

Attachment 6
(Oct. 19, 2020 DEQ Permit Application)



Non-Discharge Branch Upload/Submittal Form

Version 2 - Revised June 23, 2020

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Initial Review

Reviewer

Thornburg, Nathaniel

Is this submittal an application? (Excluding additional information.)*

☐ Yes ☒ No

If not an application what is the submittal type?*

- ☐ Annual Report
☐ Residual Annual Report
☒ Additional Information
☐ Other

Permit Number (IR)*

WQ0028552

Applicant/Permittee

Old North State Water Company, LLC

Email Notifications

Does this need review by the hydrogeologist?*

☐ Yes ☒ No

Regional Office

CO Reviewer

Admin Reviewer

Nov 29 2023

Submittal Form

OFFICIAL COPY

Nov 29 2023

Project Contact Information

Please provide information on the person to be contacted by NDB Staff regarding electronic submittal, confirmation of receipt, and other correspondence.

Name * Mark Ashness

Email Address *

mark@cegroupinc.com

Phone Number *

9196067704

Project Information

Application/Document Type *

- ☐ New (Fee Required)
☐ Modification - Major (Fee Required)
☐ Renewal with Major Modification (Fee Required)
☐ Annual Report
☒ Additional Information
☐ Other
- ☐ Modification - Minor
☐ Renewal
☐ GW-59, NDMR, NDMLR, NDAR-1, NDAR-2
☐ Residual Annual Report
☐ Change of Ownership

We no longer accept these monitoring reports through this portal. Please click on the link below and it will take you to the correct form.

https://edocs.deq.nc.gov/Forms/NonDischarge_Monitoring_Report

Permit Type: *

- ☐ Wastewater Irrigation
☐ Other Wastewater
☐ Closed-Loop Recycle
☐ Single-Family Residence Wastewater Irrigation
- ☐ High-Rate Infiltration
☒ Reclaimed Water
☐ Residuals
☐ Other

Permit Number: *

WQ0028552

Has Current Existing permit number

Applicant/Permittee Address * 3212 6th Avenue South Suite 200 Birmingham, AL 35222

Facility Name *

Briar Chapel WWTP

Please provide comments/notes on your current submittal below.

Response Comments to Add Info Letter dated 9/18/20

At this time, paper copies are no longer required. If you have any questions about what is required, please contact Nathaniel Thornburg at nathaniel.thornburg@ncdenr.gov.

Please attach all information required or requested for this submittal to be reviewed here. *

(Application Form, Engineering Plans, Specifications, Calculations, Etc.)

WQ 0028552 Add Info Response 101920.pdf

56.81MB

Upload only 1 PDF document (less than 250 MB). Multiple documents must be combined into one PDF file unless file is larger than upload limit.

* ☒ By checking this box, I acknowledge that I understand the application will not be accepted for pre-review until the fee (if required) has been received by the Non-Discharge Branch. Application fees must be submitted by check or money order and made payable to the North Carolina Department of Environmental Quality (NCDEQ). I also confirm that the uploaded document is a single PDF with all parts of the application in correct order (as specified by the application).

Mail payment to:

NCDEQ – Division of Water Resources
 Attn: Non-Discharge Branch
 1617 Mail Service Center
 Raleigh, NC 27699-1617

Signature *

Mark Ashness

Submission Date Is filled in automatically once submitted.



CE GROUP

301 GLENWOOD AVENUE, SUITE 220

RALEIGH, NC 27603

Phone: (919) 367-8790

E-Mail: mark@cegroupinc.com

October 19, 2020

Ms. Vivian Zhong
 NCDENR, Division of Water Quality
 Aquifer Protection Section
 1636 Mail Service Center
 Raleigh, North Carolina 27699-1636

Electronic Delivery

Existing Permit # WQ0028552

Briar Chapel Modification to Permit, Reclaimed Quality Water Irrigation, Post constructed Western Irrigation Pond and Transmission Line in Chatham County, NC

Dear Ms. Zhong

On behalf of Briar Chapel Utilities, please find attached our responses to your Request for Additional Info dated September 18, 2020

1. An O&M Addendum was not included in the information received August 6, 2020. Please provide an O&M Addendum addressing the inclusion of the West Storage Pond, per 15A NCAC 02U .0801.
2. Please summarize the wastewater generated in the Briar Chapel Development and served by Briar Chapel WWTP in the following table, per 15A NCAC 02T .0114(f):

Historical Brakdown of Bedrooms per Home at Briar Chapel

Dwelling Type	Daily Design Flow (GPD/Unit)	# of Units	Flow (GPD)
2 BR	112	216 units	24,192
3 BR	168	1218 units	204,624
4 BR	224	520 units	116,480
5 BR	280	74 Units	20,720
Total		2028 Units	366,016 GPD

Tributery Flow: +/- 203,000 GPD

- 2028 Briar Chapel Residential Units
- Herndon Woods Residential Units
- Woods Charter School
- Pollard Middle School
- Chatham Grove Elementary School
- Various Parks and Amenities
- SD North Commercial Area

October 19, 2020

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Nov 29 2023

Paper Flow (Permitted but not yet Occupied)

Dwelling Type	Daily Design Flow (GPD/Unit)	# of Units	Flow (GPD)
3 BR	168	200	33,600
4 BR	224	68	15,232
Comm College Site			6,000
Apt			51,140
Assisted Living			13,800
Total			113,972 GPD

Total Trib & Paper Flow:**316,972 GPD**

3. Please provide an update on Conditions I.1.a. through I.1.f. of the permit issued June 15, 2020. The July 7,
 - a. Site map showing wetted perimeter of all irrigation fields (differentiate between constructed and unconstructed, field names corresponding to Attachment B, storage structures with names; property lines with ownership identified for irrigation fields (can be a separate map), surface waters, and stormwater structures within irrigated wetted perimeter. **Attached**
 - b. The Permittee shall conduct their due diligence in locating and providing engineering certifications for all storage structures currently in use. Include details on the structure liners, storage capacity, depth to the seasonal high-water table, and underdrains. **S&ME Plans attached with discussion on underdrains**
 - c. Address underdrain systems below all storage structures. Provide drawings showing the extent and discharge points. All discharge points will require sampling to ensure the 15A NCAC 02L groundwater standards are met. **Drawings Attached**
 - d. Per 15A NCAC 02U .0402(f), the storage and five-day side-stream detention units shall have either a liner of natural material at least one foot in thickness and having the hydraulic conductivity of no greater than 1×10^{-6} centimeters per second when compacted, or a synthetic liner with an effective hydraulic conductivity no greater than that of required of the natural material liner. Address if any storage structures are exceeding the required hydraulic conductivity. **Certification of Liner Attached**
 - e. Easements for all irrigation fields. Include a table with field names, property owners, and easement book and page. **Attached with Exhibit Map Referencing Recorded Easement**
 - f. Easement(s) for all treatment and storage facilities located on land not owned by the Permittee **Attached, Western Pond Site will be conveyed upon approval**

Please contact this office should you require additional information.

Sincerely,

Mark P. Ashness, PE



Enclosures

OPERATION AND MAINTENANCE PLAN

“Post Construction Western Irrigation Pond and Transmission Line”

OVERVIEW

This storage pond, pump station, and irrigation system was designed and installed to apply irrigation water to meet the hydraulic needs of the vegetation and soils without causing erosion or runoff. The performance life of this system can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require you to perform periodic operation and maintenance to maintain satisfactory performance. The following recommendations will help you in performing adequate operation and maintenance.

