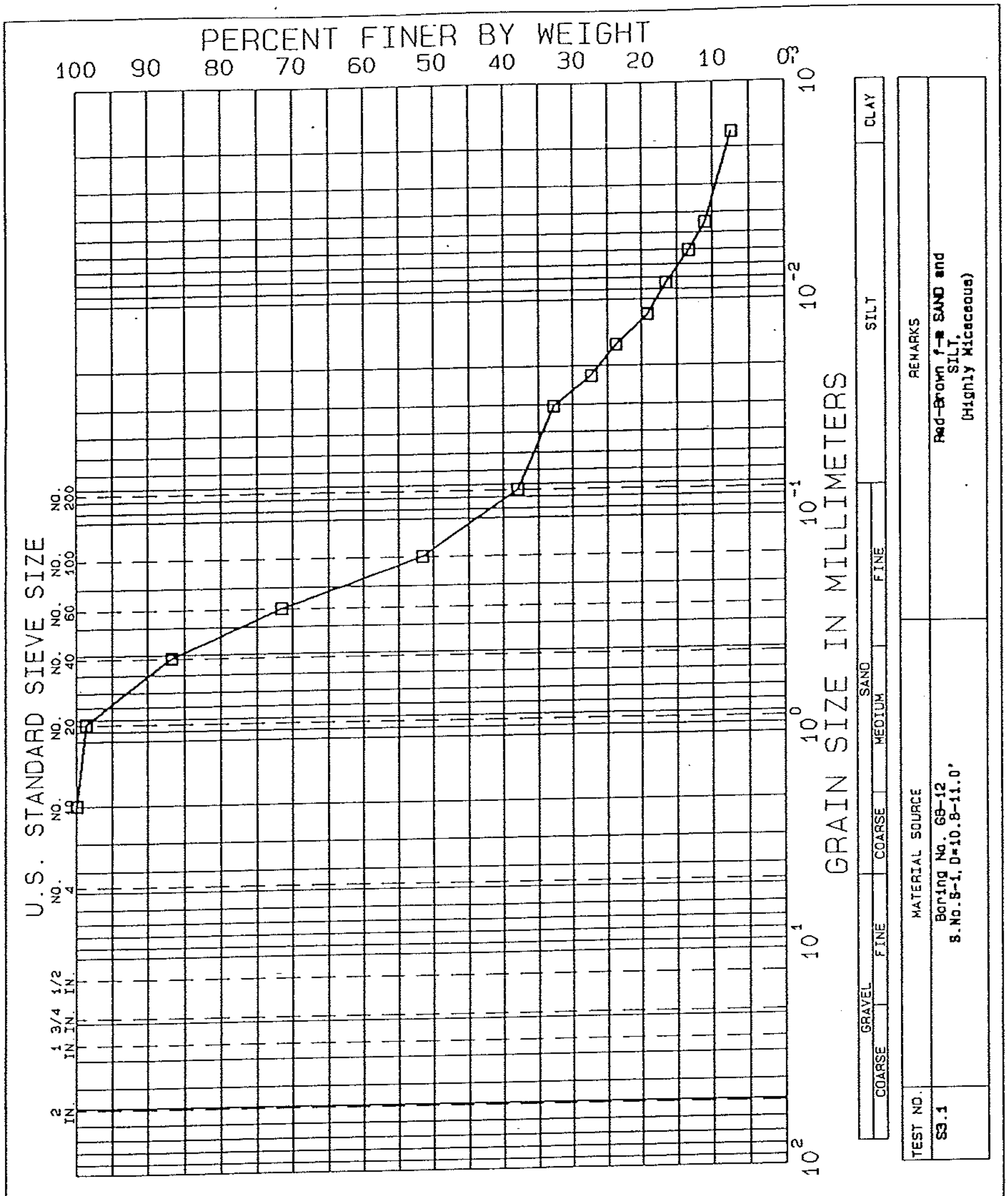
ENGINEERS AND SCIENTISTS



BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. GB-12
SAMPLE S-1
DEPTH 10.8-11.0'
TECH. MST
REVIEWER DAS

TEST SERIES
NO. 3
DATE Feb. 96

FILE 170027.0

LABORATORY TES' 'G DATA SUMMARY

Project Name S COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Reviewed by ______
Date ______
Required ______

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned FEB. 96

				IDENTIFICATION TESTS								DENSITY		STRENGTH TESTS					CONSOL.	
Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	γ_d MAX (pcf) / W_{opt} (%)	Perme-ability cm/sec	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	$\frac{C_c}{1 + e_0}$	Laboratory Log and Soil Description
GB-12	S-2	25-27	4	Average Total Unit Weight (25.0-26.7') = 112.5 Pcf																Brown f-m SAND and SILT (Highly Micaceous)
		25.1		35.7																
		25.1-25.5		Save																
		25.6		36.7																
		25.6-25.8		33.4							81.4		1.0 X EE-04	K	720	Triaxial Permeability Test				
		25.8-26.0		30.7	36	35	39	2												
		26.0		34.0																
		26.5		26.8																

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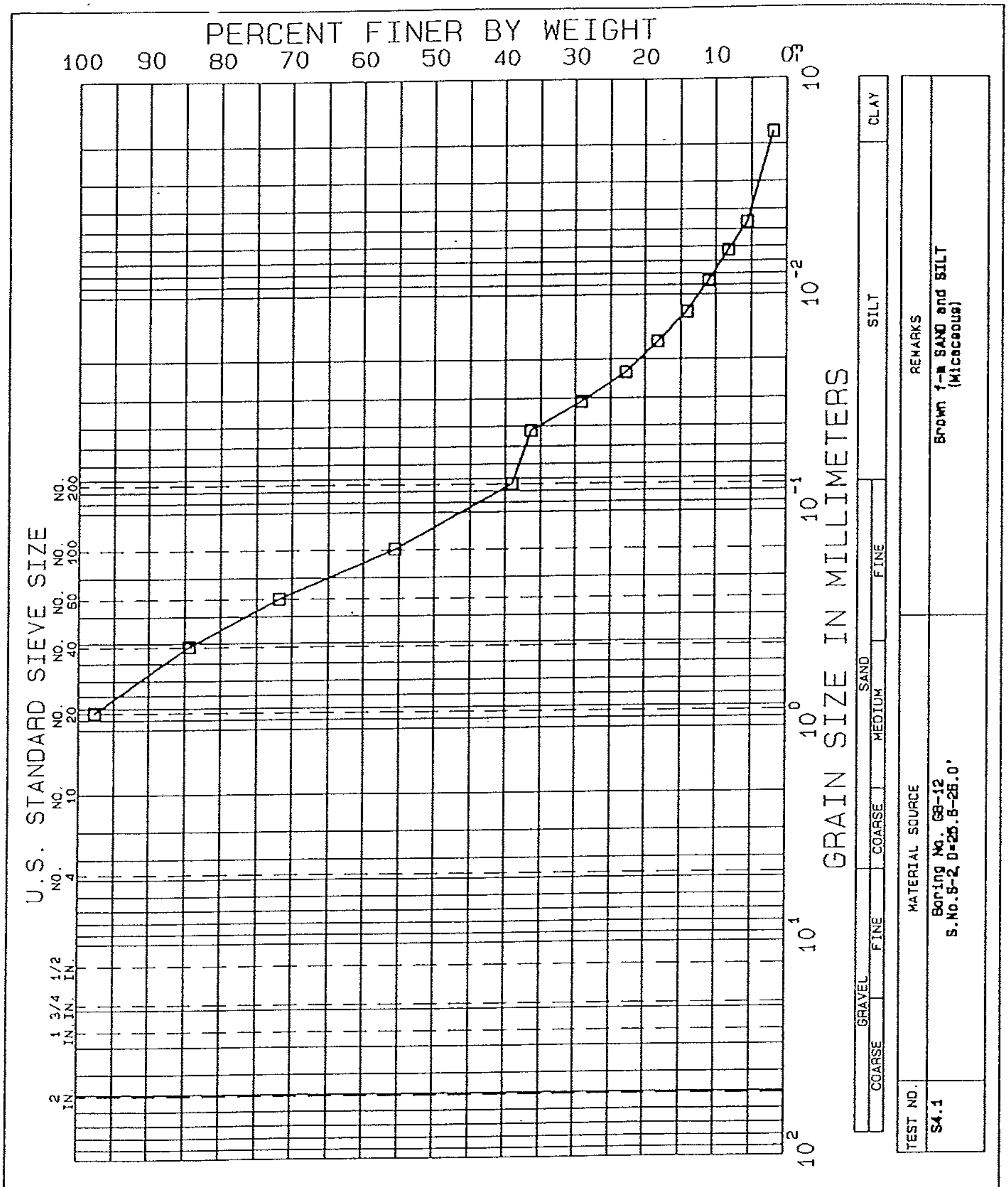
ENGINEERS AND SCIENTISTS



BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. GB-12
SAMPLE S-2
DEPTH 25.8-26.0'
TECH. MST
REVIEWER DAB

TEST SERIES NO. 4
DATE Feb. 98
FILE 170027.0

LABORATORY TES' ~G DATA SUMMARY

Project Name (S COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned FEB. 96

Reviewed by ______
Date Required ______

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS: Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	DENSITY: γ_d MAX (pcf) / W_{opt} (%)	Perme-ability cm/sec	STRENGTH TESTS: Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	CONSOL. $\frac{C_c}{1 + e_0}$	Laboratory Log and Soil Description
GB-13	S-1	15-17	1	Average Total Unit Weight (15.0-16.9') = 117.2 Pcf																
		15.3		26.3	(Sandy Silt)															From 15.0-16.3' Depth-Rust-Brown Silty Clay of high plasticity, (Vertical pocket of f-m Sand some Silt from 15.0-16.3')
		15.5		38.6	(Clay)															
		15.5-15.9		Save																
		16.0		20.4	(Sandy Silt)															From 16.3-16.9' Depth-Brown f-m SAND, some Silt (Micaceous)
		16.1		32.6	(Clay)															
		16.3-16.5			non-plastic		27	3												
		16.6		25.8	(Sandy Silt)															
		16.6-16.9		32.3							81.2		2.4 X EE-04	K	720	Triaxial Permeability Test				
		16.9		25.9	(Sandy Silt)															

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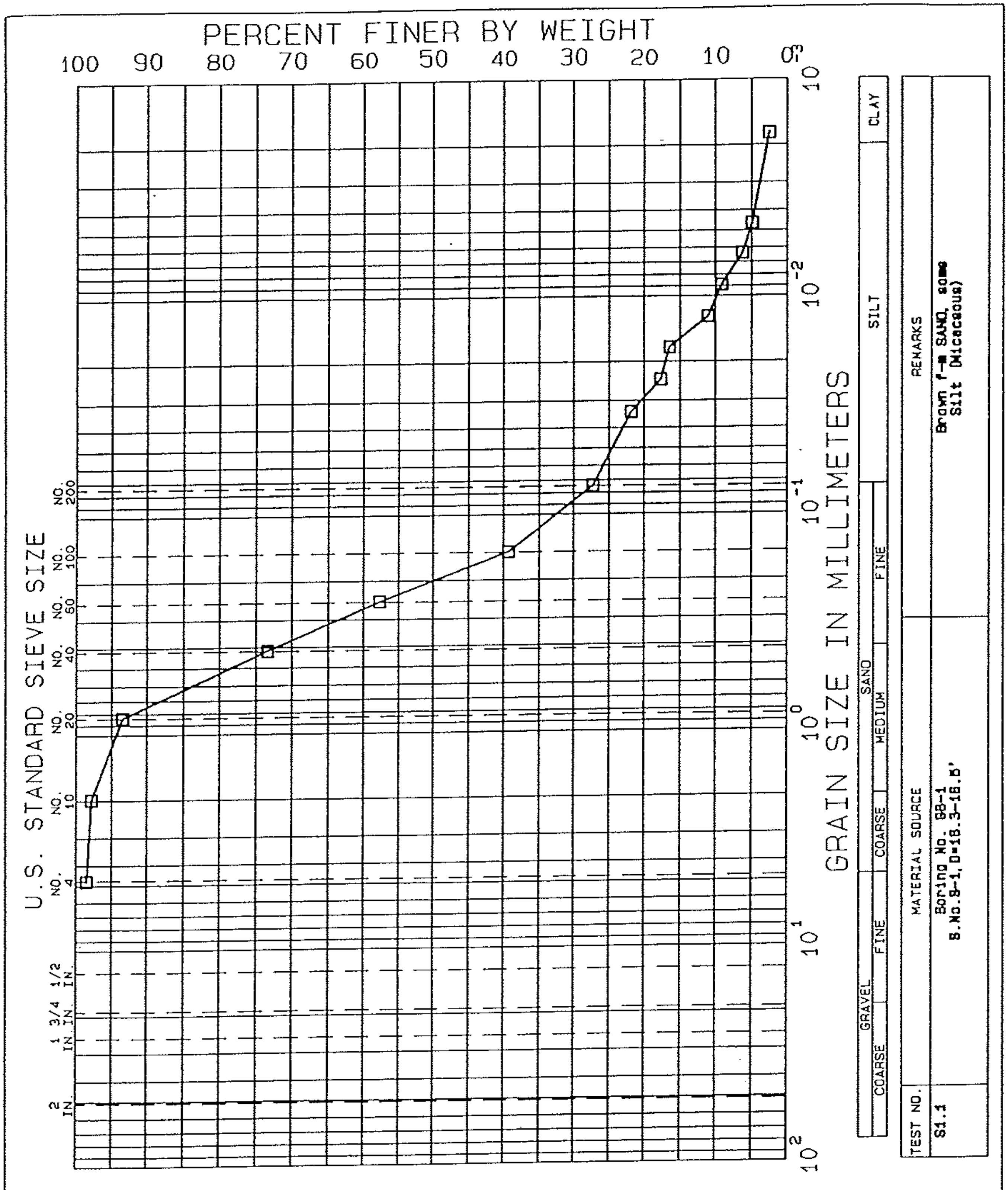
ENGINEERS AND SCIENTISTS



BANKS COUNTY ROAD 8 CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. 68-13
SAMPLE S-1
DEPTH 16.3-16.5'
TECH. MST
REVIEWER DAB

TEST SERIES
NO. 1
DATE Feb. 96

FILE 170027.0

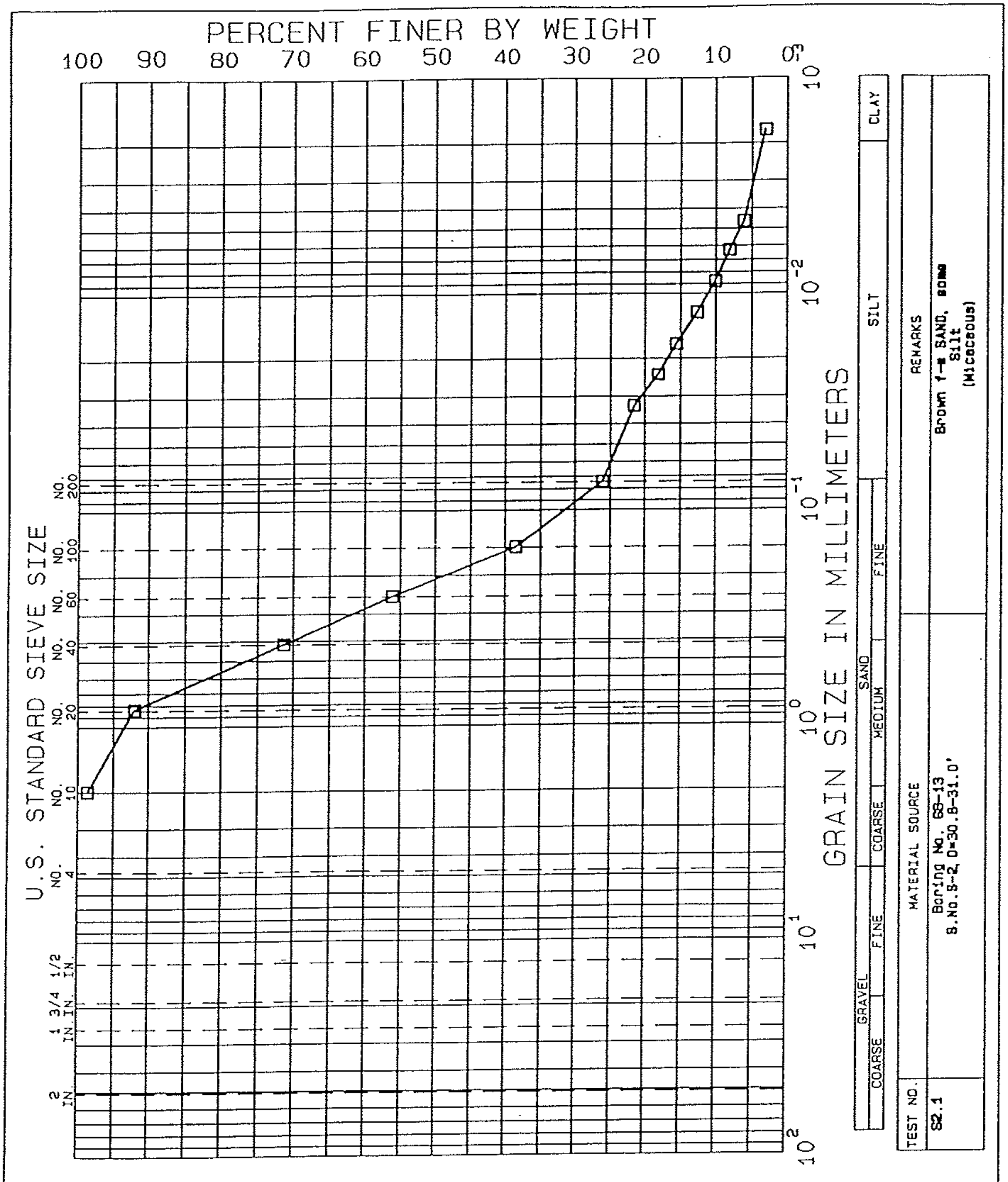
LABORATORY TEST –G DATA SUMMARY

Projec. Name 3 COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Reviewed by ____________

Project No. 170027.0   Project Engr. M. FIORI   Assigned By M. FIORI   Date Assigned FEB. 96   Date Required ____________

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS								DENSITY	Perme- ability cm/sec	STRENGTH TESTS					CONSOL.	Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	γ_d MAX (pcf) / W_{opt} (%)		Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	$\frac{C_c}{1 + e_0}$	
GB-13	S-2	30-32	2	Average Total Unit Weight (30.0-31.1') = 125.2 Pcf																Brown f-m SAND, some Silt (Micaceous)
		30.1		39.2																
		30.1-30.5		Save																
		30.6		29.3																
		30.6-30.8		32.8							91.5		9.1 X EE-06	K	720	Triaxial Permeability Test				
		30.8-31.0		30.5	non-plastic		26	4												
		31.0		30.6																
		31.5		35.5																



BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO.	GB-13	TEST SERIES	
SAMPLE	S-2	NO.	2
DEPTH	30.8-31.0'	DATE	Feb. 98
TECH.	MST		
REVIEWER	DAS	FILE	170027.0

LABORATORY TES' 'G DATA SUMMARY

Project Name ..KS COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned FEB. 96

Reviewed by ______
Date ______
Required ______

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS: Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	DENSITY: γ_d MAX (pcf) / W_{opt} (%)	Permeability cm/sec	STRENGTH TESTS: Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	CONSOL.: $\frac{C_c}{1 + e_0}$	Laboratory Log and Soil Description
GB-19	S-1	13-15	9		Average Total Unit Weight (13.0-14.1') = 102.7 Pcf															
		13.1		27.7																Red-Brown SILT & CLAY of low plasticity, and f-m SAND, (Micaceous)
		13.1-13.4		Save																
		13.5		27.6																
		13.6-13.7		27.9	43	36														
		13.7		27.3																
		13.7-14.0		31.0							83.2		3.5 X EE-06	K	720	Triaxial Permeability Test				
		14.0		27.5																
		14.0-14.1					51	11												

