Docket No. W-1300 Sub 92

# Nov 29 2023

## Attachment 6

### (Oct. 19, 2020 DEQ Permit Application)

### Non-Discharge Branch Upload/Submittal Form



Version 2 - Revised June 23, 2020

Initial Review	
Reviewer	Thornburg, Nathaniel
Is this submittal an application? (Excluding addition	nal information.)*
If not an application what is the submittal type?*	<ul> <li>Annual Report</li> <li>Residual Annual Report</li> <li>Additional Information</li> <li>Other</li> </ul>
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

Project Contact Information Project Contact Information on the person to	ion o be contacted by NDB Staff regarding electronic submittal, confi	mation of receipt, and other correspondence.
Name * Mark Ashness		
Email Address*		Phone Number*
mark@cegroupinc.com		9196067704
Project Information		
Application/Document Type *	<ul> <li>New (Fee Required)</li> </ul>	O Modification - Minor
Application/Document Type	<ul> <li>Modification - Major (Fee Required)</li> </ul>	© Renewal
	<ul> <li>Renewal with Major Modification (Fee</li> </ul>	© GW-59, NDMR, NDMLR, NDAR-1,
	Required)	NDAR-2
	Annual Report	Residual Annual Report
	• Additional Information	C Change of Ownership
	© Other	
We no longer accept these mo	nitoring 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/Ne	onDischarge_wonitoring_Report	
Permit Type:*	<ul> <li>Wastewater Irrigation</li> </ul>	<ul> <li>High-Rate Infiltration</li> </ul>
	© Other Wastewater	<ul> <li>Reclaimed Water</li> </ul>
	C Closed-Loop Recycle	C Residuals
	Single-Family Residence Wastewater	○ Other
	Irrigation	
Permit Number:*	WQ0028552	
	Has Ourrent Existing permit nu	nber
Applicant/Permittee Address*	3212 6th Avenue South Suite 200 Birmingham,	AL 35222
Facility Name *	Briar Chapel WWTP	
Please provide comments/note	es on your current submittal below.	
Response Comments to Add Info I	Letter dated 9/18/20	
At this time, paper copies are r at nathaniel.thornburg@ncden		about what is required, please contact Nathaniel Thornburg
Please attach all information re	equired or requested for this submittal to be	reviewed here.*
(Application Form, Engineering Plans, Spec		

 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.



Docket No. W-1300 Sub 92

CE GROUP

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

- 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.
- 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	<b>Daily Design Flow</b> (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

PROVIDING CIVIL / SITE & INFRASTRUCTURE CONSULTING SERVICES SINCE 1998

### Paper Flow (Permitted but not yet Occupied)

Dwelling Type	<b>Daily Design Flow</b> (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 Flov	w:		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 x 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

HAR

Enclosures

Nov 29 2023

### OPERATION AND MAINTENANCE PLAN

### "Post Construction Western Irrigation Pond and Transmission Line"

### <u>OVERVIEW</u>

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

Reclaimed Water System

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

Chatham County

# OFFICIAL COPY

Nov 29 2023

### ENGINEERING CERTIFICATION

I, <u>Hartial</u> Final I, <u>Hartial</u>, as a duly licensed North Carolina Professional Engineer, having Aperiodically / \_\_\_\_\_ 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.

