

ENGINEERING • TESTING ENVIRONMENTAL SERVICES

S&ME, Inc. 9751 Southern Pine Blvd. Charlotte, North Carolina Telephone: 704-523-4726

Fax: 704-525-3953

1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

Project: MNS - Groundwater Protection Project Boring No. M-20 Huntersville, North Carolina Location: Number: 1264-06-724 Sheet No. 1 of 2 Driller: Jay Little, NC Cert No. Boring Depth (ft): 48.0 Elevation (ft): 706.0 Date Drilled: 12/11/07 Logged By: Scott Dacus Water Level: Stabilized Water Level at 38.98 ft bls Drilling Method: Mud Rotary Well Penetration Resistance (Blows/Foot) Elev. Depth Lith-Material Description (Feet) (Feet) ology Construction **GRASS and TOPSOIL** 705 SOIL/SAPROLITE (M1): Brownish-Red, Fine Sandy, Silty, CLAY 700 SOIL/SAPROLITE (M1): Red and Yellow Striated, Medium to Fine Sandy, Clayey, SILT With Manganese Staining 695 SOIL/SAPROLITE (M1): Red and Yellow Mottled, Slightly Clayey, Fine Sandy, SILT With Manganese Staining 690 SOIL/SAPROLITE (M1): Gray and White, Silty, Fine SAND With Manganese Staining 20 685 MNSLOG.GPJ LAGWGN01.GDT 3/26/08 SOIL/SAPROLITE (M1): Tan and White, Slightly Micaceous, Fine Sandy, SILT With Manganese Staining 680 675



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Project: MNS - Groundwater Protection Project Boring No. M-20 Huntersville, North Carolina 1264-06-724 Location: Number: Sheet No. 2 of 2 Driller: Jay Little, NC Cert No. Elevation (ft): Boring Depth (ft): 48.0 706.0 Date Drilled: 12/11/07 Logged By: Scott Dacus Water Level: Stabilized Water Level at 38.98 ft bls Drilling Method: Mud Rotary Well Penetration Resistance (Blows/Foot) Depth (Feet) Elev. Lith-Material Description ology (Feet) Construction 100 35 670 SOIL/SAPROLITE (M1): Green and Brown, Clayey, Silty, Medium to Fine SAND Ĩ 665 SOIL/SAPROLITE (M1): Red, Tan, and White, Micaceous, Silty, Medium to Fine SAND 660 Boring Terminated at 48.00 ft bls Lithologic Descriptions Obtained From M-20R BORING LOG WITH WELL MNSLOG.GPJ LAGWGN01.GDT 3/26/08

COMPLETION REPORT OF WELL No. M-20

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

WATER LEVEL: Stabilized Water Level at

38.98 ft bls

LATITUDE: 35 25 37.01

DRILLING CONTRACTOR: S&ME, Inc.

LONGITUDE: 80 57 09.70

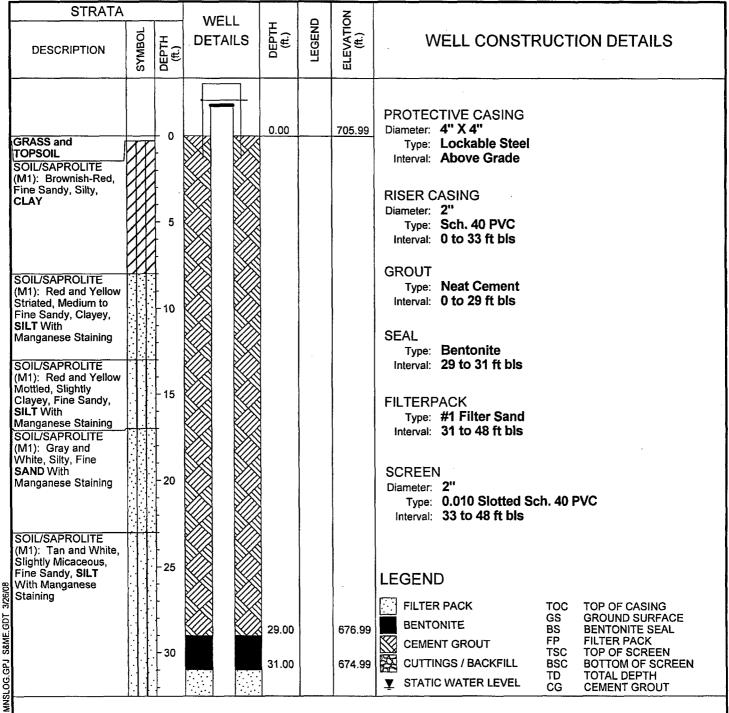
DRILLING METHOD: Mud Rotary

TOP OF CASING ELEVATION: 709.03

DATE DRILLED: 12/11/07

DATUM: MSL

LOGGED BY: Scott Dacus



MONITORING WELL

9751 Southern Pine Blvd. Charlotte, North Carolina

COMPLETION REPORT OF WELL No. M-20

Sheet 1 of 2

PROJECT: MNS - Groundwater Protection Project GROUND SURFACE ELEVATION: PROJECT NO: 1264-06-724 GROUND SURFACE ELEVATION: LOGGED BY-

LOGGED BY: **706.0**

CHECKED BY: Scott Dacus

PROJECT LOCATION:	Huntersville,	North	Carolina

STRATA			WELL		0	Z	
DESCRIPTION	SYMBOL	DEPTH (ft.)		DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
SOIL/SAPROLITE	7.7.7						(See Page 1)
(M1): Tan and White, Slightly Micaceous, Fine Sandy, SILT With Manganese Staining (continued)		-35					
SOIL/SAPROLITE (M1): Green and Brown, Clayey, Silty, Medium to Fine SAND		-40					·
SOIL/SAPROLITE (M1): Red, Tan, and White, Micaceous, Silty, Medium to Fine SAND		45					·
SAND				47.50 48.00		658.49 657.99	
							LEGEND
OG.GPJ SAME.GDT 3/26/01							FILTER PACK BENTONITE BENTONITE CEMENT GROUT CUTTINGS / BACKFILL FILTER PACK TSC TOP OF CASING GS GROUND SURFACE BS BENTONITE SEAL FP FILTER PACK TSC TOP OF SCREEN BSC BOTTOM OF SCREEN TD TOTAL DEPTH
ANSLOG.GPJ SAME.GDT 3/26/08							BENTONITE GS GROUND SURFACE BS BENTONITE SEAL FP FILTER PACK TSC TOP OF SCREEN CUTTINGS / BACKFILL BSC BOTTOM OF SCREEN



9751 Southern Pine Blvd. Charlotte, North Carolina

COMPLETION REPORT OF WELL No. M-20

Calculation of Permeability By The Rising Head Method (Slug Test)



Site Name:

MNS-GWPP

Test Date:

12/14/2007

Well Label:

M-20

Aquifer Thickness:

14. feet

Screen Length:

Casing Radius:

15. feet

Effective Radius:

1. Inches

Gravel Pack Porosity:

3. Inches 30.00%

Corrected Casing Radius:

1.844 Inches

Static Water Level:

38.98 feet

Water Table to Screen Bottom:

9.02 feet

Anisotropy Ratio:

Time Adjustment:

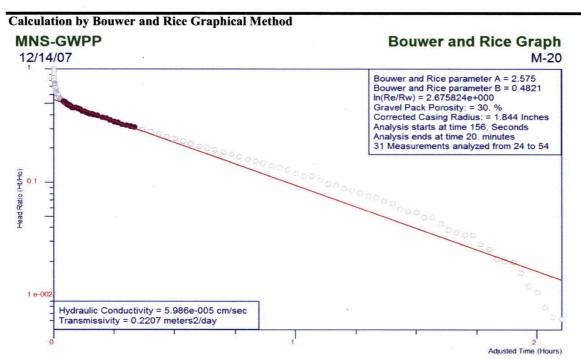
0. Seconds

Test starts with trial 0

There are 107 time and drawdown measurements

Maximum head is 3.539 feet

Minimum head is 0. feet



Analysis by Julie Petersen of S&ME, Inc.

Ho is 3,539 feet at 0. Seconds

PERMEABILITY 5.99x10⁻⁰⁵ cm/sec



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Project:	MNS	- Groun	dwate	r Protection	Project							F	Boring	No.	M-20	ıR
Location:	Hunt	ersville,	North	Carolina ————			Number:	1264-	06-724				Sheet No. 1 of 3			
Boring D	epth (ft):		75.0	Elevation	(ft):	706.2	Driller:	Jay Littl 2717	e, NC Cert N	o. I	ate D	rilled: 1	2/5/07			
Logged I	By: Julie Petersen Water Level: Stabilized Water Level at 36.32 ft bls Drilling Method: Mud Rotary															
Elev. (Feet)	Depth (Feet)	(Fact) alam Iviatelial Description									3lows/					
- - - 705			SOIL	ASS and TO ASS APROLITY CLAY		ownish-Re	d, Fine San	dy,						50		100
	5				•						26	-				
	10			./SAPROLIT ium to Fine S iing							13					
	15—		Sligh Stair		Fine Sandy, S	SILT With	Manganese	;			7					
- - - - - - - - - - - - - - - - - - -	20-			JSAPROLITION WITH MAN			ite, Silty, F	ine			12					
- - - - - - - - - - - - -	25 —			L/SAPROLIT aceous, Fine												
- - - - - - - - - - - - - - - - - - -	30-					·					7					
	-															



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2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO

Fax: 704-525-3953 DRIVE 1.4 IN. I.D. SAMPLER 1 FT. Project: MNS - Groundwater Protection Project Boring No. M-20R Huntersville, North Carolina Location: Number: 1264-06-724 Sheet No. 2 of 3 Driller: Jay Little, NC Cert No. Boring Depth (ft): 75.0 Elevation (ft): 706.2 Date Drilled: 12/5/07 Logged By: Julie Petersen Stabilized Water Level at 36.32 ft bls Water Level: Drilling Method: Mud Rotary Well Penetration Resistance (Blows/Foot) Depth Lith-Elev Material Description ology (Feet) (Feet) Construction 100 35 670 Ā SOIL/SAPROLITE (M1): Green and Brown, Clayey, Silty, Medium to Fine SAND 665 SOIL/SAPROLITE (M1): Red, Tan, and White, Micaceous, Silty, Medium to Fine SAND 45 660 50/ WEATHERED ROCK (M2): When Sampled Becomes Red, Tan, and White, Clayey, Silty, Coarse to Fine SAND 655 Roller Cone Refusal at 52.30 ft bls SOUND ROCK (D): Medium-Grained QUARTZ DIORITE, Slightly Fractured Horizontal Joint With No Staining SOUND ROCK (D): Fine-Grained QUARTZ DIORITE, Moderately Fractured Horizontal, High Angle, and Low Angle Joints With Slight Staining 650 GDT SOUND ROCK (D): Medium-Grained QUARTZ 17 DIORITE, Slightly Fractured Low Angle Joints With NL Slight Staining 645 TL BORING LOG WITH WELL, MNSLOG.GPJ TL SOUND ROCK (D): Medium-Grained QUARTZ DIORITE, Unfractured 640



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Project:			dwater Protection Project	T			Boring No. M	-20R
Location:		ersville, l	North Carolina		-06-724		Sheet No. 3 o	f 3
Boring De	pth (ft):		75.0 Elevation (ft): 706.2	Driller: Jay Littl	le, NC Cert No.	Date Dri	illed: 12/5/07	
Logged B	y: Julie I	Petersen	Water Level: Sta	bilized Water Level	at 36.32 ft bls	Drilling	Method: Mud Rotary	
Elev. (Feet)	Depth (Feet)	Lith- ology	Material Description		Well Construction		netration Resistance (Blo	
		V1 V	· · · · · · · · · · · · · · · · · · ·		Construction		50	
	70	124 171						
-25	70 —	27 Z						
635		1 1 V	SOUND ROCK (D): Medium-Grained	OUARTZ.				.
		7 7 7	DIORITE, Slightly Fractured Horizonta Staining	al Joints With No				
-	_	77.7	Stanting					.
1	75	7,7,7			,	111		
			Boring Terminated at 75.00 ft bls					
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FIELD ROCK CORE LOG

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



Core Location: M-20R 52 Roller Cone Refusal at 52.3 ft bls Horizontal Joint, No Staining Low Angle Joints, Slight Staining, Sand in Fractures Low Angle Healed Joints End of Run #1, REC - 100%, REC - 100% High Angle Joints, Slight Staining Horizontal Joint, Moderate Staining, Sand in Fracture 65 End of Run #3, REC - 99%, RQD - 96% 57 Horizontal Joint, No Staining **EXPLANATION** Horizontal Joints, No Staining Highly Fractured Zone, No Staining Meta Gabbro 58 Quartz Diorite Diorite Granite High Angle Healed Joints \bowtie Core Loss Intense Fracturing End of Run #2, REC - 100%, RQD - 80% Fractures End of Run Contact - Healed Joint End of Run #4, REC - 100%, RQD - 100%

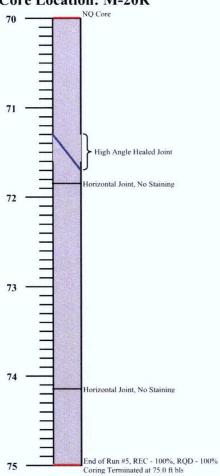
FIELD ROCK CORE LOG

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



Core Location: M-20R



EXPLANATION



Meta Gabbro



Quartz Diorite



Diorite



Granite



Core Loss



Intense Fracturing

End of Run

Fractures

Contact

Healed Joint

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

WATER LEVEL: Stabilized Water Level at

36.32 ft bls

LATITUDE: 35 25 37.00

DRILLING CONTRACTOR: S&ME, Inc.