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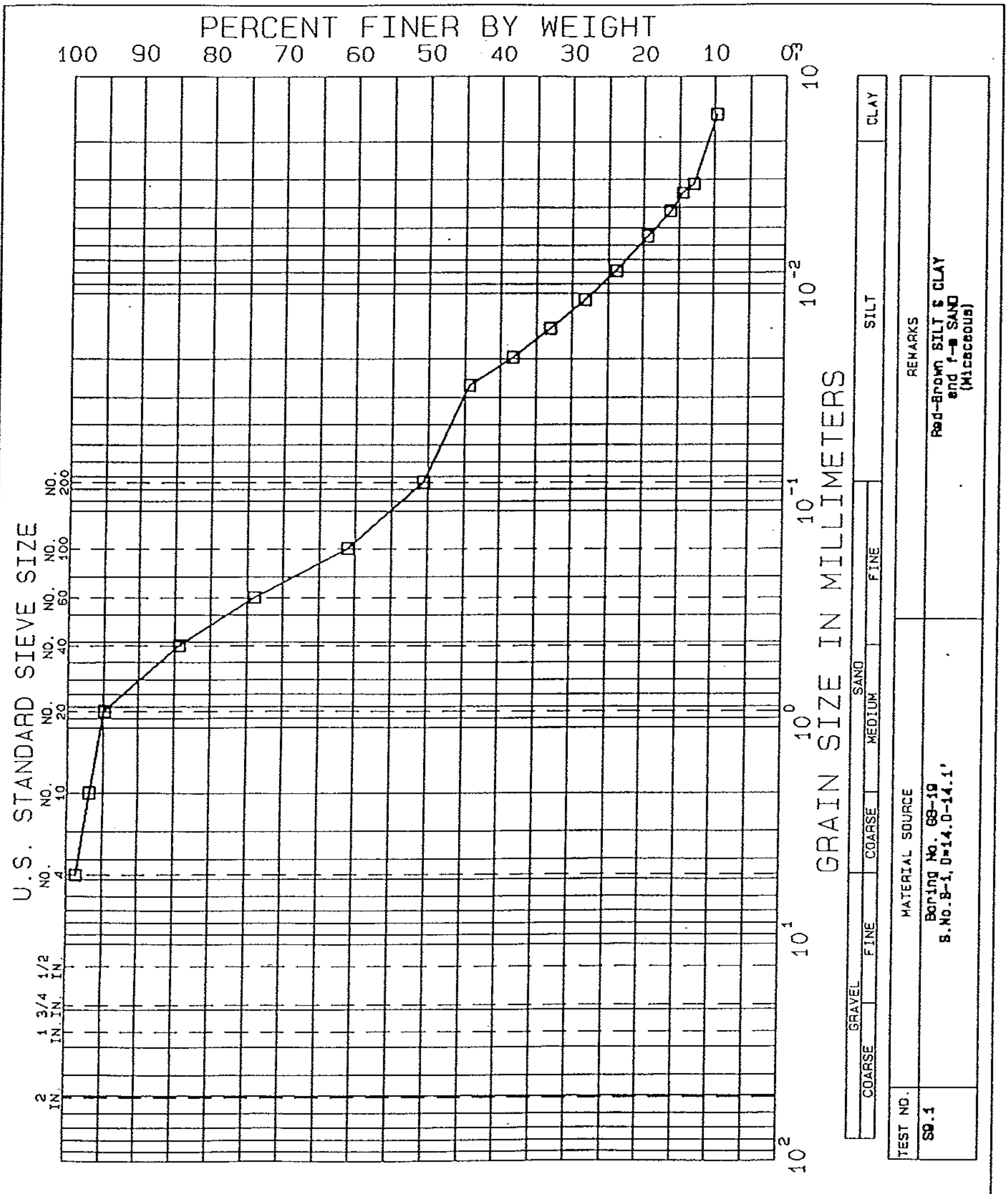
ENGINEERS AND SCIENTISTS



BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO.	GB-19	TEST SERIES NO.	9
SAMPLE	S-1	DATE	Feb. 98
DEPTH	14.0-14.1'		
TECH.	MST		
REVIEWER	DAB	FILE	170027.0

GZA GEOENVIRONMENTAL, INC.
ENGINEERS AND SCIENTISTS

LABORATORY TES' 'G DATA SUMMARY

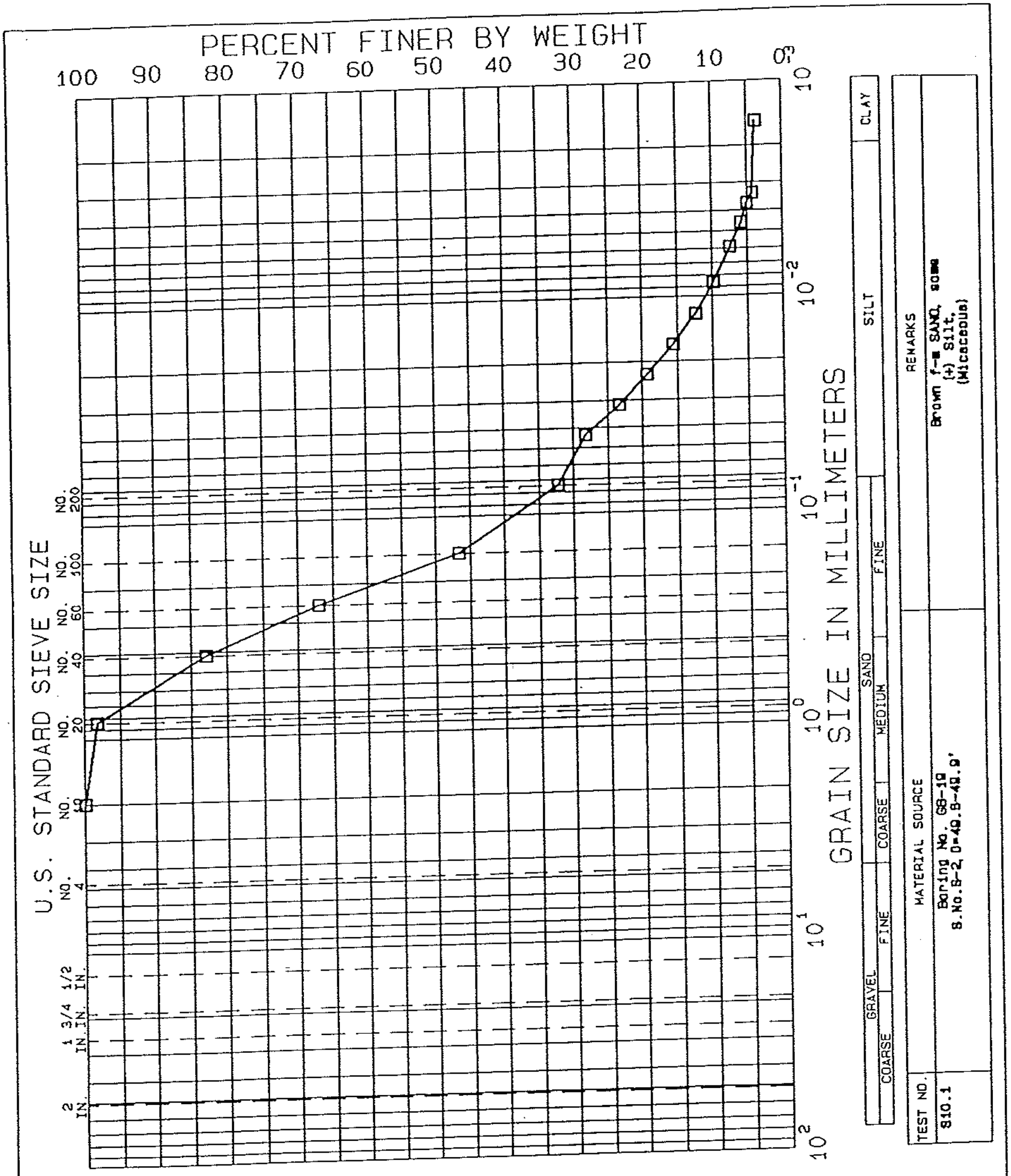
Project Name ____KS COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned FEB. 96

Reviewed by ______
Date ______
Required ______

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS: Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	DENSITY: γ_d MAX (pcf) / W_{opt} (%)	Perme-ability cm/sec	STRENGTH TESTS: Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	CONSOL.: $\frac{C_c}{1 + e_0}$	Laboratory Log and Soil Description
GB-19	S-2	48-50	10	Average Total Unit Weight (48.0-50.0') = 92.6 Pcf																
		48.6		30.1																From 48.0-49.3' Depth - Brown SILT (Micaceous)
		48.6-49.1		Save																
		49.1		31.0																From 49.3-50.0' Depth - Brown f-m SAND, some (+) Silt, (Micaceous)
		49.3-49.5		16.0	non-plastic															
		49.5		16.1																
		49.5-49.7		14.0							95.3		3.1 X EE-05	K	720	Triaxial Permeability Test				
		49.8		16.1																
		49.8-49.9					32	4												

GZA GEOENVIRONMENTAL, INC.
ENGINEERS AND SCIENTISTS



BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. GB-19
SAMPLE S-2
DEPTH 49.8-49.9'
TECH. MST
REVIEWER DAB

TEST SERIES
NO. 10
DATE Feb. 98

FILE 170027.0

LABORATORY TEST ·G DATA SUMMARY

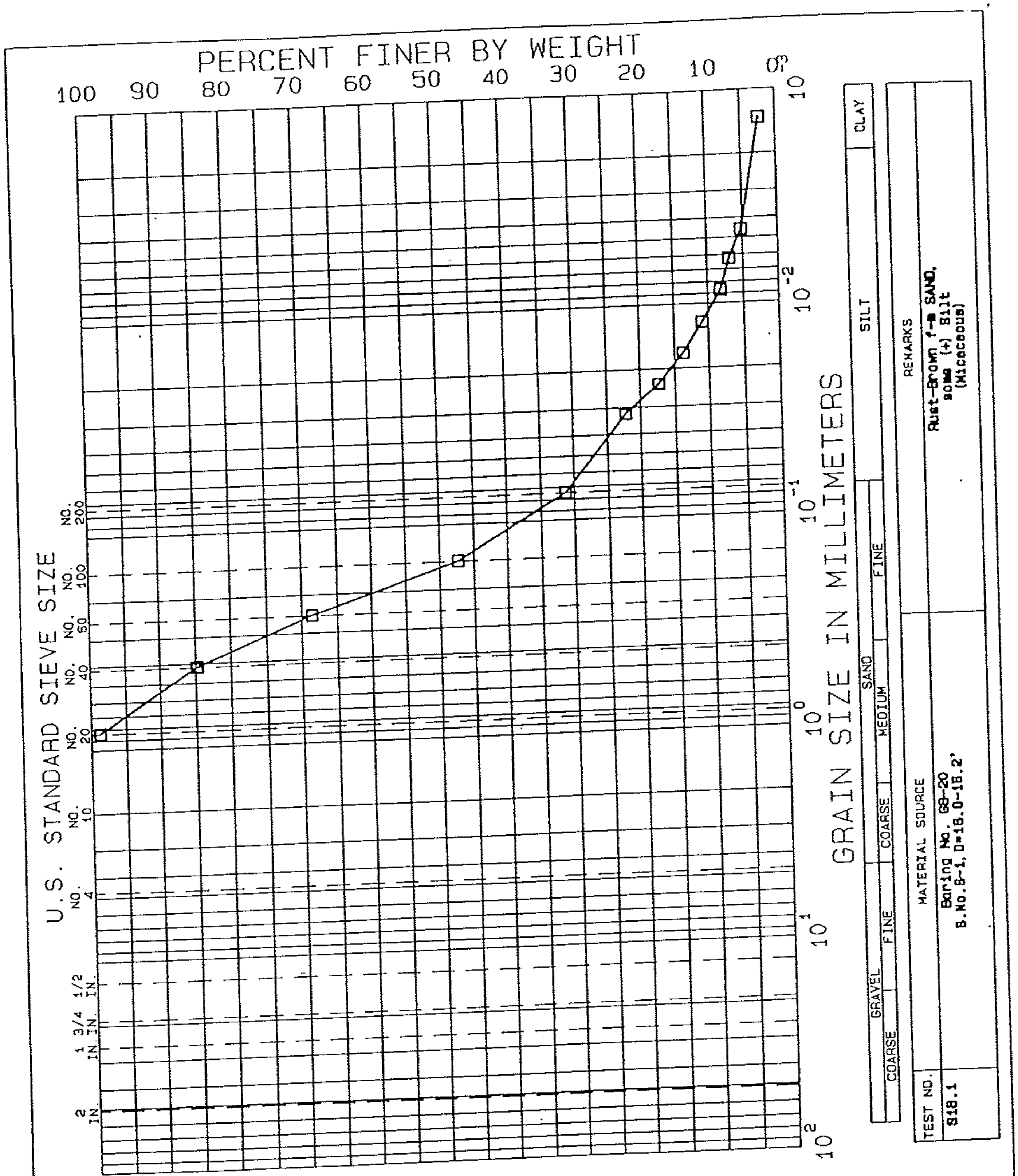
Project Name _, COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Reviewed by ______
Date ______
Required ______

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned MAR. 96

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS								DENSITY		STRENGTH TESTS					CONSOL.	Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	γ_d MAX (pcf) / W_{opt} (%)	Perme-ability cm/sec	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	$\frac{C_c}{1 + e_0}$	
GB-20	S-1	15-17	18	Average Total Unit Weight (15.0-16.7') = 114.2 Pcf																From 15.0-16.0' Depth - Vertical layer of Clay, and vertical layer of Sand, Clay layer approx. 1/3 diameter of sample, Sand layer approx. 2/3 diameter of sample.
		16.0		17.7																
		16.0-16.2			non-plastic		31	3												
		16.2		19.0																
		16.2-16.5		16.8							100.0		1.5 X EE-05	K	720	Triaxial Permeability Test				From 16.0-16.7' Depth - Rust-Brown f-m SAND, some (+) Silt, (Micaceous)
		16.5		18.5																
		16.5-16.7		Save																

GZA GEOENVIRONMENTAL, INC.
ENGINEERS AND SCIENTISTS



BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. GB-20	TEST SERIES
SAMPLE S-1	NO. 16
DEPTH 16.0-16.2'	DATE Feb. 98
TECH. MST	
REVIEWER DAS	FILE 170027.0

LABORATORY TES[illegible]G DATA SUMMARY

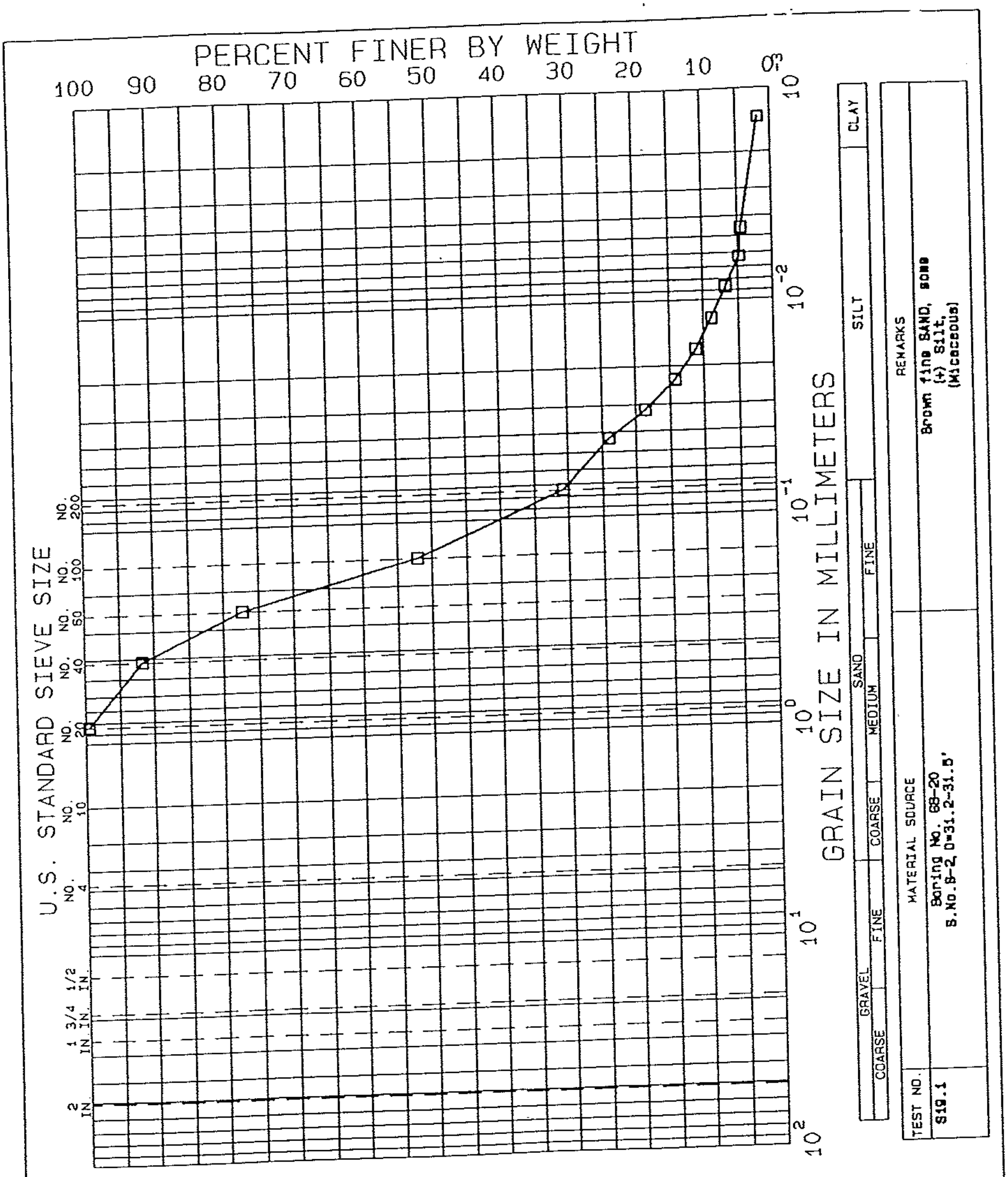
Project Name S COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Reviewed by ____________
Date ____________
Required ____________

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned MAR. 96

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS: Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	DENSITY: γ_d MAX (pcf) / W_{opt} (%)	Perme-ability cm/sec	STRENGTH TESTS: Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	CONSOL.: $\frac{C_c}{1 + e_0}$	Laboratory Log and Soil Description
GB-20	S-2	30-32	19		Average Total Unit Weight (30.0-32.0') = 103.6 Pcf															Brown fine SAND, some (+) Silt, (Micaceous)
		30.7		10.2																
		30.7-31.2		Save																
		31.2		10.2																
		31.2-31.5				non-plastic	31	3												
		31.5		10.3																
		31.5-31.7		10.9							87.9		1.6 X EE-04	K	720	Triaxial Permeabilty Test				
		31.7		13.7																

GZA GEOENVIRONMENTAL, INC.
ENGINEERS AND SCIENTISTS



BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. GB-20
SAMPLE S-2
DEPTH 31.2-31.5'
TECH. WST
REVIEWER DAB