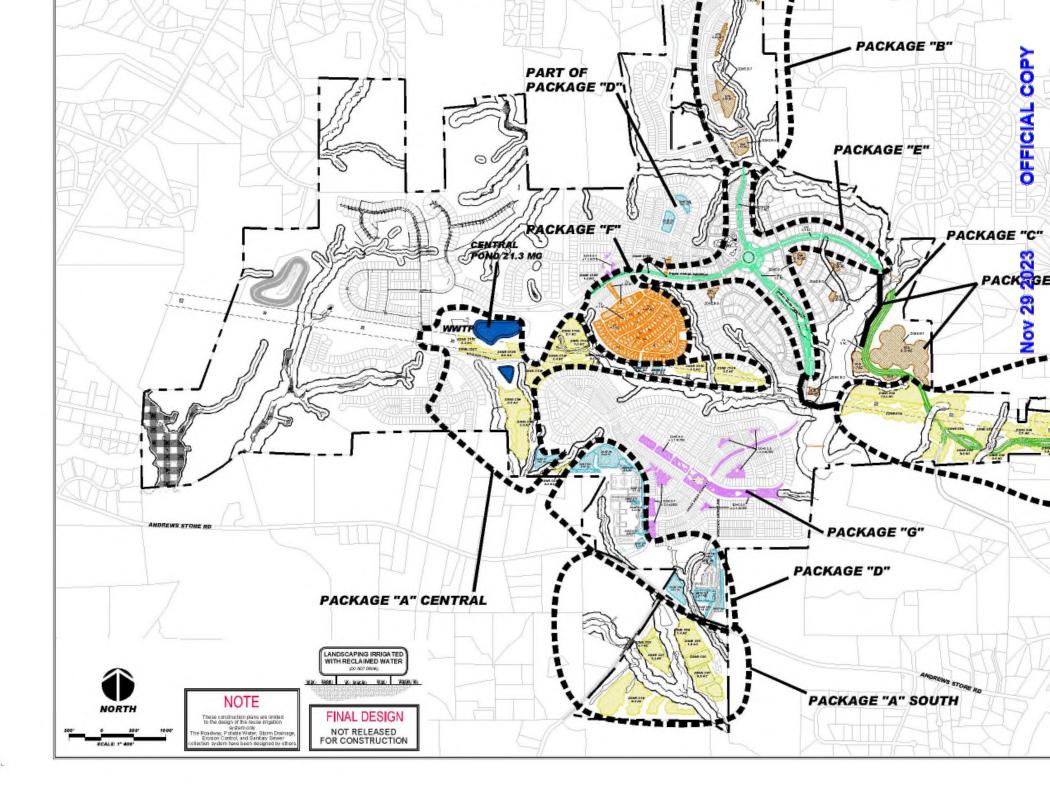
Description of variations: OT Line 100

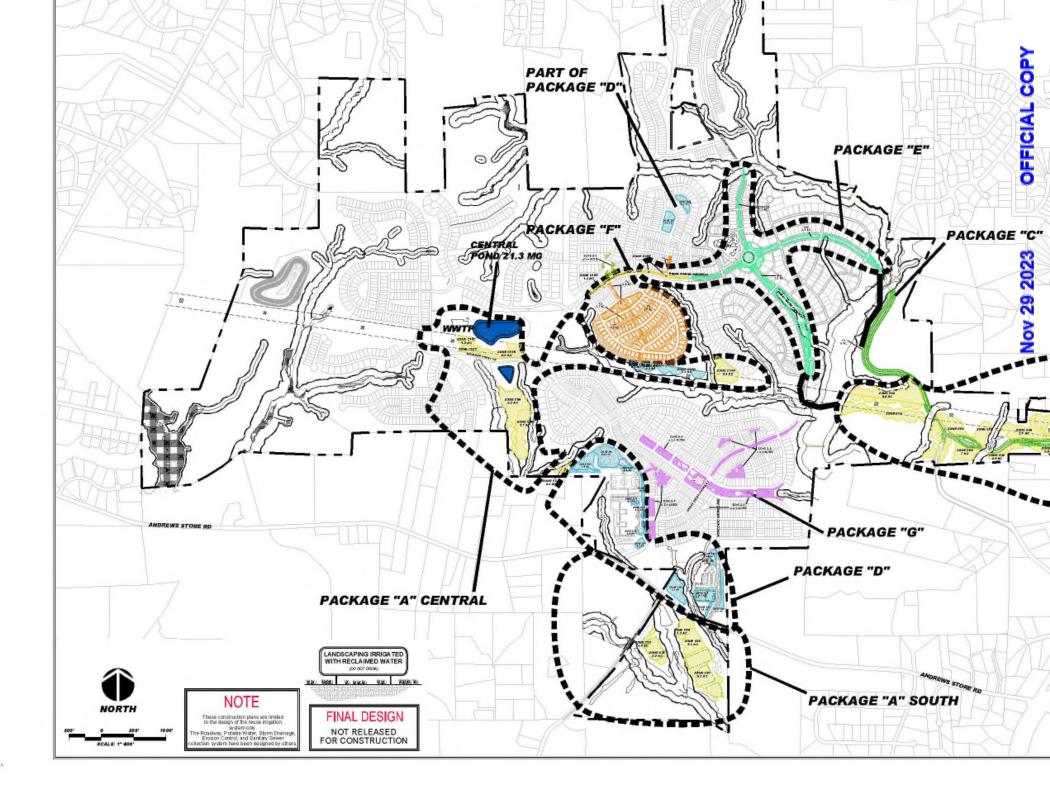
Professional Engineer's Na CE Groo Firm Name 30 George Address	me FIAC	<b>C-1739</b> Firm No.	OFESSION THE SEAL 18894
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919 367-8790			K Printer State
Telephone	Email	.com	Seal, Signature, and Date

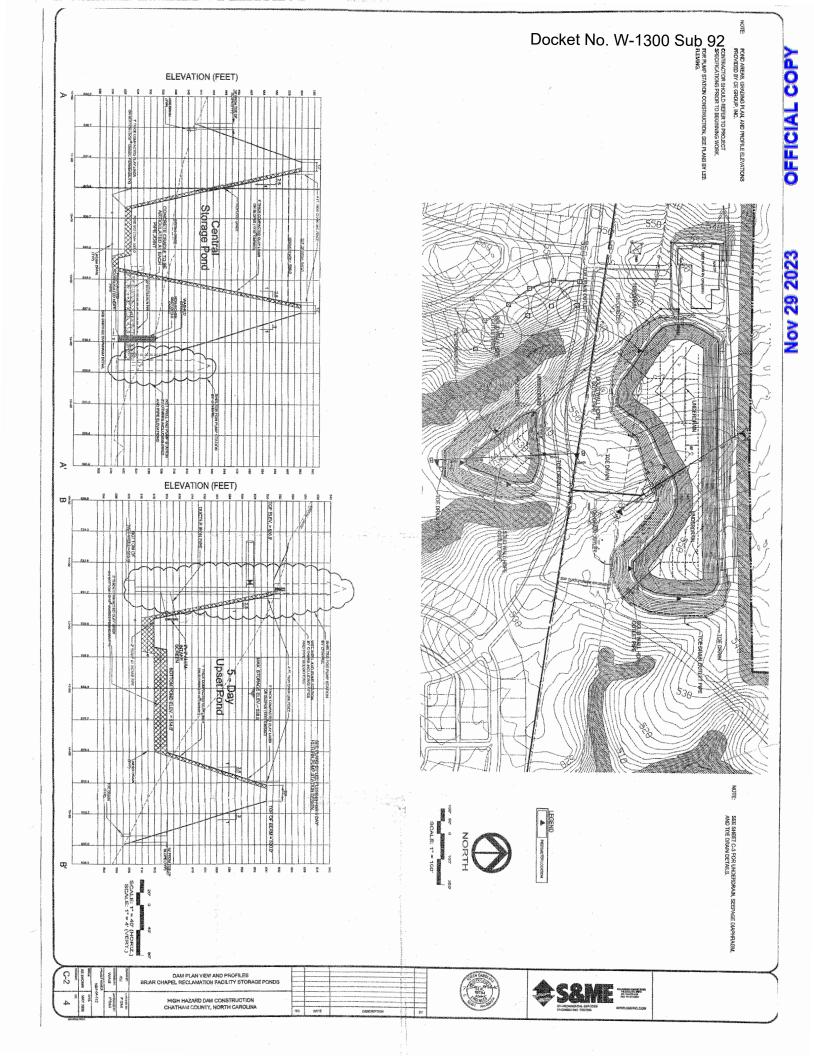
THE COMPLETED ENGINEERING CERTIFICATION, INCLUDING ALL SUPPORTING DOCUMENTATION, SHALL BE SENT TO THE FOLLOWING ADDRESS:

### 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









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 1x10<sup>-6</sup> 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-

1

S&ME, INC. / 3201 Spring Forest Road / Raleigh, NC 27616 / p 919.872.2660 f 919.876.3958 / www.smeinc.com

Nov 29 2023

Central Pond and 5-Day Upset Pond - Chatham County, NC

December 11, 2007

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  $1 \times 10^{-6}$  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  $1 \times 10^{-6}$ 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.

Central Pond and 5-Day Upset Pond - Chatham County, NC

December 11, 2007

### 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  $7x10^{-7}$  to  $3x10^{-8}$  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  $1 \times 10^{-6}$  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.