LONGITUDE: 80 57 09.63

DATE DRILLED: 12/5/07

DRILLING METHOD: Mud Rotary

TOP OF CASING ELEVATION: 709.17

DATUM: MSL

LOGGED BY: Julie Petersen

STRATA	,		WELL	_	٥	N O	
DESCRIPTION	SYMBOL	DEPTH (ft.)	DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
GRASS and TOPSOIL SOIL/SAPROLITE (M1): Brownish-Red, Fine Sandy, Silty, CLAY SOIL/SAPROLITE (M1): Red and Yellow Striated, Medium to Fine Sandy, Clayey, SILT With Manganese Staining SOIL/SAPROLITE (M1): Red and Yellow Mottled, Slightly Clayey, Fine Sandy, SILT With Manganese Staining SOIL/SAPROLITE (M1): Gray and White, Silty, Fine SAND With Manganese Staining SOIL/SAPROLITE (M1): Tan and White, Slightly Micaceous, Fine Sandy, SILT With Manganese Staining SOIL/SAPROLITE (M1): Tan and White, Slightly Micaceous, Fine Sandy, SILT With Manganese Staining	S	- 0 - 5 - 10 - 20 - 25		0.00		706.17	PROTECTIVE CASING Diameter: 4" X 4" Type: Lockable Steel Interval: Above Grade RISER CASING Diameter: 2" Type: Sch. 40 PVC Interval: 0 to 62.49 ft bis GROUT Type: Neat Cement Interval: 0 to 59.92 ft bis SEAL Type: K-Packer Interval: 59.92 to 62.22 FILTERPACK Type: N/A Interval: N/A SCREEN Diameter: 2" Type: 0.010 Slotted Sch. 40 PVC Interval: 62.92 to 67.92 ft bis LEGEND FILTER PACK BENTONITE BS GROUND SURFACE BENTONITE SEAL FILTER PACK TOC TOP OF CASING GROUND SURFACE BENTONITE SEAL FILTER PACK TOC TOP OF SCREEN TOC TOP OF SCREEN BISTONITE SEAL FILTER PACK TOC TOP OF SCREEN TOC TOP OF SCREEN TOC TOP OF SCREEN TOC TOP OF SCREEN TOTOP OF SC
O Javan	Ш	<u> </u>		1	<u></u>	L	STATIC WATER LEVEL CG CEMENT GROUT

9751 Southern Pine Blvd. Charlotte, North Carolina **COMPLETION REPORT OF** WELL No. M-20R

Sheet 1 of 2

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT NO: 1204-06-724
PROJECT LOCATION: Huntersville, North Carolina

GROUND SURFACE ELEVATION:

LOGGED BY: **706.2**

CHECKED BY: Julie Petersen

STRATA ELEVATION (ft.) WELL DEPTH (ft.) LEGEND SYMBOI DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS DESCRIPTION (See Page 1) 35 SOIL/SAPROLITE (M1): Green and Brown, Clayey, Silty, Medium to Fine SAND SOIL/SAPROLITE (M1): Red, Tan, and White, Micaceous. Silty, Medium to Fine SAND WEATHERED ROCK (M2): When Sampled Becomes Red, Tan, and White, Clayey, Silty, Coarse to Fine SAND SOUND ROCK (D): Medium-Grained QUARTZ DIORITE, - 55 Slightly Fractured Horizontal Joint With 1,4 No Staining SOUND ROCK (D): Fine-Grained 15 17 QUARTZ DIORITE. 59.92 646.25 -60 Moderately Fractured 77 Horizontal, High Angle and Low Angle Joints 12 61.92 644.25 With Slight Štaining 643.95 62.22 SOUND ROCK (D): 62.92 643.25 Medium-Grained QUARTZ DIORITE, -65 Slightly Fractured Low 7 1 Angle Joints With 77 Slight Staining 77 67.42 638.75 SOUND ROCK (D): 67.92 638.25 Medium-Grained 77 QUARTZ DIORITE, 1₁ Unfractured LEGEND 70.00 636.17 - 70 **FILTER PACK** TOC TOP OF CASING GS **GROUND SURFACE** SOUND ROCK (D): BENTONITE BENTONITE SEAL BS Medium-Grained 77 FP QUARTZ DIORITE. **FILTER PACK CEMENT GROUT TSC** TOP OF SCREEN Slightly Fractured 75.00 631.17 **CUTTINGS / BACKFILL BSC BOTTOM OF SCREEN** Horizontal Joints With TD TOTAL DEPTH No Staining **▼** STATIC WATER LEVEL CG **CEMENT GROUT**



9751 Southern Pine Blvd. Charlotte, North Carolina COMPLETION REPORT OF WELL No. M-20R

SPLIT SPOON SAMPLE PICTURES

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724

Boring Number:

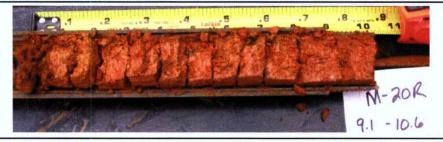
M-20R

Sample No: 1
Depth (ft-bls): 3.1 - 5.6
Blow Count: 7 * 11 * 15



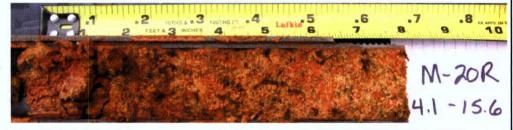
Sample No: 2
Depth (ft-bls): 9.1 - 10.6

Blow Count: 5 * 6 * 7



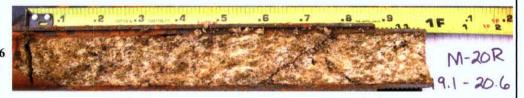
Sample No: 3
Depth (ft-bls): 14.1 - 15.6

Blow Count: 3 * 3 * 4



Sample No: 4

Depth (ft-bls): 19.1 - 20.6 Blow Count: 3 * 5 * 7



Sample No: 5

Depth (ft-bls): 24.1 - 25.6 Blow Count: 3 * 3 * 4



Sample No: 6
Depth (ft-bls): 29.1 - 30.6

Blow Count: 2 * 3 * 4



SPLIT SPOON SAMPLE PICTURES

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



M-20R

Sample No:

Depth (ft-bls): 34.1 - 35.6

Blow Count: 3 * 3 * 5



Sample No:

Depth (ft-bls): 39.1 - 40.6

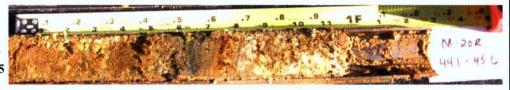
Blow Count: 3 * 4 * 6



Sample No:

Depth (ft-bls): 44.1 - 45.6

Blow Count: 12 * 12 * 15



Sample No:

Depth (ft-bls): 49.1 - 50.6 No Recovery

Blow Count:

ROCK CORE PICTURES

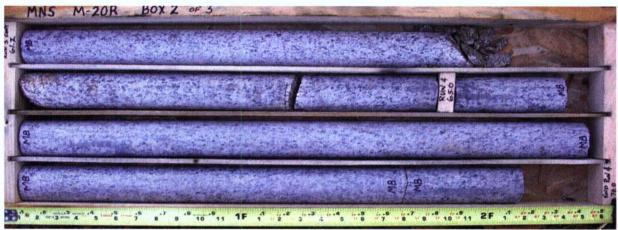
McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724

Core Location: M-20R









CLASSIFICATION:

52.3' to 54.6': Medium-Grained Quartz Diorite 54.6' to 59': Fine-Grained Quartz Diorite 59' to 75': Medium-Grained Quartz Diorite

Calculation of Permeability By The Rising Head Method (Slug Test)



Site Name: MNS-GWPP **Test Date:** 12/13/2007 Well Label: M-20R **Aguifer Thickness:** 37. feet 5. feet Screen Length: **Casing Radius:** 1. Inches **Effective Radius:** 1.5 Inches **Static Water Level:** 36.32 feet Water Table to Screen Bottom: 31.6 feet

Anisotropy Ratio:

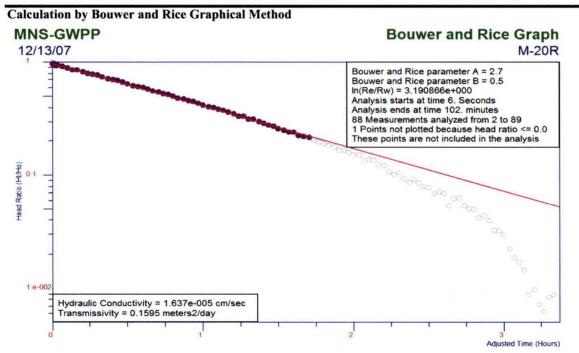
Time Adjustment:

0. Seconds

Test starts with trial 0

There are 139 time and drawdown measurements

Maximum head is 1.932 feet Minimum head is 0. feet



Analysis by Julie Petersen of S&ME, Inc.

Ho is 1.932 feet at 0. Seconds

PERMEABILITY 1.64 x 10⁻⁰⁵ cm/sec

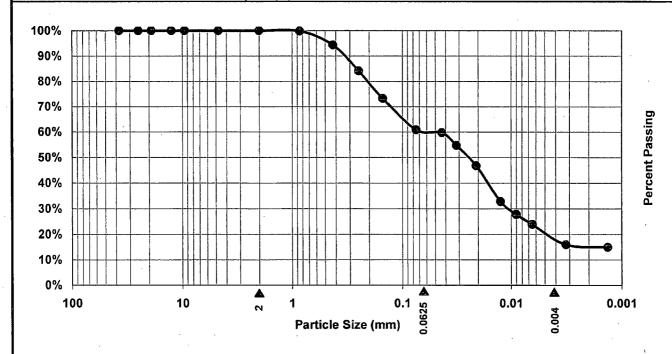
PARTICLE SIZE ANALYSIS OF SOILS FOR USE IN FETTER AND BEAR DIAGRAMS

 Boring No.:
 Sample No.:
 Depth:

 M-20R
 SS-2
 9.1 to 10.6 ft bls

Sample Description:

Red and Yellow, Medium to Fine Sandy, Clayey, Silt



	> 2 mm	2 mm - 0.0625 mm	0.0625 mm - 0.004 mm	<0.004 mm
From Graph:	% Gravel	% Sand	% Silt	% Clay
	0.0%	39.5%	42.7%	17.8%
Adjusted for Calculations	0%	40%	43%	18%

Notes:

Grain size distribution taken from grain size with hydrometer data located in Appendix II.

Gravel, sand, silt and clay sizes based on Wentworth Scale.

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\sim		* .		_		

McGuire Nuclear Station - GWPP

S&ME Project No.:

1264-06-724



FETTER AND BEAR DIAGRAMS

S&ME PROJECT: McGuire Nuclear Station - GWPP

S&ME PROJECT NO.: 1264-06-724



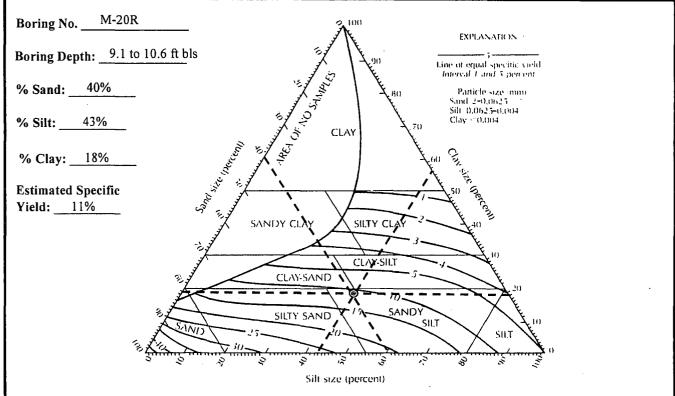
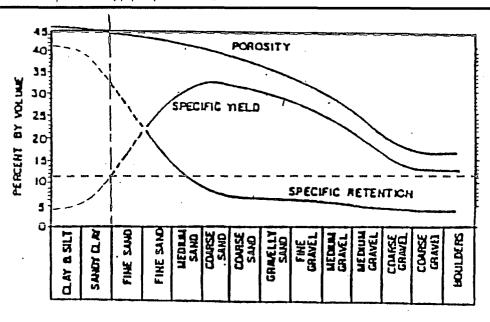


FIGURE 4.11 Textural classification triangle for unconsolidated materials showing the relation between particle size and specific yield. Source: A. I. Johnson, U.S. Geological Survey Water-Supply Paper 1662-D, 1967.



Estimated Porosity: 45%

Variation of Porosity, Specific Yield, and Specific Retention with Grain Size (after Bear, 1972)

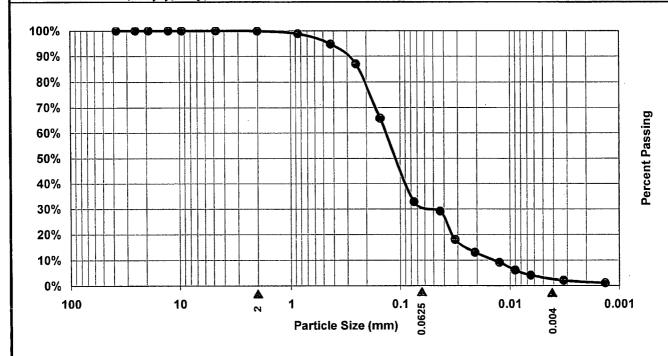
PARTICLE SIZE ANALYSIS OF SOILS FOR USE IN FETTER AND BEAR DIAGRAMS

 Boring No.:
 Sample No.:
 Depth:

 M-20R
 SS-8
 39.1 to 40.6 ft bls

Sample Description:

Green and Brown, Clayey, Silty, Medium to Fine Sand



	> 2 mm	2 mm - 0.0625 mm	0.0625 mm - 0.004 mm	<0.004 mm
From Graph:	% Gravel	% Sand	% Silt	% Clay
_	0.1%	68.3%	29.2%	2.5%
Adjusted for Calculations	. 0%	68%	29%	2%

Notes:

Grain size distribution taken from grain size with hydrometer data located in Appendix II.