TEST SERIES
NO. 19
DATE Mar. 98

FILE 170027.0

LABORATORY TES' ˜G DATA SUMMARY

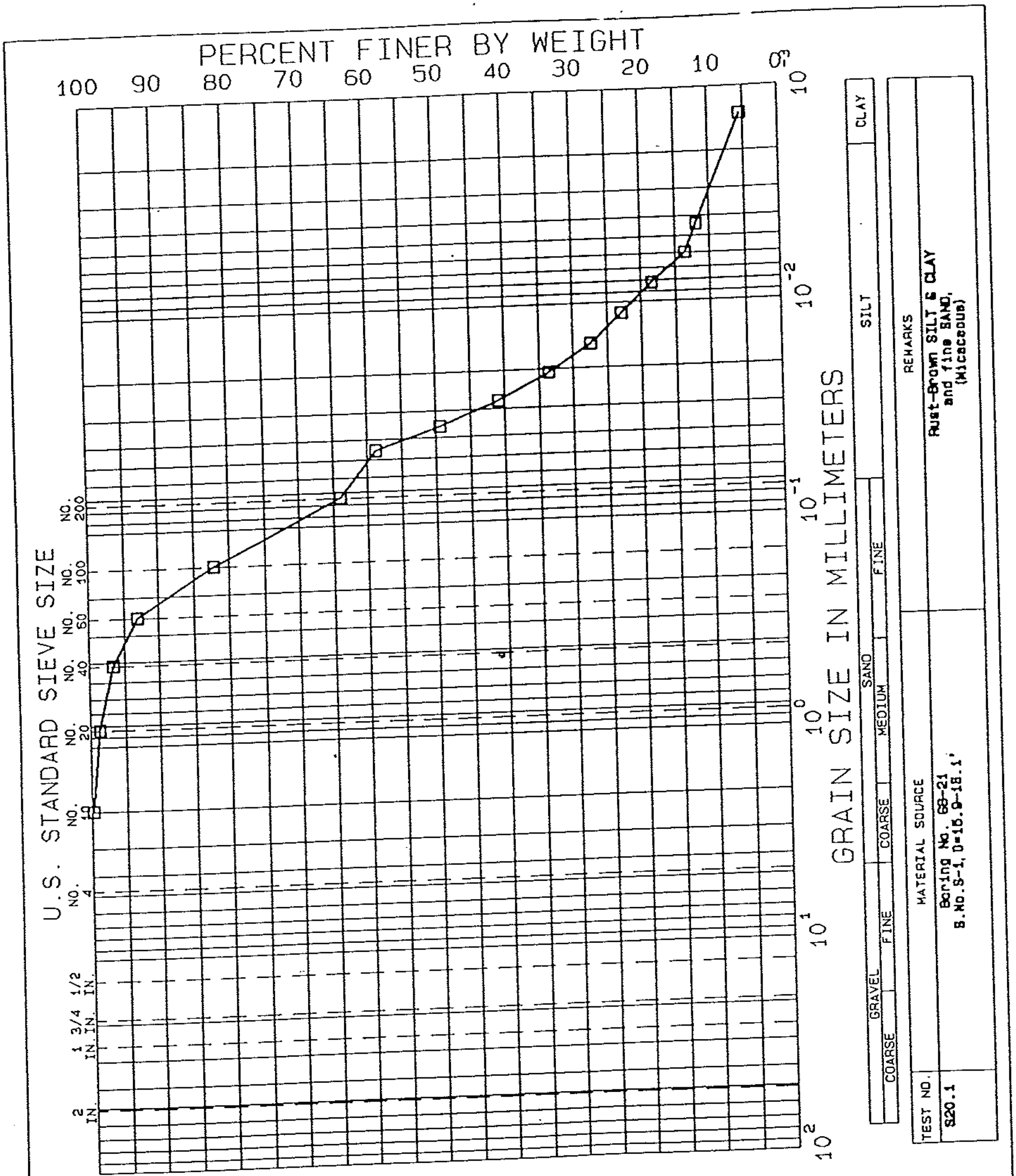
Project Name ; COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Reviewed by ______
Date Required ______

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned MAR. 96

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS							DENSITY		Perme-ability cm/sec	STRENGTH TESTS					CONSOL.	Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	γ_d MAX (pcf) / W_{opt} (%)		Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	$\frac{C_c}{1 + e_0}$	
GB-21	S-1	15-17	20		Average Total Unit Weight (15.0-17.0') = 95.3 Pcf															Rust-Brown SILT & CLAY of low plasticity, and fine SAND, (Micaceous)
		15.3		37.3																
		15.3-15.6		Save																
		15.6		36.3																
		15.9-16.1			54	42	64	8												
		16.1		35.2																
		16.2-16.4		38.8							70.2		9.5 X EE-05	K	720	Triaxial Permeability Test				
		16.4		37.9																

GZA GEOENVIRONMENTAL, INC.
ENGINEERS AND SCIENTISTS



BANKS COUNTY ROAD 8 CHAMBERS, USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. 88-21
SAMPLE S-1
DEPTH 15.9-16.1'
TECH. MST
REVIEWER DAB

TEST SERIES NO. 20
DATE Mar. 98

FILE 170027.0

LABORATORY TES[illegible]G DATA SUMMARY

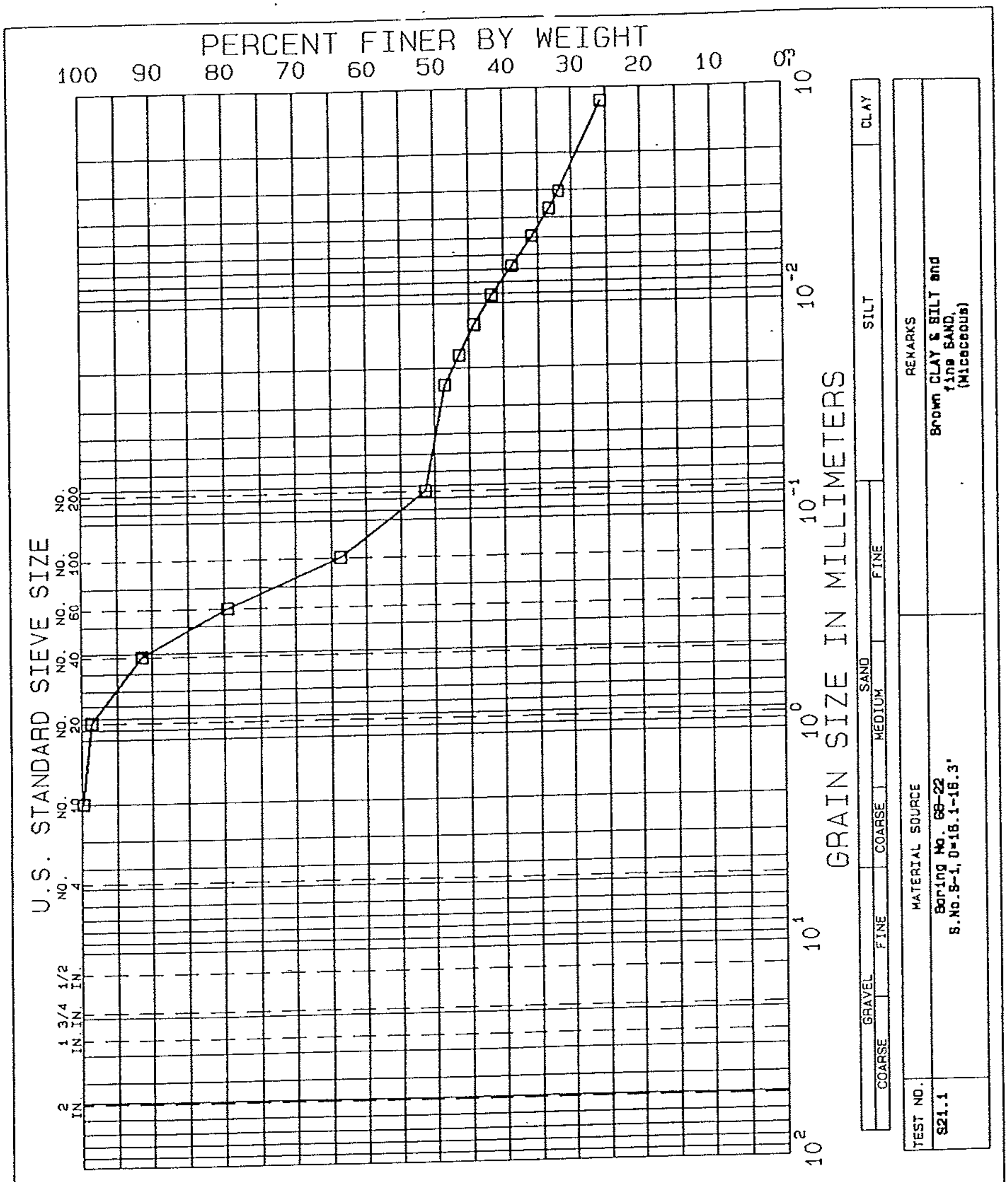
Project Name [illegible]KS COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned MAR. 96

Reviewed by ______
Date ______
Required ______

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS: Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	DENSITY: γ_d MAX (pcf) / W_{opt} (%)	Permeability cm/sec	STRENGTH TESTS: Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	CONSOL.: $\frac{C_c}{1 + e_0}$	Laboratory Log and Soil Description
GB-22	S-1	15-17	21		Average Total Unit Weight (15.0-17.0') = 128.0 Pcf															Brown CLAY & SILT of medium plasticity, and fine SAND (Micaceous)
		15.2		23.0																
		15.7		20.7																
		15.7-15.9		Save																
		15.9-16.1		19.8							108.2		1.5 X EE-07	K	720	Triaxial Permeability Test				
		16.1		24.0																
		16.1-16.3			36	22	51	29												
		16.6		31.7																

GZA GEOENVIRONMENTAL, INC.
ENGINEERS AND SCIENTISTS



BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. 88-22
SAMPLE S-1
DEPTH 16.1-18.3'
TECH. MST
REVIEWER DAS

TEST SERIES
NO. 21
DATE Mar. 98

FILE 170027.0

LABORATORY TEST 'G DATA SUMMARY

Project Name ___ KS COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Project No. 170027.00 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned MAR. 96

Reviewed by ______
Date ______
Required ______

				IDENTIFICATION TESTS								DENSITY		STRENGTH TESTS					CONSOL.	
Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	γ_d MAX (pcf) / W_{opt} (%)	Permeability cm/sec	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	$\frac{C_c}{1 + e_0}$	Laboratory Log and Soil Description
GB-25	UP-1	17-19	14	Average Total Unit Weight (17.0-18.1') = 97.6 Pcf																Rust-Brown SILT & CLAY, some (+) fine Sand (Micaceous)
		17.1		33.1																
		17.1-17.5		Save																
		17.5		33.3																
		17.5-17.8		30.5							64.1		1.6 X EE-04	K	720	Triaxial Permeability Test				
		17.8		32.9																
		17.8-18.0		33.1	55	49	67	8												
		18.0		33.3																

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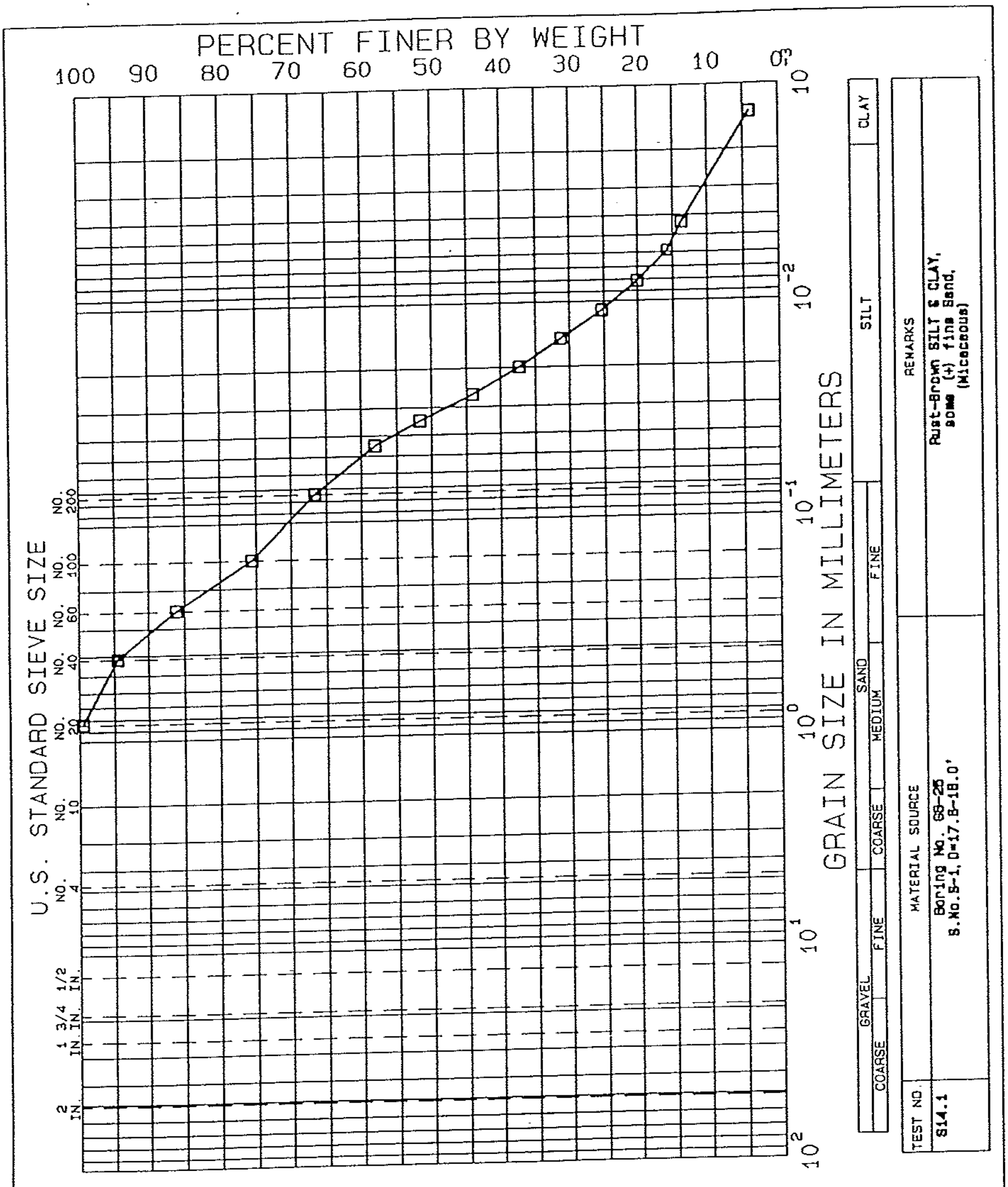


BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. GB-25
SAMPLE S-1
DEPTH 17.8-18.0'
TECH. MST
REVIEWER DAB

TEST SERIES
NO. 14
DATE Feb. 96

FILE 170027.0

LABORATORY TEST''G DATA SUMMARY

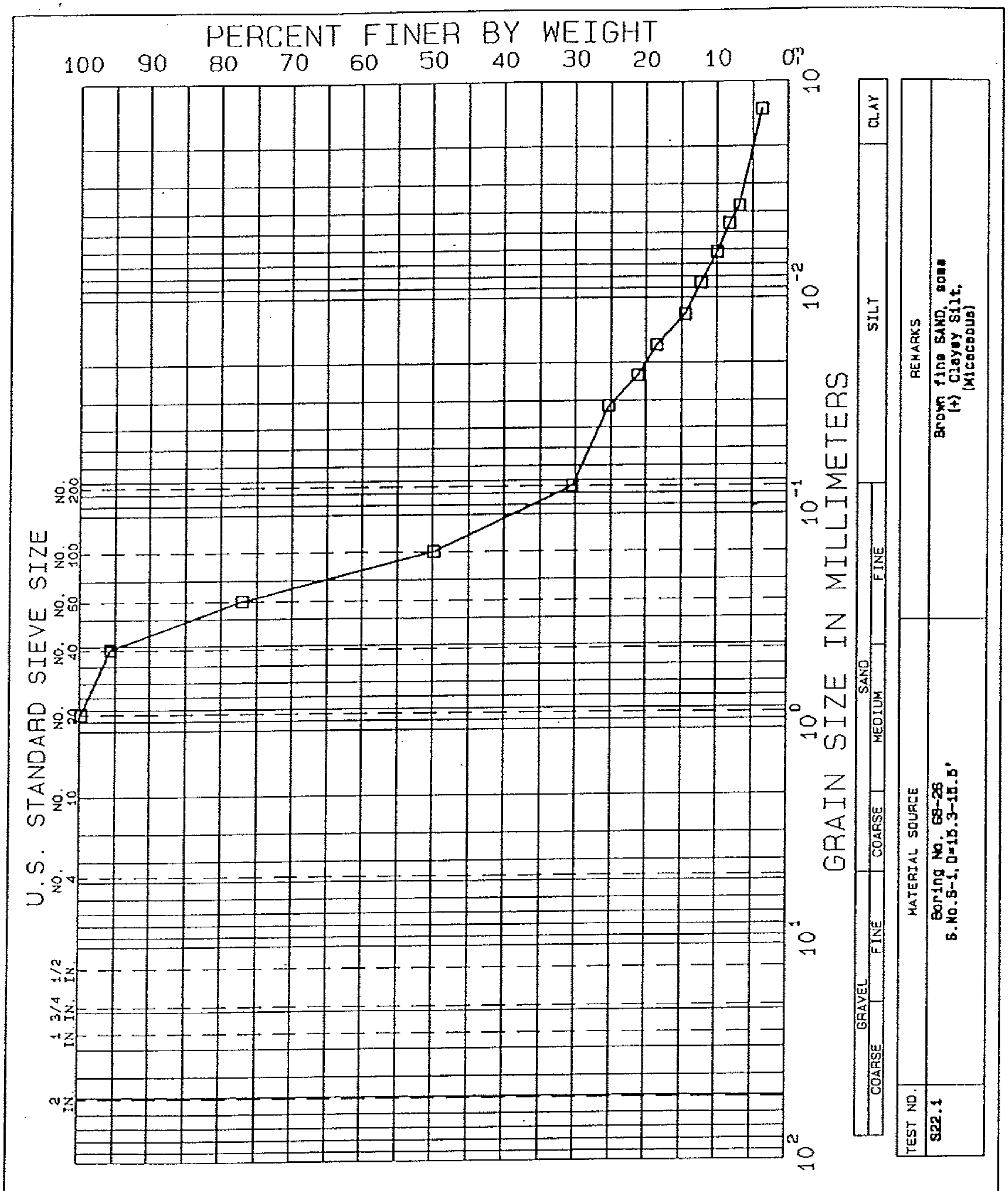
Project Name _ 3 COUNTY ROAD B CHAMBERS, Ucn WASTE, BANKS COUNTY GA.