GENERAL RECOMMENDATIONS

Pond and Irrigation Pump Station

- Perform Annual Inspection of Irrigation Pumps, Wet Well, Building, and Controls.
- Monthly, Field Review Impoundment Slopes for Stabilization (reseed and stabilize as necessary)

Irrigation Lines and Controls

- Operate the system when needed to furnish water for landscape and plant growth.
- Operate the system at the pressure, discharge rate, duration and frequency as designed and permitted by a licensed operator through the State of NC.
- Check to make sure that all connections are watertight and all valves are working properly.
- Visually check all irrigation areas daily and maintain the system on a regular schedule per manufacturers recommendations.
- Check the sprinkler heads monthly for wear, and replace with proper parts when defective or excessive wear is found. Raise or adjust sunken heads. Make sure that sprinklers are discharging at the correct angle and that impact sprinkler heads are rotating properly.
- Controller and controller programming monthly — Check the controller to make sure it is operating and programmed properly.

- Valves — Monthly Use the controller to manually operate the valves through a cycle to make sure they are operating properly. Adjust the flow control stems on the valves if needed
- Field wiring — Monthly, Check to see if the automatic valves are receiving the proper voltage and current, check for shorts in the wiring.
- Promptly repair all leaks or weeping heads, by replacing gaskets or worn parts. All irrigation heads are located in zones isolated from main transmission line. Utilize electronic or manual gate valve to isolate a specific zone. For repairs to main transmission line, close in line gate valves and deactivate irrigation pump station.
- During limited-seasonal use, drain and place the removable part of the system in an area where it will not be damaged. Annually or more often as required isolate and flush heads in each given spray zone.
- Maintain all pumps, piping, valves and other electrical and mechanical equipment in good operating condition following the manufacturer's recommendations
- Immediately repair any vandalism.
- Maintain soils and turfgrass to maximize water absorption and reduce runoff potential, including: maintain soil cover, improve soil structure, add or maintain natural organic matter in the soil, and improve drainage).
- Monitor daily water use per zone as required in permit. Limit irrigation dose to .3" with a minimum 2 hour soak cycle between re-application. Inspect Spray patterns to insure discharge is not blocked by plant material. Remove vegetation restricting effective discharge.
- Monitor flow sensors entering each zone and compare with daily flow allocation to each spray zone in master control system. Inspect zone if significant variations are identified.

Contacts:

- NCDENR Regional Office

Mail to:
1628 Mail Service Center
Raleigh, NC 27699-1628

Location: 3800 Barrett Drive
Raleigh, NC 27609
919/791-4200
FAX 919/571-4718

-

Chatham County Emergency Operations

12 East Street, P.O. Box 1809, Pittsboro, NC 27312
TEL (919) 542-8211 FAX (919) 542-8272

Permit No. WQ0028552
Old North State Water Company, LLC
Briar Chapel Development

Reclaimed Water System

Chatham County

ENGINEERING CERTIFICATION

☒ Partial ☐ Final

I, Mark P. Ashness, as a duly licensed North Carolina Professional Engineer, having ☒ periodically / ☐ fully observed the construction of the permitted facilities, do hereby state to the best of my abilities that the facility was constructed in compliance with G.S. 143-215.1, Administrative Code Title 15A Subchapter 02T, this permit, and the Division-approved plans and specifications.

Documentation of any variation to this permit, and the Division-approved plans and specifications, is in the attached as-built drawings.

Description of variations: Asbuilt plans attached
reflect completion of Western storage
Pond and Irrigation line as depicted.

<u>Mark P. Ashness</u>			
Professional Engineer's Name			
<u>CE Group Inc</u>	<u>C-1739</u>		
Firm Name	Firm No.		
<u>301 Glenwood Ave, Suite 220</u>			
Address			
<u>Raleigh</u>	<u>NC</u>	<u>27603</u>	
City	State	Zip Code	
<u>919 367-8790</u>			
Telephone	<u>mark@cegroupinc.com</u>		Seal, Signature, and Date
Email			

THE COMPLETED ENGINEERING CERTIFICATION, INCLUDING ALL SUPPORTING DOCUMENTATION, SHALL BE SENT TO THE FOLLOWING ADDRESS:

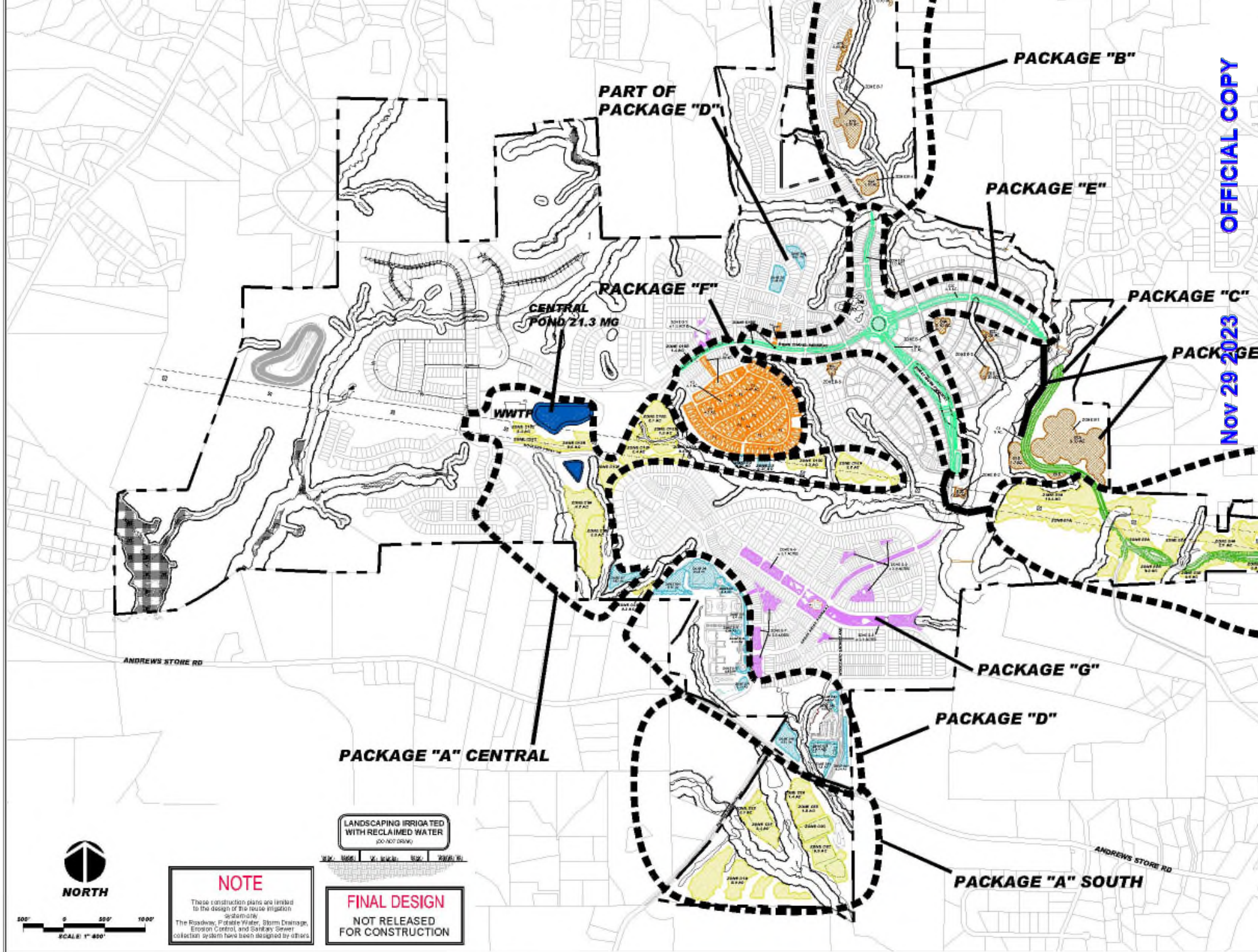
NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF WATER RESOURCES
NON-DISCHARGE BRANCH

By U.S. Postal Service
1617 MAIL SERVICE CENTER
RALEIGH, NORTH CAROLINA 27699-1617

By Courier/Special Delivery
512 N. SALISBURY ST.
RALEIGH, NORTH CAROLINA 27604

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Nov 29 2023



PART OF
PACKAGE "D"