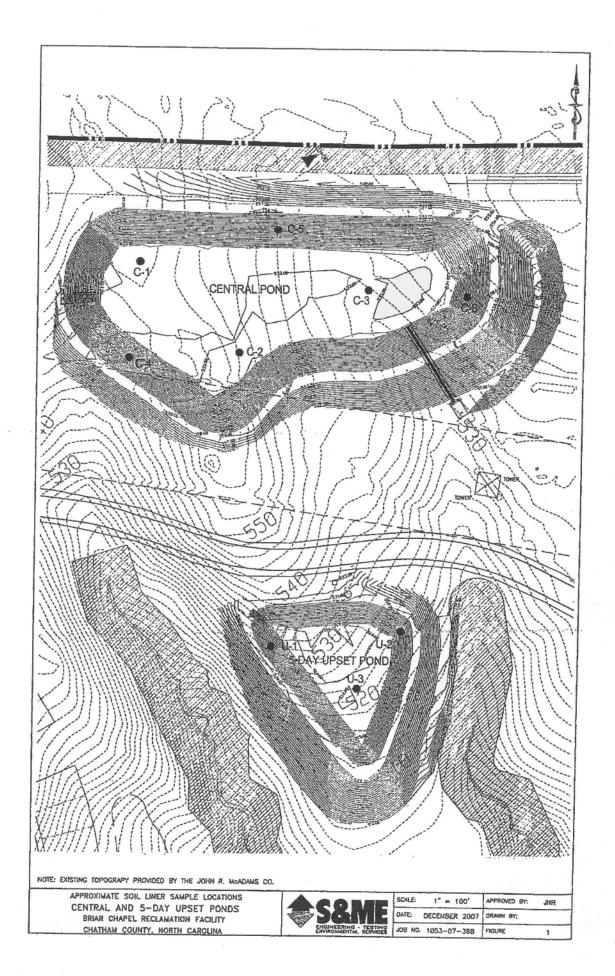
. Nathan Reeves, P.E Geotechnical Engineering Ma N.C. Registration No. 29

NES L Wes Lowder, P.E.

Vice President N.C. Registration No. 18819

S:\PROJECTS\2007\07-398 Briar Chapel/ # ##### (Viewstruct\Report\07-398 Revised Soil Liner Summary.doc

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Nov 29 2023

### 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 x 10 <sup>-8</sup>
C-2	Central Pond Bottom	3.0 x 10 <sup>-8</sup>
C-3	Central Pond Bottom	7.8 x 10 <sup>-8</sup>
C-4	Central Pond Interior Slope	4.7 x 10 <sup>-7</sup>
C-5	Central Pond Interior Slope	6.3 x 10 <sup>-7</sup>
C-6	Central Pond Interior Slope	$3.2 \times 10^{-7}$
U-1	5-Day Upset Pond Interior Slope	7.3 x 10 <sup>-7</sup>
U-2	5-Day Upset Pond Interior Slope	2.2 x 10 <sup>-7</sup>
U-3	5-Day Upset Pond Bottom	3.1 x 10 <sup>-8</sup>

\* Permeability test performed in general accordance with ASTM D 5804

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ASTM D 422: Particle Size Analysis of Soils Technician / Certification #: <u>Mal Krajan</u> Certification #:												-	(	500				
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T countra	al Responsibility: Mal Krajan Position: Laboratory Manager												-		and the second se			

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

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Permeability C-1

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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	972	
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	4 8880	21.5	21.5	21.5	0.965	6.60	9.74	6.74	9.60	85.86	84.43	9.3	
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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

Permeability C

0

5000

2.0E-08

1.0E-08

0.0E+00

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

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Liquid Lin	and the second se	the second s	Name and Address of the Owner, which the	the second s	the second se				the second s					and the second se		
Plastic Lin	mit: ND		icity Inde			Percent									Size: #	-
		Initi		le Co	onditions				in tout	A Strainer			Final	Sampl	e Cond	iticas
and the second se	eight (cm):		8.250	Wet	Unit Weig	ht (lbs/f	2):	116.0			t (cm):	And in case of the local division of the loc	8.2	THE R OWNER WATER OF	Dry U	
Dia	meter (cm):		7.287		Unit Weig	The rest of the local division in which the rest of the local division in the local divi	the same state of the local division of the	87.9	I	Diameter (cm):					Per	centSa
the second s	rea (cm <sup>2</sup> ):		41.70	Percent Saturation: 8						Area (cm <sup>2</sup> )						Void ]
Vol	lume (cm <sup>3</sup> ):		344.07		Void Ra	tio:	(	0.8950		Volume (cm <sup>3</sup> ) 3						Poro
TAXABLE IN COLUMN	eight (gran		639.4	Porosity: 0.4723					We	t weig	ht (gra	3.2	Meas	sureo E		
Dry W	eight (gran	ns):	484.2		Station	Correcti	ons (cm)	)	Dry	Weig	tht (gra	ms)	484	4.2		-
Perce	ent Moistur	sture: 29.9 Influent: 18.181 Effluent: 18.656 Percent Moisture: 32										.8	MDD (	pcf): N		
Testing S	Station	Bui	rette Areas	(cm	<sup>2</sup> ):	Effect	ive Con	solidatio	n Stress	(þši): •	3.0	Pên	neant L	liquid	Jsed:	Dea
6	Inf	-	and the second se	fluer	pharmont manage				i):		Infl	lént Pr	éssure (	psi):	71.0	Exlu
S	tart		End		Timê	Tem	perature	(°C)	Corr.	In	ltial	E	nal	hj.	h <sub>2</sub>	Grad-
Date	Time	Date	Tim	ė.	(seconds)	-Initial	Final	Avg.	Factor	INF.	EFF.	INF.	EFF.	(cm)	(cm)	ient
11/14/07	7:26:00 AM	11/14/01	7 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	162
11/14/07	7:57:00 AM	11/14/0			3480	21.5	21.5	21.5	0.965	6.80	9.50	6.92	9.38	83.62	82.39	10.1
11/14/07	8:55:00 AM	11/14/0	7 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	11/14/0	7 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 D	Determine	d.			ļ	1							1	Av	erages
References	s:	· · · · · · · · · · · · · · · · · · ·												-		Cond
ASTM D	5084: Measure						ous Mate	erials Usi	ing a Flexi	ble Wa	ll Perme	ameter			9.0E-08	
	2216: Laborat														8.5E-08	× .
	4318: Liquid I						Call Cla	anifi anti-	- Creators						8.0E-08	-
	2487: Classifi			gmee	ring Purposes	(Unined	5011 C18	Issincano	on System	) .					7.5E-08	-