Reviewed by ____________
Date Required ____________

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned MAR. 96

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS: Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	DENSITY: γ_d MAX (pcf) / W_{opt} (%)	Perme-ability cm/sec	STRENGTH TESTS: Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	CONSOL.: $\frac{C_c}{1 + e_0}$	Laboratory Log and Soil Description
GB-26	S-1	14-16	22		Average Total Unit Weight (14.0-15.8') = 90.0 Pcf															Brown fine SAND, some (+) Clayey Silt, (Micaceous)
		14.2		28.5																
		14.6		30.3																
		14.6-15.0		Save																
		15.0		24.0																
		15.0-15.3		29.8							68.4		2.3 X EE-04	K	720	Triaxial Permeability Test				
		15.3-15.5			52	47	30	5												
		15.5		31.7																

GZA GEOENVIRONMENTAL, INC.
ENGINEERS AND SCIENTISTS



BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. 68-26
SAMPLE S-1
DEPTH 15.3-15.5'
TECH. MST
REVIEWER DAS

TEST SERIES
NO. 22
DATE Mar. 98

FILE 170027.0

LABORATORY TEST G DATA SUMMARY

Project Name S COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned MAR. 96

Reviewed by ______
Date ______
Required ______

Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	IDENTIFICATION TESTS Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	DENSITY γ_d MAX (pcf) / W_{opt} (%)	Permeability cm/sec	STRENGTH TESTS Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	CONSOL. $\frac{C_c}{1 + e_0}$	Laboratory Log and Soil Description
GB-26	S-2	28.0-30.0	23		Average Total Unit Weight (28.0-29.8') = 102.9 Pcf															
		28.2		30.3																Brown f-m SAND, some (-) Clayey Silt, (Micaceous)
		28.7		20.6																
		28.7-28.9		Save																
		28.9-29.2		25.4							75.5		3.1 X EE-04	K	720	Triaxial Permeability Test				
		29.2		21.9																
		29.2-29.4			36	35	24	4												
		29.6		19.7																

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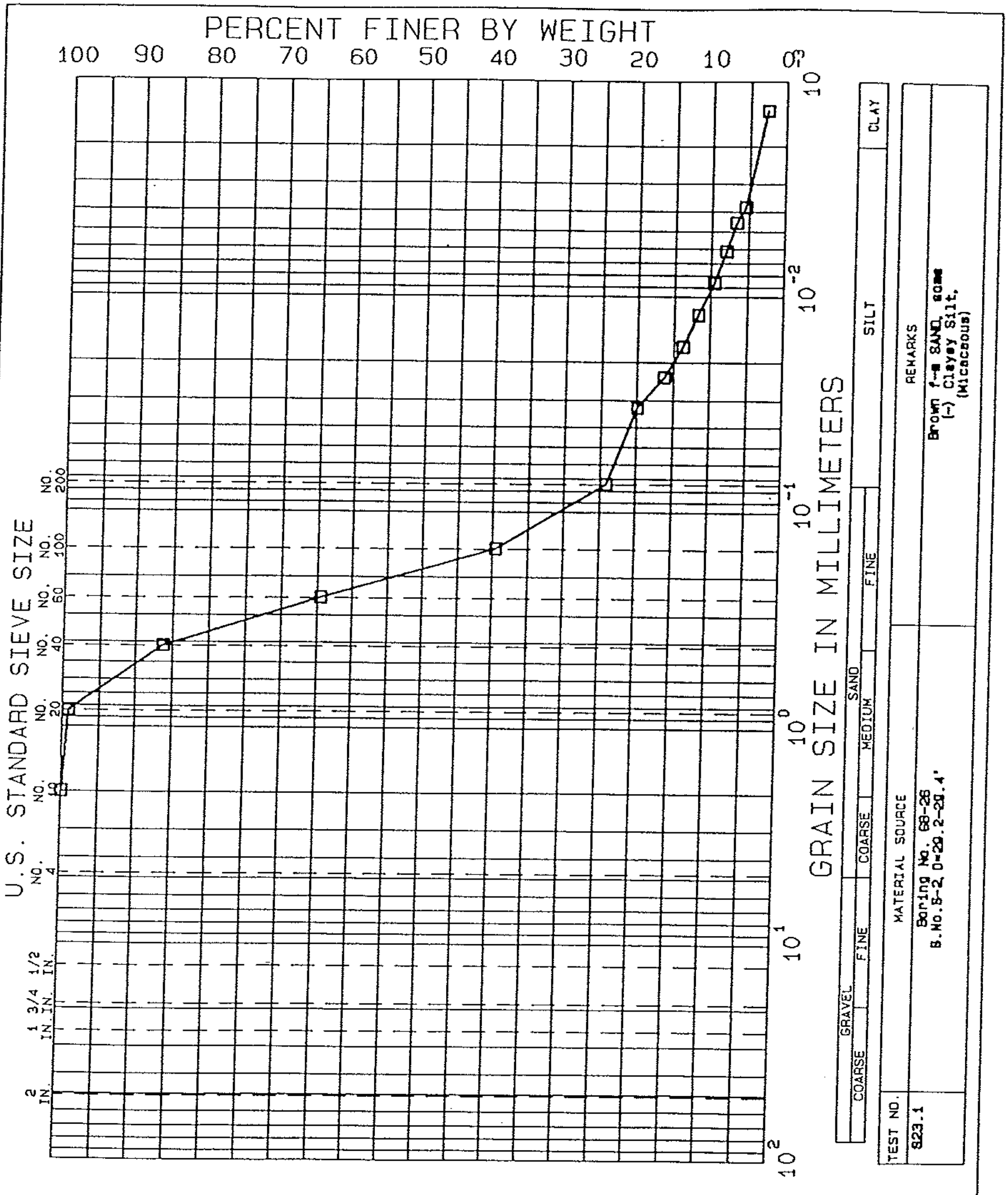
ENGINEERS AND SCIENTISTS



BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. 98-26
SAMPLE S-2
DEPTH 29.2-29.4'
TECH. MST
REVIEWER DAS

TEST SERIES NO. 23
DATE Mar. 98

FILE 170027.0

GZA GEOENVIRONMENTAL, INC.
ENGINEERS AND SCIENTISTS

LABORATORY TES7 ~G DATA SUMMARY

Project Name ___ 3 COUNTY ROAD B CHAMBERS, USA WASTE, BANKS COUNTY GA.

Reviewed by ______
Date Required ______

Project No. 170027.0 Project Engr. M. FIORI Assigned By M. FIORI Date Assigned MAR. 96

				IDENTIFICATION TESTS								DENSITY		STRENGTH TESTS					CONSOL.	
Boring or Test Pit No.	Sample No.	Depth ft.	Lab No.	Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	ORG %	G_s	Dry unit wt. pcf	MAX γ_d (pcf) / W_{opt} (%)	Permeability cm/sec	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	$\frac{C_c}{1 + e_0}$	Laboratory Log and Soil Description
GB-27	S-1	14-16	24		Average Total Unit Weight (14.0-15.2') = 114.3 Pcf															Brown fine SAND and SILT (Micaceous)
		14.1		34.5																
		14.3-14.5			non-plastic		45	7												
		14.5		26.2																
		14.5-14.8		41.4							71.1		2.1 X EE-05	K	720	Triaxial Permeability Test				
		14.8		25.3																
		14.8-15.1		Save																
		15.1		31.1																

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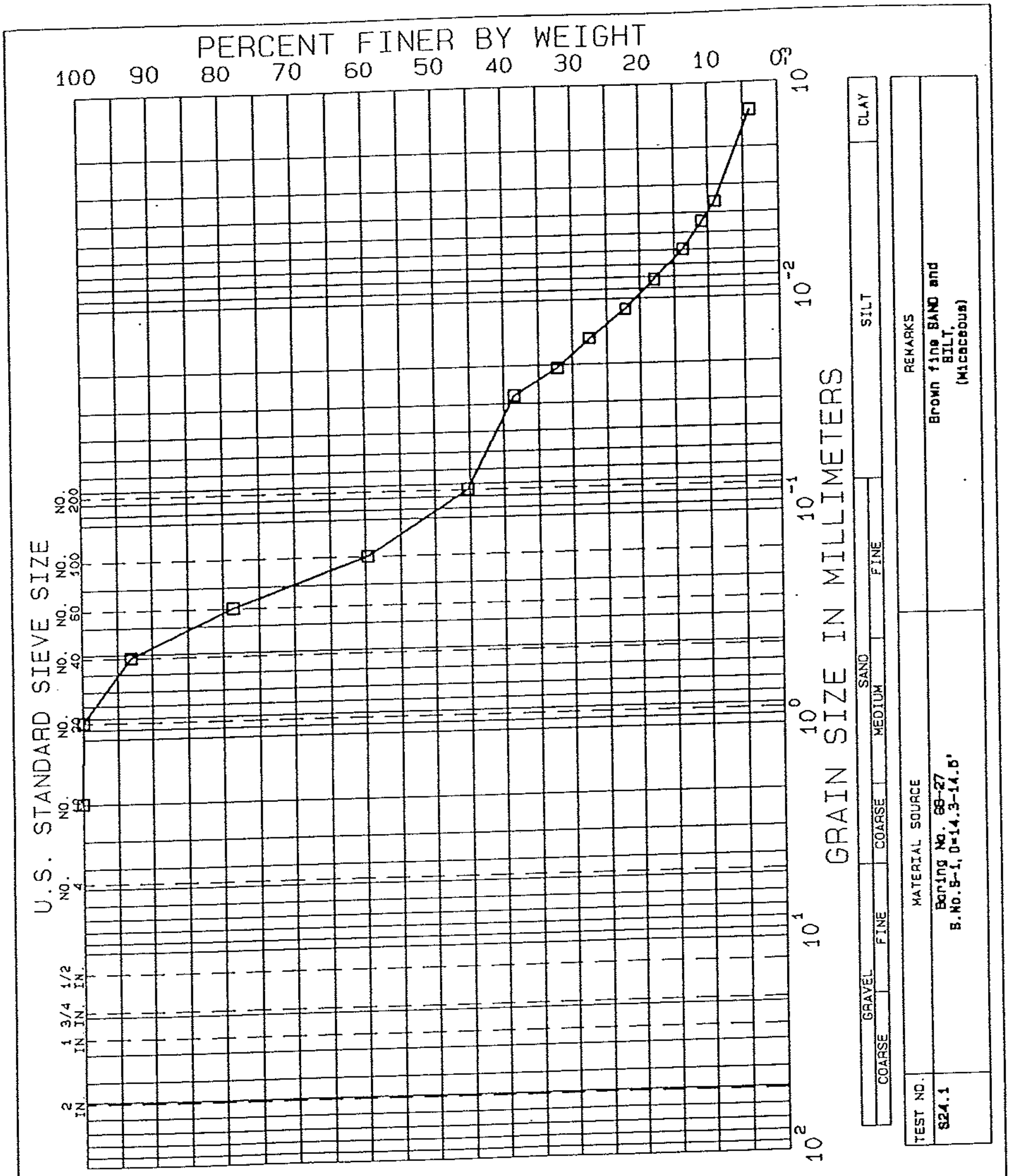
ENGINEERS AND SCIENTISTS



BANKS COUNTY ROAD B CHAMBERS,
USA WASTE, BANKS COUNTY, GA.

GRADATION TESTS

BORING NO. 88-27
SAMPLE S-1
DEPTH 14.3-14.5'
TECH. MST
REVIEWER DAS

TEST SERIES
NO. 24
DATE Mar. 98

FILE 170027.0

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	EB
Date	05/21/13
Checked By	[signature]

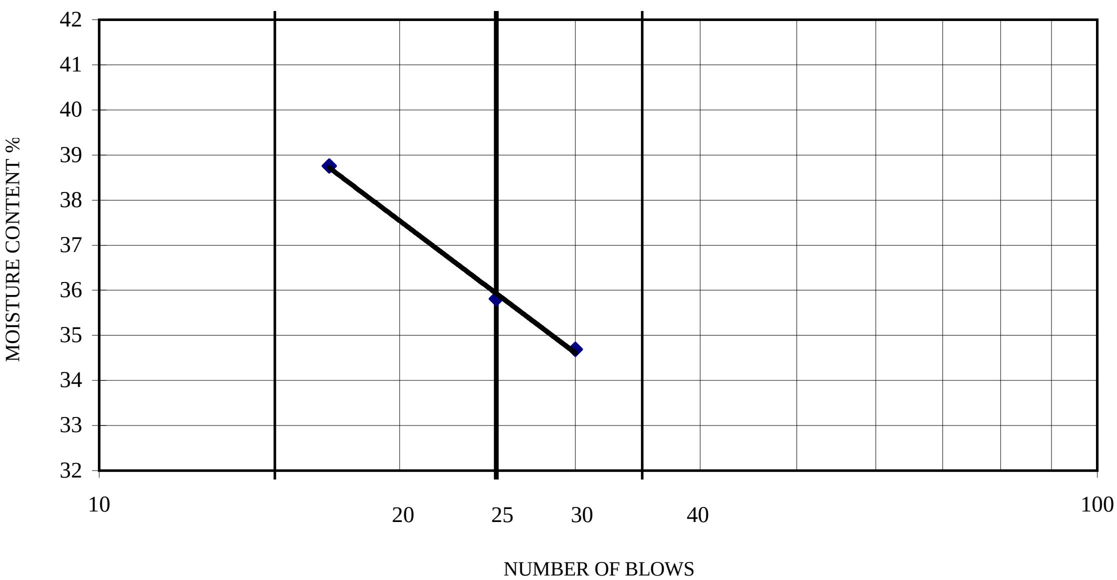
Client Pr. #	I002-320	Lab. PR. #	1308-08-1
Pr. Name	R&B Site Suitability	S. Type	UD
Sample ID	15691/PZ-28	Depth/Elev.	25-26.5'
Location	PZ-28	Add. Info	-

ASTM D 4318/AASHTO T 88, T 89
Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)

LIQUID LIMIT

Number of Blows	30	25	17
Mass of Wet Sample & Tare, g	42.52	36.79	42.02
Mass of Dry Sample & Tare, g	38.26	33.51	36.97
Mass of Tare, g	25.98	24.35	23.94
Moisture Content, %	34.69	35.81	38.76

Oven ID #	12/13/14/15
Balance ID #	2
Liquid Limit Device ID #	56



PLASTIC LIMIT

Mass of Wet Sample & Tare, g	33.81	40.43
Mass of Dry Sample & Tare, g	30.66	37.36
Mass of Tare, g	21.27	28.19
Moisture Content, %	33.55	33.48

PREPARATION PROCEDURE: DRY

NOTE: MATERIAL PASSING NO. 40 SIEVE WAS USED FOR TEST

NATURAL MOISTURE

Mass of Wet Sample & Tare, g	520.50
Mass of Dry Sample & Tare, g	444.30
Mass of Tare, g	0.00
Moisture Content, %	17.15

LIQUID LIMIT (LL)	36
PLASTIC LIMIT (PL)	34
PLASTICITY INDEX (PI)	2
LIQUIDITY INDEX (LI)	-8.42

DESCRIPTION: Light Brown and White Silty Sand

USCS (ASTM D2487; D2488): SM

AASHTO (M 145): NA

TIMELY ENGINEERING SOIL TESTS, LLC

1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	05/20/13
Checked By	[signature]

Client Pr. #	I002-320	Lab. PR. #	1308-08-1
Pr. Name	R&B Site Suitability	S. Type	UD
Sample ID	15691/PZ-28	Depth/Elev.	25-26.5'
Location	PZ-28	Add. Info	-

ASTM D 422/AASHTO T 88
Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

As-Received Moisture Content

Mass of Wet Sample & Tare, g	520.50
Mass of Dry Sample & Tare, g	444.30
Mass of Tare, g	0.00
Moisture Content, %	17.2

Moisture Content of Material Used for Hydrometer Analysis

Mass of Wet Sample & Tare, g	354.30
Mass of Dry Sample & Tare, g	321.10
Mass of Tare, g	98.50
Moisture Content, %	14.9

Mass of Total Sample before separation on #4 sieve & Tare, g	994.90
Mass of Tare, g	0.00
Total Mass of Dry Sample, g	865.77

Mass of Sample used for hydrometer analysis, g	101.60
Dry Mass, g	88.41
% of Total Sample passing #4 sieve	100.0

SIEVE ANALYSIS

PORTION OF SAMPLE RETAINED ON #4 SIEVE

Mass of Tare, g: 0.00

Sieve Size		Sample & Tare, g	% RETAINED	%PASSING
12"	COBBLES		0.0	100.0
3"	COARSE GRAVEL		0.0	100.0
2.5"	COARSE GRAVEL		0.0	100.0
2"	COARSE GRAVEL		0.0	100.0
1.5"	COARSE GRAVEL		0.0	100.0
1"	COARSE GRAVEL		0.0	100.0
.75"	FINE GRAVEL		0.0	100.0
.5"	FINE GRAVEL		0.0	100.0
.375"	FINE GRAVEL		0.0	100.0
#4	COARSE SAND	0.00	0.0	100.0

PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)

Sieve Size		Cumulative Mass retained, g	% PASSING
#10	MEDIUM SAND	0.10	99.9
#20	MEDIUM SAND	3.29	96.3
#40	FINE SAND	15.16	82.9
#60	FINE SAND	26.69	69.8
#100	FINE SAND	37.85	57.2
#200	FINES	49.54	44.0

Remarks

HYDROMETER ANALYSIS

Length of Dispersion Period	1 Minute
Mechanical Dispersion Device ID #	61
Amount of Dispersing Agent (ml)	125.0
Specific Gravity (assumed)	2.700
Specific Gravity (tested)	
Starting time	11:40

PARTICLE-SIZE ANALYSIS

% COBBLES	0.0	% MEDIUM SAND	17.0
% COARSE GRAVEL	0.0	% FINE SAND	38.9
% FINE GRAVEL	0.0	% FINES	44.0
% COARSE SAND	0.1	% TOTAL SAMPLE	100.0
% CLAY(<0.005mm)	2.9	% CLAY(<0.002mm)	0.8

Date	Time	Testing time (min)	Reading	Temp (°C)	K	Composite Correction	Actual Reading	Effective Depth (cm)	a	Particle Diam. (mm)	Percent Passing
05/21/13	11:42	2	23.0	25.2	0.01267	5.0	18.0	13.4	0.99	0.0328	20.2
05/21/13	11:45	5	18.5	25.2	0.01267	5.0	13.5	14.1	0.99	0.0213	15.1
05/21/13	11:55	15	15.0	25.2	0.01267	5.0	10.0	14.7	0.99	0.0126	11.2
05/21/13	12:10	30	12.0	25.2	0.01267	5.0	7.0	15.2	0.99	0.0090	7.8
05/21/13	12:40	60	9.0	25.2	0.01267	5.0	4.0	15.7	0.99	0.0065	4.5
05/21/13	15:50	250	6.0	25.2	0.01267	5.0	1.0	16.2	0.99	0.0032	1.1
05/22/13	11:40	1440	5.5	25.2	0.01267	5.0	0.5	16.3	0.99	0.0013	0.6

Hydrometer 152H ID #	451190	Oven ID #	12/13/14/15
Sieve Shaker ID #	54/130	Balance ID#	1/6/7

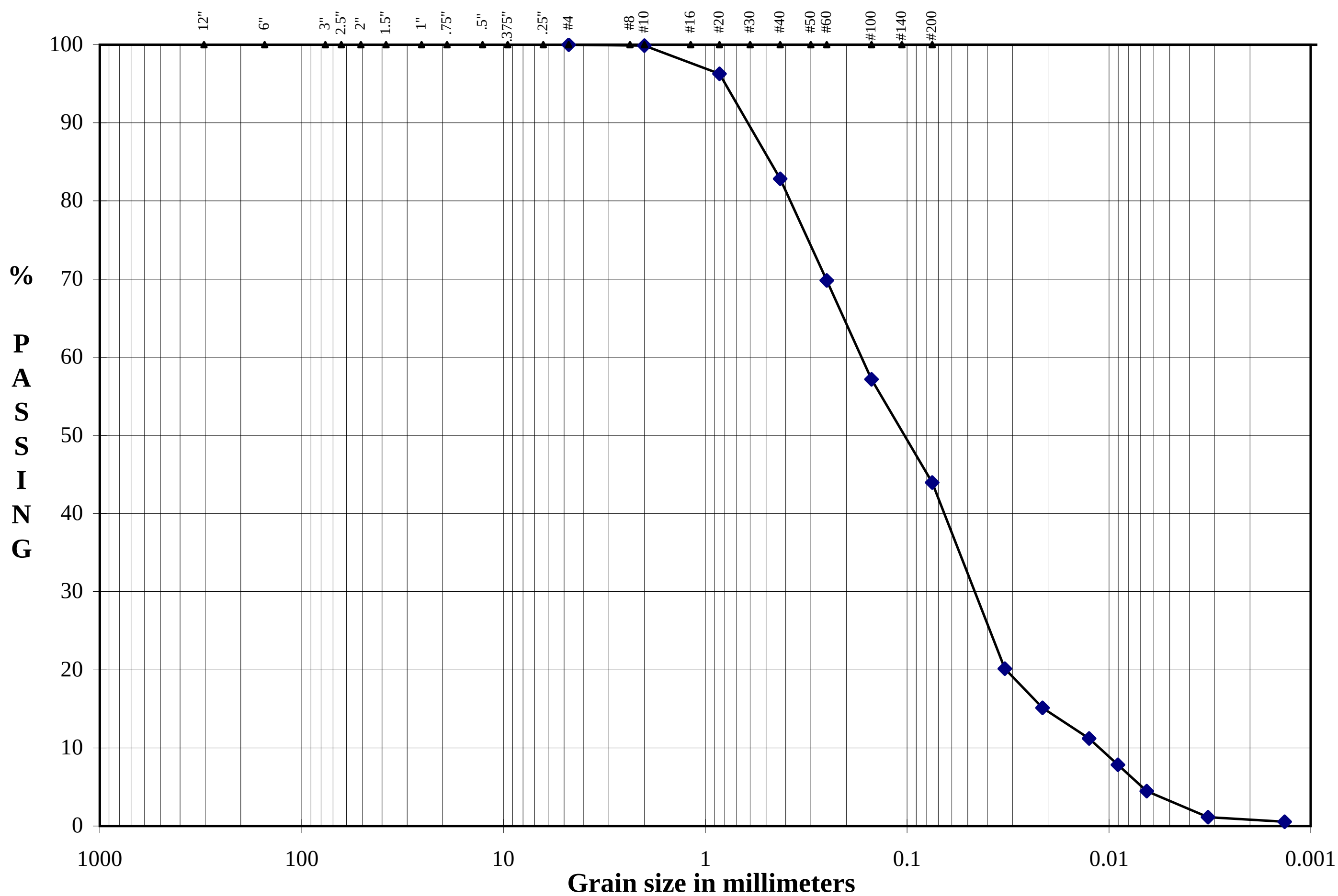
TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI		
Date	05/20/13		
Checked By			
Client Pr. #	I002-320	Lab. PR. #	1308-08-1
Pr. Name	R&B Site Suitability	S. Type	UD
Sample ID	15691/PZ-28	Depth/Elev.	25-26.5'
Location	PZ-28	Add. Info	-