Gravel, sand, silt and clay sizes based on Wentworth Scale.

S&ME Project:

McGuire Nuclear Station - GWPP

S&ME Project No.:

1264-06-724



FETTER AND BEAR DIAGRAMS

S&ME PROJECT: McGuire Nuclear Station - GWPP

S&ME PROJECT NO.: 1264-06-724



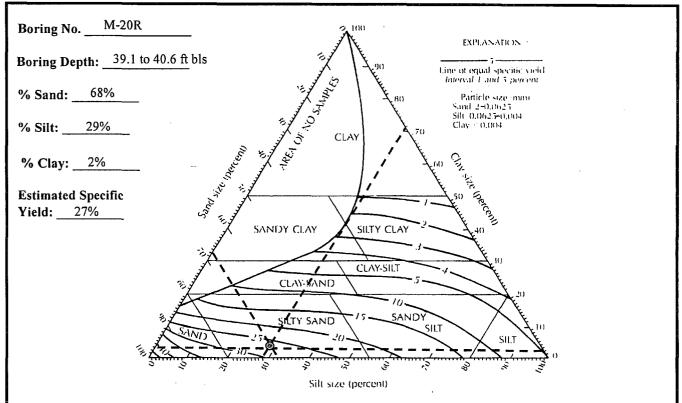
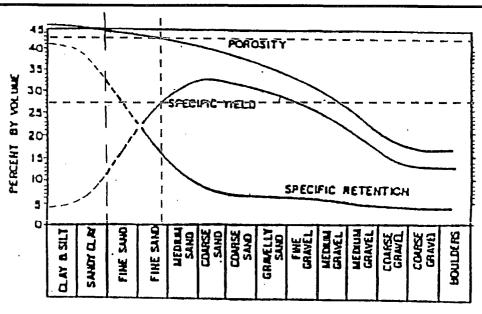


FIGURE 4.11 Textural classification triangle for unconsolidated materials showing the relation between particle size and specific yield. Source: A. I. Johnson, U.S. Geological Survey Water-Supply Paper 1662-D, 1967.



Estimated Porosity: 43%

Variation of Porosity, Specific Yield, and Specific Retention with Grain Size (after Bear, 1972)

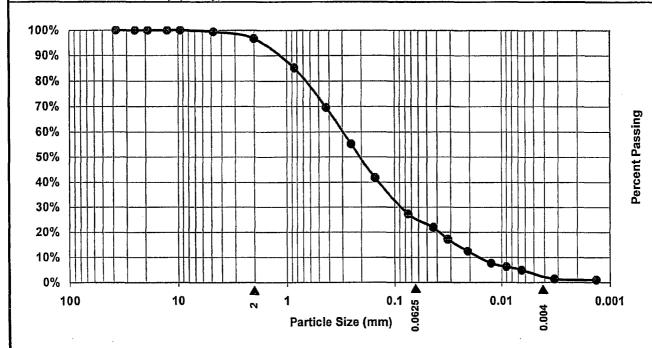
PARTICLE SIZE ANALYSIS OF SOILS FOR USE IN FETTER AND BEAR DIAGRAMS

 Boring No.:
 Sample No.:
 Depth:

 M-20R
 SS-10
 49.1 to 50.6 ft bls

Sample Description:

Red, Tan, and White, Clayey, Silty, Coarse to Fine Sand



	> 2 mm	2 mm - 0.0625 mm	0.0625 mm - 0.004 mm	<0.004 mm
From Graph:	% Gravel	% Sand	% Silt	% Clay
	3.3%	71.2%	23.3%	2.2%
Adjusted for Calculations	0%	74%	24%	2%

Notes:

Grain size distribution taken from grain size with hydrometer data located in Appendix II. Gravel, sand, silt and clay sizes based on Wentworth Scale.

S&ME Project:

McGuire Nuclear Station - GWPP

S&ME Project No.:

1264-06-724



FETTER AND BEAR DIAGRAMS

S&ME PROJECT: McGuire Nuclear Station - GWPP

S&ME PROJECT NO.: 1264-06-724



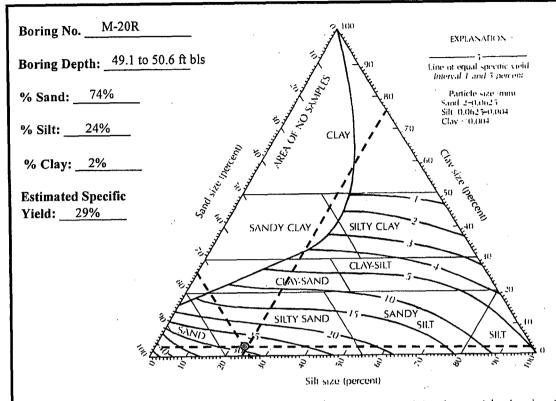
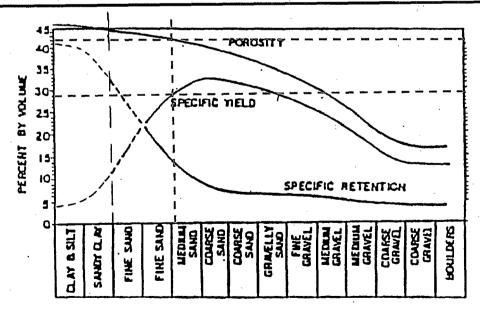


FIGURE 4.11 Textural classification triangle for unconsolidated materials showing the relation between particle size and specific yield. Source: A. I. Johnson, U.S. Geological Survey Water-Supply Paper 1662-D, 1967.



Estimated Porosity: 42.5%

Variation of Porosity, Specific Yield, and Specific Retention with Grain Size (after Bear, 1972)



S&ME, Inc. 9751 Southern Pine Blvd. Charlotte, North Carolina Telephone: 704-523-4726 Fax: 704-525-3953

1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586. 2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO

DRIVE 1.4 IN. I.D. SAMPLER 1 FT. Project: MNS - Groundwater Protection Project Boring No. M-21 Huntersville, North Carolina Location: Number: 1264-06-724 Sheet No. 1 of 2 Driller: Jay Little, NC Cert No. Elevation (ft): Boring Depth (ft): 50.5 764.7 Date Drilled: 12/12/07 Logged By: Scott Dacus Water Level: Stabilized Water Level at 35.83 ft bls Drilling Method: Mud Rotary Well Penetration Resistance (Blows/Foot) Depth (Feet) Elev. Lith-Material Description (Feet) ology Construction 100 SOIL/SAPROLITE (M1): Orange, Brown, Tan, and Red, Medium to Fine Sandy, Clayey SILT With Manganese Staining 760 12 - 755 10 - 750 745 740 .GDT -735



S&ME, Inc. 9751 Southern Pine Blvd. Charlotte, North Carolina Telephone: 704-523-4726 Fax: 704-525-3953

1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586. 2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO

DRIVE 1.4 IN. I.D. SAMPLER 1 FT. Project: MNS - Groundwater Protection Project Boring No. M-21 Huntersville, North Carolina 1264-06-724 Location: Number: Sheet No. 2 of 2 Jay Little, NC Cert No. Driller: Boring Depth (ft): Elevation (ft): 764.7 Date Drilled: 12/12/07 Logged By: Scott Dacus Water Level: Stabilized Water Level at 35.83 ft bls Drilling Method: Mud Rotary Well Penetration Resistance (Blows/Foot) Elev. Depth Lith-Material Description (Feet) (Feet) ology Construction 100 Ţ 725 SOIL/SAPROLITE (M1): White and Gray, Micaceous, Silty, Medium to Fine SAND ~720 -715 SOIL/SAPROLITE (M1): Tan, Micaceous, Silty, Medium to Fine SAND Boring Terminated at 50.50 ft bls BORING LOG WITH WELL MNSLOG.GPJ LAGWGN01.GDT 3/26/08

COMPLETION REPORT OF WELL No. M-21

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

WATER LEVEL: Stabilized Water Level at

35.83 ft bls

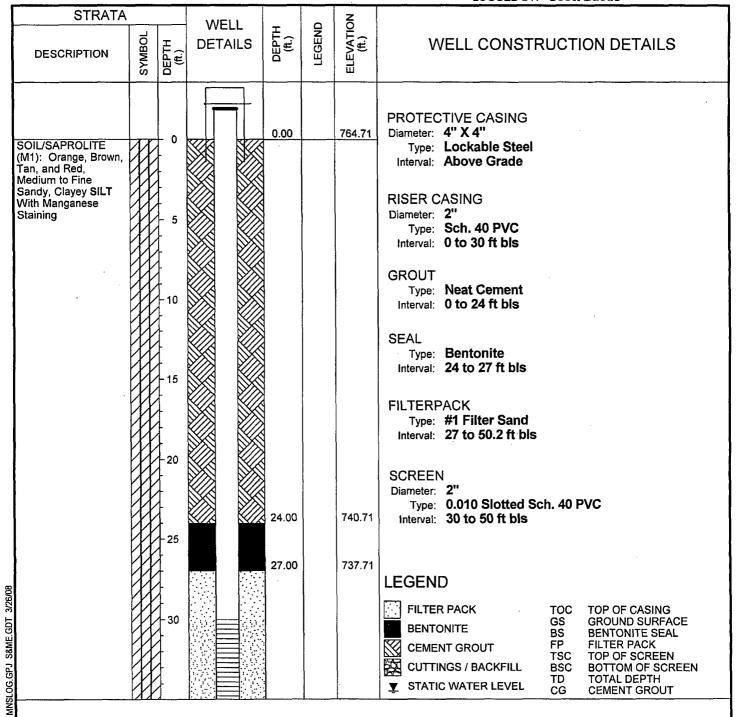
LATITUDE: 35 25 36.18

LONGITUDE: 80 56 47.86

DRILLING CONTRACTOR: S&ME, Inc. DRILLING METHOD: Mud Rotary

TOP OF CASING ELEVATION: 767.65

DATUM: MSL **DATE DRILLED: 12/12/07** LOGGED BY: Scott Dacus



ENGINEERING • TESTING ENVIRONMENTAL SERVICES

9751 Southern Pine Blvd. Charlotte, North Carolina **COMPLETION REPORT OF** WELL No. M-21

Sheet 1 of 2

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

GROUND SURFACE ELEVATION:

LOGGED BY: **764.7**

CHECKED BY: Scott Dacus

STRATA ELEVATION (ft.) WELL DEPTH (ft.) LEGEND SYMBOL DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS DESCRIPTION (See Page 1) 35 SOIL/SAPROLITE (M1): Orange, Brown, Tan, and Red, Medium to Fine Sandy, Clayey SILT With Manganese Staining (continued) SOIL/SAPROLITE (M1): White and Gray, Micaceous, Silty, Medium to Fine SAND 45 49.50 715.21 50.00 714.71 SOIL/SAPROLITE 50.20 714.51 (M1): Tan, 50.50 714.21 Micaceous, Silty, Medium to Fine SAND **LEGEND FILTER PACK** TOC TOP OF CASING **GROUND SURFACE** GS **BENTONITE** BS **BENTONITE SEAL** FP **FILTER PACK CEMENT GROUT** TOP OF SCREEN **TSC CUTTINGS / BACKFILL** BOTTOM OF SCREEN BSC TD TOTAL DEPTH **▼** STATIC WATER LEVEL **CEMENT GROUT**



9751 Southern Pine Blvd. Charlotte, North Carolina

COMPLETION REPORT OF WELL No. M-21

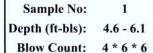
SPLIT SPOON SAMPLE PICTURES

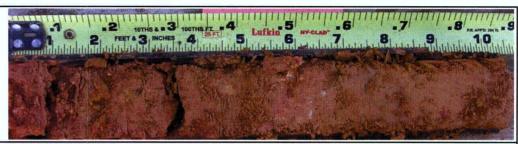
McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724

Boring Number:

M-21





Sample No: 2 Depth (ft-bls): 9.6 - 11.1 Blow Count: 3 * 4 * 6



Sample No: Depth (ft-bls): 14.6 - 16.1 Blow Count: 3 * 3 * 5



Sample No:

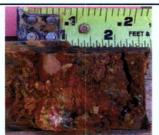
Blow Count: 3 * 4 * 4

Depth (ft-bls): 19 - 20.5 No Recovery

Sample No: Depth (ft-bls): 24 - 25.5 Blow Count: 4 * 6 * 8



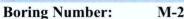
Sample No: Depth (ft-bls): 29 - 30.5 Blow Count: 3 * 3 * 6



SPLIT SPOON SAMPLE PICTURES

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



M-21

Sample No: Depth (ft-bls): 34 - 35.5 Blow Count: 2 * 3 * 4



Sample No: Depth (ft-bls): 39 - 40.5 **Blow Count:** 1 * 1 * 3



Sample No: Depth (ft-bls): 44 - 45.58

Blow Count: 1 * 2 * 3



Sample No: 10 Depth (ft-bls): 49 - 50.5 Blow Count: 3 * 3 * 8



Calculation of Permeability By The Rising Head Method (Slug Test)



Site Name:

MNS-GWPP

Test Date:

12/18/2007

Well Label:

M-21

Aquifer Thickness:

19.17 feet

Screen Length:

20. feet

Casing Radius:

1. Inches

Effective Radius:

3. Inches

Gravel Pack Porosity:

30.00%

Corrected Casing Radius:

1.844 Inches

Static Water Level:

35.83 feet

Water Table to Screen Bottom:

14.17 feet

Anisotropy Ratio:

Time Adjustment:

0. Seconds

Test starts with trial 0

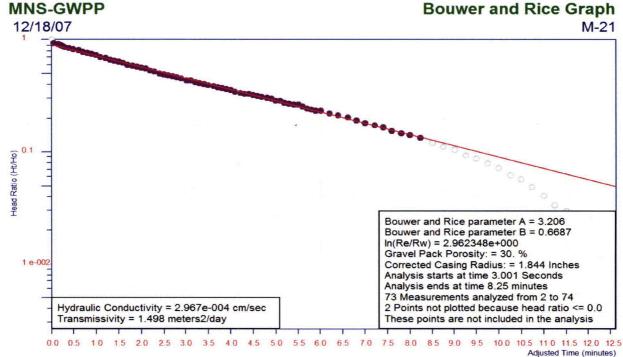
There are 92 time and drawdown measurements

Maximum head is 3.454 feet

Minimum head is 0, feet

Calculation by Bouwer and Rice Graphical Method

Bouwer and Rice Graph



Analysis by Julie Petersen of S&ME, Inc.