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

0

10000

7.0E-08

	Location: Central Pond Offset: NA Sample Description: (Visual) T- Liquid Limit: ND Specific Gravity: 2.668 Sample Type: undisturbed Sampled E																LAY-	
			And in case of the local division in the loc				Name and Address of the Owner, or other											
,	Plastic Li	mit: ND		and the second se	city Inde			Percent									Size: #	
				the second se	and the second se	and the second second	nditions .		A 18 100 14	1999 - 1999 -	and a second second	1.4 m		1. 10 M			e Conc	litions
		eight (cm					Unit Weig	the second s		118.9	the second s		t (cm):	the second second	8.3			nit We
		meter (c		And a support of the local division of the l	the state of the s	Dry Unit Weight (lbs/ft):				100.8	I		er (cm)	):	7.3		Per	cer S
		rea (cm <sup>2</sup>	2		42.03	F	Percent Sat			71.7		Area (cm <sup>2</sup> )				03		Vord 1
		lume (cn			348.98		Void Ra			0.6510	the second s	and the second se	e (cm)	the second day is not	348	The local division in which the local division in which the local division in the local		Pero
	The second se	veight (g			664.9		Porosi			0.3943	and the second se		ht (gra		72		Mea	sur 😡 E
	and the second designed in the second designe												56	-	MOD	pcf): N		
	Percent Moisture: 17.5 Influent: -2.454 Effluent: -2.613 Percent Moisture: 29												.4	INDU (	poil. 14			
	Testing	Station		Bur	itte Areas	(cm	):	Efféct	ve Con	solidatio	n Štress	(psi):	3.0	Per	meant T	iquid I	Jsed:	Dea
	4		Influ	ent: 0.	720 In	fluen	0.720	G	ell Pres	sure (ps	))))))))))))))))))))))))))))))))))))))	73.0	Influ	ient Pr	essure (	psi):	70.0	Falu
	S	start			End		Time	Temj	eraturi	(°C)	Corf	In	tial	a Fi	nsl	h.	hi -	Grad-
	Date	Time	e	Date	Time	e :	(seconds)	Initial	Fiual	Avg.	Factor	INF.	EFF.	INF.	EFF.	(cm)	(cm)	ient
	11/14/07	10:51:00	AM 1	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	56
	11/14/07	11:36:00	AM 1	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	5.0
	11/14/07	3:05:00)	PM 1	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
					L					1								
	Remarks:	ND= No	ot Det	ermined	l.											-	Av	erages:
	2																	Condu
	References		surem	ent of H	dranlie Co	anduc	tivity of Satu	rated Por	nie Mate	riale I Ini	ng a Flavi	hle Wel	1 Permes	meter			5.4E-07 r	
	ASTM D	2216: Labo	oratory	Determi	ination of	Water	Content of S	loils	AND TATOL	1 1013 081	ng a riexi	DIC WAL	T T CITICA	metel		1 4	5.2E-07	
	ASTM D 4	4318: Liqu	id Lin	nit, Plasti	c Limit, &	Plast	ticity Index of	f Soils									.0E-07	1
	ASTM D 2	2487: Clas	sificat	ion of Sc	ils for Eng	gineer	ing Purposes	(Unified	Soil Cla	ssificatio	n System)						.6E-07	

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

2000

4.4E-07

4.2E-07

	Central Pon			Offset: NA         Sample Description: (Visual) O-E           vity: 2.668         Sample Type: undisturbed         Sampled By								l) O-B	Sandy	' Silty C	LAY-
Liquid Lin	and the second se		ic Gravity:	and a second sec						and the second second				E, Inc.	
Plastic Li	mit: ND	And in case of the local division of the loc	ity Index: ]	and the second se	Percent ]	Passing	; #200:	64.1						Size: #	
		Initia	l Sample (	Conditions	11, 11 20 21 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	14	Section.	a standarda	See a free	in the second	14	Final	Sampl	e Cond	litions
And in case of the local division of the loc	eight (cm):			et Unit Weigl			19.5		Height (cm):					Dry U	nitWe
Dia	meter (cm):		the second s	y Unit Weigl		3):	99.8	I	Diamet	er (cm)	):	7.3	08	Per	cen S
A	rea (cm <sup>2</sup> ):		41.95	Percent Satu		78.9	Area (cm <sup>2</sup> )				41.	.95		Vojd	
	lume (cm <sup>3</sup> ):	and the second se	38.59	Void Ra			.6674	the second division of	the second s	$e(cm^3)$	the second se		1.59		loro
the second secon	reight (grams	the second s	648.2								67		Meas	surel .	
and the second s	leight (gram	the second se	541.5	the second s	Correctio	the second s	the second day is a second day of the second day	the second se		ht (gra			1.5	MDD (pcf):	
Perce	ent Moisture	:	19.7	Influent: -2.454 Effluent: -2.613 Percent Moisture: 24								+.2			
Testing S	Station	Bure	tte Areas (ct	m <sup>2</sup> ):	Effecti	e Con	olidatio	n Stress	(psi)	3.0	Pen	neant I	iquid T	Used:	De
4	Infl	uent: 0.	the second s	ent: 0.720	G	ell Pres	sure (psi	)	73.0	. Influ	ient Pre	essure (	psi):	70.0	. Nit
S	tart		End	Time	Temp	erature	(°C)	Corr,	In	tial	F	nal		hi	Grad
Date	Time	Date	Time	(seconds)	Initial	Final	Avg.	Factor	INF.	EFF.	INF.	EFF.	(cm)	(cm)	feat.
11/16/07	4:16:00 AM	11/16/07	6:36:00 AN	1 8400	21.5	21.5	21.5	0.965	1.10	50.00	2.30	47.90		45.76	69
11/16/07	6:36:00 AM	11/16/07	11:02:00 AM	M 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	4 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 De	etermined							21					Av	erages
															Cond
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 #: <u>Mal Krajan</u> Technical Responsibility: <u>Mal Krajan</u>

Certification #:

Position: Laboratory Manager

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

Permeability (

0

1000

6.4E-07

6.2E-07

6.0E-07

5.8E-07 5.6E-07

5.4E-07

-		i: Central Pond Offset: NA Sample Description: (Visual) T- imit: ND Specific Gravity: 2.668 Sample Type: undisturbed Sampled E															LAY-		
lane of the second			and the second data			and the second data in the second data is a second data in the second data i		and the second sec	A	-	Contraction of the local division of the loc	the second day of the		and the second second			the second s	The second se	
]	Plastic Lin	mit: ND				y Inde		and the second day in the second day is a second day of the second			g #200:					A IN CONTRACTOR	and the second se	Size: #	
			i	Ini		and the second second designs,	e Co	nditions	Service Service	stle at light of an	1. 41 C. 4 2	- ANA		A CONTRACTOR OF THE			the second second	e.Cond	litias
	He	eight (cn	n):				Wet	Unit Weigh	ht (lbs/f	a):	122.2		Height	: (cm):		7.9		Dry U	nitWe
	Dia	meter (c	:m):		_			Unit Weigh		2):	98.9	I	Diameter (cm):				96	Per	rcent S
	A	rea (cm <sup>2</sup>	):		41	.85	P	ercent Satu	iration:		93.0		Area	$(cm^2)$		41.	81		V d
		ume (cr				0.73		Void Ra	tio:		0.6835		Volum	$e(cm^3)$	)	330	and the second s		Inoro
1	Wet w	eight (g	ram	s):	_	7.5		Porosit	y:		0.4060	We	t weig	ht (gra	ms)	664		Mea	sural l
	Dry W	eight (g	gram	s):	52	23.9	4	Station	Correcti	ons (em	)	Dry	Weig	ht (gra	ms)	52	3.9	1	pcf): N
	Perce	ent Mois	sture	:	2	3.8	Influent: -2.190 Effluent: -2.825 Percent Moisture: 26						26	5.8		pul. R			
[	Testing S	Station		B	urette	e Areas	(cm <sup>2</sup>	):	Effect	ive Con	solidatio	n Stress	(psi):	3.0	Perr	meant I	iquid	Used:	De
	2		Infl	pa.	0.72		fluen	. Proventing to the local division of the lo	the second s		sure (psi		73.0		· · · · · · · · · · · · · · · · · · ·	essure (		70.0	fi
	S	tart			Er	ba		Time	Tem	peraturo	(°C)	Corr	- Ini	tial	2 10	nal	e chi	h <sub>2</sub>	Grad
	Date	Time		Date		Tim	e:	(seconds)	Initial	Final	Avg	Factor	INF:	EFF.		EFF.	(cm)	(em)	e tent
	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	and the second s	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=N	ot D	etermin	neđ.			·····				I		1	1	<u> </u>		A	verages
	References	5:															-		Cond
								tivity of Satu		ous Mat	erials Usi	ng a Flexi	ble Wal	l Perme	ameter			4.0E-07	
								r Content of S ticity Index of										3.0E-07 2.0E-07	E
								ring Purposes		Soil Cla	sificatio	n System						1.0E-07	F
	ASTM D	854: Spec	ific G	fravity o	of Soi	ils	D	Br arbones	( Summer	Sour On		an o javoni						0.0E+00	0 · 200
	ASTM D 854: Specific Gravity of Soils ASTM D 422: Particle Size Analysis of Soils														0 . 700				