ASTM D 422/AASHTO T 88

Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

Particle-Size Analysis



Boulders	Cobbles	Gravel		Sand			Fines
		Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

D_{10}	NA	mm
D_{30}	NA	mm
D_{60}	NA	mm
Cu	NA	
Cc	NA	

DESCRIPTION: Light Brown and White Silty Sand

USCS (ASTM D2487; D2488): SM

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

		Tested By	AV
		Date	05/21/13
		Checked By	[signature]
Client Pr. #	I002-320	Lab. PR. #	1308-08-1
Pr. Name	R&B Site Suitability	S. Type	UD
Sample ID	15691/PZ-28	Depth/Elev.	25-26.5'
Location	PZ-28	Add. Info	-

ASTM D 5084; Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method D, Constant Rate of Flow)

Initial Sample Data (Before Test)

Height	3.053 in	7.75 cm		
Diameter	2.870 in	7.29 cm		
Area	6.47 in^2	41.74 cm^2		
Volume	323.65 cm^3	0.0114 ft^3		
Mass	520.50 g	1.15 lb		
Specific Gravity	2.650 (Assumed)			
Dry Density	85.7 pcf			

Moisture Content

Mass of wet sample & tare	520.50 g
Mass of dry sample & tare	444.30 g
Mass of tare	0.00 g
% Moisture	17.2

Test Data

Speed	3	
Board Number	1	
Cell Number	16	
Flow Pump Number	1B	
Flow Pump Rate	2.87E-02	cm^3/sec
B - Value	0.95	
Cell Pressure	98.0	psi
Back Pressure	80.0	psi
Confining (Effective) Pressure	18.0	psi
Max Head	27.43	cm
Min Head	26.73	cm
Maximum Gradient	3.54	
Minimum Gradient	3.45	

Final Data (After Test)

Average Height of Sample		3.050 in	7.75 cm	
Average Diameter of Sample		2.865 in	7.28 cm	
Area	6.45 in^2	41.59 cm^2		
Volume	322.21 cm^3	0.0114 ft^3	Dry Density	86.1 pcf
Mass	591.40 g	1.30 lb	Vol. of Voids	154.44 cm^3
			Vol. of Solids	167.77 cm^3
			Void Ratio	0.92
			Saturation	95.1 %

Moisture Content

Mass of wet sample & tare	668.00 g
Mass of dry sample & tare	521.30 g
Mass of tare	77.00 g
% Moisture	33.0

TIME FUNCTION			Δ t	READING	Head	Gradient	Temp.	PERMEABILITY (cm/sec)			
DATE	HOUR	MIN	(sec)	(psi)	(cm)		T_x(°C)	@ T_x	R_T	@ 20 °C	
05/21/13	10	0	-	0.39	27.43	3.54	22.0	-	-	-	
05/21/13	10	2	120	0.38	26.73	3.45	22.0	1.97E-04	0.953	1.88E-04	
05/21/13	10	4	120	0.39	27.43	3.54	22.0	1.97E-04	0.953	1.88E-04	
05/21/13	10	6	120	0.38	26.73	3.45	22.0	1.97E-04	0.953	1.88E-04	*
05/21/13	10	8	120	0.39	27.43	3.54	22.0	1.97E-04	0.953	1.88E-04	*
05/21/13	10	10	120	0.38	26.73	3.45	22.0	1.97E-04	0.953	1.88E-04	*
05/21/13	10	12	120	0.39	27.43	3.54	22.0	1.97E-04	0.953	1.88E-04	*

Reported Average Hydraulic Conductivity* 1.9E-04 cm/sec

Note: Deaired Water Used for Permeability Test.

DESCRIPTION: Light Brown and White Silty Sand

USCS (ASTM D2487;2488): SM

REMARKS: Portion of sample used for testing located 3" above bottom of shelby tube.

Flow pump ID #	22	Balance ID #	1/6/7	Differential Pressure Transducer ID #	70/68
Thermometer ID #	63	Oven ID #	14/15	Board Pressure Transducer ID #	64
Syringe ID #	141			Pore Pressure Transducer ID #	26/27

TIMELY ENGINEERING SOIL TESTS, LLC	1874 Forge Street Tucker, GA 30084 Phone: 770-938-8233 Fax: 770-923-8973 Web: www.test-llc.com	Tested By	EB
		Date	05/21/13
		Checked By	[signature]

Client Pr. #	I002-320	Lab. PR. #	1308-08-1
Pr. Name	R&B Site Suitability	S. Type	UD
Sample ID	15692/PZ-29	Depth/Elev.	15-16.5'
Location	PZ-29	Add. Info	-

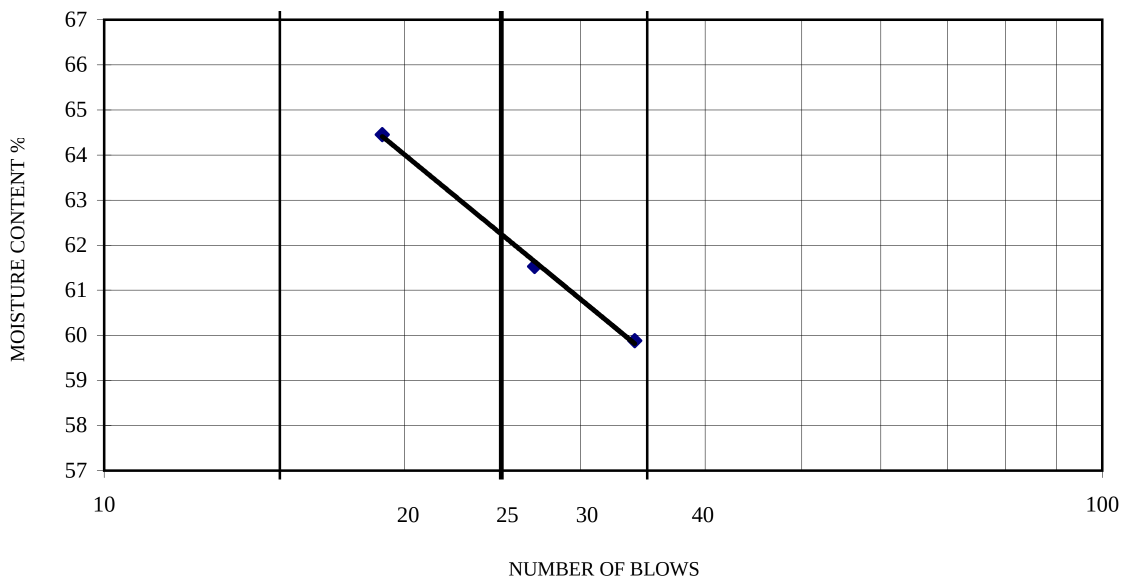
ASTM D 4318/AASHTO T 88, T 89

Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)

LIQUID LIMIT

Number of Blows	34	27	19
Mass of Wet Sample & Tare, g	40.71	40.06	40.95
Mass of Dry Sample & Tare, g	34.71	34.67	34.06
Mass of Tare, g	24.69	25.91	23.37
Moisture Content, %	59.88	61.53	64.45

Oven ID #	12/13/14/15
Balance ID #	2
Liquid Limit Device ID #	56



PLASTIC LIMIT

Mass of Wet Sample & Tare, g	37.93	37.97
Mass of Dry Sample & Tare, g	34.28	34.11
Mass of Tare, g	25.86	25.27
Moisture Content, %	43.35	43.67

PREPARATION PROCEDURE: DRY

NOTE: MATERIAL PASSING NO. 40 SIEVE WAS USED FOR TEST

NATURAL MOISTURE

Mass of Wet Sample & Tare, g	459.80
Mass of Dry Sample & Tare, g	322.90
Mass of Tare, g	0.00
Moisture Content, %	42.40

LIQUID LIMIT (LL)	62
PLASTIC LIMIT (PL)	44
PLASTICITY INDEX (PI)	18
LIQUIDITY INDEX (LI)	-0.09

DESCRIPTION: Red and Brown Elastic Silt with Sand

USCS (ASTM D2487; D2488): MH

AASHTO (M 145): NA

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	05/20/13
Checked By	[signature]

Client Pr. #	I002-320	Lab. PR. #	1308-08-1
Pr. Name	R&B Site Suitability	S. Type	UD
Sample ID	15692/PZ-29	Depth/Elev.	15-16.5'
Location	PZ-29	Add. Info	-

ASTM D 422/AASHTO T 88
Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

As-Received Moisture Content

Mass of Wet Sample & Tare, g	459.80
Mass of Dry Sample & Tare, g	322.90
Mass of Tare, g	0.00
Moisture Content, %	42.4

Moisture Content of Material Used for Hydrometer Analysis

Mass of Wet Sample & Tare, g	320.20
Mass of Dry Sample & Tare, g	260.20
Mass of Tare, g	101.80
Moisture Content, %	37.9

Mass of Total Sample before separation on #4 sieve & Tare, g	590.20
Mass of Tare, g	0.00
Total Mass of Dry Sample, g	428.06

Mass of Sample used for hydrometer analysis, g	100.00
Dry Mass, g	72.53
% of Total Sample passing #4 sieve	100.0

SIEVE ANALYSIS

PORTION OF SAMPLE RETAINED ON #4 SIEVE

Mass of Tare, g: 0.00

Sieve Size		Sample & Tare, g	% RETAINED	%PASSING
12"	COBBLES		0.0	100.0
3"	COARSE GRAVEL		0.0	100.0
2.5"	COARSE GRAVEL		0.0	100.0
2"	COARSE GRAVEL		0.0	100.0
1.5"	COARSE GRAVEL		0.0	100.0
1"	COARSE GRAVEL		0.0	100.0
.75"	FINE GRAVEL		0.0	100.0
.5"	FINE GRAVEL		0.0	100.0
.375"	FINE GRAVEL		0.0	100.0
#4	COARSE SAND	0.00	0.0	100.0

PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)

Sieve Size		Cumulative Mass retained, g	% PASSING
#10	MEDIUM SAND	0.00	100.0
#20	MEDIUM SAND	0.21	99.7
#40	FINE SAND	2.04	97.2
#60	FINE SAND	5.97	91.8
#100	FINE SAND	10.23	85.9
#200	FINES	14.80	79.6

Remarks

HYDROMETER ANALYSIS

Length of Dispersion Period	1 Minute
Mechanical Dispersion Device ID #	61
Amount of Dispersing Agent (ml)	125.0
Specific Gravity (assumed)	2.700
Specific Gravity (tested)	
Starting time	11:42

PARTICLE-SIZE ANALYSIS

% COBBLES	0.0	% MEDIUM SAND	2.8
% COARSE GRAVEL	0.0	% FINE SAND	17.6
% FINE GRAVEL	0.0	% FINES	79.6
% COARSE SAND	0.0	% TOTAL SAMPLE	100.0
% CLAY(<0.005mm)	12.0	% CLAY(<0.002mm)	6.2

Date	Time	Testing time (min)	Reading	Temp (°C)	K	Composite Correction	Actual Reading	Effective Depth (cm)	a	Particle Diam. (mm)	Percent Passing
05/21/13	11:44	2	33.5	25.2	0.01267	5.0	28.5	11.6	0.99	0.0306	38.9
05/21/13	11:47	5	29.0	25.2	0.01267	5.0	24.0	12.4	0.99	0.0199	32.8
05/21/13	11:57	15	23.0	25.2	0.01267	5.0	18.0	13.4	0.99	0.0120	24.6
05/21/13	12:12	30	20.0	25.2	0.01267	5.0	15.0	13.9	0.99	0.0086	20.5
05/21/13	12:42	60	16.0	25.2	0.01267	5.0	11.0	14.6	0.99	0.0062	15.0
05/21/13	15:52	250	10.5	25.2	0.01267	5.0	5.5	15.5	0.99	0.0032	7.6
05/22/13	11:42	1440	9.0	25.2	0.01267	5.0	4.0	15.7	0.99	0.0013	5.5

Hydrometer 152H ID #	451190	Oven ID #	12/13/14/15
Sieve Shaker ID #	54/130	Balance ID#	1/6/7

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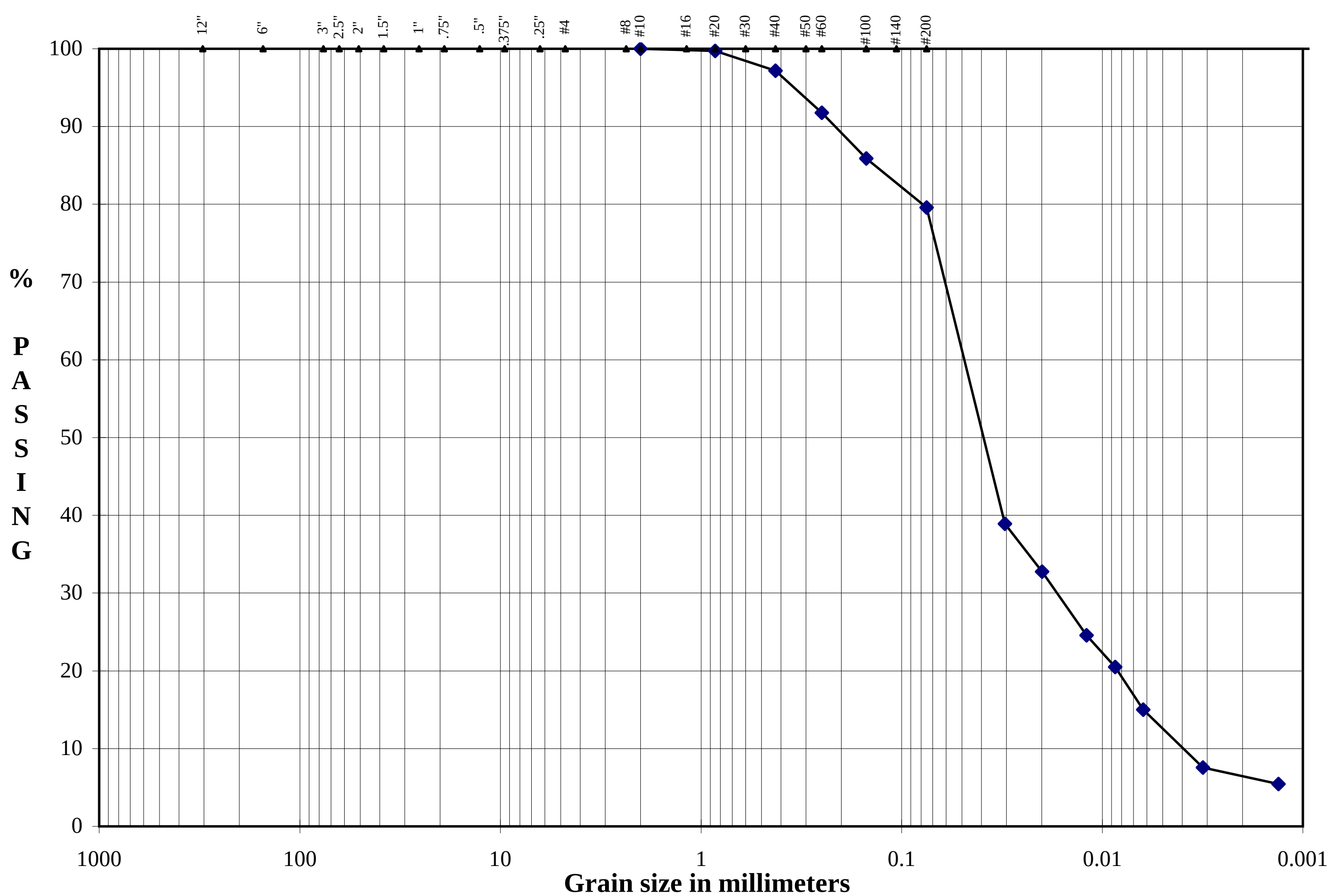
Tested By	RI
Date	05/20/13
Checked By	LB

Client Pr. #	I002-320	Lab. PR. #	1308-08-1
Pr. Name	R&B Site Suitability	S. Type	UD
Sample ID	15692/PZ-29	Depth/Elev.	15-16.5'
Location	PZ-29	Add. Info	-

ASTM D 422/AASHTO T 88

Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

Particle-Size Analysis



Boulders	Cobbles	Gravel		Sand			Fines
		Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

D_{10}	NA	mm
D_{30}	NA	mm
D_{60}	NA	mm
Cu	NA	
Cc	NA	

DESCRIPTION: Red and Brown Elastic Silt with Sand

USCS (ASTM D2487; D2488): MH

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	AV
Date	05/21/13
Checked By	[signature]

Client Pr. #	I002-320	Lab. PR. #	1308-08-1
Pr. Name	R&B Site Suitability	S. Type	UD
Sample ID	15692/PZ-29	Depth/Elev.	15-16.5'
Location	PZ-29	Add. Info	-

ASTM D 5084; Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method D, Constant Rate of Flow)

Initial Sample Data (Before Test)

Height	3.041	in	7.72	cm
Diameter	2.850	in	7.24	cm
Area	6.38	in^2	41.16	cm^2
Volume	317.90	cm^3	0.0112	ft^3
Mass	459.80	g	1.01	lb
Specific Gravity	2.650	(Assumed)		
Dry Density	63.4	pcf		

Moisture Content

Mass of wet sample & tare	459.80	g
Mass of dry sample & tare	322.90	g
Mass of tare	0.00	g
% Moisture	42.4	

Test Data

Speed	3	
Board Number	3	
Cell Number	13	
Flow Pump Number	1A	
Flow Pump Rate	2.87E-02	cm^3/sec
B - Value	0.95	
Cell Pressure	90.0	psi
Back Pressure	80.0	psi
Confining (Effective) Pressure	10.0	psi
Max Head	36.58	cm
Min Head	35.87	cm
Maximum Gradient	4.68	
Minimum Gradient	4.59	

Final Data (After Test)

Average Height of Sample			3.080	in	7.82	cm
Average Diameter of Sample			2.879	in	7.31	cm
Area	6.51	in^2	42.00	cm^2		
Volume	328.57	cm^3	0.0116	ft^3		
Mass	521.70	g	1.15	lb		

Dry Density	61.5	pcf
Vol. of Voids	206.37	cm^3
Vol. of Solids	122.20	cm^3
Void Ratio	1.69	
Saturation	95.9	%

Moisture Content

Mass of wet sample & tare	594.30	g
Mass of dry sample & tare	397.00	g
Mass of tare	74.10	g
% Moisture	61.1	

TIME FUNCTION			Δ t	READING	Head	Gradient	Temp.	PERMEABILITY (cm/sec)			
DATE	HOUR	MIN	(sec)	(psi)	(cm)		T_x(°C)	@ T_x	R_T	@ 20 °C	
05/21/13	10	0	-	0.52	36.58	4.68	22.0	-	-	-	
05/21/13	10	2	120	0.51	35.87	4.59	22.0	1.47E-04	0.953	1.41E-04	
05/21/13	10	4	120	0.52	36.58	4.68	22.0	1.47E-04	0.953	1.41E-04	
05/21/13	10	6	120	0.51	35.87	4.59	22.0	1.47E-04	0.953	1.41E-04	*
05/21/13	10	8	120	0.52	36.58	4.68	22.0	1.47E-04	0.953	1.41E-04	*
05/21/13	10	10	120	0.51	35.87	4.59	22.0	1.47E-04	0.953	1.41E-04	*
05/21/13	10	12	120	0.52	36.58	4.68	22.0	1.47E-04	0.953	1.41E-04	*

Reported Average Hydraulic Conductivity* 1.4E-04 cm/sec

Note: Deaired Water Used for Permeability Test.

DESCRIPTION

Red and Brown Elastic Silt with Sand

USCS (ASTM D2487;2488): MH

REMARKS

Portion of sample used for testing located 4" above bottom of shelby tube.