Ho is 3.454 feet at 0. Seconds

PERMEABILITY 2.97 x 10⁻⁰⁴ cm/sec

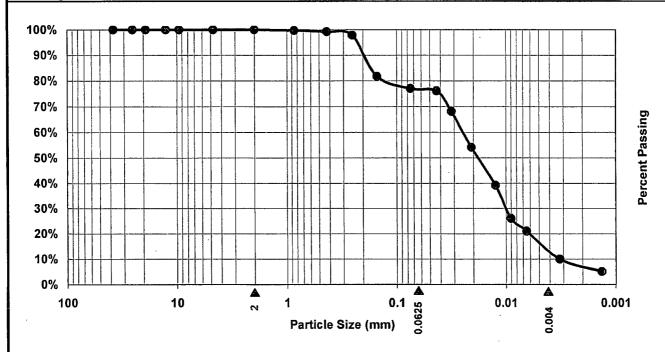
PARTICLE SIZE ANALYSIS OF SOILS FOR USE IN FETTER AND BEAR DIAGRAMS

 Boring No.:
 Sample No.:
 Depth:

 M-21
 SS-3
 14.6 to 16.1 ft bls

Sample Description:

Orange, Brown, Tan, and Red, Medium to Fine Sandy, Clayey, Silt



	> 2 mm	2 mm - 0.0625 mm	0.0625 mm - 0.004 mm	<0.004 mm
From Graph:	% Gravel	% Sand	% Silt	% Clay
	0.0%	23.3%	64.1%	12.6%
Adjusted for Calculations	0%	23%	64%	13%

Notes:

Grain size distribution taken from grain size with hydrometer data located in Appendix II.

Gravel, sand, silt and clay sizes based on Wentworth Scale.

S&ME Project:

McGuire Nuclear Station - GWPP

S&ME Project No.:

1264-06-724



FETTER AND BEAR DIAGRAMS

S&ME PROJECT: McGuire Nuclear Station - GWPP

S&ME PROJECT NO.: 1264-06-724



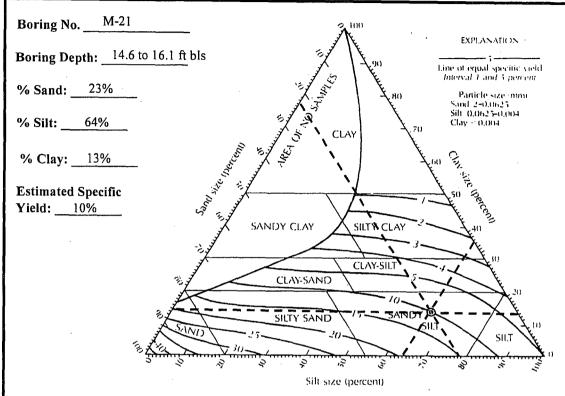
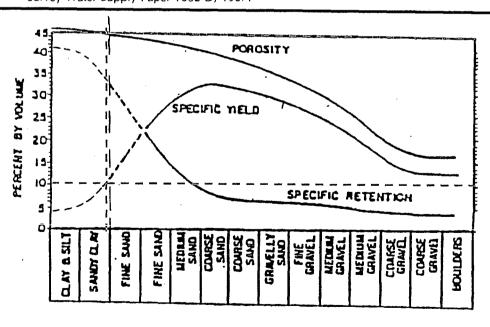


FIGURE 4.11 Textural classification triangle for unconsolidated materials showing the relation between particle size and specific yield. Source: A. I. Johnson, U.S. Geological Survey Water-Supply Paper 1662-D, 1967.



Estimated Porosity: ___45%

Variation of Porosity, Specific Yield, and Specific Retention with Grain Size (after Bear, 1972)



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1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586. 2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. 1.D. SAMPLER 1 FT.

Project:		G- Groun		Protection		-323-393		DRIVE 1.4 IN. 1.1	J. GAIVII	LLK		ring l	No. N	1-22			
Location	: Hunt	ersville,	North (Carolina			Number: 1264	-06-724			S	heet N	o. 1 o	f 2			
Boring D	epth (ft):	60.0 Elevation (ft): 786.7 Driller: Justin Millwood, NC Cert. No. 3439 Date Drilled: 12/7/07															
Logged I	Logged By: Courtney Withers Water Level: Stabilized Water Level at 49.69 ft bls Drilling Method: 41/4" H.S.A.																
Elev. (Feet)	Depth (Feet)	Lith- ology		Mater	ial Descr	ription		Well Construction	0	Penetration Resistance (Blows/Foot) 0 50 100							
			SOIL/ SILT	SAPROLIT	E (M1): R	ed, Very Fi	ne Sandy, Clayey,										
	5						White, and ese Staining										
- - - - -775 - - -	10																
- - - 770	15			,		,											
765	20-			/SAPROLIT			n-Brown, ganese Nodules										
760	25						, White, and esse Staining										
BONING TOO WITH WAS LOCATED TAKEN TOO SHALL BE S	30-		SILT		anese Stair	ning; Vertic	White, Fine Sandy, al Quartz Gravel										



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1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

Project: MNS - Groundwater Protection Project Boring No. M-22 Huntersville, North Carolina Location: 1264-06-724 Number: Sheet No. 2 of 2 Driller: Justin Millwood, NC Boring Depth (ft): 60.0 Elevation (ft): 786.7 Date Drilled: 12/7/07 Cert. No. 3439 Logged By: Courtney Withers Water Level: Stabilized Water Level at 49.69 ft bls Drilling Method: 41/4" H.S.A. Well Penetration Resistance (Blows/Foot) Elev. Depth Lith-Material Description (Feet) (Feet) ology Construction 100 750 SOIL/SAPROLITE (M1): Tan, Micaceous, SILT With Manganese Staining - 740 SOIL/SAPROLITE (M1): Tan, Orange, and White, Very Ţ Micaceous, Fine Sandy, SILT With Manganese Staining; 50 White, Silty, Medium to Fine Sand Lense From 50.30 ft to 50.60 ft bls 735 730 BORING LOG WITH WELL MNSLOG.GPJ LAGWGNO1.GDT 3/26/08 WEATHERED ROCK (M2): When Sampled Becomes Tan, Orange, and White, Micaceous, Silty, Medium to Fine SAND With Manganese Staining Boring Terminated at 60.00 ft bls Lithologic Descriptions Obtained From M-22R

COMPLETION REPORT OF WELL No. M-22

DRILLING CONTRACTOR: S&ME, Inc.

DATE DRILLED: 12/7/07

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

WATER LEVEL: Stabilized Water Level at

49.69 ft bls

LATITUDE: 35 25 37.45

LONGITUDE: 80 56 37.37

DRILLING METHOD: 41/4" H.S.A.

TOP OF CASING ELEVATION: 789.33

DATUM: MSL

LOGGED BY: Courtney Withers

						LOGGED BY: Courtney Withers
STRATA					z	
DESCRIPTION	SYMBOL	WELL DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
SOIL/SAPROLITE (M1): Red, Very Fine Sandy, Clayey, SILT			0.00		786.71	PROTECTIVE CASING Diameter: 4" X 4" Type: Lockable Steel Interval: Above Grade RISER CASING Diameter: 2"
SOIL/SAPROLITE (M1): Orange, Red, White, and Brown, Silty, Fine SAND With Manganese Staining	-11					Type: Sch. 40 PVC Interval: 0 to 45 ft bls GROUT Type: Neat Cement Interval: 0 to 40 ft bls SEAL Type: Bentonite
SOIL/SAPROLITE (M1): Dark Reddish-Brown, Micaceous, Silty, Fine SAND With Manganese Nodules	- 2					Interval: 40 to 42.8 ft bls FILTERPACK Type: #1 Filter Sand Interval: 42.8 to 60 ft bls SCREEN Diameter: 2" Type: 0.010 Slotted Sch. 40 PVC Interval: 45 to 60 ft bls
SOIL/SAPROLITE (M1): Orange, Red, White, and Brown, Silty, Fine SAND With Manganese Staining	-2					LEGEND FILTER PACK GS GROUND SURFACE BS BENTONITE BS BENTONITE CEMENT GROUT TSC TOP OF CASING GS GROUND SURFACE BS BENTONITE SEAL FP FILTER PACK TSC TOP OF SCREEN BSC BOTTOM OF SCREEN TD TOTAL DEPTH TOTAL DEPTH CG CEMENT GROUT

9751 Southern Pine Blvd. Charlotte, North Carolina

COMPLETION REPORT OF WELL No. M-22

Sheet 1 of 2

PROJECT: MNS - Groundwater Protection Project
PROJECT NO: 1264-06-724
PROJECT LOCATION: Huntersville, North Carolina

GROUND SURFACE ELEVATION:

LOGGED BY: **786.7**

CHECKED BY: Courtney Wither

STRATA		***				z	
DESCRIPTION	SYMBOL	DEPTH (ft.)	WELL. DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
			·				(See Page 1)
SOIL/SAPROLITE (M1): Orange and White, Fine Sandy, SILT With Manganese Staining; Vertical Quartz Gravel Vein From 39.00 ft to 40.10 ft bls (continued)		35		40.00		746.71 743.91	
SOIL/SAPROLITE (M1): Tan, Micaceous, SILT With Manganese Staining SOIL/SAPROLITE (M1): Tan, Orange,		-45					
and White, Very Micaceous, Fine Sandy, SILT With Manganese Staining; White, Silty, Medium to Fine Sand Lense From 50.30 ft to 50.60 ft bls		-55					
WEATHERED ROCK (M2): When Sampled Becomes Tan, Orange, and White, Micaceous, Silty, Medium to Fine SAND With Manganese Staining		60		59.50 60.00		727.21 726.71	
ANSLOG.GPJ. S&ME.GDT. 3/26/08							LEGEND FILTER PACK GS GROUND SURFACE BS BENTONITE BS BENTONITE SEAL CEMENT GROUT CUTTINGS / BACKFILL STATIC WATER LEVEL CG CEMENT GROUT CG CEMENT GROUT



9751 Southern Pine Blvd. Charlotte, North Carolina

COMPLETION REPORT OF WELL No. M-22

Calculation of Permeability By The Rising Head Method (Slug Test)



Site Name: **MNS-GWPP Test Date:** 12/13/2007 Well Label: M-22 **Aquifer Thickness:** 15.31 feet Screen Length: 15. feet **Casing Radius:** 1. Inches **Effective Radius:** 3. Inches **Gravel Pack Porosity:** 30.00% **Corrected Casing Radius:** 1.844 Inches **Static Water Level:** 49.69 feet Water Table to Screen Bottom: 10.31 feet

Anisotropy Ratio:

Time Adjustment:

0. Seconds

Test starts with trial 0

There are 104 time and drawdown measurements

Maximum head is 0.568 feet Minimum head is 0. feet

Calculation by Bouwer and Rice Graphical Method **MNS-GWPP Bouwer and Rice Graph** 12/13/07 Bouwer and Rice parameter A = 2.741 Bouwer and Rice parameter B = 0.5205 In(Re/Rw) = 2.721688e+000 Gravel Pack Porosity: = 30. % Corrected Casing Radius: = 1.844 Inches Analysis starts at time 21. Seconds Analysis ends at time 5.5 minutes 39 Measurements analyzed from 5 to 43 1 Points not plotted because head ratio <= 0.0 These points are not included in the analysis Head Ratio (Ht/Ho) Hydraulic Conductivity = 3.267e-004 cm/sec Transmissivity = 1.317 meters2/day Adjusted Time (minutes)

Analysis by Julie Petersen of S&ME, Inc.