PACKAGE "E"

PACKAGE "C"

PACKAGE "F"

CENTRAL
POND 21.3 MG

WWTP

PACKAGE "G"

PACKAGE "D"

PACKAGE "A" CENTRAL

PACKAGE "A" SOUTH

ANDREWS STONE RD

ANDREWS STONE RD



100' 0 500' 1000'
SCALE: 1" = 400'

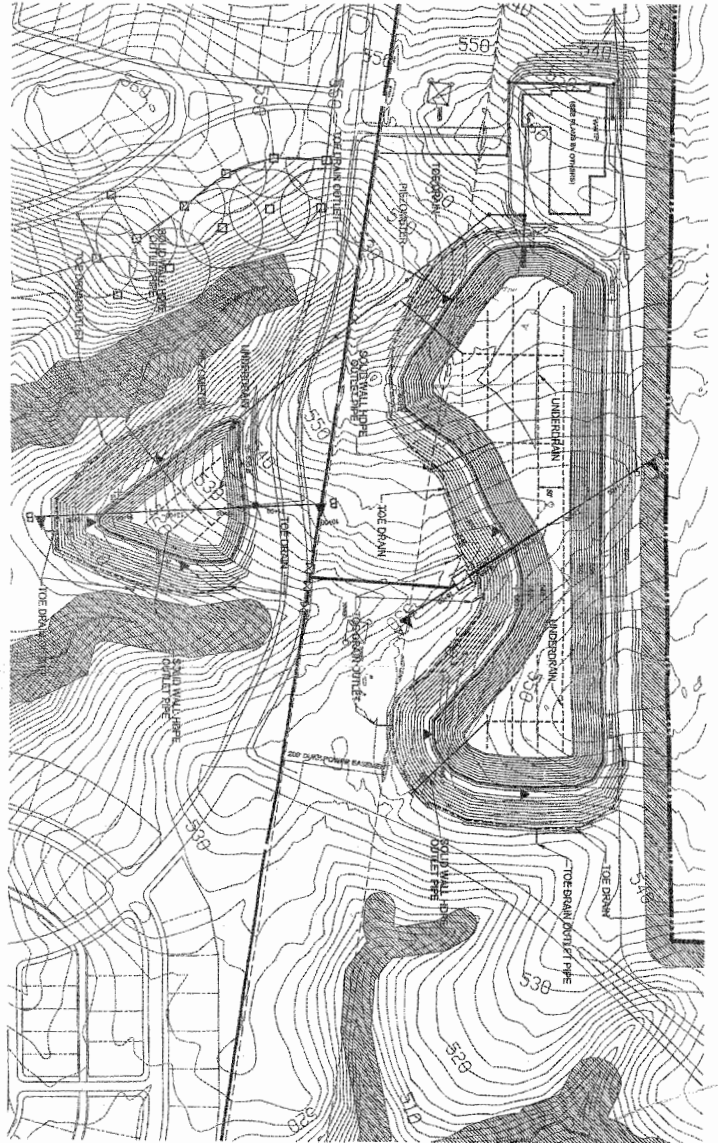
NOTE

These construction plans are limited to the design of the house irrigation system only.
The Roadway, Potable Water, Storm Drainage, Erosion Control, and Sanitary Sewer collection system have been designed by others.

LANDSCAPING IRRIGATED
WITH RECLAIMED WATER
(DO NOT DRINK)

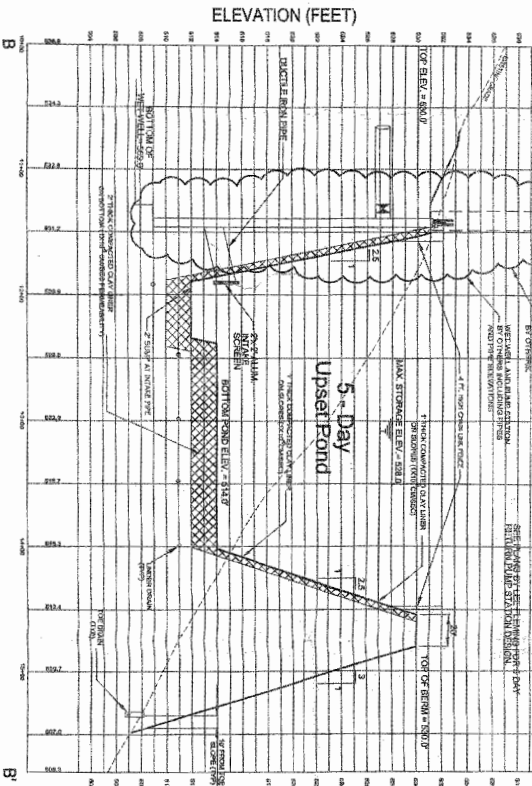
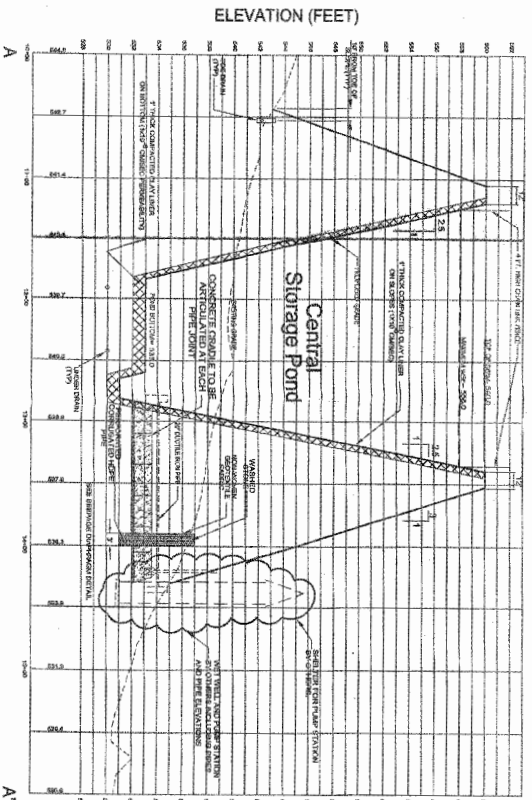
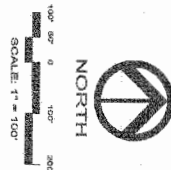
FINAL DESIGN
NOT RELEASED
FOR CONSTRUCTION

NOTE:
ROAD AREA, GRADING PLAN AND PROFILE ELEVATIONS
PROVIDED BY CE GROUP, INC.
CONTRACTOR SHOULD REFER TO PROJECT
SPECIFICATIONS PRIOR TO BEGINNING WORK
FOR PUMP STATION CONSTRUCTION, SEE PLANS BY LEE
BLANK.



NOTE:
SEE SHEET C-2 FOR UNDERDRAIN SEEVAGE DIAGRAM
AND THE BRAN DETAILS.

LEGEND
1. UNDERDRAIN LOCATION



SCALE: 1" = 40' (HORIZ.)
SCALE: 1" = 4' (VERT.)

DAM PLAN VIEW AND PROFILES
BRIAR CHAPEL RECLAMATION FACILITY STORAGE PONDS

HIGH HAZARD DAM CONSTRUCTION
CHATHAM COUNTY, NORTH CAROLINA



NO.	DATE	DESCRIPTION	BY
C-2	4		



December 11, 2007

NNP – Briar Chapel, LLC
5850 Fayetteville Street, Suite 201
Durham, North Carolina 27713

Attention: Mr. Ed Timoney, P.E.

Reference: **Revised Summary of Soil Liner Construction and Testing**
Central Pond and 5-Day Upset Pond
Briar Chapel Parkway and Boulder Point Drive
Briar Chapel Development
Chatham County, North Carolina
S&ME Project No. 1051-07-398
Former S&ME Project No. 1053-05-615

Dear Ed:

This revised report summarizes construction of soil liners for the Central Pond and 5-Day Upset Pond, our field observation and testing, and laboratory permeability test results on samples collected from soil liners. Our original report has been revised to include a plan showing approximate locations of samples collected from the soil liners.