Flow pump ID #	22	Balance ID #	1/6/7	Differential Pressure Transducer ID #	24/25
Thermometer ID #	63	Oven ID #	14/15	Board Pressure Transducer ID #	29
Syringe ID #	140			Pore Pressure Transducer ID #	26/27

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Tested By	EB
Date	05/21/13
Checked By	[signature]

Client Pr. #	I002-320	Lab. PR. #	1308-08-1
Pr. Name	R&B Site Suitability	S. Type	UD
Sample ID	15693/PZ-30	Depth/Elev.	30-31.5'
Location	PZ-30	Add. Info	-

ASTM D 4318

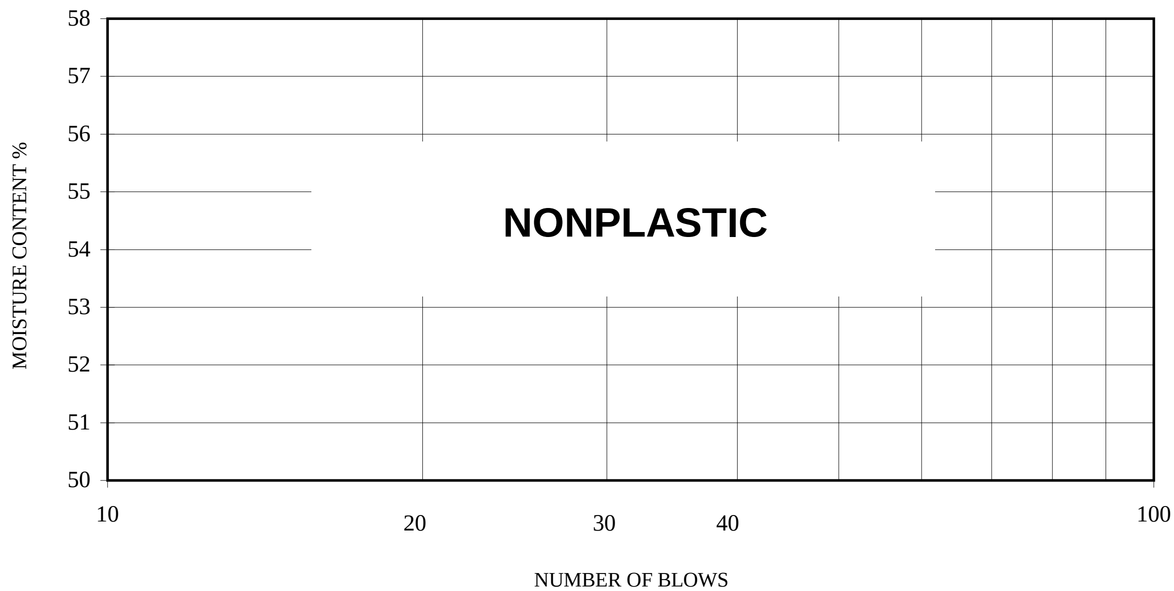
Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)

LIQUID LIMIT

Number of Blows	10	10
Weight of Wet Sample & Tare, g	48.32	37.93
Weight of Dry Soil & Tare, g	42.70	34.01
Weight of Tare, g	28.62	24.15
Moisture Content, %	39.91	39.76

Liquid Limit Device ID # 56

NOTES: 1. Material appears to be Nonplastic. (Liquid Limit or Plastic Limit test could not be performed.)
2. Material passing No. 40 sieve was used for test.



PLASTIC LIMIT

Weight of Wet Soil & Tare, g	44.96	42.72
Weight of Dry Soil & Tare, g	40.30	37.78
Weight of Tare, g	28.65	25.42
Moisture Content, %	40.00	39.97

PREPARATION PROCEDURE	DRY
Oven ID Number	12/13/14/15
Balance ID Number	2

NATURAL MOISTURE

Weight of Wet Soil & Tare, g	658.80
Weight of Dry Soil & Tare, g	539.20
Weight of Tare, g	0.00
Moisture Content, %	22.18

LIQUID LIMIT (LL)	NP
PLASTIC LIMIT (PL)	NP
PLASTICITY INDEX (PI)	NP
LIQUIDITY INDEX (LI)	-

DESCRIPTION: Gray and White Silty Sand

USCS (ASTM D2487;2488): SM

AASHTO (M 145): NA

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Tested By	RI
Date	02/20/13
Checked By	

Client Pr. #	I002-320	Lab. PR. #	1308-08-1
Pr. Name	R&B Site Suitability	S. Type	UD
Sample ID	15693/PZ-30	Depth/Elev.	30-31.5'
Location	PZ-30	Add. Info	-

ASTM D 422/AASHTO T 88
Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

As-Received Moisture Content

Mass of Wet Sample & Tare, g	658.80
Mass of Dry Sample & Tare, g	539.20
Mass of Tare, g	0.00
Moisture Content, %	22.2

Moisture Content of Material Used for Hydrometer Analysis

Mass of Wet Sample & Tare, g	309.50
Mass of Dry Sample & Tare, g	269.30
Mass of Tare, g	91.20
Moisture Content, %	22.6

Mass of Total Sample before separation on #4 sieve & Tare, g	790.30
Mass of Tare, g	0.00
Total Mass of Dry Sample, g	644.77

Mass of Sample used for hydrometer analysis, g	101.60
Dry Mass, g	82.89
% of Total Sample passing #4 sieve	100.0

SIEVE ANALYSIS

PORTION OF SAMPLE RETAINED ON #4 SIEVE

Mass of Tare, g: 0.00

Sieve Size		Sample & Tare, g	% RETAINED	%PASSING
12"	COBBLES		0.0	100.0
3"	COARSE GRAVEL		0.0	100.0
2.5"			0.0	100.0
2"			0.0	100.0
1.5"			0.0	100.0
1"			0.0	100.0
.75"	FINE GRAVEL		0.0	100.0
.5"			0.0	100.0
.375"			0.0	100.0
#4	COARSE SAND	0.00	0.0	100.0

PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)

Sieve Size		Cumulative Mass retained, g	% PASSING
#10	MEDIUM SAND	0.10	99.9
#20		12.35	85.1
#40	FINE SAND	31.11	62.5
#60		46.60	43.8
#100		59.41	28.3
#200	FINES	69.54	16.1

Remarks

HYDROMETER ANALYSIS

Length of Dispersion Period	1 Minute
Mechanical Dispersion Device ID #	61
Amount of Dispersing Agent (ml)	125.0
Specific Gravity (assumed)	2.700
Specific Gravity (tested)	
Starting time	11:44

PARTICLE-SIZE ANALYSIS

% COBBLES	0.0	% MEDIUM SAND	37.4
% COARSE GRAVEL	0.0	% FINE SAND	46.4
% FINE GRAVEL	0.0	% FINES	16.1
% COARSE SAND	0.1	% TOTAL SAMPLE	100.0
% CLAY(<0.005mm)	1.3	% CLAY(<0.002mm)	0.0

Date	Time	Testing time (min)	Reading	Temp (^oC)	K	Composite Correction	Actual Reading	Effective Depth (cm)	a	Particle Diam. (mm)	Percent Passing
05/21/13	11:46	2	13.0	25.2	0.01267	5.0	8.0	15.1	0.99	0.0348	9.6
05/21/13	11:49	5	11.5	25.2	0.01267	5.0	6.5	15.3	0.99	0.0222	7.8
05/21/13	11:59	15	9.0	25.2	0.01267	5.0	4.0	15.7	0.99	0.0130	4.8
05/21/13	12:14	30	8.0	25.2	0.01267	5.0	3.0	15.9	0.99	0.0092	3.6
05/21/13	12:44	60	7.0	25.2	0.01267	5.0	2.0	16.0	0.99	0.0066	2.4
05/21/13	15:54	250	5.0	25.2	0.01267	5.0	0.0	16.4	0.99	0.0032	0.0
05/22/13	11:44	1440	5.0	25.2	0.01267	5.0	0.0	16.4	0.99	0.0014	0.0

Hydrometer 152H ID #	451190	Oven ID #	12/13/14/15
Sieve Shaker ID #	54/130	Balance ID#	1/6/7

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Web: www.test-llc.com

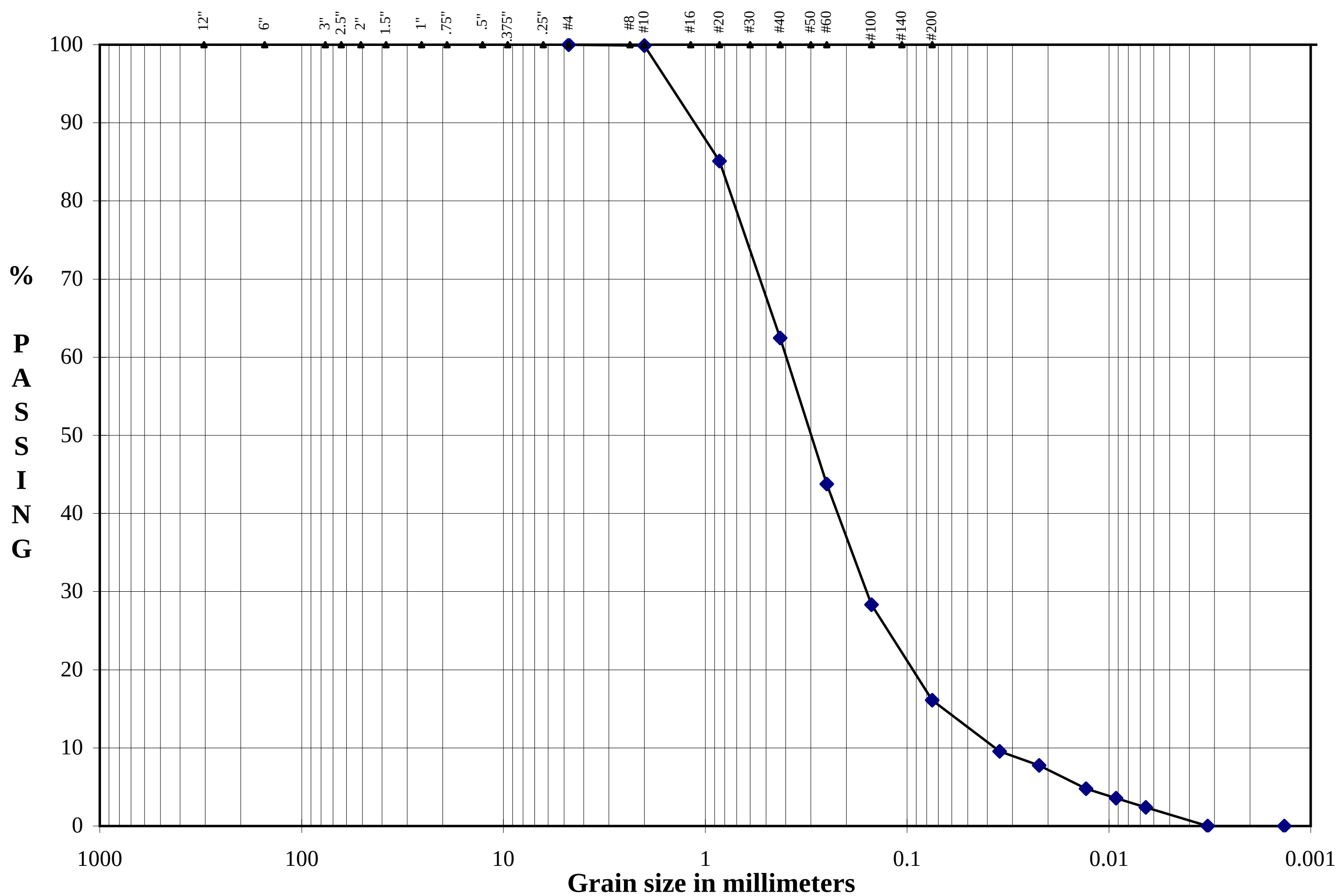
Tested By	RI
Date	02/20/13
Checked By	*(signature)*

Client Pr. #	I002-320	Lab. PR. #	1308-08-1
Pr. Name	R&B Site Suitability	S. Type	UD
Sample ID	15693/PZ-30	Depth/Elev.	30-31.5'
Location	PZ-30	Add. Info	-

ASTM D 422/AASHTO T 88

Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

Particle-Size Analysis



Boulders	Cobbles	Gravel: Coarse	Gravel: Fine	Sand: Coarse	Sand: Medium	Sand: Fine	Fines: Silt or Clay

D_{10}	NA	mm
D_{30}	NA	mm
D_{60}	NA	mm
Cu	NA	
Cc	NA	

DESCRIPTION: Gray and White Silty Sand

USCS (ASTM D2487; D2488): SM

T.E.S.T.

TIMELY ENGINEERING SOIL TESTS, LLC

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Phone: 770-938-8233
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Web: www.test-llc.com

Tested By	AV
Date	05/21/13
Checked By	

Client Pr. #	I002-320	Lab. PR. #	1308-08-1
Pr. Name	R&B Site Suitability	S. Type	UD
Sample ID	15693/PZ-30	Depth/Elev.	30-31.5'
Location	PZ-30	Add. Info	-

ASTM D 5084; Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method D, Constant Rate of Flow)

Initial Sample Data (Before Test)

Height	3.059	in	7.77	cm
Diameter	2.879	in	7.31	cm
Area	6.51	in^2	42.00	cm^2
Volume	326.33	cm^3	0.0115	ft^3
Mass	658.80	g	1.45	lb
Specific Gravity	2.650	(Assumed)		
Dry Density	103.1	pcf		

Moisture Content

Mass of wet sample & tare	658.80	g
Mass of dry sample & tare	539.20	g
Mass of tare	0.00	g
% Moisture	22.2	

Test Data

Speed	3	
Board Number	11	
Cell Number	15	
Flow Pump Number	2A	
Flow Pump Rate	2.87E-02	cm^3/sec
B - Value	0.95	
Cell Pressure	107.0	psi
Back Pressure	80.0	psi
Confining (Effective) Pressure	27.0	psi
Max Head	32.36	cm
Min Head	31.65	cm
Maximum Gradient	4.16	
Minimum Gradient	4.07	

Final Data (After Test)

Average Height of Sample			3.060	in	7.77	cm
Average Diameter of Sample			2.873	in	7.30	cm
Area	6.48	in^2	41.82	cm^2		
Volume	325.07	cm^3	0.0115	ft^3		
Mass	659.40	g	1.45	lb		

Dry Density	103.6	pcf
Vol. of Voids	121.36	cm^3
Vol. of Solids	203.72	cm^3
Void Ratio	0.60	
Saturation	98.5	%

Moisture Content

Mass of wet sample & tare	727.40	g
Mass of dry sample & tare	608.00	g
Mass of tare	68.80	g
% Moisture	22.1	

TIME FUNCTION			Δ t	READING	Head	Gradient	Temp.	PERMEABILITY (cm/sec)			
DATE	HOUR	MIN	(sec)	(psi)	(cm)		T_x(°C)	@ T_x	R_T	@ 20 °C	
05/21/13	10	20	-	0.46	32.36	4.16	22.0	-	-	-	
05/21/13	10	22	120	0.45	31.65	4.07	22.0	1.66E-04	0.953	1.59E-04	
05/21/13	10	24	120	0.46	32.36	4.16	22.0	1.66E-04	0.953	1.59E-04	
05/21/13	10	26	120	0.45	31.65	4.07	22.0	1.66E-04	0.953	1.59E-04	*
05/21/13	10	28	120	0.46	32.36	4.16	22.0	1.66E-04	0.953	1.59E-04	*
05/21/13	10	30	120	0.45	31.65	4.07	22.0	1.66E-04	0.953	1.59E-04	*
05/21/13	10	32	120	0.46	32.36	4.16	22.0	1.66E-04	0.953	1.59E-04	*

Reported Average Hydraulic Conductivity* 1.6E-04 cm/sec

Note: Deaired Water Used for Permeability Test.

DESCRIPTION

Gray and White Silty Sand

USCS (ASTM D2487;2488): SM

REMARKS

Portion of sample used for testing located 3" above bottom of shelby tube.

Flow pump ID #	244	Balance ID #	1/6/7	Differential Pressure Transducer ID #	262
Thermometer ID #	63	Oven ID #	14/15	Board Pressure Transducer ID #	216
Syringe ID #	245			Pore Pressure Transducer ID #	28

$$e_L = G.\gamma_W.S.d_L \tag{5}$$

where, e_L is the void ratio at liquid limit, G the specific gravity, γ_W the unit weight of water, S the specific surface, and d_L the interparticle separation distance at liquid limit. Identifying 'd' as the void ratio, equation (5) can be expressed as:

$$e_L = a' - b' \log \sigma_L \tag{6}$$

where, a' and b' are constants like in equation (4), and σ_L the effective stress at liquid limit. Due to difference in specific surfaces of different soils, e_L can be different for the same order of σ_L and d_L. Hence liquid limit can be regarded as a state at which the separation distance between particles or their aggregated units are under force-field- equilibrium and e_L can be a normalisation parameter at macro level to generalise the behaviour of different fine grained soils. Thus, all the water held at liquid limit of soils can be considered as interacting water directly under the influence of interparticle forces which is also dependent upon pore size distribution. Attractive force is predominant only within a distance of 20 A° and practically no force exerted beyond a distance of about to 300 A°. It has also been experimentally established that the pore size distribution curves for different soils at their liquid limits are of the same type.

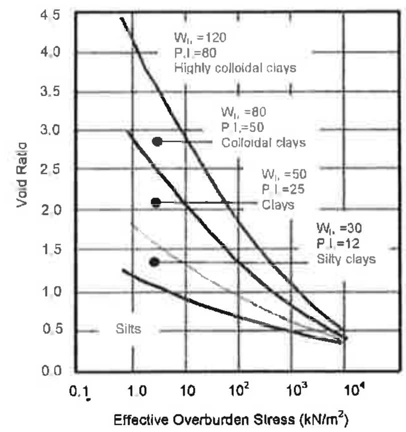


Figure 4. Approximate relation between void ratio and overburden stress for clay sediments, as a function of the Atterberg's liquid limit (LL) and Plasticity index (PI) (Lambe and Whitman, 1969)

Test data on permeability indicate that at liquid limit water contents, the permeability coefficient, k, is of the same order for all soils. Considering the state of soil in volume basis, the weight of solid particles is inversely proportional to the liquid limit water contents for unit volume of soils, i.e. the weight of the soil particles in unit volume will be such as to provide same order of surface area and hence the same order of physico-chemical potential for all soils. Thus, the resulting microstructure, depending upon the physico – chemical potential in unit volume, can be of the same pattern. These unique conditions of same consolidation / suction pressure, constant shear strength, and same order of permeability at liquid limit, can be represented as a datum state in relation to which all other state and stress conditions can be normalised. In particular, the compression equation of normally consolidated uncemented saturated soils, upon normalisation, would result in the form (Nagaraj et al., 1990):

$$\frac{e}{e_L} = a - b \log p \tag{7}$$

where, 'e' is the in-situ void ratio, and effective stress 'p' equals to '$\sigma - u$'
The above explanation and formulation can be used not only for pure clays but also for natural soils containing coarser particles because of the fact that the clay particles form a coating around the coarser particles preventing a direct contact between them or the coarse particles float in a matrix of clay particles. It is proved experimentally that coarser particles reduce the physico-chemical potential of the soil proportionately without altering the basic mode of stress release. Hence e_L should correspond to the modified liquid limit of the soil as a whole taking into account for the reduction in physico-chemical potential.

$$WL_{modified} = WL\left(1 - \frac{F}{100}\right) \tag{8}$$

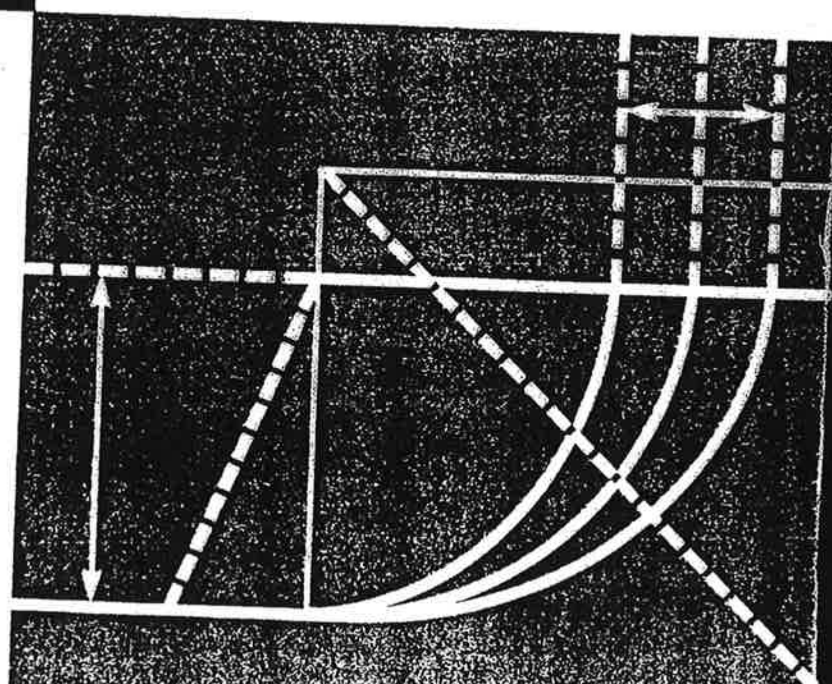
where, $WL_{modified}$ is the liquid limit of the soil as a whole, WL the liquid limit for soil fraction finer than 425 micron, and 'F' the fraction of soil coarser than 425 micron expressed as a number. Double layer theory can be applied to soils if the modified liquid limit value is appreciable, at least to the extent of 30-35%.