Technician / Certification #: <u>Mal Krajan</u> Technical Responsibility: <u>Mal Krajan</u>

Certification #:

.

1 4

Position: Laboratory Manager

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

Permeability (

Plastic Limit: ND       Plasticity Index: ND       Percent Passing #200: 61.1       Maximum Particle Size: #4         Initial Sample Conditions         Height (cm):       8.394       Wet Unit Weight (lbs/ft):       127.0       Height (cm):       8.394       Dry Unit W         Diameter (cm):       7.273       Dry Unit Weight (lbs/ft):       108.2       Diameter (cm):       7.273       Percent Saturation:       85.8       Area (cm <sup>2</sup> ):       41.54       Vercent Saturation:       85.8       Area (cm <sup>2</sup> ):       41.54       Vercent Saturation:       0.5431       Volume (cm <sup>3</sup> ):       348.73       For         Volume (cm <sup>3</sup> ):       348.73       Void Ratio:       0.5431       Volume (cm <sup>3</sup> )       348.73       For         Dry Weight (grams):       604.5       Station:Corrections (cm)       Dry Weight (grams)       604.5       Measured         Testing Station       Burette Areas (cm <sup>2</sup> ):       Effective Consolidation Stress (bsi):       3.0       Percent Liquid Used:       De         3       Influent:       0.720       Influent:       0.720       Cell Pressure (bsi):       73.0       Influent Fressure (psi):       70.0       Final         11/17/07       43600 AM       11/17/07       635:00 AM       7140       21.5       21.5       0.965       0.	Location: 5-Day Opset Fond Offset: IVA Sample Description: (Visua										1			LAI-				
Initial Sample ConditionsFinal Sample ConditionsHeight (cm):8.394Wet Unit Weight (lbs/ft):127.0Height (cm):8.394Dry Unit Weight (lbs/ft):Diameter (cm):7.273Dry Unit Weight (lbs/ft):108.2Diameter (cm):7.273Percent Saturation:Area (cm <sup>2</sup> ):41.54Percent Saturation:85.8Area (cm <sup>2</sup> ):41.54Volume (cm3):Volume (cm3):348.73Void Ratio:0.5431Volume (cm3):348.73ForWet weight (grams):709.7Porosity:0.3519Wet weight (grams):604.5Measuration:Dry Weight (grams):604.5Statton Corrections (cm)Dry Weight (grams):604.5MDD (pcf): NDry Weight (grams):0.720Influent:2.962Percent Moisture:22.2MDD (pcf): NTesting StationBurette Areas (cm2):Effective Consolidation Stress (isi):3.0Permeant Liquid Used:De3Influent:0.720Influent:0.720Cell Pressure (psi):73.0Influent Pressure (psi):70.0StartEndTimeRendTimeAvg.FactorINFEFF.influent influent11/17/076:35:00 AM714021.521.521.50.9650.002.1048.0049.8045.9011/17/0710:42:00 AM11/17/0710:42:00 AM11/17/0721.521.521.50.9655.0045.0040.0011/17/0710:42:00 AM11/17	A	And a summer summer stranger	A			2.676 Sample Type: undisturbed Sampled By								ed By:	the second se			
Height (cm):       8.394       Wet Unit Weight (lbs/ft):       127.0       Height (cm):       8.394       Dry Unit Weight (lbs/ft):         Diameter (cm):       7.273       Dry Unit Weight (lbs/ft):       108.2       Diameter (cm):       7.273       Percent Sturation:       85.8       Area (cm <sup>2</sup> ):       41.54       Vol         Area (cm <sup>2</sup> ):       41.54       Percent Saturation:       85.8       Area (cm <sup>2</sup> ):       41.54       Vol         Volume (cm <sup>2</sup> ):       348.73       Void Ratio:       0.5431       Volume (cm <sup>2</sup> ):       348.73       Intro         Wet weight (grams):       709.7       Porosity:       0.3519       Wet weight (grams)       604.5       Measures         Percent Moisture:       17.4       Influent: -2.962       Effluent: -2.962       Percent Moisture:       2.2       MDD (pcf): N         Testing Station       Burette Areas (cm <sup>2</sup> )       10.720       Effective Cohsdulation Stress (bsi):       3.0       Permeant Liquid Used:       De         3       Influent:       0.720       Influent:       0.720       Cell Pressure (CS)       Core :       Influent Pressure (psi):       70.0       Frating influent Pressure (psi):       70.0       Frating influent Pressure (psi):       70.0       Frating influent Pressure (psi):       70.0       Fratin influent Pres	Plastic Li	mit: ND	Plastic	city Inde	x: N	D	Percent	Passin	g #200:	61.1			Maxin	num Pa	article	Size: #	4	
Diameter (cm):       7.273       Dry Unit Weight (lbs/ft):       108.2       Diameter (cm):       7.273       Percent S         Area (cm <sup>2</sup> ):       41.54       Percent Saturation:       85.8       Area (cm <sup>2</sup> )       41.54       Veril         Volume (cm <sup>3</sup> ):       348.73       Void Ratio:       0.5431       Volume (cm <sup>3</sup> )       348.73       Hor         Wet weight (grams):       709.7       Porosity:       0.3519       Wet weight (grams)       738.9       Measure         Dry Weight (grams):       604.5       Station Gorrections (cm)       Dry Weight (grams)       604.5       MDD (pcf): N         Testing Station       Burette Areas (cm <sup>2</sup> ):       Effective Consolidation Stress (bsi):       3.0       Percent Liquid Used:       De         3       Influent:       0.720       Influent:       0.720       Cell Pressure (psi):       73.0       Influent Pressure (psi):       70.0       Stat         Date       Time       Bat       Time       Gee ondsi:       Influent:       Factor       Nr. EFF:       (cm)       (cm)       fat         11/17/07       6:35:00 AM       T140       21.5       21.5       0.965       0.00       2.10       48.00       49.80       45.90       3         11/17/07       <				Final Sample Conditions														
Area (cm <sup>2</sup> ):       41.54       Percent Saturation:       85.8       Area (cm <sup>2</sup> )       41.54       Vol         Volume (cm <sup>3</sup> ):       348.73       Void Ratio:       0.5431       Volume (cm <sup>3</sup> )       348.73       Farma         Wet weight (grams):       709.7       Porosity:       0.3519       Wet weight (grams)       738.9       Measure         Dry Weight (grams):       604.5       Station Corrections (cm)       Dry Weight (grams)       604.5       MDD (pcf): N         Testing Station       Burette Areas (cm <sup>2</sup> ):       1nfluent:       2.962       Percent Moisture:       22.2       MDD (pcf): N         3       Influent:       0.720       Influent:       2.962       Percent Moisture:       22.2       MDD (pcf): N         3       Influent:       0.720       Influent:       2.962       Percent Moisture:       22.2       MDD (pcf): N         3       Influent:       0.720       Influent:       4.962       Factor       NNF. EFF.       MD (pcf): N         3       Influent:       0.720       Influent:       Final       Avg.       Factor       NNF. EFF.       MD (pcf): N         11/17/07       4:36:00 AM       11/17/07       6:35:00 AM       7140       21.5       21.5       0.965	Height (cm): 8.394					Unit Weig	3):	127.0		Height (cm):				94	Dry Unit We			