Ho is 0.568 feet at 0. Seconds

PERMEABILITY 3.27 x 10⁻⁰⁴ cm/sec



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1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

Project: MNS - Groundwater Protection Project Boring No. M-22R Location: Huntersville, North Carolina 1264-06-724 Number: Sheet No. 1 of 3 Driller: Justin Millwood, NC Boring Depth (ft): 95.6 Elevation (ft): 786.8 Date Drilled: 12/3/07 Cert. No. 3439 Logged By: Courtney Withers Water Level: Stabilized Water Level at 49.42 ft bls Drilling Method: 41/4" H.S.A. Well Penetration Resistance (Blows/Foot) Depth Lith-Elev. Material Description (Feet) (Feet) ology Construction SOIL/SAPROLITE (M1): Red, Very Fine Sandy, Clayey, 785 780 SOIL/SAPROLITE (M1): Orange, Red, White, and Brown, Silty, Fine SAND With Manganese Staining 775 770 SOIL/SAPROLITE (M1): Dark Reddish-Brown, Micaceous, Silty, Fine SAND With Manganese Nodules 765 MNSLOG.GPJ LAGWGN01.GDT 3/26/08 SOIL/SAPROLITE (M1): Orange, Red, White, and Brown, Silty, Fine SAND With Manganese Staining 760 BORING LOG WITH WELL 755 SOIL/SAPROLITE (M1): Orange and White, Fine Sandy, SILT With Manganese Staining; Vertical Quartz Gravel Vein From 39.00 ft to 40.10 ft bls



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1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

Project: MNS - Groundwater Protection Project Boring No. M-22R Location: Huntersville, North Carolina 1264-06-724 Number: Sheet No. 2 of 3 Driller: Justin Millwood, NC Boring Depth (ft): 95.6 Elevation (ft): 786.8 Date Drilled: 12/3/07 Cert. No. 3439 Logged By: Courtney Withers Water Level: Stabilized Water Level at 49.42 ft bls Drilling Method: 41/4" H.S.A. Well Penetration Resistance (Blows/Foot) Elev. Depth Lith-Material Description (Feet) (Feet) ology Construction - 750 745 SOIL/SAPROLITE (M1): Tan, Micaceous, SILT With Manganese Staining **-740** SOIL/SAPROLITE (M1): Tan, Orange, and White, Very Micaceous, Fine Sandy, SILT With Manganese Staining; White, Silty, Medium to Fine Sand Lense From 50.30 ft to 50.60 ft bls 735 55 - 730 BORING LOG WITH WELL MNSLOG.GPJ LAGWGN01.GDT 3/26/08 50/ WEATHERED ROCK (M2): When Sampled Becomes Tan, Orange, and White, Micaceous, Silty, Medium to Fine SAND With Manganese Staining 50/ 3 50/ X



S&ME, Inc. 9751 Southern Pine Blvd. Charlotte, North Carolina Telephone: 704-523-4726

1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO

ENVIRONMENTAL SERVICES Fax: 704-525-3953 DRIVE 1.4 IN. I.D. SAMPLER I FT. Project: MNS - Groundwater Protection Project Boring No. M-22R Location: Huntersville, North Carolina 1264-06-724 Number: Sheet No. 3 of 3 95.6 Driller: Justin Millwood, NC Boring Depth (ft): Elevation (ft): 786.8 Date Drilled: 12/3/07 Cert. No. 3439 Logged By: Courtney Withers Stabilized Water Level at 49.42 ft bls Water Level: Drilling Method: 41/4" H.S.A. Well Penetration Resistance (Blows/Foot) Elev. Depth Lith-Material Description (Feet) (Feet) ology Construction 100 Auger Refusal at 72.00 ft bls -715 SOUND ROCK (D): Medium-Grained QUARTZ DIORITE, Intensely Fractured Horizontal, High Angle, and Low Angle Joints With Slight to Moderate Staining SOUND ROCK (D): Medium-Grained QUARTZ -710 DIORITE, Slightly Fractured Low Angle Joints With No Staining SOUND ROCK (D): Coarse-Grained QUARTZ DIORITE, Unfractured 705 SOUND ROCK (D): Medium-Grained QUARTZ DIORITE, Slightly Fractured Low Angle Joints With No Staining NL SOUND ROCK (D): Coarse-Grained QUARTZ 17 DIORITE, Moderately Fractured Horizontal, High Angle, and Low Angle Joints With Slight to Heavy Staining 700 - 695 BORING LOG WITH WELL MNSLOG.GPJ LAGWGN01.GDT Boring Terminated at 95.60 ft bls

FIELD ROCK CORE LOG

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



Core Location: M-22R NQ Core / Auger Refusal at 72.0 ft bls Quartz Fragments ow Angle Joints, Moderate Staining Horizontal Joint, Moderate Staining ow Angle Joint, Moderate Staining ow Angle Joint, Slight Staining Low Angle Joint, No Staining High Angle Joint, Slight Staining 75 High Angle Joint, Slight Staining End of Run #1, REC - 100%, RQD - 82% Horizontal Joint, Slight Staining 85 Intensely Fractured Zone, Slight Staining; Core Loss ow Angle Joint, No Staining End of Run #3, REC - 100%, RQD - 100% 86 **EXPLANATION** Meta Gabbro Low Angle Joints, No Staining Quartz Diorite Diorite Granite \bowtie Core Loss Horizontal Joint, Slight Staining Intense Fracturing Low Angle Joint, No Staining Fractures End of Run End of Run #2, REC - 91%, REC - 83% Contact - Healed Joint High Angle Joint, Heavy Staining

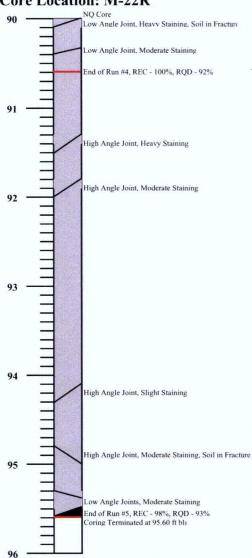
FIELD ROCK CORE LOG

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724

\$S&ME

Core Location: M-22R



EXPLANATION



Meta Gabbro



Quartz Diorite



Diorite



Granite



Core Loss



Intense Fracturing



Fractures
End of Run



Contact

COMPLETION REPORT OF WELL No. M-22R

DATE DRILLED: 12/3/07

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

WATER LEVEL: Stabilized Water Level at

49.42 ft bls

LATITUDE: 35 25 37.48

DRILLING CONTRACTOR: S&ME, Inc.

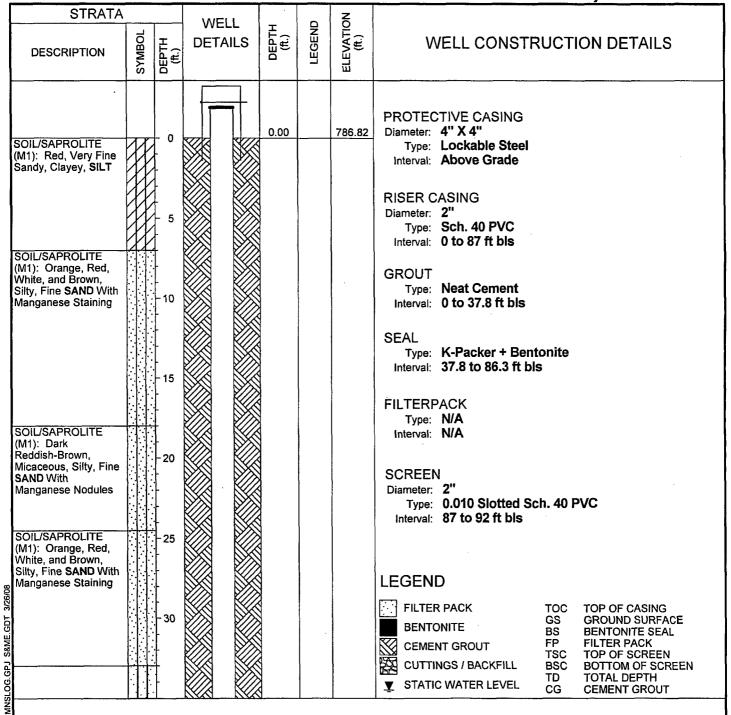
LONGITUDE: 80 56 37.32

DRILLING METHOD: 41/4" H.S.A.

TOP OF CASING ELEVATION: 789.42

DATUM: MSL

LOGGED BY: Courtney Withers



9751 Southern Pine Blvd. Charlotte, North Carolina **COMPLETION REPORT OF** WELL No. M-22R

Sheet 1 of 3

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

GROUND SURFACE ELEVATION:

LOGGED BY: **786.8**

CHECKED BY: Courtney Wither

STRATA			WELL			N.	
DESCRIPTION	SYMBOL	DEPTH (ft.))	DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
						·	(See Page 1)
SOIL/SAPROLITE (M1): Orange and White, Fine Sandy, SILT With Manganese Staining; Vertical Quartz Gravel Vein From 39.00 ft to 40.10 ft bls (continued)		- 40		37.80		749.02	
SOIL/SAPROLITE (M1): Tan, Micaceous, SILT With Manganese Staining		-45 -					
SOIL/SAPROLITE (M1): Tan, Orange, and White, Very Micaceous, Fine Sandy, SILT With Manganese Staining; White, Silty, Medium to Fine Sand Lense From 50.30 ft to 50.60 ft bls		-50	Ţ				
WEATHERED ROCK (M2): When Sampled Becomes Tan, Orange, and White, Micaceous, Silty, Medium to Fine SAND With Manganese Staining	158158	65					
SOUND ROCK (D): Medium-Grained QUARTZ DIORITE, Intensely Fractured Horizontal, High Angle and Low Angle Joints With Slight to Moderate Staining	77 77 77 77 77 77	-75		,			FILTER PACK BENTONITE CEMENT GROUT CUTTINGS / BACKFILL STATIC WATER LEVEL FILTER PACK GS GROUND SURFACE BS BENTONITE SEAL FP FILTER PACK TSC TOP OF SCREEN BOTTOM OF SCREEN TO TOTAL DEPTH CG CEMENT GROUT



9751 Southern Pine Blvd. Charlotte, North Carolina

COMPLETION REPORT OF WELL No. M-22R

PROJECT: MNS - Groundwater Protection Project GROUND SURFACE ELEVATION:

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

LOGGED BY: **786.8**

CHECKED BY: Courtney Wither

STRATA			18/51/			z	•
DESCRIPTION	SYMBOL	DEPTH (ft.)	WELL DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
SOUND ROCK (D): Medium-Grained QUARTZ DIORITE, Slightly Fractured Low Angle Joints With No Staining (continued) SOUND ROCK (D): Coarse-Grained QUARTZ DIORITE, Unfractured SOUND ROCK (D): Medium-Grained QUARTZ DIORITE, Slightly Fractured Low Angle Joints With No Staining SOUND ROCK (D): Coarse-Grained QUARTZ DIORITE, Moderately Fractured Horizontal, High Angle, and Low Angle Joints With Slight to Heavy Staining	TOBMAS	HI DEPTH 80 82 82 82 (ft.)		86.00 86.30 87.00 91.50 92.00 95.60	LEGENE	700.82 700.52 699.82 695.32 694.82 691.22	WELL CONSTRUCTION DETAILS (See Page 1) LEGEND FILTER PACK TOC TOP OF CASING GS GROUND SURFACE
NSLOG.GPJ. S&ME.GDT 3/Z6/08							BENTONITE BS BENTONITE SEAL CEMENT GROUT FP FILTER PACK TSC TOP OF SCREEN TSC TOP OF SCREEN TO TOTAL DEPTH CG CEMENT GROUT TOTAL DEPTH CG CEMENT GROUT



9751 Southern Pine Blvd. Charlotte, North Carolina

COMPLETION REPORT OF WELL No. M-22R

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



M-22R

血 Sample No: Depth (ft-bls): 9.3 - 10.8 9.3'-10.8' **Blow Count:** 2 * 2 * 3 O Sample No: 2 Depth (ft-bls): 14.3 - 15.8 **Blow Count:** 4 * 4 * 7 血 Sample No: Depth (ft-bls): 19.3 - 20.8 5 * 5 * 7 **Blow Count:** 曲 Sample No: Depth (ft-bls): 24.3 - 25.8 **Blow Count:** Sample No: 5 Depth (ft-bls): 29.3 - 30.8 29.3'-30.8' 2 * 4 * 4 **Blow Count:** O Sample No: M-22R Depth (ft-bls): 34.3 - 35.8 34.3/-35.8 2 * 3 * 4 **Blow Count:**

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



Boring Number: M-22R

血 M-22R Sample No: 7 Depth (ft-bls): 39.3 - 40.8 39.31-40.81 **Blow Count:** 3 * 3 * 4 Sample No: Depth (ft-bls): 44.3 - 45.8 **Blow Count:** 5 * 5 * 6 M-22R Sample No: Depth (ft-bls): 49.3 - 50.8 49.3-50.8 **Blow Count:** 3 * 4 * 6 Sample No: 10 M-aar Depth (ft-bls): 54.3 - 55.8 54.31-55.2 **Blow Count:** 4 * 6 * 6 Sample No: 11 m-aaR Depth (ft-bls): 59.3 - 60.8 Blow Count: 12 * 30 * 50/2 593'-60.8' Sample No: 12 Depth (ft-bls): 64.3 - 65.8 46 * 50/3 **Blow Count:**

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724

Boring Number:

M-22R

\$S&ME

Sample No: 13 M-22R
Depth (ft-bls): 69.3 - 70.8
Blow Count: 50/4

49.3-70.8

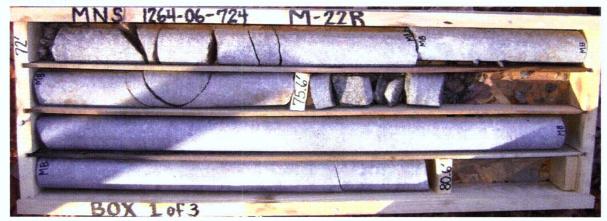
ROCK CORE PICTURES

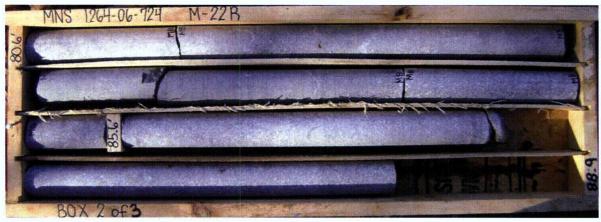
McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724

Core Location: M-22R









CLASSIFICATION:

72' to 80.55': Medium-Grained Quartz Diorite 80.55' to 81.45': Coarse-Grained Quartz Diorite 81.45' to 84.45': Medium-Grained Quartz Diorite 84.45' to 95.6': Coarse-Grained Quartz Diorite



Site Name:

MNS - GWPP

Date:

12/7/2007

Boring I.D.