From the above discussion, it is obvious that the determination of void ratio (e_L) at liquid limit and correlating it to the in-situ void ratio (e) and other important parameter like OCR is of utmost importance because of the unique

BRAJA M. DAS

Principles of Geotechnical Engineering

Third Edition



So, for a given overburden pressure, p, the void ratio in the field can be estimated if the liquid limit and the specific gravity of the soil solid are known.

E.2 CORRELATION FOR COMPRESSION INDEX

Several correlations for the compression index are available now. They have been developed by testing various clays. Some of these correlations are given in Table E.1. It is important to realize that they are for estimation purposes only.

TABLE E.1 Correlations for Compression Index, C_c*

Equation	Reference	Region of applicability
$C_c = 0.007(LL - 7)$	Skempton (1944)	Remolded clays
$C_c = 0.01w_N$		Chicago clays
$C_c = 1.15(e_O - 0.27)$	Nishida (1956)	All clays
$C_c = 0.30(e_O - 0.27)$	Hough (1957)	Inorganic cohesive soil: silt, silty clay, clay
$C_c = 0.0115w_N$		Organic soils, peats, organic silt, and clay
$C_c = 0.0046(LL - 9)$		Brazilian clays
$C_c = 0.75(e_O - 0.5)$		Soils with low plasticity
$C_c = 0.208e_O + 0.0083$		Chicago clays
$C_c = 0.156e_O + 0.0107$		All clays

* After Rendon-Herrero (1980)

Note: e_O = *in situ* void ratio; w_N = *in situ* water content

REFERENCES

Hough, B. K. (1957). *Basic Soils Engineering*. New York: Ronald Press.

Nagaraj, T., and Murty, B. R. S. (1985). "Prediction of the Preconsolidation Pressure and Recompression Index of Soils," *Geotechnical Testing Journal*, Vol. 8, No. 4, 199–202.

Nishida, Y. (1956). "A Brief Note on Compression Index of Soils," *Journal of the Soil Mechanics and Foundations Division*, ASCE, Vol. 82, No. SM3, 1027-1–1027-14.

Rendon-Herrero, O. (1980). "Universal Compression Index Equation," *Journal of the Geotechnical Engineering Division*, ASCE, Vol. 106, No. GT11, 1179–1200.

Skempton, A. W. (1944). "Notes on the Compressibility of Clays," *Quarterly Journal of the Geological Society of London*, Vol. 100, 119–135.

Attachment 6:
Global Slope Stability

ATLANTIC COAST CONSULTING, INC.

GEORGIA REGISTERED No. 27863 PROFESSIONAL ENGINEER JULIE ELIZABETH HEADRICK

5-5-17

OBJECTIVE:

Verify the global stability of the final configuration of the coal combustible residual (CCR) waste mass for the R&B Landfill Horizontal Expansion, with respect to failure surfaces passing through the liner system and the underlying subgrade. The stability of the waste mass was evaluated under both static and seismic conditions.

METHOD:

The waste mass global stability was evaluated with the circular surfaces search under static and seismic conditions. For the purpose of this analysis, a critical slope was selected from the disposal areas, which is represented by its longest length and steepest grade. The section selected was considered to be representative of the worst case scenario for the disposal area. The location of the critical slope section utilized in the stability analyses is presented in Figure 2A-1. The geometry of the landfill and subsurface soils along the analyzed cross section is shown in Figure 2A-2.

To identify critical failure planes, the computer program XSTABL Version 5.202 was used to perform stability calculations utilizing the Bishop method of slices for circular surfaces. XSTABL was utilized to search through the anticipated zone of failures to identify the critical failure planes with the lowest factor of safety.

The next step in the evaluation was to input the geometry and soil/waste mass into XSTABL and run static analyses on the landfill mass. This allows for the identification of the critical failure planes with the lowest factors of safety. The potential for permanent deformations under seismic conditions was calculated by applying the Maximum Horizontal Acceleration (MHA) in lithified earth material expected for the site a horizontal acceleration.

DATA:

The waste parameters used for the calculations were taken from a May 2000 technical paper "Municipal Solid Waste Slope Failure. I: Waste and Foundation Soil Properties", by Eid, Stark, Evans, and Sherry. The soil properties used are from onsite field test as well as specified soil properties for the landfill construction quality assurance plan. The geosynthetic properties are the minimum required by the construction quality assurance plan. The CCR properties are values anticipated based on laboratory testing on coal combustion products from Duke Energy Lee Steam Station. The laboratory data was in the Report of Geotechnical Investigation "New

Ash Landfill for Lee Steam Station" prepared for SCS Engineers by WPC on July 10, 2008 and within the Landfill Siting Study Coal Combustion Products Landfill prepared for Duke Energy by SCS Engineers on October 16, 2008.

The following assumptions were also used in the preparation of the stability analysis:

- The groundwater surface will be consistent with the contours shown on Atlantic Coast Consulting's Figure 4, Site Plan, dated September 2013 from the Site Acceptability Report.
- The seismic coefficient will be 0.15 g (horizontal) and 0.0 (vertical).

Soil Layer Data:

The following material properties were used based on experience with similar materials and the references cited above.

Onsite Soil (XSTABL soil unit 1)
unit wt. = 110 pcf   phi = 27 degrees   c=500 psf

Protective Cover Layer (XSTABL soil unit 2)
unit wt. = 110 pcf   phi = 27 degrees   c = 500 psf

Double sided Geocomposite (XSTABL soil unit 3)
unit wt. = 100 pcf   phi = 20.4 degrees   c = 0 psf

Textured HDPE Geomembrane Liner (XSTABL soil unit 4)
unit wt. = 100 pcf   phi = 27   c = 0 psf

Geosynthetic Clay Liner (XSTABL soil unit 5)
unit wt. = 100 pcf   phi = 20 degrees   c = 0 psf

Recompacted Liner Base (XSTABL soil unit 6)
unit wt. = 120 pcf   phi = 30 degrees   c = 500 psf

CCR (XSTABL soil unit 7)
unit wt. = 115 pcf   phi = 29 degrees   c = 90 psf

Fully drained conditions were assumed within the landfill due to the presence of the leachate collection system.

The results of the stability analyses are summarized below and detailed in the attached XSTABL outputs.

RESULTS:

The XSTABL program outputs for the critical analyses show the geometry of the critical cross section evaluated for failure, the location of the critical failure surfaces and the associated factors of safety. The minimum factor of safety against failure for the evaluation scenarios are as follows:

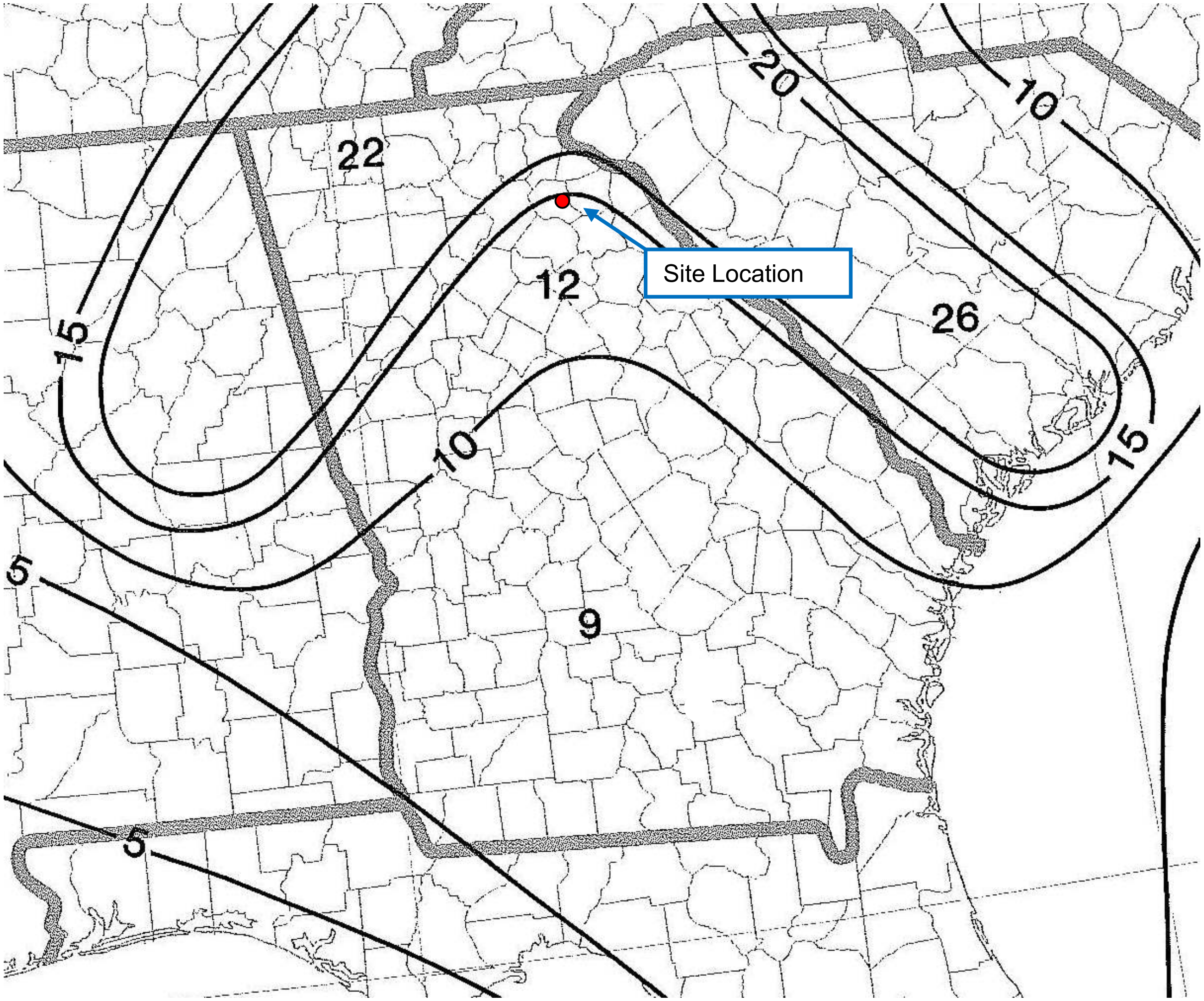
Factor of Safety (Bishop Circular, w/o seismic) (ARB-1A) = 1.979
Factor of Safety (Bishop Circular, w seismic) (ARB-1B) = 1.280

The calculated factors of safety for static conditions are greater than 1.5, and are therefore considered adequate in terms of long term stability. The calculated factors of safety for the seismic conditions are greater than 1.0, therefore no permanent deformations are expected in the landfill subgrade when subjected to the MHA.

CONCLUSION:

The analyses indicate that the proposed landfill geometry is adequately designed in consideration of the global slope stability under static and seismic conditions.

Date Figure Created: July 30, 2013



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Roswell, GA 30075
o 770.594.5998
f 770.594.5967
www.atlcc.net

LEGEND

Contour is the horizontal acceleration expressed as percent of gravity.

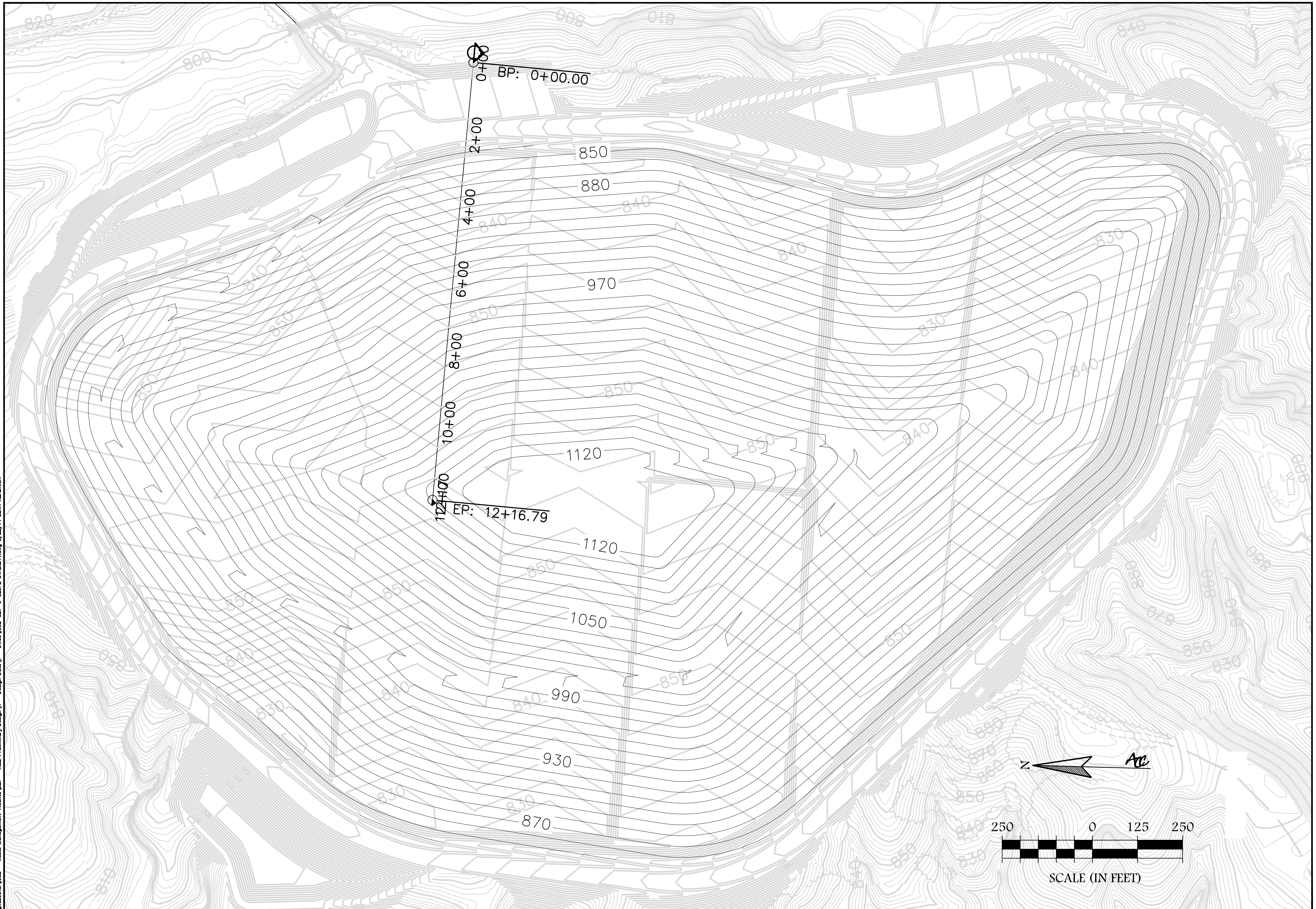
Adapted from U.S. Geological Survey (1990) Probabilistic earthquake acceleration and velocity maps for the United States and Puerto Rico, U.S. Geological Survey, Miscellaneous Field Studies Map MF-2120, Map C.- Horizontal acceleration (90 percent probability of not being exceeded in 250 years).

N

Map is not to scale.

Figure 14
Seismic Impact Zones
R&B Landfill
Banks County, Georgia

Figure 2A-1:
Slope Stability Section Plan



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WASTE MANAGEMENT
610 BENNETT ROAD
HOMER, GEORGIA
30547

PROJECT:
R&B LANDFILL
HORIZONTAL
EXPANSION

BANKS, COUNTY GA

REVISIONS

Drawn by: BFH

Checked by:

PROJECT NUMBER:
I002-327

August 2014

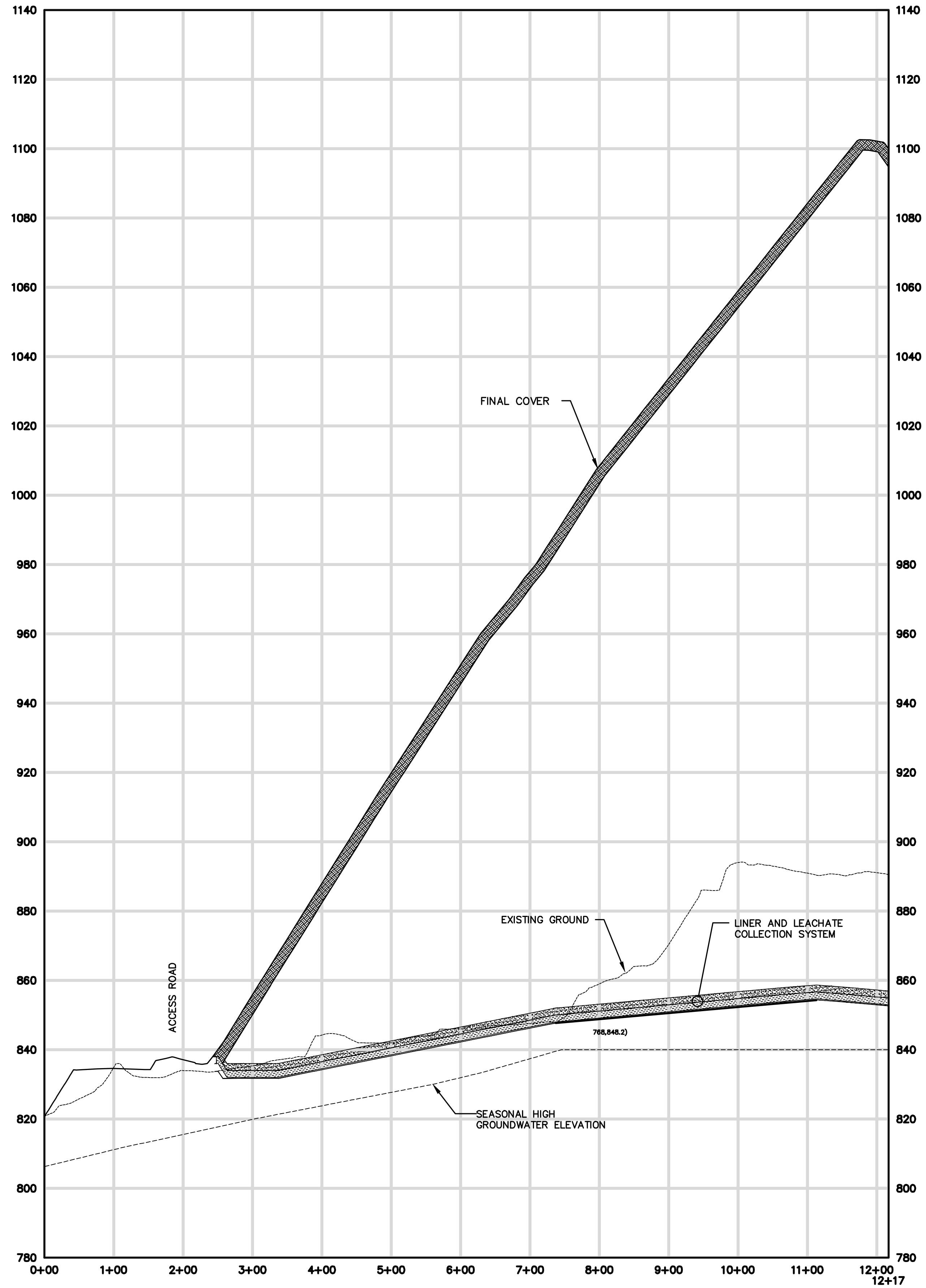
SLOPE
STABILITY
ANALYSIS

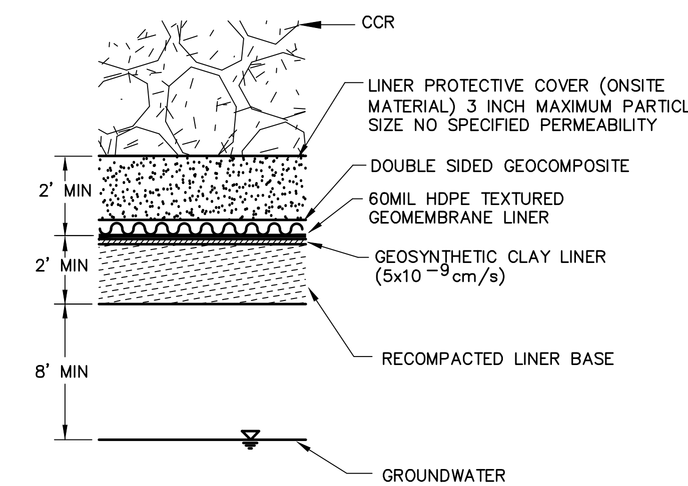
SECTION PLAN

FIGURE 2A-1

Figure 2A-2:

Slope Stability Section Profile





LINER SYSTEM DETAIL

N.T.S.