Volume (cm <sup>3</sup> ):       348.73       Void Ratio:       0.5431       Volume (cm <sup>3</sup> )       348.73       Hor         Wet weight (grams):       709.7       Porosity:       0.3519       Wet weight (grams)       738.9       Measured         Dry Weight (grams):       604.5       Station Corrections (cm)       Dry Weight (grams)       604.5       Measured         Percent Moisture:       17.4       Influent: -2.962       Effluent: -2.962       Percent Moisture:       22.2       MDD (pcf): N         Testing Station       Burette Areas (cm <sup>2</sup> ):       Effective Consolidation Stress (bsi):       3.0       Permeant Liquid Used:       De         3       Influent:       0.720       Influent:       0.720       Cell Pressure (psi):       73.0       Influent Pressure (psi):       70.0       Fail         11/17/07       4:36:00 AM       11/17/07       6:35:00 AM       7140       21.5       21.5       0.965       2.0       5.00       4.0.0       49.80       45.90       3         11/17/07       6:35:00 AM       11/17/07       10:42:00 AM       14820       21.5       21.5       0.965       2.00       2.10       48.00       37.70       46.6         11/17/07       10:42:00 AM       11/17/07       12:11:00 PM       5340 <td colspan="4">Diameter (cm): 7.273</td> <td colspan="4">and the second sec</td> <td>108.2</td> <td>I</td> <td>Diamet</td> <td>er (cm)</td> <td>):</td> <td>7.2</td> <td>.73</td> <td colspan="2">Percer<sup>*</sup>S</td>	Diameter (cm): 7.273				and the second sec				108.2	I	Diamet	er (cm)	):	7.2	.73	Percer <sup>*</sup> S		
Volume (cm <sup>3</sup> ):       348.73       Void Ratio:       0.5431       Volume (cm <sup>3</sup> )       348.73       Hor         Wet weight (grams):       709.7       Porosity:       0.3519       Wet weight (grams)       738.9       Measured         Dry Weight (grams):       604.5       Station Corrections (cm)       Dry Weight (grams)       604.5       Measured         Percent Moisture:       17.4       Influent: -2.962       Effluent: -2.962       Percent Moisture:       22.2       MDD (pcf): N         Testing Station       Burette Areas (cm <sup>2</sup> ):       Effective Consolidation Stress (bsi):       3.0       Permetent Liquid Used:       De         3       Influent:       0.720       Offective Consolidation Stress (bsi):       3.0       Influent Pressure (psi):       70.0       Final       ht       hz       Grad         11/17/07       4:36:00 AM       11/17/07       6:35:00 AM       7140       21.5       21.5       0.965       0.20       50.00       2.10       48.00       37.70       32.80       48.70       37.70       32.80       48.73       49.00       37.70       46.6         11/17/07       6:35:00 AM       7140       21.5       21.5       0.965       0.00       2.10       48.00       37.70       46.6	A	rea $(cm^2)$ :	4	41.54	F	Percent Sat	uration:		85.8		Area (cm <sup>2</sup> )				.54	Ved		
Dry Weight (grams):       604.5       Station Corrections (cm)       Dry Weight (grams)       604.5       MDD (pcf): N         Percent Moisture:       17.4       Influent: -2.962       Effluent: -2.962       Percent Moisture:       22.2       MDD (pcf): N         Testing Station       Burette Areas (cm <sup>2</sup> ):       Effective Consolidation Stress (bsi):       3.0       Permeant Liquid Used:       De         3       Influent:       0.720       Influent:       0.720       Cell Presente (psi):       73.0       Influent Pressure (psi):       70.0       Permeant Liquid Used:       De         Start       End       Time       Record (score)       Final       Avg.       Factor       INF: EFF:       Influent       hi       Gad         11/17/07       4:36:00 AM       11/17/07       6:35:00 AM       7140       21.5       21.5       0.965       0.20       50.00       2.10       48.00       49.80       45.90       37.00         11/17/07       10:42:00 AM       11/17/07       10:42:00 AM       14820       21.5       21.5       0.965       5.00       45.00       45.90       40.00       37.70       4.6         11/17/07       10:42:00 AM       14820       21.5       21.5       0.965       5.00       45.0	Vo	lume (cm <sup>3</sup> ):	and the second second		Void Ratio:				0.5431		Volum	$e(cm^3)$	)	348	348.73		F <sub>17</sub> ro	
Dry Weight (grams):       604.5       Station Corrections (cm)       Dry Weight (grams)       604.5       MDD (pcf): N         Percent Moisture:       17.4       Influent: -2.962       Effluent: -2.962       Percent Moisture:       22.2       MDD (pcf): N         Testing Station       Burette Areas (cm.)       Effective Consolidation Stress (bsi):       3.0       Permeant Liquid Used:       De         3       Influent:       0.720       Influent:       0.720       Cell Pressure (psi):       73.0       Influent Pressure (psi):       70.0       Permeant Liquid Used:       De         start       End       Time       Oate       Time       Grad       Number and transform (cm.)       Influent:       Number and transform (cm.)       Percent Moisture:       22.2         11/17/07       4:36:00 AM       11/17/07       6:35:00 AM       Time       Temperature (°C)       Corr (INF, EFF, INF, EFF, (cm.)       Number (cm.)       Station (c	Wet weight (grams): 709.7										the second					Mea	sural	