PROJECT INFORMATION

Soil liner requirements for the Central Pond and 5-Day Upset Pond were provided in S&ME Dam Design Submittal dated June 3, 2005 (S&ME Project No. 1051-04-112). The specified permeability for the soil liners is 1×10^{-6} centimeters per second. The required compacted thickness of the soil liners is 12 inches for the Central Pond bottom and interior slopes, and the 5-Day Upset Pond interior slopes. The required compacted thickness of soil liner for the 5-Day Upset Pond bottom is 24 inches.

SOIL LINER TEST PADS

Prior to construction of the Central Pond and 5-Day Upset Pond soil liners, two soil liner test pads were constructed by Thompson Contracting using methods similar to those described in the following section. An exception is the first test pad was not treated with sodium bentonite. Test pads were approximately 35 feet by 100 feet and had a compacted thickness of approximately 12 inches. Test pad materials consisted predominantly of on-

site silts and clays.

After construction of the first test pad, S&ME collected four relatively undisturbed samples from the test pad and subjected them to falling-head permeability testing in our laboratory. Some of the samples exhibited permeabilities greater than the specified 1×10^{-6} centimeters per second.

A second test pad was constructed using similar materials and construction methods compared to the first test pad. However, the approximate upper 6 inches of the second test pad was mixed with sodium bentonite at an application rate of about 2.5 pounds per square foot. S&ME collected four relatively undisturbed samples from the second test pad and subjected them to falling-head permeability testing in our laboratory. Tested samples exhibited permeabilities less than the required permeability of 1×10^{-6} centimeters per second, which met project specifications.

SOIL LINER CONSTRUCTION

Soil liner construction for the Central Pond and 5-Day Upset Pond consisted of placing liner materials in compacted lifts ranging from about 6 to 8 inches. Soil liners consisted predominantly of on-site silts and clays which were stockpiled prior to liner construction. The approximate upper 6 inches of the soil liners were treated with sodium bentonite at an application rate of about 2.5 pounds per square foot.

Soil liners were initially constructed to their required compacted thicknesses without bentonite treatment. After construction to the required thicknesses, sodium bentonite was spread on the liner and mixed to a depth of approximately 6 inches. Moisture was added to the bentonite-soil mix and the mix was compacted.

FIELD TESTING AND OBSERVATION

S&ME observed soil liner construction and performed in-place density testing of soil liner materials. Any areas which did not meet the required density (95 percent of the standard Proctor maximum dry density) were reworked until the required density was achieved. Liner materials were placed near optimum moisture. Soil liner material types were observed by S&ME to confirm their consistency with materials used for the second test pad. S&ME observed placement and mixing of sodium bentonite to confirm that the application rate and depth of treatment was consistent with those used for the second test pad. S&ME also performed several hand auger borings within the soil liners to confirm the required thicknesses. Hand auger borings indicated thicknesses of approximately 12 inches for the Central Pond soil liner and 5-Day Upset Pond interior slopes, and approximately 24 inches for the bottom of the 5-Day Upset Pond. Measured thicknesses are generally consistent with required thicknesses.

SOIL LINER SAMPLING AND PERMEABILITY TESTING

Following completion of the soil liners, S&ME collected relatively undisturbed samples of soil liners at random locations. Six samples were collected from the Central Pond soil liner, and three samples were collected from the 5-Day Upset Pond soil liner. Samples were collected from pond bottoms and interior slopes. Approximate locations of soil samples are shown on the attached Figure 1.

Collected samples were returned to our laboratory for falling head permeability testing. Permeabilities of these samples ranged from about 7×10^{-7} to 3×10^{-8} centimeters per second, as shown on the attached table. Individual laboratory test data sheets are also attached.

CONCLUSIONS


Measured permeabilities of soil samples obtained from constructed soil liners are lower than the specified permeability of 1×10^{-6} centimeters per second. Based on our field testing and observation during soil liner construction, and permeability results of soil liner samples, it is our opinion that the soil liners for the Central Pond and 5-Day Upset Pond meet the specified permeability.

CLOSURE

S&ME, Inc. appreciates the opportunity provide our services on this project. If you have any questions concerning this report, please contact us.

Sincerely,

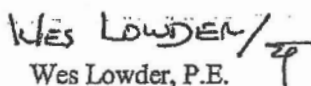
S&ME, Inc.


J. Nathan Reeves, P.E.

Geotechnical Engineering Manager

N.C. Registration No. 29383

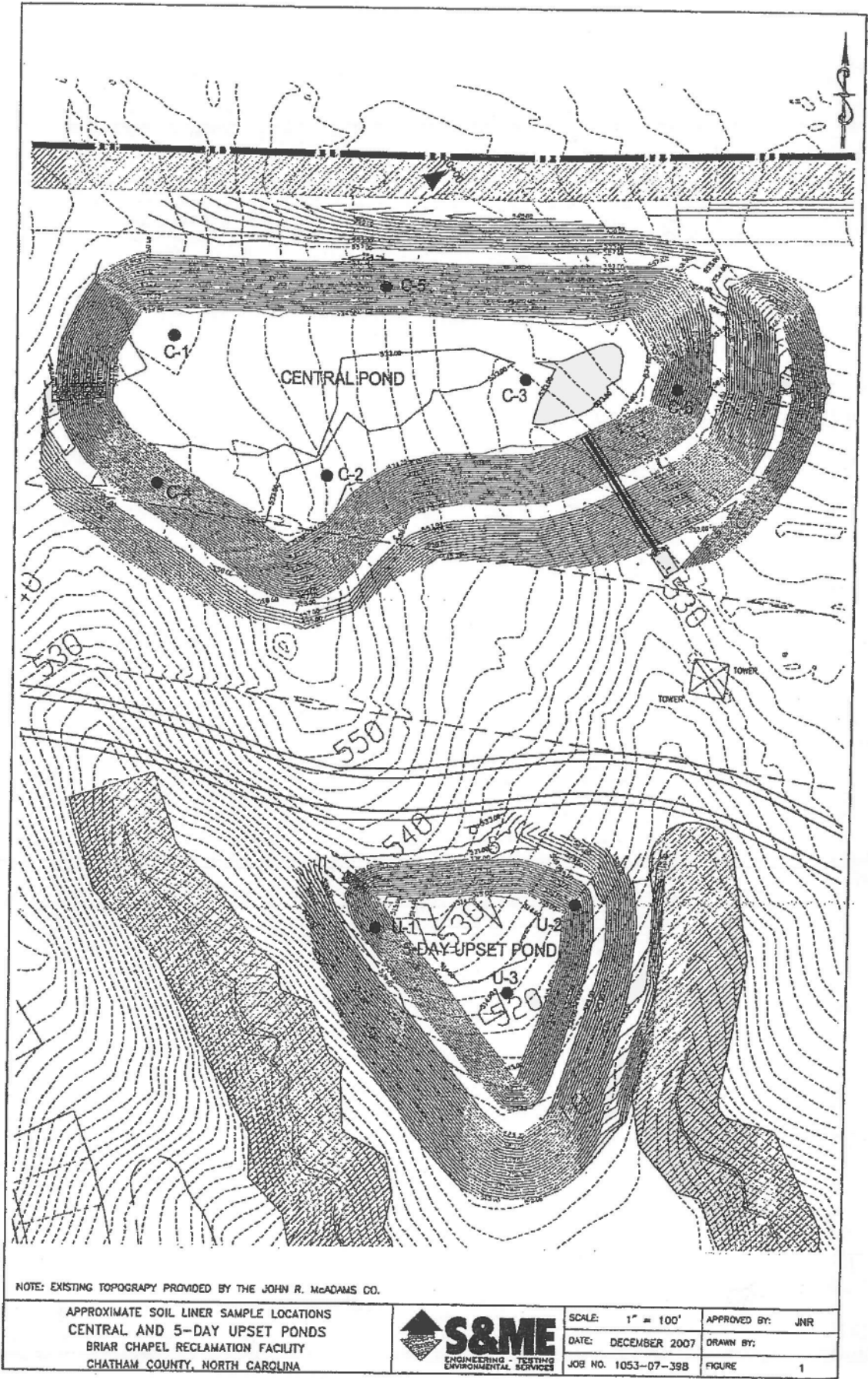



Wes Lowder, P.E.