M-22R

Test Interval:

54.5' to 57.5' 57.5 ft bls

(Soil/Saprolite)

Total Depth of Hole:

3 ft

1753.05 cm

Length of Open Hole:

91.46 cm

Transformation Ratio m=

Performed by:

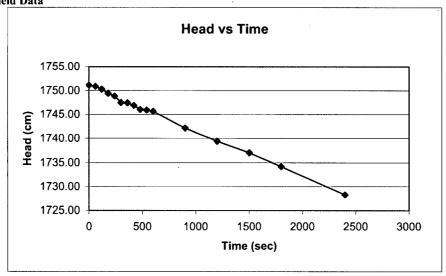
Courtney Withers

Time (sec)	Head (cm)	Permeability (cm/sec)		<u>Calculations</u>
0	1751.10			(21)
60	1750.88	5.22E-07	d^2	$\ln\left(\frac{2mL}{mL_{\odot}}\right)$
120	1750.27	1.45E-06	"	H_{\bullet} for $\left \frac{m\omega}{D}\right\rangle 4$
180	1749.45	1.98E-06	$K_h = \frac{1}{2}$	$\frac{\langle D \rangle}{\langle n \rangle} \ln \frac{ D }{ D }$
240	1748.87	1.39E-06	∥ ″ 8⋅⊿	$L \cdot (t_2 - t_1) \stackrel{\text{def}}{=} H_2$
300	1747.53	3.23E-06	, <u>, , , , , , , , , , , , , , , , , , </u>	
360	1747.44	2.18E-07	Where:	
420	1746.92	1.25E-06	K _h	is the Horizontal Coefficient of Permeability (cm/sec)
480	1746.07	2.05E-06	H ₁	is the Piezometric Head for time; $t = t_1$ (cm)
540	1745.95	3.01E-07	H ₂	is the Piezometric Head for time; $t = t_2$ (cm)
600	1745.67	6.61E-07	D	is the Diameter of the Standpipe (cm)
900	1742.16	1.69E-06	d	is the diameter of the Open Length (cm),
1200	1739.42	1.33E-06	m	is the Transformation Ratio, Where
1500	1737.04	1.15E-06		$m = \sqrt{K_b/K_{\perp}}$ K _h is the Horizontal Permeability
1800	1734.21	1.37E-06		$K_{\rm v}$ is the Vertical Permeability
2400	1728.32	1.43E-06	L	is the Open Length of Hole (cm)
			Spreadsheet as	ssumes 3" ID Pipe; NQ Hole, OD = 3"

MEAN PERMEABILITY (cm/sec)

1.33E-06

Graph of Field Data





Site Name:

MNS - GWPP

Date:

12/4/2007

Boring I.D.

M-22R

Test Interval:

71.6' to 75.6'

(Sound Rock)

Total Depth of Hole:

75.6 ft bls

2304.87 cm

Length of Open Hole:

4 ft

121.95 cm

Transformation Ratio m=

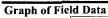
Performed by:

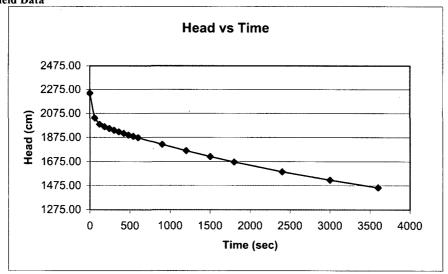
Courtney Withers

Time (sec)	Head (cm)	Permeability (cm/sec)		Calculations
0	2245.03			(21)
60	2037.93	3.33E-04	d^2	$\cdot \ln \left(\frac{2mL}{L} \right)$
120	1984.97	9.05E-05	"	H_1 for $\left \frac{m^2}{D}\right ^4$
180	1965.52	3.39E-05	$ K_h = \frac{1}{2}$	${}$ \cdot $\ln {}$
240	1949.91	2.74E-05	" 8· <i>I</i>	$L \cdot (t_2 - t_1) \qquad H_2$
300	1935.98	2.47E-05		
360	1922.26	2.45E-05	Where:	
420	1909.15	2.35E-05	K _h	is the Horizontal Coefficient of Permeability (cm/sec)
480	1896.13	2.35E-05	H_1	is the Piezometric Head for time; $t = t_1$ (cm)
540	1884.94	2.03E-05	H ₂	is the Piezometric Head for time; $t = t_2$ (cm)
600	1873.20	2.15E-05	D	is the Diameter of the Standpipe (cm)
900	1817.41	2.08E-05	d	is the diameter of the Open Length (cm),
1200	1764.94	2.01E-05	m	is the Transformation Ratio, Where
1500	1717.56	1.87E-05		$m = \sqrt{K_b/K_{}}$ K _h is the Horizontal Permeability
1800	1672.04	1.85E-05		$K_{\rm v}$ is the Vertical Permeability
2400	1591.43	1.70E-05	L	is the Open Length of Hole (cm)
3000	1521.40	1.55E-05		
3600	1458.78	1.45E-05	Spreadsheet as	ssumes 3" ID Pipe; NQ Hole, OD = 3"

MEAN PERMEABILITY (cm/sec)

4.40E-05







Site Name:

Date:

MNS - GWPP 12/5/2007

Boring 1.D.

M-22R

Test Interval:

71.6' to 80.6'

(Sound Rock)

Total Depth of Hole:

80.6 ft bls

2457.32 cm 274.39 cm

Length of Open Hole:

9 ft

Transformation Ratio m=

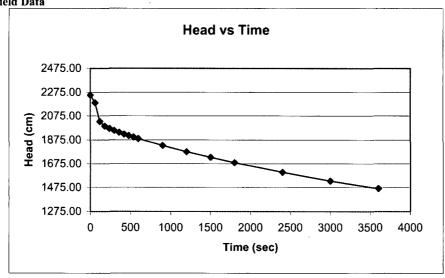
Performed by: Courtney Withers

Time (sec)	Head (cm)	Permeability (cm/sec)		<u>Calculations</u>
0	2253.17			(2
60	2187.01	5.62E-05	d^2	$\ln\left(\frac{2mL}{mL}\right)$
120.	2029.76	1.41E-04	"	H_{\cdot} for $\left \frac{1}{D}\right ^{4}$
180	1990.55	3.68E-05	$ K_h = \frac{1}{2}$	
240	1970.88	1.87E-05	∥ ″ 8⋅.	$L \cdot (t_2 - t_1) \qquad H_2$
300	1953.41	1.68E-05		
360	1939.02	1.39E-05	Where:	
420	1924.33	1.43E-05	K _h	is the Horizontal Coefficient of Permeability (cm/sec)
480	1911.07	1.30E-05	H ₁	is the Piezometric Head for time; $t = t_1$ (cm)
540	1898.81	1.21E-05	H ₂	is the Piezometric Head for time; $t = t_2$ (cm)
600	1886.31	1.25E-05	. D	is the Diameter of the Standpipe (cm)
900	1828.54	1.17E-05	d	is the diameter of the Open Length (cm),
1200	1776.25	1.09E-05	m	is the Transformation Ratio, Where
1500	1728.08	1.04E-05		$m = \sqrt{K_b/K}$ K _h is the Horizontal Permeability
1800	1683.78	9.79E-06	1	K_{v} is the Vertical Permeability
2400	1603.11	9.26E-06	L	is the Open Length of Hole (cm)
3000	1529.66	8.84E-06		
3600	1468.20	7.73E-06	Spreadsheet as	ssumes 3" ID Pipe; NQ Hole, OD = 3"

MEAN PERMEABILITY (cm/sec)

2.38E-05





Calculation of Permeability By The Rising Head Method (Slug Test)



Site Name: MNS-GWPP **Test Date:** 12/13/2007 Well Label: M-22R **Aquifer Thickness:** 47.58 feet Screen Length: 5. feet **Casing Radius:** 1. Inches **Effective Radius:** 1.5 Inches **Static Water Level:** 49.42 feet Water Table to Screen Bottom: 42.58 feet **Anisotropy Ratio:**

Time Adjustment:

0. Seconds

Test starts with trial 0

There are 84 time and drawdown measurements

Maximum head is 1.454 feet Minimum head is 0, feet

Calculation by Bouwer and Rice Graphical Method MNS-GWPP **Bouwer and Rice Graph** 12/13/07 M-22R Bouwer and Rice parameter A = 2.7 Bouwer and Rice parameter B = 0.5 In(Re/Rw) = 3.308372e+000 Analysis starts at time 9. Seconds Analysis ends at time 8. minutes 40 Measurements analyzed from 4 to 43 2 Points not plotted because head ratio <= 0.0 These points are not included in the analysis Hydraulic Conductivity = 1.995e-004 cm/sec Transmissivity = 2.5 meters2/day 10 Adjusted Time (minutes)

Analysis by Julie Petersen of S&ME, Inc.

Ho is 1.454 feet at 0. Seconds

PERMEABILITY 2.00 x 10⁻⁰⁴ cm/sec



S&ME, Inc. 9751 Southern Pine Blvd. Charlotte, North Carolina Telephone: 704-523-4726 Fax: 704-525-3953

1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

Project:	Doi ing 170. 171-25										23				
Location	: Hunt	ersville,	North Carolina		Number:	1264-	-06-724				Sheet	No.	lof	2	
Boring D	Depth (ft):		50.9 Elevation	(ft): 775.5	Driller:	Justin M Cert. No	Millwood, NC Date Drilled: 11/29/07								
Logged By: Courtney Withers Water Level: Stabilized Water Leve							at 37.66 ft bls Drilling Method: 41/4" H.S.A.								
Elev. (Feet)	Depth (Feet)	Lith- ology	Mate	rial Description			Well Construction			netration		ance (Blow		t) 100
775			GRASS and TO								Т	Ĭ			
E			SOIL/SAPROLIT	ΓΕ (M1): Reddish-Bro	wn, Clayey	,SILT									
<u> -</u>													,		·
E	_ 													İ	
770	5 —											\vdash	+	+	H
_	_		Slightly Clayey, 1	TE (M1): Reddish-Yell Fine Sandy, SILT With											
Ė	_		Staining	,											
_ 765	10-							IM	6					+-	H
F															
E													-		
F								_							
_ 760	15-			TE (M1): Yellow-Brov				IM	8	++			-	+-	\vdash
-	_			Very Fine Sandy, SILT ing; Large Manganese											
	-														
-														ļ	
755	20-								7		\perp		_	+-	
755	_														
-	_														
3/26/08	_														
5 - 750	25—							M	-	-	-			-	\sqcup
750 	-														
<u>5</u> -				TE (M1): White, Tan,											
	-		With Manganese	, Clayey, Coarse to Fine Nodules	г эап ау, SI	LΙ									
WINST.	30-												_		
745	-							ĺΫ							
<u>∓</u> _ }-	_				÷									•	
750	-														
		<u> </u>						X							



S&ME, Inc. 9751 Southern Pine Blvd. Charlotte, North Carolina Telephone: 704-523-4726 Fax: 704-525-3953

1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. 1.D. SAMPLER 1 FT.

Project: MNS - Groundwater Protection Project Boring No. M-23 Huntersville, North Carolina 1264-06-724 Location: Number: Sheet No. 2 of 2 Driller: Justin Millwood, NC Boring Depth (ft): 50.9 Elevation (ft): 775.5 Date Drilled: 11/29/07 Cert. No. 3439 Logged By: Courtney Withers Water Level: Stabilized Water Level at 37.66 ft bls Drilling Method: 41/4" H.S.A. Depth (Feet) Well Penetration Resistance (Blows/Foot) Elev. Lith-Material Description (Feet) ology Construction **- 740** Ţ 735 -730 12 - 725 Boring Terminated at 50.90 ft bls BORING LOG WITH WELL MNSLOG.GPJ LAGWGN01.GDT 3/26/08

DATE DRILLED: 11/29/07

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

WATER LEVEL: Stabilized Water Level at

37.66 ft bls

LATITUDE: 35 25 39.69

DRILLING CONTRACTOR: S&ME, Inc.

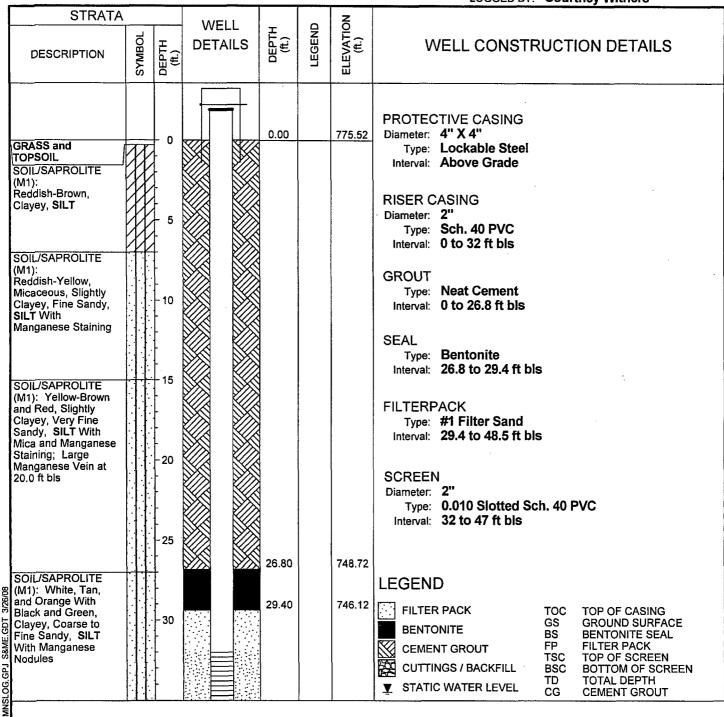
LONGITUDE: 80 56 23.01

DRILLING METHOD: 41/4" H.S.A.