SCALE
1"=100' HORIZONTAL
1"=20' VERTICAL

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REVISIONS

Drawn by:	Checked by:
BFH	

PROJECT NUMBER:
I002-327

August 2014

SLOPE
STABILITY
ANALYSIS

SECTION
PROFILE

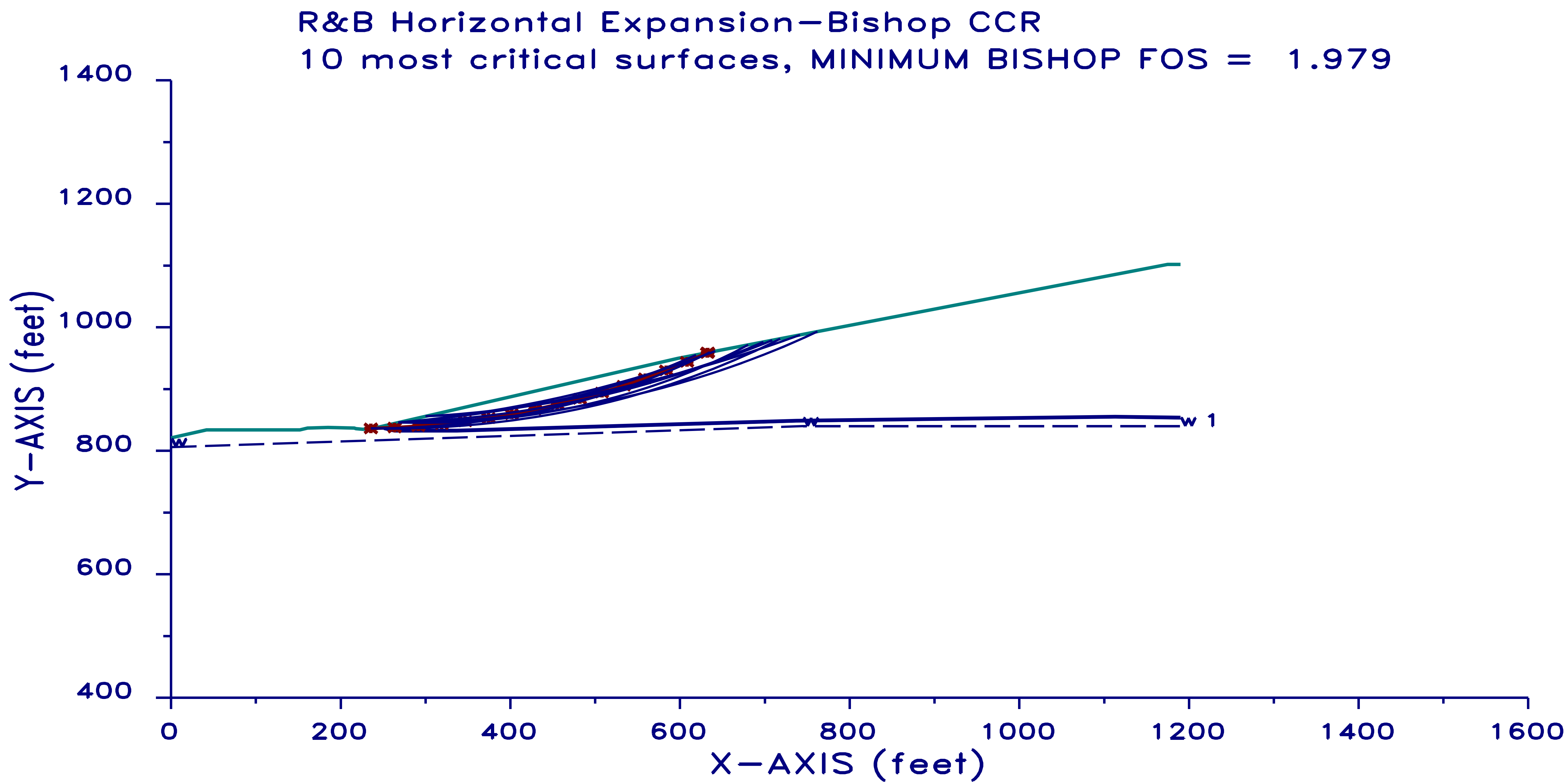
FIGURE 2A-2

P:\Industrial\I002 - Waste Management-Atlanta\327 - R&B Preliminary Design\4 - Design Data\1 - DWGs\I002-327-0-SLOPE STABILITY.dwg 4/5/17 MATHIEU TRUNNELL

ATLANTIC COAST CONSULTING, INC.

Bishop Circular

ARB-1A 4-05-** 9:50



XSTABL File: ARB-1A   4-05-**   9:50

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*       Slope Stability Analysis        *
*              using the                *
*           Method of Slices            *
*                                       *
*        Copyright (C) 1992 - 97        *
*   Interactive Software Designs, Inc.  *
*       Moscow, ID 83843, U.S.A.        *
*                                       *
*         All Rights Reserved           *
*                                       *
*  Ver. 5.202               96 - 1599  *
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```

Problem Description : R&B Horizontal Expansion-Bishop CCR

SEGMENT BOUNDARY COORDINATES
----

12 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	821.0	42.0	834.0	1
2	42.0	834.0	152.0	834.0	1
3	152.0	834.0	161.0	837.0	1
4	161.0	837.0	185.0	838.0	1
5	185.0	838.0	216.0	837.0	1
6	216.0	837.0	218.0	836.0	1
7	218.0	836.0	226.0	835.0	1
8	226.0	835.0	234.0	836.0	1
9	234.0	836.0	243.0	838.0	1
10	243.0	838.0	598.0	950.0	7
11	598.0	950.0	1175.0	1102.0	7
12	1175.0	1102.0	1190.0	1102.0	7

25 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment

1	251.0	838.0	263.5	834.0	2
2	263.5	834.0	337.0	834.0	2
3	337.0	834.0	737.0	850.0	2
4	737.0	850.0	1113.0	856.6	2
5	1113.0	856.6	1190.0	855.0	2
6	251.0	836.0	263.5	832.0	3
7	263.5	832.0	337.0	832.0	3
8	337.0	832.0	737.0	848.0	3
9	737.0	848.0	1113.0	854.6	3
10	1113.0	854.6	1190.0	853.0	3
11	251.0	835.8	263.5	831.8	4
12	263.5	831.8	337.0	831.8	4
13	337.0	831.8	737.0	847.8	4
14	737.0	847.8	1113.0	854.4	4
15	1113.0	854.4	1190.0	852.8	4
16	251.0	835.7	263.5	831.7	5
17	263.5	831.7	337.0	831.7	5
18	337.0	831.7	737.0	847.7	5
19	737.0	847.7	1113.0	854.3	5
20	1113.0	854.3	1190.0	852.7	5
21	251.0	835.5	263.5	831.5	6
22	263.5	831.5	337.0	831.5	6
23	337.0	831.5	737.0	847.5	6
24	737.0	847.5	1113.0	854.1	6
25	1113.0	854.1	1190.0	852.5	6

ISOTROPIC Soil Parameters
----

7 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	110.0	110.0	500.0	27.00	.000	.0	1
2	110.0	110.0	500.0	27.00	.000	.0	1
3	100.0	100.0	.0	20.40	.000	.0	1
4	100.0	100.0	.0	27.00	.000	.0	1
5	100.0	100.0	.0	20.00	.000	.0	1
6	120.0	120.0	500.0	30.00	.000	.0	1
7	115.0	115.0	90.0	29.00	.000	.0	1

1 Water surface(s) have been specified

Unit weight of water = 62.40 (pcf)

Water Surface No. 1 specified by 3 coordinate points

****
PHREATIC SURFACE,
****

Point No.	x-water (ft)	y-water (ft)
1	.00	806.00
2	745.00	840.00
3	1190.00	840.00

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

1000 trial surfaces will be generated and analyzed.

100 Surfaces initiate from each of 10 points equally spaced along the ground surface between x = 10.0 ft
and x = 300.0 ft

Each surface terminates between x = 400.0 ft
and x = 1180.0 ft

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = 650.0 ft

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

28.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED BISHOP METHOD * * * * *

The most critical circular failure surface is specified by 17 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	235.56	836.35
2	263.52	837.73
3	291.42	840.11
4	319.22	843.48
5	346.87	847.85
6	374.36	853.20
7	401.63	859.52
8	428.67	866.82
9	455.42	875.07
10	481.87	884.27
11	507.97	894.41
12	533.69	905.48
13	559.00	917.46
14	583.86	930.33
15	608.25	944.08
16	632.14	958.69
17	632.90	959.19

**** Simplified BISHOP FOS = 1.979 ****

The following is a summary of the TEN most critical surfaces

Problem Description : R&B Horizontal Expansion-Bishop CCR

FOS Circle Center Radius Initial Terminal
Resisting

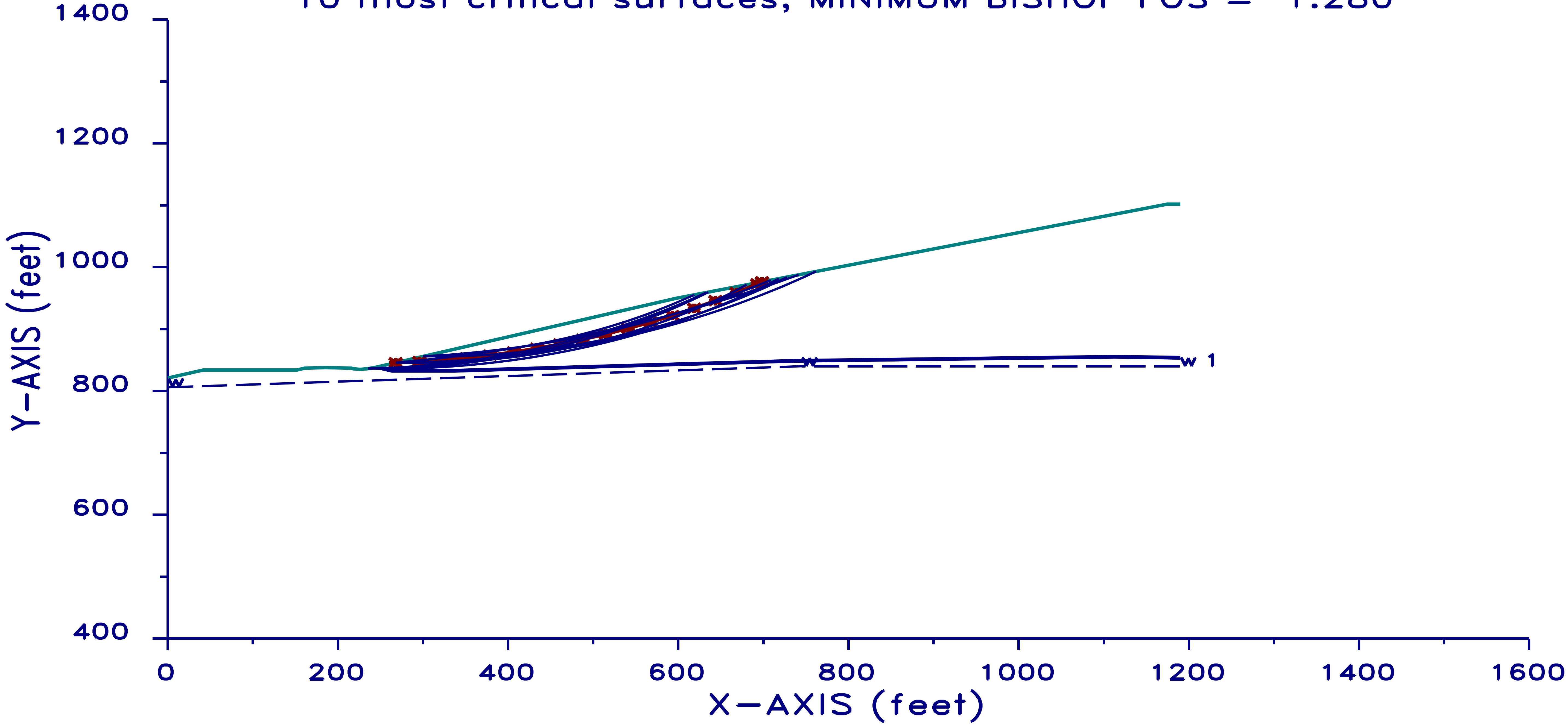
	(BISHOP)	x-coord	y-coord		x-coord	x-coord	Moment
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft-lb)
1.	1.979	210.77	1620.62	784.67	235.56	632.90	4.172E+08
2.	1.980	237.67	1538.67	702.32	235.56	635.26	4.250E+08
3.	1.985	223.41	1767.68	922.92	267.78	698.40	5.610E+08
4.	1.991	294.29	1498.67	653.39	267.78	680.37	4.820E+08
5.	1.995	272.40	1505.08	649.68	300.00	618.79	2.195E+08
6.	1.999	257.03	1639.60	803.54	235.56	718.12	7.687E+08
7.	2.007	134.74	1937.82	1100.08	267.78	641.58	3.708E+08
8.	2.009	263.07	1764.17	918.36	267.78	761.81	8.443E+08
9.	2.010	227.53	1836.92	983.61	300.00	708.77	4.932E+08
10.	2.016	97.45	2275.59	1439.89	267.78	741.35	7.946E+08

* * * END OF FILE * * *

Bishop Circular with Seismic

ARB-1B 4-05-** 10:33

R&B Horizontal Expansion-Bishop CCR
10 most critical surfaces, MINIMUM BISHOP FOS = 1.280



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*        Slope Stability Analysis       *
*               using the               *
*            Method of Slices           *
*                                       *
*         Copyright (C) 1992 - 97       *
*   Interactive Software Designs, Inc.  *
*        Moscow, ID 83843, U.S.A.       *
*                                       *
*          All Rights Reserved          *
*                                       *
*  Ver. 5.202                96 - 1599  *
*****************************************
```

Problem Description : R&B Horizontal Expansion-Bishop CCR

SEGMENT BOUNDARY COORDINATES
----

12 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	821.0	42.0	834.0	1
2	42.0	834.0	152.0	834.0	1
3	152.0	834.0	161.0	837.0	1
4	161.0	837.0	185.0	838.0	1
5	185.0	838.0	216.0	837.0	1
6	216.0	837.0	218.0	836.0	1
7	218.0	836.0	226.0	835.0	1
8	226.0	835.0	234.0	836.0	1
9	234.0	836.0	243.0	838.0	1
10	243.0	838.0	598.0	950.0	7
11	598.0	950.0	1175.0	1102.0	7
12	1175.0	1102.0	1190.0	1102.0	7

25 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment

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4	737.0	850.0	1113.0	856.6	2
5	1113.0	856.6	1190.0	855.0	2
6	251.0	836.0	263.5	832.0	3
7	263.5	832.0	337.0	832.0	3
8	337.0	832.0	737.0	848.0	3
9	737.0	848.0	1113.0	854.6	3
10	1113.0	854.6	1190.0	853.0	3
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12	263.5	831.8	337.0	831.8	4
13	337.0	831.8	737.0	847.8	4
14	737.0	847.8	1113.0	854.4	4
15	1113.0	854.4	1190.0	852.8	4
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17	263.5	831.7	337.0	831.7	5
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20	1113.0	854.3	1190.0	852.7	5
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22	263.5	831.5	337.0	831.5	6
23	337.0	831.5	737.0	847.5	6
24	737.0	847.5	1113.0	854.1	6
25	1113.0	854.1	1190.0	852.5	6

ISOTROPIC Soil Parameters

----

7 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	110.0	110.0	500.0	27.00	.000	.0	1
2	110.0	110.0	500.0	27.00	.000	.0	1
3	100.0	100.0	.0	20.40	.000	.0	1
4	100.0	100.0	.0	27.00	.000	.0	1
5	100.0	100.0	.0	20.00	.000	.0	1
6	120.0	120.0	500.0	30.00	.000	.0	1
7	115.0	115.0	90.0	29.00	.000	.0	1

1 Water surface(s) have been specified

Unit weight of water = 62.40 (pcf)

Water Surface No. 1 specified by 3 coordinate points

****
PHREATIC SURFACE,
****

Point No.	x-water (ft)	y-water (ft)
1	.00	806.00
2	745.00	840.00
3	1190.00	840.00

A horizontal earthquake loading coefficient
of .150 has been assigned

A vertical earthquake loading coefficient
of .000 has been assigned

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

1000 trial surfaces will be generated and analyzed.

100 Surfaces initiate from each of 10 points equally spaced along the ground surface between x = 10.0 ft
and x = 300.0 ft

Each surface terminates between x = 400.0 ft
and x = 1180.0 ft

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = 650.0 ft

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

28.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

****
-- WARNING -- WARNING -- WARNING -- WARNING -- (# 48)

****
Negative effective stresses were calculated at the base of a slice.
This warning is usually reported for cases where slices have low self
weight and a relatively high "c" shear strength parameter. In such
cases, this effect can only be eliminated by reducing the "c" value.

****

USER SELECTED option to maintain strength greater than zero

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED BISHOP METHOD * * * * *

The most critical circular failure surface is specified by 18 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	267.78	845.82
2	295.72	847.59
3	323.60	850.20
4	351.38	853.67
5	379.05	857.97

6	406.58	863.11
7	433.93	869.08
8	461.09	875.88
9	488.04	883.50
10	514.74	891.93
11	541.17	901.17
12	567.31	911.21
13	593.13	922.04
14	618.61	933.64
15	643.73	946.02
16	668.46	959.14
17	692.78	973.02
18	698.40	976.45

**** Simplified BISHOP FOS = 1.280 ****

The following is a summary of the TEN most critical surfaces

Problem Description : R&B Horizontal Expansion-Bishop CCR

	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	1.280	223.41	1767.68	922.92	267.78	698.40	5.380E+08
2.	1.285	210.77	1620.62	784.67	235.56	632.90	4.002E+08
3.	1.286	237.67	1538.67	702.32	235.56	635.26	4.078E+08
4.	1.287	294.29	1498.67	653.39	267.78	680.37	4.625E+08
5.	1.288	263.07	1764.17	918.36	267.78	761.81	8.103E+08
6.	1.289	257.03	1639.60	803.54	235.56	718.12	7.380E+08
7.	1.293	227.53	1836.92	983.61	300.00	708.77	4.732E+08
8.	1.294	97.45	2275.59	1439.89	267.78	741.35	7.622E+08
9.	1.296	272.40	1505.08	649.68	300.00	618.79	2.105E+08
10.	1.297	314.66	1584.92	729.09	300.00	727.55	5.239E+08

* * * END OF FILE * * *