Vice President

N.C. Registration No. 18819

S:\PROJECTS\2007\07-398 Briar Chapel / 07-398 NGS Construct\Report\07-398 Revised Soil Liner Summary.doc



**LABORATORY MEASURED PERMEABILITY OF SOIL LINER SAMPLES
CENTRAL POND AND 5-DAY UPSET POND
BRIAR CHAPEL DEVELOPMENT
S&ME PROJECT NO. 1053-07-398**

Sample No.	Location	Permeability (cm/sec)*
C-1	Central Pond Bottom	2.7×10^{-8}
C-2	Central Pond Bottom	3.0×10^{-8}
C-3	Central Pond Bottom	7.8×10^{-8}
C-4	Central Pond Interior Slope	4.7×10^{-7}
C-5	Central Pond Interior Slope	6.3×10^{-7}
C-6	Central Pond Interior Slope	3.2×10^{-7}
U-1	5-Day Upset Pond Interior Slope	7.3×10^{-7}
U-2	5-Day Upset Pond Interior Slope	2.2×10^{-7}
U-3	5-Day Upset Pond Bottom	3.1×10^{-8}

* Permeability test performed in general accordance with ASTM D 5804

Location: Central Pond Onset: NA Sample Description: (visual) C-B sandy clayey
 Liquid Limit: ND Specific Gravity: 2.668 Sample Type: undisturbed Sampled By: S&ME, Inc.
 Plastic Limit: ND Plasticity Index: ND Percent Passing #200: 63.3 Maximum Particle Size: #4

Initial Sample Conditions					Ethal Sample Conditions				
Height (cm):	8.779	Wet Unit Weight (lbs/ft ³):	113.8		Height (cm):	8.752	Dry Unit Weight (lbs/ft ³):		
Diameter (cm):	7.264	Dry Unit Weight (lbs/ft ³):	81.4		Diameter (cm):	7.252	Percent Saturation:		
Area (cm ²):	41.44	Percent Saturation:	90.0		Area (cm ²):	41.31	Void Ratio:		
Volume (cm ³):	363.82	Void Ratio:	1.0443		Volume (cm ³):	361.50	Porosity:		
Wet weight (grams):	663.2	Porosity:	0.5108		Wet weight (grams):	653.2	Station Corrections (cm):		
Dry Weight (grams):	474.6				Dry Weight (grams):	474.6			
Percent Moisture:	35.2	Influent: 18.219	Effluent: 18.335		Percent Moisture:	37.6			

Testing Station	Burette Areas (cm ²):		Effective Consolidation Stress (psi):		3.0	Permeant Liquid Used:		Deair
5	Influent: 0.196	Influent: 0.196	Cell Pressure (psi):		73.0	Influent Pressure (psi):		71.0

Start		End		Time (seconds)	Temperature (°C)			Corr. Factor	Initial		Final		h ₁ (cm)	h ₂ (cm)	Grav ies
Date	Time	Date	Time		Initial	Final	Avg.		INF.	EFF.	INF.	EFF.			
11/12/07	5:53:00 AM	11/12/07	6:29:00 AM	2160	21.5	21.5	21.5	0.965	6.50	9.85	6.54	9.82	87.29	86.94	10.0
11/12/07	6:29:00 AM	11/12/07	7:15:00 AM	2760	21.5	21.5	21.5	0.965	6.54	9.82	6.58	9.80	86.94	86.63	9.9
11/12/07	7:15:00 AM	11/12/07	8:40:00 AM	5100	21.5	21.5	21.5	0.965	6.58	9.80	6.64	9.77	86.63	86.17	9.9
11/12/07	8:40:00 AM	11/12/07	11:08:00 AM	8880	21.5	21.5	21.5	0.965	6.64	9.77	6.70	9.65	86.17	85.25	9.8

Remarks: ND= Not Determined.

Averages:

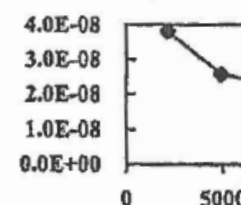
References:

ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
 ASTM D 2216: Laboratory Determination of Water Content of Soils
 ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
 ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
 ASTM D 854: Specific Gravity of Soils
 ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: Mal Krajan
 Technical Responsibility: Mal Krajan

Certification #:
 Position: Laboratory Manager

Conduct



Location: Central Pond Offset: NA Sample Description: (Visual) U-B Sandy Silty CLAY (L)
 Liquid Limit: ND Specific Gravity: 2.668 Sample Type: undisturbed Sampled By: S&ME, Inc.
 Plastic Limit: ND Plasticity Index: ND Percent Passing #200: 64.6 Maximum Particle Size: #4

Initial Sample Conditions					Final Sample Conditions				
Height (cm):	9.117	Wet Unit Weight (lbs/ft ³):	108.8		Height (cm):	9.107	Dry Unit Weight (lbs/ft ³):		
Diameter (cm):	7.315	Dry Unit Weight (lbs/ft ³):	78.5		Diameter (cm):	7.282	Percent Saturation:		
Area (cm ²):	42.03	Percent Saturation:	86.3		Area (cm ²):	41.65	Void Ratio:		
Volume (cm ³):	383.15	Void Ratio:	1.1216		Volume (cm ³):	379.29	Porosity:		
Wet weight (grams):	667.8	Porosity:	0.5287		Wet weight (grams):	675.2	Station Corrections (cm):		
Dry Weight (grams):	481.6	Station Corrections (cm):			Dry Weight (grams):	481.6	Influent: 18.181 Effluent: 18.656		
Percent Moisture:	36.3	Influent: 18.181 Effluent: 18.656			Percent Moisture:	40.2			

Testing Station	Burette Area (cm ²):		Effective Consolidation Stress (psi):		3.0	Permeant Liquid Used:		Deair
6	Influent: 0.196	Influent: 0.196	Cell Pressure (psi):	73.0	Influent Pressure (psi):	71.0		Equ

Start		End		Time (seconds)	Temperature (°C)			Corr. Factor	Initial		Final		h ₁ (cm)	h ₂ (cm)	Grav
Date	Time	Date	Time		Initial	Final	Avg.		INF.	EFF.	INF.	EFF.			
11/12/07	5:43:00 AM	11/12/07	6:29:00 AM	2760	21.5	21.5	21.5	0.965	6.48	9.86	6.51	9.82	87.09	86.73	9.5
11/12/07	6:29:00 AM	11/12/07	7:15:00 AM	2760	21.5	21.5	21.5	0.965	6.51	9.82	6.53	9.80	86.73	86.53	9.5
11/12/07	7:15:00 AM	11/12/07	8:40:00 AM	5100	21.5	21.5	21.5	0.965	6.53	9.80	6.60	9.74	86.53	85.86	9.5
11/12/07	8:40:00 AM	11/12/07	11:08:00 AM	8880	21.5	21.5	21.5	0.965	6.60	9.74	6.74	9.60	85.86	84.43	9.3

Remarks: ND= Not Determined.