TOP OF CASING ELEVATION: 778.23

DATUM: MSL

LOGGED BY: Courtney Withers



9751 Southern Pine Blvd. Charlotte, North Carolina **COMPLETION REPORT OF** WELL No. M-23

Sheet 1 of 2

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

GROUND SURFACE ELEVATION:

LOGGED BY: **775.5**

CHECKED BY: Courtney Wither

STRATA ELEVATION (ft.) WELL DEPTH (ft.) LEGEND SYMBOL DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **DESCRIPTION** (See Page 1) 35 SOIL/SAPROLITE (M1): White, Tan, and Orange With Black and Green, Clayey, Coarse to Fine Sandy, SILT With Manganese Nodules (continued) 729.02 46.50 47.00 728.52 48.50 727.02 50.90 724.62 **LEGEND** MONITORING WELL MNSLOG.GPJ S&ME.GDT 3/26/08 FILTER PACK TOC TOP OF CASING GS **GROUND SURFACE** BENTONITE BS FP **BENTONITE SEAL** FILTER PACK **CEMENT GROUT TSC** TOP OF SCREEN **CUTTINGS / BACKFILL BSC BOTTOM OF SCREEN** TD TOTAL DEPTH ▼ STATIC WATER LEVEL **CEMENT GROUT** CG



9751 Southern Pine Blvd. Charlotte, North Carolina **COMPLETION REPORT OF** WELL No. M-23

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724

Boring Number:

M-23

Sample No: 1

Depth (ft-bls): 9.4 - 10.9

Blow Count: 3 * 2 * 4

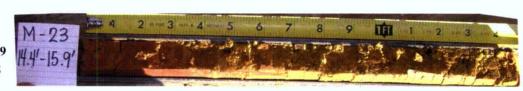


Sample No:

2

Depth (ft-bls): 14.4 - 15.9

Blow Count: 4 * 3 * 5



Sample No:

. . .

Depth (ft-bls): 19.4 - 20.9

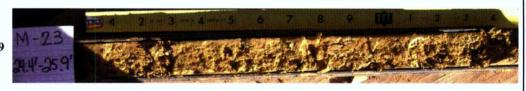
Blow Count: 3 * 3 * 4



Sample No:

Depth (ft-bls): 24.4 - 25.9

Blow Count: 2 * 3 * 4



Sample No:

5

Depth (ft-bls): 29.4 - 30.9

Blow Count: 2 * 2 * 3



Sample No: 6

Depth (ft-bls): 34.4 - 35.9

Blow Count: 2 * 3 * 4

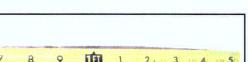


McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



M-23



Sample No: 7

Depth (ft-bls): 39.4 - 40.9

Blow Count: 2 * 2 * 2

Sample No: 8

Depth (ft-bls): 44.4 - 45.9 Blow Count: 2 * 3 * 3



Sample No: 9

Depth (ft-bls): 49.4 - 50.9

Blow Count: 3 * 5 * 7





Site Name:

MNS - GWPP

Date:

11/30/2007

Boring I.D.

M-23

Test Interval:

Performed by:

39.3' to 42.3'

(Soil/Saprolite)

Total Depth of Hole:

42.3 ft bls

1289.63 cm

Length of Open Hole:

3 ft

91.46 cm

Transformation Ratio m=

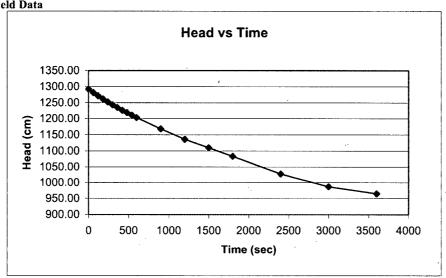
Courtney Withers

Time (sec)	Head (cm)	Permeability (cm/sec)		<u>Calculations</u>
0	1292.80			(2
60	1281.74	3.61E-05	d^2 .	$\ln\left(\frac{2mL}{m}\right)$
120	1271.65	3.32E-05		H_{\bullet} for $\frac{m_{\bullet}}{D}$ $\downarrow 4$
180	1261.65	3.32E-05	$ K_{h} = \frac{1}{2}$	$\frac{\langle D \rangle}{\langle D \rangle} \cdot \ln \frac{ D \rangle}{\langle D \rangle}$
240	1252.53	3.05E-05	$\ \cdot\ = 8 \cdot I$	$L \cdot (t_2 - t_1) = H_2$
300	1243.45	3.06E-05		
360	1235.24	2.78E-05	Where:	
420	1226.40	3.02E-05	K _h	is the Horizontal Coefficient of Permeability (cm/sec)
480	1219.02	2.54E-05	H ₁	is the Piezometric Head for time; t = t ₁ (cm)
540	1211.07	2.75E-05	H ₂	is the Piezometric Head for time; $t = t_2$ (cm)
600	1203.38	2.68E-05	D	is the Diameter of the Standpipe (cm)
900	1168.48	2.47E-05	d	is the diameter of the Open Length (cm),
1200	1136.80	2.31E-05	m	is the Transformation Ratio, Where
1500	1110.30	1.98E-05	,	$m = \sqrt{K_h/K_y}$ K _h is the Horizontal Permeability
1800	1083.60	2:05E-05		$K_{\rm v}$ is the Vertical Permeability
2400	1027.44	2.24E-05	L	is the Open Length of Hole (cm)
3000	987.16	1.68E-05		
3600	965.27	9.43E-06	Spreadsheet as:	sumes 3" ID Pipe; NQ Hole, OD = 3"

MEAN PERMEABILITY (cm/sec)

2.58E-05





Calculation of Permeability By The Rising Head Method (Slug Test)



Site Name: MNS-GWPP **Test Date:** 12/13/2007 Well Label: M-23**Aquifer Thickness:** 14.34 feet Screen Length: 15. feet **Casing Radius:** 1. Inches **Effective Radius:** 3. Inches **Gravel Pack Porosity:** 30.00% **Corrected Casing Radius:** 1.844 Inches 37.66 feet

Static Water Level: Water Table to Screen Bottom:

Anisotropy Ratio:

Time Adjustment:

0. Seconds

9.34 feet

Test starts with trial 0

There are 101 time and drawdown measurements

Maximum head is 3.146 feet Minimum head is 0. feet

Calculation by Bouwer and Rice Graphical Method

MNS-GWPP **Bouwer and Rice Graph** 12/13/07 Bouwer and Rice parameter A = 2.617 Bouwer and Rice parameter B = 0.4881 ln(Re/Rw) = 2.689586e+000 Gravel Pack Porosity: = 30. % Corrected Casing Radius: = 1.844 Inches Analysis starts at time 66. Seconds Analysis ends at time 16. minutes 27 Measurements analyzed from 18 to 44 2 Points not plotted because head ratio <= 0.0 These points are not included in the analysis Head Ratio (Ht/Ho) 1 e-002 Hydraulic Conductivity = 8.227e-005 cm/sec Transmissivity = 0.3107 meters2/day

Analysis by Julie Petersen of S&ME, Inc.

Ho is 3.146 feet at 0. Seconds

Adjusted Time (Hours)

PERMEABILITY

8.23 x 10⁻⁰⁵ cm/sec

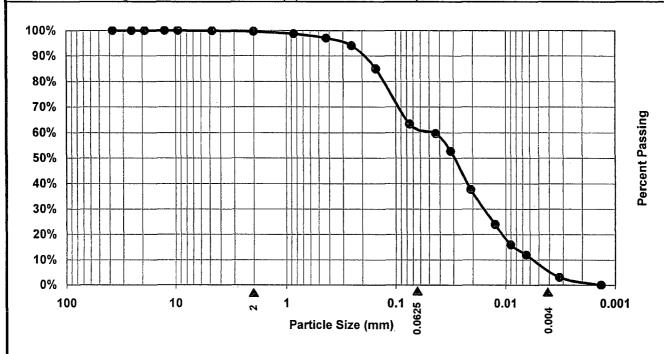
PARTICLE SIZE ANALYSIS OF SOILS FOR USE IN FETTER AND BEAR DIAGRAMS

 Boring No.:
 Sample No.:
 Depth:

 M-23
 SS-5
 29.4 to 30.9 ft bls

Sample Description:

White, Tan, Orange With Black and Green, Clayey, Coarse to Fine Sandy, Silt



•	> 2 mm	2 mm - 0.0625 mm	0.0625 mm - 0.004 mm	<0.004 mm
From Graph:	% Gravel	% Sand	% Silt	% Clay
	0.4%	37.5%	57.0%	5.1%
Adjusted for Calculations	0%	38%	57%	5%

Notes:

Grain size distribution taken from grain size with hydrometer data located in Appendix II.

Gravel, sand, silt and clay sizes based on Wentworth Scale.

S&ME Project:

McGuire Nuclear Station - GWPP

S&ME Project No.:

1264-06-724



FETTER AND BEAR DIAGRAMS

S&ME PROJECT: McGuire Nuclear Station - GWPP

S&ME PROJECT NO.: 1264-06-724



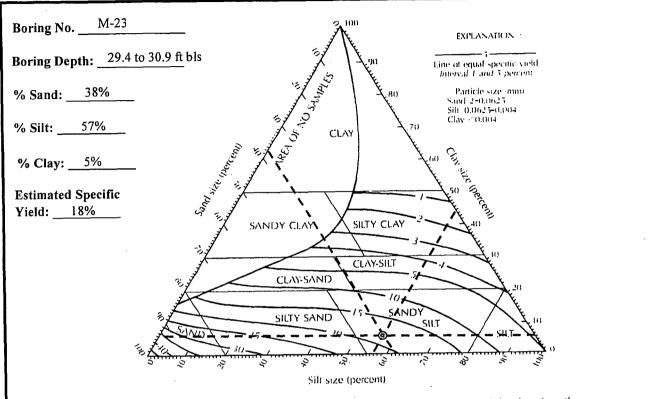
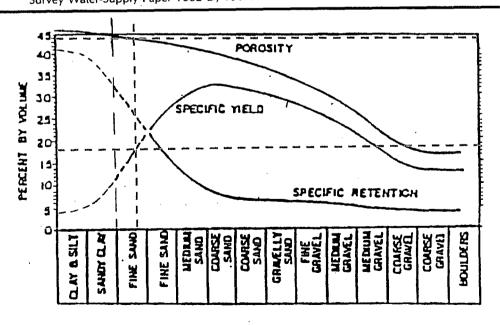


FIGURE 4.11 Textural classification triangle for unconsolidated materials showing the relation between particle size and specific yield. Source: A. I. Johnson, U.S. Geological Survey Water-Supply Paper 1662-D, 1967.



Estimated Porosity: 44%

Variation of Porosity, Specific Yield, and Specific Retention with Grain Size (after Bear, 1972)



S&ME, Inc. 9751 Southern Pine Blvd. Charlotte, North Carolina Telephone: 704-523-4726 Fax: 704-525-3953

1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

Project:	Project: MNS - Groundwater Protection Project Boring										0
Location	n: Huntersville ,	North Carolina		Number:	1264-	06-724		Sheet No. 1 of 2			
Boring I	Depth (ft):	50.7 Elevation (ft): 733.5	Driller:	Justin M Cert. No	lillwood, NC . 3439	Date Dr	rilled: 5/17/07			
Logged By: Courtney Withers Water Level: Stabilized Water Level at 42.59 ft bls Drilling Method:									Iud Rotar	у	
Elev. (Feet)	Depth Lith- (Feet) ology	Mater	ial Description			Well Construction	1	netration Re		Blows/I	1
			E (M1): Red, Micaceo	ous, Slightly	y	I S S			50		100
E		Sandy, Clayey, SI	LT								
<u> </u>											
- 730 -											
E	5-									+-	
F											
E											
- 725							1 1				
.[10-										
_											
720 			E (M1): Yellow, Red,								
	15		Manganese Staining; From 17.00 to 17.25 ft		m to						
F											
-											
715											.
<u> -</u>	20							- '			
_			E (M1): White, Tan, a		Silty,						
710 - - -		Medium to Fine S	AND With Manganese	Staining							.
132	25										
SN01.6											
LAGW T			E (M1): White, Tan,	and Black,	···						
705 — 705		Micaceous, Slight	ly Sandy, SILT								
MNSTO	30—										
WELL]]]]										
MTH 			E (M1): Greenish-Bla		ıd						
BORING LOG WITH WELL MINSLOG GPJ LAGWGND1.GDT		White, Micaceous Staining	, Clayey, SILT With M	/langanese							
800R 											



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1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO

Fax: 704-525-3953 DRIVE 1.4 IN. I.D. SAMPLER 1 FT. Project: MNS - Groundwater Protection Project Boring No. M-30 Location: Huntersville, North Carolina Number: 1264-06-724 Sheet No. 2 of 2 Driller: Justin Millwood, NC Boring Depth (ft): Elevation (ft): 733.5 Date Drilled: 5/17/07 Cert. No. 3439 Logged By: Courtney Withers Water Level: Stabilized Water Level at 42.59 ft bls Drilling Method: Mud Rotary Penetration Resistance (Blows/Foot) Depth Lith-Well Elev. Material Description (Feet) (Feet) ology Construction 695 SOIL/SAPROLITE (M1): Greenish-Black and Tan, Ā Micaceous, Slightly Sandy, SILT With Manganese 690 Staining and White, Medium to Fine Sand Lenses WEATHERED ROCK (M2): When Sampled Becomes 685 Greenish-Black and Tan, Micaceous, Silty, Medium to Fine SAND With Manganese Staining Boring Terminated at 50.70 ft bls Lithologic Descriptions Obtained From M-30R BORING LOG WITH WELL MNSLOG.GPJ LAGWGN01.GDT 3/26/08

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

WATER LEVEL: Stabilized Water Level at

42.59 ft bls

LATITUDE: 35 25 38.90

DRILLING CONTRACTOR: S&ME, Inc.