Testing Station         Burette Areas (cm <sup>2</sup> ):         Effective Consolidation Stress (bsi):         3.0         Permeant Liquid Used:         De           3         Influent:         0.720         Influent:         0.720         Cell Presente (psi)         73.0         Influent Pressure (psi):         70.0         Permeant Liquid Used:         De           3         Influent:         0.720         Influent:         0.720         Cell Presente (psi)         73.0         Influent Pressure (psi):         70.0         Permeant Liquid Used:         De           0         Date         Time         Date         Time         (seconds)         Initiat         Final         Avg.         Factor         INF. EFF.         INF.         EFF.         (cm)         int           11/17/07         4:36:00 AM         11/17/07         6:35:00 AM         7140         21.5         21.5         0.965         0.20         50.00         2.10         48.00         49.80         45.90         2           11/17/07         6:35:00 AM         11/17/07         10:42:00 AM         14820         21.5         21.5         0.965         5.00         45.00         45.90         40.00         3           11/17/07         10:42:00 AM         14820         21.5	No. of Concession, name of Street, or other Designation, or other	No. of Concession, name of Street, or other Designation, or other			Station Corrections (cm)							_			604.5		-	
3       Influent:       0.720       Cell Pressure (bsi):       73.0       Anfluent Pressure (psi):       70.0       Influent:         Start       End       Time       Cell Pressure (PSI):       73.0       Anfluent Pressure (psi):       70.0       Influent:         Date       Time       (seconds)       Initial       Fractor       Initial       Initial       Initial       Phi       N.F.       Initial       Initial       Phi       N.F.       Initial       Initial       Initial <th cols<="" td=""><td colspan="5">Percent Moisture: 17.4</td><td colspan="7">Influent: -2.962 Effluent: -2.962 Percent Moistur</td><td>re:</td><td>22</td><td>2.2</td><td colspan="2">INDE (poi). IN</td></th>	<td colspan="5">Percent Moisture: 17.4</td> <td colspan="7">Influent: -2.962 Effluent: -2.962 Percent Moistur</td> <td>re:</td> <td>22</td> <td>2.2</td> <td colspan="2">INDE (poi). IN</td>	Percent Moisture: 17.4					Influent: -2.962 Effluent: -2.962 Percent Moistur							re:	22	2.2	INDE (poi). IN	
Start         End         Time         Temperature (°C)         Corr         Initial         Final         h         h         Gat           Date         Time         Date         Time         (seconds)         Initial         Final         Ayg.         Factor         INF. EFF         INF. EFF         (cm)         (cm)         (cm)         ist           11/17/07         4:36:00 AM         11/17/07         6:35:00 AM         7140         21.5         21.5         0.965         0.20         50.00         2.10         48.00         49.80         45.90         57           11/17/07         6:35:00 AM         11/17/07         10:42:00 AM         14820         21.5         21.5         0.965         2.10         48.00         45.90         40.00         37.70         4.6           11/17/07         10:42:00 AM         11/17/07         12:11:00 PM         5340         21.5         21.5         0.965         5.00         45.00         40.00         37.70         4.6           11/17/07         12:11:00 PM         14040         21.5         21.5         0.965         6.10         43.80         40.00         37.70         32.80         4.2           1/17/07         12:11:00 PM	Testing S	Testing Station   Burette Areas (cm <sup>2</sup> ); Effective Consolidation Stress (bsi); 3.0 Permeant Li										iquid i	Jsed:	Dea				
Date         Time         Date         Time         (seconds)         Initial         Final         Avg.         Factor         INF.         EFF.         INF.         EFF.         (cm)	3	Infl	uent: 0.	720 In	fluer	t: 0.720	i i i c	ell Pres	sure (psi)		73.0	. Infli	ient Pr	essure (	psi):	70.0	Eth	
Date         Time         Oate         Time         (seconds)         Initial         Final         Avg.         Factor         INF.         EFF.         (cm)	S	tart		End	1	Time	Tem	perature	(°C)	Corr	Ini	tial	Ē	nal	h	h <sub>2</sub>	Gad-	
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       \$	Date	Time	Date	Time		(seconds)	Initial	Final	Avg	Factor	INF.	EFF."	INF.	EFF.	(cm)	1. 1. 1.	int	
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       A         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       45.00       37.70       4.6         11/17/07       12:11:00 PM       11/17/07       4:05:00 PM       14040       21.5       21.5       0.965       6.10       43.80       40.00       37.70       4.6         11/17/07       12:11:00 PM       11/17/07       4:05:00 PM       14040       21.5       21.5       0.965       6.10       43.80       8.50       41.30       37.70       32.80       4.2         Averages         References:         ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter       1.0E-06       1.0E-06 <td>11/17/07</td> <td>4:36:00 AM</td> <td>11/17/07</td> <td>6:35:00</td> <td>AM</td> <td>7140</td> <td></td> <td>the second s</td> <td>and the local division of the local division</td> <td>the state of the s</td> <td>0.20</td> <td>50.00</td> <td>2.10</td> <td>48.00</td> <td>49.80</td> <td>the lot of the lot of</td> <td>the second se</td>	11/17/07	4:36:00 AM	11/17/07	6:35:00	AM	7140		the second s	and the local division of the local division	the state of the s	0.20	50.00	2.10	48.00	49.80	the lot of	the second se	
11/17/07       12:11:00 PM       11/17/07       4:05:00 PM       14040       21.5       21.5       0.965       6.10       43.80       8.50       41.30       37.70       32.80       4.2         Remarks: ND= Not Determined.         References:         Averages         Cond         ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter	11/17/07	6:35:00 AM	11/17/07	10:42:00	0:42:00 AM		21.5	21.5	21.5	0.965	2.10	48.00	5.00	45.00	45.90	40.00		
Remarks: ND= Not Determined.       Averages         References:       Cond         ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter       1.0E-06	11/17/07	10:42:00 AM	11/17/07 12:11:00		11:00 PM 5340		21.5	21.5	21.5	0.965	5.00	45.00	6.10	43.80	40.00	37.70	4.6	
References: ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter	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	4.2	
References: ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter	Densel	ND-N-I		1														
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter 1.0E-06	Remarks: ND= Not Determined.													AV	erages:			
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter	References														-[		Condu	
A STM D 2216:1 aboratory Determination of Water Content of Soils	ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter													1.0E-06				