Averages:

References:

ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
 ASTM D 2216: Laboratory Determination of Water Content of Soils
 ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
 ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
 ASTM D 854: Specific Gravity of Soils
 ASTM D 422: Particle Size Analysis of Soils

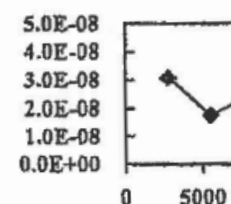
Technician / Certification #: Mal Krajan

Certification #:

Technical Responsibility: Mal Krajan

Position: Laboratory Manager

Conduct



Location: Central Pond		Offset: NA		Sample Description: (Visual) O-B Sandy Silty CLAY-(
Liquid Limit: ND		Specific Gravity: 2.668		Sample Type: undisturbed	
Plastic Limit: ND		Plasticity Index: ND		Sampled By: S&ME, Inc.	
		Percent Passing #200: 62.6		Maximum Particle Size: #4	
Initial Sample Conditions				Final Sample Conditions	
Height (cm):	8.250	Wet Unit Weight (lbs/ft ³):	116.0	Height (cm):	8.235
Diameter (cm):	7.287	Dry Unit Weight (lbs/ft ³):	87.9	Diameter (cm):	7.278
Area (cm ²):	41.70	Percent Saturation:	89.1	Area (cm ²):	41.60
Volume (cm ³):	344.07	Void Ratio:	0.8950	Volume (cm ³):	342.59
Wet weight (grams):	639.4	Porosity:	0.4723	Wet weight (grams)	643.2
Dry Weight (grams):	484.2	Station Corrections (cm)		Dry Weight (grams)	484.2
Percent Moisture:	29.9	Influent: 18.181	Effluent: 18.656	Percent Moisture:	32.8

Testing Station	Burette Areas (cm ²):		Effective Consolidation Stress (psi):		3.0	Permeant Liquid Used:		Dea
6	Influent: 0.196	Influent: 0.196	Cell Pressure (psi):	73.0	Influent Pressure (psi):	71.0	Efflu	

Start		End		Time (seconds)	Temperature (°C)			Corr. Factor	Initial		Final		h ₁ (cm)	h ₂ (cm)	Grad- ient
Date	Time	Date	Time		Initial	Final	Avg.		INF.	EFF.	INF.	EFF.			
11/14/07	7:26:00 AM	11/14/07	7:57:00 AM	1860	21.5	21.5	21.5	0.965	6.73	9.57	6.80	9.50	84.33	83.62	16.2
11/14/07	7:57:00 AM	11/14/07	8:55:00 AM	3480	21.5	21.5	21.5	0.965	6.80	9.50	6.92	9.38	83.62	82.39	16.1
11/14/07	8:55:00 AM	11/14/07	4:32:00 PM	27420	21.5	21.5	21.5	0.965	6.92	9.38	7.75	8.55	82.39	73.92	9.5
11/14/07	4:32:00 PM	11/14/07	6:22:00 PM	6600	21.5	21.5	21.5	0.965	7.75	8.55	7.94	8.37	73.92	72.04	8.9

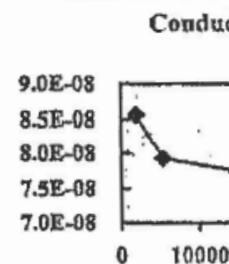
Remarks: ND= Not Determined.

References:

ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
 ASTM D 2216: Laboratory Determination of Water Content of Soils
 ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
 ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
 ASTM D 854: Specific Gravity of Soils
 ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: Mal Krajan
 Technical Responsibility: Mal Krajan

Certification #:
 Position: Laboratory Manager



Location: Central Pond

Offset: NA

Sample Description: (Visual) T-O Sandy Silty CLAY-(

Liquid Limit: ND

Specific Gravity: 2.668

Sample Type: undisturbed

Sampled By: S&ME, Inc.

Plastic Limit: ND

Plasticity Index: ND

Percent Passing #200: 66.1

Maximum Particle Size: #4

Initial Sample Conditions				Final Sample Conditions		
Height (cm):	8.304	Wet Unit Weight (lbs/ft ³):	118.9	Height (cm):	8.304	Dry Unit Weight (lbs/ft ³):
Diameter (cm):	7.315	Dry Unit Weight (lbs/ft ³):	100.8	Diameter (cm):	7.315	Percent Saturation:
Area (cm ²):	42.03	Percent Saturation:	71.7	Area (cm ²):	42.03	Void Ratio:
Volume (cm ³):	348.98	Void Ratio:	0.6510	Volume (cm ³):	348.98	Porosity:
Wet weight (grams):	664.9	Porosity:	0.3943	Wet weight (grams):	729.6	Measured Bulk Density (pcf):
Dry Weight (grams):	563.7	Station Corrections (cm):		Dry Weight (grams):	563.7	MDD (pcf): ND
Percent Moisture:	17.5	Influent: -2.454	Effluent: -2.613	Percent Moisture:	29.4	

Testing Station:	Burette Areas (cm ²):		Effective Consolidation Stress (psi):		3.0	Permeant Liquid Used:	Deaerated Water
4	Influent: 0.720	Influent: 0.720	Cell Pressure (psi):	73.0	Influent Pressure (psi):	70.0	Reduction Factor:

Start		End		Time (seconds)	Temperature (°C)			Corr. Factor	Initial		Final		h _i (cm)	h _f (cm)	Gradient
Date	Time	Date	Time		Initial	Final	Avg.		INF.	EFF.	INF.	EFF.			
11/14/07	10:51:00 AM	11/14/07	11:36:00 AM	2700	21.5	21.5	21.5	0.965	1.20	50.00	1.90	49.70	48.96	47.96	5.8
11/14/07	11:36:00 AM	11/14/07	3:05:00 PM	12540	21.5	21.5	21.5	0.965	1.90	49.70	4.00	48.10	47.96	44.26	5.6
11/14/07	3:05:00 PM	11/14/07	7:05:00 PM	14400	21.5	21.5	21.5	0.965	4.00	48.10	6.00	46.20	44.26	40.36	5.1
11/14/07	7:05:00 PM	11/15/07	4:15:00 AM	33000	21.5	21.5	21.5	0.965	6.00	46.20	9.90	42.10	40.36	32.36	4.4

Remarks: ND= Not Determined.

Averages:

References:

ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

ASTM D 2216: Laboratory Determination of Water Content of Soils

ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils

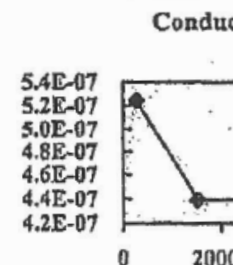
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 854: Specific Gravity of Soils

ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: Mal Krajan

Certification #:

Technical Responsibility: Mal KrajanPosition: Laboratory Manager

Location: Central Pond		Offset: NA		Sample Description: (Visual) O-B Sandy Silty CLAY-			
Liquid Limit: ND		Specific Gravity: 2.668		Sample Type: undisturbed		Sampled By: S&ME, Inc.	
Plastic Limit: ND		Plasticity Index: ND		Percent Passing #200: 64.1		Maximum Particle Size: #4	
Initial Sample Conditions				Final Sample Conditions			
Height (cm):	8.072	Wet Unit Weight (lbs/ft ³):	119.5	Height (cm):	8.072	Dry Unit We	
Diameter (cm):	7.308	Dry Unit Weight (lbs/ft ³):	99.8	Diameter (cm):	7.308	Percent S	
Area (cm ²):	41.95	Percent Saturation:	78.9	Area (cm ²):	41.95	Void R	
Volume (cm ³):	338.59	Void Ratio:	0.6674	Volume (cm ³):	338.59	Pro	
Wet weight (grams):	648.2	Porosity:	0.4003	Wet weight (grams)	672.3	Measure of L	
Dry Weight (grams):	541.5	Station Corrections (cm)		Dry Weight (grams)	541.5		
Percent Moisture:	19.7	Influent: -2.454	Effluent: -2.613	Percent Moisture:	24.2		MDD (pcf): N

Testing Station	Burette Areas (cm ²):		Effective Consolidation Stress (psi):		3.0	Permeant Liquid Used:		Deaerated
4	Influent:	0.720	Influent:	0.720	Cell Pressure (psi):	73.0	Influent Pressure (psi):	70.0

Start		End		Time	Temperature (°C)			Corr.	Initial		Final		h ₁	h ₂	Grad-
Date	Time	Date	Time	(seconds)	Initial	Final	Avg.	Factor	INF.	EFF.	INF.	EFF.	(cm)	(cm)	ient
11/16/07	4:16:00 AM	11/16/07	6:36:00 AM	8400	21.5	21.5	21.5	0.965	1.10	50.00	2.30	47.90	49.06	45.76	0.9
11/16/07	6:36:00 AM	11/16/07	11:02:00 AM	15960	21.5	21.5	21.5	0.965	2.30	47.90	5.50	44.80	45.76	39.46	5.3
11/16/07	11:02:00 AM	11/16/07	1:25:00 PM	8580	21.5	21.5	21.5	0.965	5.50	44.80	6.90	43.30	39.46	36.56	4.7
11/16/07	1:25:00 PM	11/16/07	3:20:00 PM	6900	21.5	21.5	21.5	0.965	6.90	43.30	8.00	42.10	36.56	34.26	4.4

Remarks: ND= Not Determined.

References:

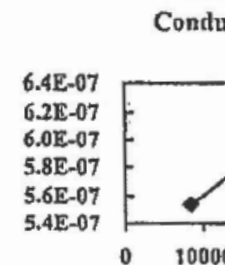
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
 ASTM D 2216: Laboratory Determination of Water Content of Soils
 ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
 ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
 ASTM D 854: Specific Gravity of Soils
 ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: Mal Krajan
 Technical Responsibility: Mal Krajan

Certification #:
 Position: Laboratory Manager

S&ME, INC. 3109 Spring Forest Road, Raleigh, N.C. 27616

Permeability (C



Location: Central Pond		Offset: NA		Sample Description: (Visual) T-O Sandy Silty CLAY-		
Liquid Limit: ND		Specific Gravity: 2.668		Sample Type: undisturbed		Sampled By: S&ME, Inc.
Plastic Limit: ND		Plasticity Index: ND		Percent Passing #200: 66.1		Maximum Particle Size: #4
Initial Sample Conditions				Final Sample Conditions		
Height (cm):	7.902	Wet Unit Weight (lbs/ft ³):	122.2	Height (cm):	7.900	Dry Unit We.
Diameter (cm):	7.300	Dry Unit Weight (lbs/ft ³):	98.9	Diameter (cm):	7.296	Percent S
Area (cm ²):	41.85	Percent Saturation:	93.0	Area (cm ²):	41.81	Void R
Volume (cm ³):	330.73	Void Ratio:	0.6835	Volume (cm ³):	330.28	Pro
Wet weight (grams):	647.5	Porosity:	0.4060	Wet weight (grams)	664.2	Measured B MDD (pcf): N
Dry Weight (grams):	523.9	Station Corrections (cm)		Dry Weight (grams)	523.9	
Percent Moisture:	23.8	Influent: -2.190	Effluent: -2.825	Percent Moisture:	26.8	

Testing Station	Burette Areas (cm ²):		Effective Consolidation Stress (psi):		3.0	Permeant Liquid Used:	Dea
2	Influent: 0.720	Influent: 0.720	Cell Pressure (psi):	73.0	Influent Pressure (psi):	70.0	Efflu

Start		End		Time	Temperature (°C)			Corr.	Initial		Final		h ₁	h ₂	Grad-
Date	Time	Date	Time	(seconds)	Initial	Final	Avg.	Factor	INF.	EFF.	INF.	EFF.	(cm)	(cm)	test
11/14/07	7:32:00 AM	11/14/07	4:22:00 PM	31800	21.5	21.5	21.5	0.965	3.40	50.00	6.70	46.10	47.24	40.04	5
11/14/07	4:22:00 PM	11/14/07	5:09:00 PM	2820	21.5	21.5	21.5	0.965	6.70	46.10	6.90	45.80	40.04	39.54	5.0
11/14/07	5:09:00 PM	11/15/07	5:42:00 AM	45180	21.5	21.5	21.5	0.965	6.90	45.80	10.10	42.20	39.54	32.74	4.6
11/15/07	5:42:00 AM	11/15/07	8:11:00 AM	8940	21.5	21.5	21.5	0.965	10.10	42.20	10.90	41.40	32.74	31.14	4.0

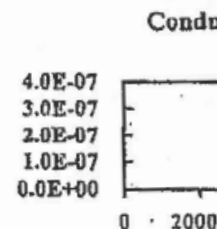
Remarks: ND= Not Determined.

References:

ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
 ASTM D 2216: Laboratory Determination of Water Content of Soils
 ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
 ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
 ASTM D 854: Specific Gravity of Soils
 ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: Mal Krajan
 Technical Responsibility: Mal Krajan

Certification #:
 Position: Laboratory Manager



S&ME, INC. 3109 Spring Forest Road, Raleigh, N.C. 27616

Permeability C

Location: 5-Day Upset Pond

Onset: NA

Sample Description: (Visual) F-C Silty CLAY -

Liquid Limit: ND

Specific Gravity: 2.676

Sample Type: undisturbed

Sampled By: S&ME, Inc.

Plastic Limit: ND

Plasticity Index: ND

Percent Passing #200: 61.1

Maximum Particle Size: #4

Initial Sample Conditions				Final Sample Conditions			
Height (cm):	8.394	Wet Unit Weight (lbs/ft ³):	127.0	Height (cm):	8.394	Dry Unit Weight (lbs/ft ³):	108.2
Diameter (cm):	7.273	Dry Unit Weight (lbs/ft ³):	108.2	Diameter (cm):	7.273	Percent Saturation:	85.8
Area (cm ²):	41.54	Percent Saturation:	85.8	Area (cm ²):	41.54	Void Ratio:	0.5431
Volume (cm ³):	348.73	Void Ratio:	0.5431	Volume (cm ³):	348.73	Porosity:	0.3519
Wet weight (grams):	709.7	Porosity:	0.3519	Wet weight (grams):	738.9	Station Corrections (cm)	
Dry Weight (grams):	604.5	Station Corrections (cm)		Dry Weight (grams):	604.5	Influent: -2.962	Effluent: -2.962
Percent Moisture:	17.4	Influent: -2.962	Effluent: -2.962	Percent Moisture:	22.2		

Testing Station:	3	Burette Areas (cm ²):	Influent: 0.720	Influent: 0.720	Effective Consolidation Stress (psi):	3.0	Permeant Liquid Used:	Deaerated Water
					Cell Pressure (psi):	73.0	Influent Pressure (psi):	70.0

Date	Start		Date	End		Time (seconds)	Temperature (°C)			Corr. Factor	Initial		Final		h ₁ (cm)	h ₂ (cm)	GSD
	Time			Time			Initial	Final	Avg.		INF	EFF	INF	EFF			
11/17/07	4:36:00 AM		11/17/07	6:35:00 AM		7140	21.5	21.5	21.5	0.965	0.20	50.00	2.10	48.00	49.80	45.90	4.6
11/17/07	6:35:00 AM		11/17/07	10:42:00 AM		14820	21.5	21.5	21.5	0.965	2.10	48.00	5.00	45.00	45.90	40.00	4.2
11/17/07	10:42:00 AM		11/17/07	12:11:00 PM		5340	21.5	21.5	21.5	0.965	5.00	45.00	6.10	43.80	40.00	37.70	
11/17/07	12:11:00 PM		11/17/07	4:05:00 PM		14040	21.5	21.5	21.5	0.965	6.10	43.80	8.50	41.30	37.70	32.80	

Remarks: ND= Not Determined.