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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 #: <u>Mal Krajan</u> Technical Responsibility: <u>Mal Krajan</u>

Certification #: Position: Laboratory Manager 1.0E-06 8.0E-07 6.0E-07 4.0E-07 2.0E-07 0.0E+00 0 10000

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

Permeability UD

Location:	the second s	the second se			Offset: NA Sample Description: (Visual) 1-0.5								the second s	and the second se	LAI-(		
	iquid Limit: ND Specific Gravity: 2.676 Sample Type: undisturbed									and the second se		ampled By: S&ME, Inc.					
Plastic Lin	astic Limit: ND Plasticity Index: ND Percent Passing #200: 63.3 Maximum F														and the second se		
													ample				
He	ight (cm):		8.17	77 Wet	Wet Unit Weight (lbs/ft			and the second se			(cm):		8.1		Dry Unit		
Diameter (cm): 7.332				Unit Weig		3):	105.2	Diameter (cm):			:	7.3		Percert			
Area (cm <sup>2</sup> ): 42.22			22 P	ercent Sati	iration:		84.5		Area	$(cm^2)$		42.22		V ,			
	ume (cm <sup>3</sup> )	):	345.	.25	Void Ra	tio:	0	.5876	7	Volume (cm <sup>3</sup> )			345	.25	Ingro		
Wetw	eight (gran	ms):	680	0.5	Porosity: 0.3701					t weigh	nt (gran	ms)	72(	).2	Measurol H		
Dry W	eight (gra	ms):	581	1.7	Station	Correctio	ons (cm)		Dry	Weig	ht (gra	ms)	58:	7	MDD (pcf): N		
Perce	ent Moistu	re:	18.	1.6 L	Influent: -2.962 Effluent: -2.962					rcent N	loistu	re:	23.8				
Testing S	Station	B	urette	Areas (cm <sup>2</sup>	s (cm <sup>2</sup> ): Effective Consolidation Stress (psi): 3.0 Perme						neant Liquid L		Ised:	Dea			
3 Influent: 0.720 Influent: 0.720 Cell Pressure (psi):								the second s							1 flu		
9	tart		End	d T	Time	Tem		(°C)	Cort	Íni	fial	Fi	ial	h.	ha		
1	itart Time	Dat	End		Time (seconds)		perature		Corr.	•				b <sub>1</sub>	h <sub>2</sub>	Grid-	
Date	Time	Date		Tinte	(seconds)	Initial	erature Final	Avg.	Eactor	INF.	EFF.	INF.	EFF.	(cm)	(cm)	Grid-	
Date 11/14/07	Time 3:45:00 AN	1 11/14/	07 10	Tinte ):50:00 AM	(seconds) 25500	Initial 21.5	Final 21.5	Avg. 21.5	Eactor 0.965	INF. 0.60	EFF. 50.00	INF. 3.30	EFF. 48.00	(cm) 49.40	(cm) 44.70	Grid-	
Date 11/14/07 11/14/07	Time 3:45:00 AN 10:50:00 AI	4 11/14/ M 11/14/	07 10 07 11	Time 0:50:00 AM 1:36:00 AM	(seconds) 25500 2760	Initial 21.5 21.5	Final 21.5 21.5	Avg. 21.5 21.5	Eactor	INF. 0.60 3.30	EFF. 50.00 48.00	INF. 3.30 3.50	EFF. 48.00 47.90	(cm) 49.40 44.70	(cm) 44.70 44.40	GMd-	
Date 11/14/07 11/14/07 11/14/07	Time 3:45:00 AN 10:50:00 AI 11:36:00 AI	M 11/14/ M 11/14/ M 11/14/	07 10 07 11 07 8	Time 0:50:00 AM 1:36:00 AM 0:08:00 PM	(seconds) 25500 2760 30720	Initial 21.5 21.5 21.5	Final 21.5 21.5 21.5	Avg. 21.5 21.5 21.5	Eactor: 0.965 0.965 0.965	INF. 0.60 3.30 3.50	50.00 48.00 47.90	INF. 3.30 3.50 6.50	EFF. 48.00 47.90 45.50	(cm) 49.40 44.70 44.40	(cm) 44.70 44.40 39.00	Ghld- 88 24 5.1	
Date 11/14/07 11/14/07	Time 3:45:00 AN 10:50:00 AI	M 11/14/ M 11/14/ M 11/14/	07 10 07 11 07 8	Time 0:50:00 AM 1:36:00 AM	(seconds) 25500 2760	Initial 21.5 21.5	Final 21.5 21.5	Avg. 21.5 21.5	Eactor	INF. 0.60 3.30	EFF. 50.00 48.00	INF. 3.30 3.50 6.50	EFF. 48.00 47.90	(cm) 49.40 44.70	(cm) 44.70 44.40	GMd-	
Date 11/14/07 11/14/07 11/14/07 11/14/07	Time 3:45:00 AN 10:50:00 AI 11:36:00 AI 8:08:00 PN	4 11/14/ M 11/14/ M 11/14/ A 11/14/	07 10 07 11 07 8 07 4:	Time 0:50:00 AM 1:36:00 AM 0:08:00 PM	(seconds) 25500 2760 30720	Initial 21.5 21.5 21.5	Final 21.5 21.5 21.5	Avg. 21.5 21.5 21.5	Eactor: 0.965 0.965 0.965	INF. 0.60 3.30 3.50	50.00 48.00 47.90	INF. 3.30 3.50 6.50	EFF. 48.00 47.90 45.50	(cm) 49.40 44.70 44.40	(cm) 44.70 44.40 39.00 36.10	6 Md- 8 8 2 4 5.1 4.6	
Date 11/14/07 11/14/07 11/14/07 11/14/07	Time 3:45:00 AN 10:50:00 AI 11:36:00 AI	4 11/14/ M 11/14/ M 11/14/ A 11/14/	07 10 07 11 07 8 07 4:	Time 0:50:00 AM 1:36:00 AM 0:08:00 PM	(seconds) 25500 2760 30720	Initial 21.5 21.5 21.5	Final 21.5 21.5 21.5	Avg. 21.5 21.5 21.5	Eactor: 0.965 0.965 0.965	INF. 0.60 3.30 3.50	50.00 48.00 47.90	INF. 3.30 3.50 6.50	EFF. 48.00 47.90 45.50	(cm) 49.40 44.70 44.40	(cm) 44.70 44.40 39.00 36.10	Shid 88 24 5.1 4.6 erages	
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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 U

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References: ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter												5.0E-08							
ASTM D 2216: Laboratory Determination of Water Content of Soils													4.0E-08 3.0E-08 2.0E-08	*					
ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)														2.0E-08	-				
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Technician / Certification #: <u>Mal Krajan</u> Technical Responsibility: <u>Mal Krajan</u>

Certification #:

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Position: Laboratory Manager

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

Permeability UD-

### Docket No. W-1300 Sub 92

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

### 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.