Averages:

References:

ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

ASTM D 2216: Laboratory Determination of Water Content of Soils

ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 854: Specific Gravity of Soils

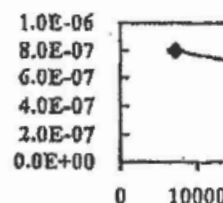
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: Mal Krajan

Certification #:

Technical Responsibility: Mal KrajanPosition: Laboratory Manager

Conductivity



S&ME, INC. 3109 Spring Forest Road, Raleigh, N.C. 27616

Permeability UD

Location: 5-Day Upset Pond		Offset: NA		Sample Description: (Visual) T-O Sandy Silty CLAY	
Liquid Limit: ND		Specific Gravity: 2.676		Sample Type: undisturbed	
Plastic Limit: ND		Plasticity Index: ND		Percent Passing #200: 63.3	
				Maximum Particle Size: #4	
Initial Sample Conditions				Final Sample Conditions	
Height (cm):	8.177	Wet Unit Weight (lbs/ft ³):	123.0	Height (cm):	8.177
Diameter (cm):	7.332	Dry Unit Weight (lbs/ft ³):	105.2	Diameter (cm):	7.332
Area (cm ²):	42.22	Percent Saturation:	84.5	Area (cm ²):	42.22
Volume (cm ³):	345.25	Void Ratio:	0.5876	Volume (cm ³):	345.25
Wet weight (grams):	680.5	Porosity:	0.3701	Wet weight (grams):	720.2
Dry Weight (grams):	581.7	Station Corrections (cm)		Dry Weight (grams):	581.7
Percent Moisture:	18.6	Influent: -2.962	Effluent: -2.962	Percent Moisture:	23.8

Testing Station	Burette Areas (cm ²):		Effective Consolidation Stress (psi):		3.0	Permeant Liquid Used:	Dea
3	Influent: 0.720	Influent: 0.720	Cell Pressure (psi):	73.0	Influent Pressure (psi):	70.0	Efflu

Start		End		Time (seconds)	Temperature (°C)			Corr. Factor	Initial		Final		h ₁ (cm)	h ₂ (cm)	Grad- at
Date	Time	Date	Time		Initial	Final	Avg.		INF.	EFF.	INF.	EFF.			
11/14/07	3:45:00 AM	11/14/07	10:50:00 AM	25500	21.5	21.5	21.5	0.965	0.60	50.00	3.30	48.00	49.40	44.70	5.8
11/14/07	10:50:00 AM	11/14/07	11:36:00 AM	2760	21.5	21.5	21.5	0.965	3.30	48.00	3.50	47.90	44.70	44.40	5.4
11/14/07	11:36:00 AM	11/14/07	8:08:00 PM	30720	21.5	21.5	21.5	0.965	3.50	47.90	6.50	45.50	44.40	39.00	5.1
11/14/07	8:08:00 PM	11/15/07	4:15:00 AM	29220	21.5	21.5	21.5	0.965	6.50	45.50	8.00	44.10	39.00	36.10	4.6

Remarks: ND= Not Determined.

Averages:

References:

ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
 ASTM D 2216: Laboratory Determination of Water Content of Soils
 ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
 ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
 ASTM D 854: Specific Gravity of Soils
 ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: Mal Krajan

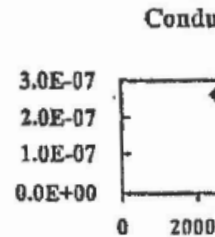
Certification #:

Technical Responsibility: Mal Krajan

Position: Laboratory Manager

S&ME, INC. 3109 Spring Forest Road, Raleigh, N.C. 27616

Permeability U



Location: 5-Day Upset Pond		Offset: NA		Sample Description: (Visual) 1-O Sandy Silty CLAY-G	
Liquid Limit: ND		Specific Gravity: 2.676		Sample Type: undisturbed	
Plastic Limit: ND		Plasticity Index: ND		Sampled By: S&ME, Inc.	
		Percent Passing #200: 66.2		Maximum Particle Size: #4	
Initial Sample Conditions				Final Sample Conditions	
Height (cm):	8.543	Wet Unit Weight (lbs/ft ³):	112.4	Height (cm):	8.538
Diameter (cm):	7.272	Dry Unit Weight (lbs/ft ³):	83.3	Diameter (cm):	7.270
Area (cm ²):	41.53	Percent Saturation:	100.0	Area (cm ²):	41.51
Volume (cm ³):	354.82	Void Ratio:	1.0044	Volume (cm ³):	354.42
Wet weight (grams):	638.8	Porosity:	0.5011	Wet weight (grams)	650.4
Dry Weight (grams):	473.5	Station Corrections (cm)		Dry Weight (grams)	473.5
Percent Moisture:	39.9	Influent: 18.219	Effluent: 18.335	Percent Moisture:	37.4

Testing Station	Burette Areas (cm ²):		Effective Consolidation Stress (psi):		3.0	Permeant Liquid Used:		Deaerated
5	Influent: 0.196	Influent: 0.196	Cell Pressure (psi):	63.0	Influent Pressure (psi):	61.5	Effluent Pressure (psi):	61.5

Start		End		Time (seconds)	Temperature (°C)			Corr. Factor	Initial		Final		h ₁ (cm)	h ₂ (cm)	Grad- i.e.
Date	Time	Date	Time		Initial	Final	Avg.		INF.	EFF.	INF.	EFF.			
11/14/07	7:25:00 AM	11/14/07	7:57:00 AM	1920	21.5	21.5	21.5	0.965	6.78	9.83	6.82	9.78	120.92	120.46	14.1
11/14/07	7:57:00 AM	11/14/07	8:55:00 AM	3480	21.5	21.5	21.5	0.965	6.82	9.78	6.86	9.70	120.46	119.85	14.1
11/14/07	8:55:00 AM	11/14/07	4:23:00 PM	26880	21.5	21.5	21.5	0.965	6.86	9.70	7.42	9.30	119.85	114.95	13.8
11/14/07	4:23:00 PM	11/15/07	5:40:00 AM	47820	21.5	21.5	21.5	0.965	7.42	9.30	8.40	8.82	114.95	107.50	13.0

Remarks: ND= Not Determined.

Averages:

References:

ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
 ASTM D 2216: Laboratory Determination of Water Content of Soils
 ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
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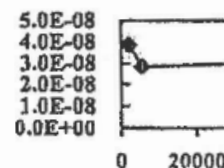
Technician / Certification #: Mal Krajan

Certification #:

Technical Responsibility: Mal Krajan

Position: Laboratory Manager

Conductivity



S&ME, INC. 3109 Spring Forest Road, Raleigh, N.C. 27616

Permeability UD-

Report of Subsurface Exploration
Briar Chapel Storage Pond and Reclamation Facility
Chatham County, North Carolina

S&ME Project No. 1051-04-112
August 2, 2004

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Nov 29 2023

7.5 Toe Drains

To reduce the potential for surface sloughing along the downstream slopes of pond dams and to increase the overall stability of the embankment, we recommend that toe drains be installed. The toe drain should be located about 10 feet upstream of the downstream toe. Drains should consist of a 6 inch diameter, heavy duty (highway grade), perforated, corrugated HDPE pipe surrounded in NCDOT No. 57 or No. 67 stone wrapped in a non-woven geotextile fabric (Mirafi 160N, Amoco 4551 or equivalent). The drain trench should be at least 2 feet wide and should extend at least 2 feet into the original subgrade soils.

7.6 Underdrains

Depending on groundwater depths, underdrain systems may be required beneath ponds to improve subgrade stability during construction and to allow for groundwater draw-down if ponds are ever drained for maintenance purposes. Also, NCDENR groundwater regulations or other regulations may require separation between pond bottoms and groundwater. Underdrain systems may be required to provide such separation.

Underdrains (if installed) should extend at least 3 feet below pond bottoms. Underdrains should consist of 6-inch diameter highway grade perforated corrugated HDPE pipe wrapped in filter fabric (Mirafi 160N, Amoco 4551, or equivalent). Underdrains should be spaced no more than 50 feet apart throughout pond bottoms and should be connected to a header pipe. We expect that header pipes can gravity drain into an existing ditch or drain feature. Drains should be installed and activated several weeks prior to final excavation to design pond subgrade elevations. Depending on groundwater conditions during pond excavations, drain spacings closer than 50 feet may be needed to provide adequate subgrade stability.