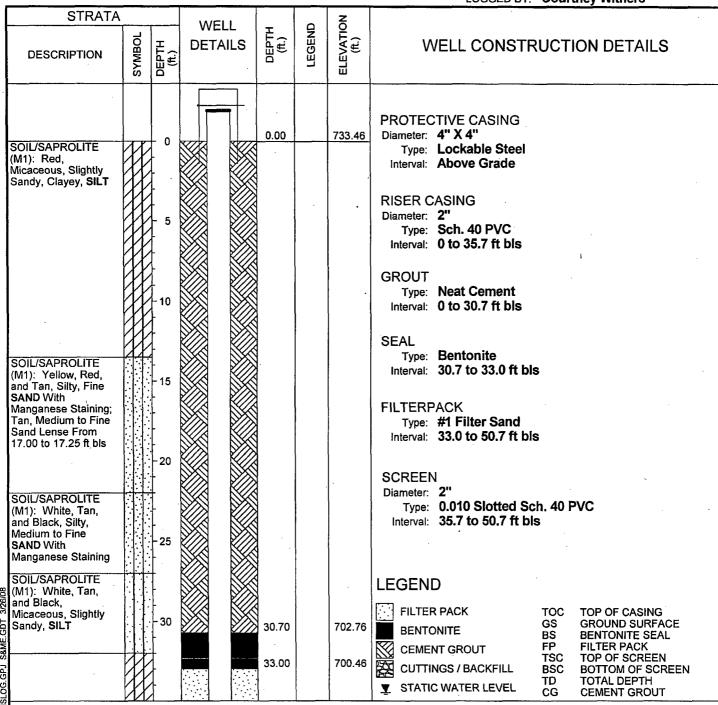
LONGITUDE: 80 57 02.23

DRILLING METHOD: Mud Rotary DATE DRILLED: 5/17/07

TOP OF CASING ELEVATION: 736.50

DATUM: MSL

LOGGED BY: Courtney Withers





9751 Southern Pine Blvd. Charlotte, North Carolina

COMPLETION REPORT OF WELL No. M-30

PROJECT: MNS - Groundwater Protection Project
PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

GROUND SURFACE ELEVATION:

LOGGED BY: 733.5

CHECKED BY: Courtney Wither

STRATA			11/511			z	One one of the
DESCRIPTION	SYMBOL	DEPTH (ft.)	DETAILS	DEPTH (ft.)	TEGEND	ELEVATIO (ft.)	WELL CONSTRUCTION DETAILS
		(1) 35 40 -45 -50	WELL DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (f.) (7.) (6.2)	WELL CONSTRUCTION DETAILS (See Page 1)
VSLOG.GPJ S&ME.GDT 3/26/08							LEGEND FILTER PACK BENTONITE CEMENT GROUT CUTTINGS / BACKFILL STATIC WATER LEVEL CEGEND TOC TOP OF CASING GS GROUND SURFACE BS BENTONITE SEAL FP FILTER PACK TSC TOP OF SCREEN TOTAL DEPTH CG CEMENT GROUT



9751 Southern Pine Blvd. Charlotte, North Carolina

COMPLETION REPORT OF WELL No. M-30

Calculation of Permeability By The Rising Head Method (Slug Test)



Site Name: MNS-GWPP **Test Date:** 5/23/2007 Well Label: M-30 **Aguifer Thickness:** 13.11 feet **Screen Length:** 15. feet **Casing Radius:** 1. Inches **Effective Radius:** 3. Inches **Gravel Pack Porosity:** 30.00% **Corrected Casing Radius:** 1.844 Inches **Static Water Level:** 42.59 feet Water Table to Screen Bottom: 8.11 feet **Anisotropy Ratio:**

Time Adjustment:

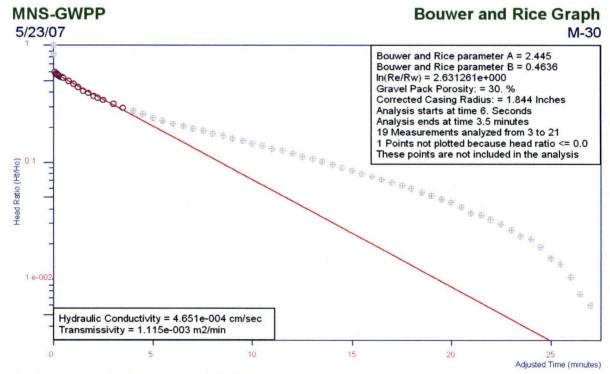
0. Seconds

Test starts with trial 0

There are 69 time and drawdown measurements

Maximum head is 1.326 feet Minimum head is 0. feet

Calculation by Bouwer and Rice Graphical Method



Analysis by Julie Petersen of S&ME, Inc.

Ho is 1.326 feet at 0. Seconds

PERMEABILITY

4.65E-04 cm/sec



S&ME, Inc. 9751 Southern Pine Blvd. Charlotte, North Carolina Telephone: 704-523-4726 Fax: 704-525-3953

1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

Project: MNS - Groundwater Protection Project Boring No. M-30R Huntersville, North Carolina Location: Number: 1264-06-724 Sheet No. 1 of 3 Driller: Justin Millwood, NC Boring Depth (ft): 89.6 Elevation (ft): 733.8 Date Drilled: 5/14/07 Cert. No. 3439 Logged By: Courtney Withers Water Level: Stabilized Water Level at 42.88 ft bls Drilling Method: Mud Rotary Penetration Resistance (Blows/Foot) Well Elev. Depth Lith-Material Description (Feet) (Feet) ology Construction 100 SOIL/SAPROLITE (M1): Red, Micaceous, Slightly Sandy, Clayey, SILT 19 730 13 725 SOIL/SAPROLITE (M1): Yellow, Red, and Tan, Silty, -720 Fine SAND With Manganese Staining; Tan, Medium to Fine Sand Lense From 17.00 to 17.25 ft bls. 13 -715 20 SOIL/SAPROLITE (M1): White, Tan, and Black, Silty, Medium to Fine SAND With Manganese Staining 14 -710 SOIL/SAPROLITE (M1): White, Tan, and Black, Micaceous, Slightly Sandy, SILT MNSLOG.GPJ **- 705** 30 SOIL/SAPROLITE (M1): Greenish-Black, Tan, and White, Micaceous, Clayey, SILT With Manganese 11 Staining 700



665

Roller Cone Refusal at 69.7 ft bls

S&ME, Inc. 9751 Southern Pine Blvd. Charlotte, North Carolina

1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

> 50/ 2 ×

2. PENETRATION (N-VALUE) IS THE NUMBER OF

Telephone: 704-523-4726 BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO ENGINEERING • TESTING ENVIRONMENTAL SERVICES Fax: 704-525-3953 DRIVE 1.4 IN. I.D. SAMPLER 1 FT. Project: MNS - Groundwater Protection Project Boring No. M-30R Huntersville, North Carolina 1264-06-724 Location: Number: Sheet No. 2 of 3 Driller: Justin Millwood, NC Boring Depth (ft): 89.6 Elevation (ft): 733.8 Date Drilled: 5/14/07 Cert. No. 3439 Logged By: Courtney Withers Water Level: Stabilized Water Level at 42.88 ft bls Drilling Method: Mud Rotary Well Penetration Resistance (Blows/Foot) Elev. Depth Lith-Material Description (Feet) (Feet) ology Construction 13 695 SOIL/SAPROLITE (M1): Greenish-Black and Tan, Micaceous, Slightly Sandy, SILT With Manganese 41 Staining and White, Medium to Fine Sand Lenses 690 50/ X WEATHERED ROCK (M2): When Sampled Becomes 685 Greenish-Black and Tan, Micaceous, Silty, Medium to Fine SAND With Manganese Staining 50/ X 680 50/ \boxtimes BORING LOG WITH WELL MNSLOG.GPJ LAGWGN01.GDT 3/26/08 675 50/ \boxtimes



S&ME, Inc. 9751 Southern Pine Blvd. Charlotte, North Carolina Telephone: 704-523-4726 Fax: 704-525-3953

1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

Project: MNS - Groundwater Protection Project Boring No. M-30R Location: Huntersville, North Carolina 1264-06-724 Number: Sheet No. 3 of 3 Justin Millwood, NC 89.6 Driller: Boring Depth (ft): Elevation (ft): 733.8 Date Drilled: 5/14/07 Cert. No. 3439 Logged By: Courtney Withers Water Level: Stabilized Water Level at 42.88 ft bls Drilling Method: Mud Rotary Well Penetration Resistance (Blows/Foot) Elev. Depth Lith-Material Description (Feet) (Feet) ology Construction + PARTIALLY WEATHERED/FRACTURED ROCK + (WF): Medium-Grained GRANITE, Intensely Fractured, + + With Intermittent Soil Seams + - 660 75 SOUND ROCK (D): Medium-Grained QUARTZ NL DIORITE With Intermittent Fine-Grained DIORITE and Possible Volcanic Intrusion; Moderately to Intensely Fractured 655 650 645 Boring Terminated at 89.55 ft bls BORING LOG WITH WELL MNSLOG.GPJ LAGWGN01.GDT 3/26/08

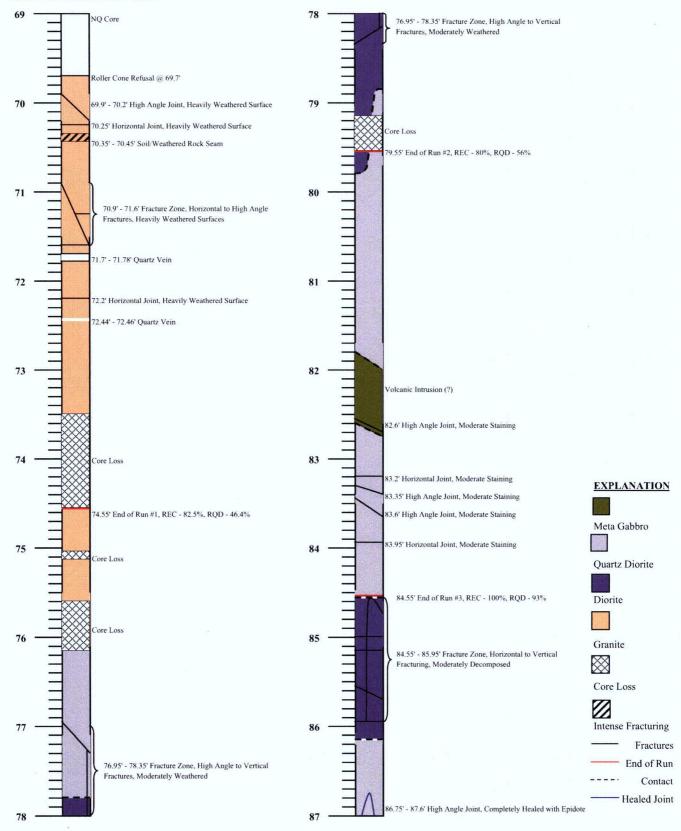
FIELD ROCK CORE LOG

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



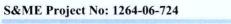
Core Location: M-30R



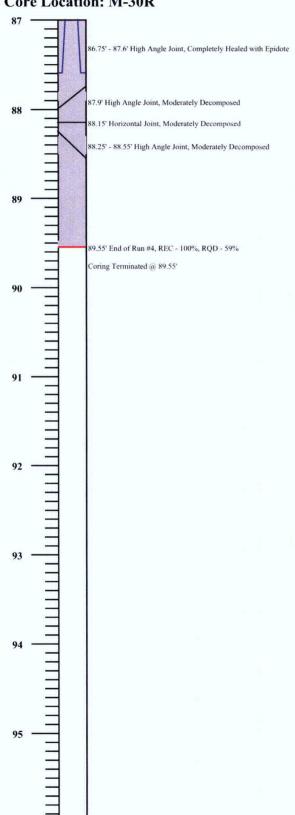
FIELD ROCK CORE LOG

McGuire Nuclear Station - Groundwater Protection Project

Core Location: M-30R







Meta Gabbro Quartz Diorite Diorite Granite Core Loss Intense Fracturing Fractures End of Run Contact

Healed Joint

COMPLETION REPORT OF WELL No. M-30R

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

WATER LEVEL: Stabilized Water Level at

42.88 ft bls

LATITUDE: 35 25 38.92

LONGITUDE: 80 57 02.19

DRILLING CONTRACTOR: S&ME, Inc. DRILLING METHOD: Mud Rotary

DATE DRILLED: 5/14/07

TOP OF CASING ELEVATION: 736.99

DATUM: MSL

LOGGED BY: Courtney Withers

						LOGGED BT: Countries Withers
STRATA	T	WELL	Ŧ	٩D	NOL	
DESCRIPTION	SYMBOL DEPTH	DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
SOIL/SAPROLITE (M1): Red, Micaceous, Slightly Sandy, Clayey, SILT	5		0.00	·	733.80	PROTECTIVE CASING Diameter: 4" X 4" Type: Lockable Steel Interval: Above Grade RISER CASING Diameter: 2" Type: Sch. 40 PVC Interval: 0 to 72.1 ft bls GROUT Type: Neat Cement Interval: 0 to 70 ft bls
SOIL/SAPROLITE (M1): Yellow, Red, and Tan, Silty, Fine SAND With Manganese Staining; Tan, Medium to Fine Sand Lense From 17.00 to 17.25 ft bls.	-15					SEAL Type: K-Packer + Bentonite Interval: 70 to 72.3 ft bis FILTERPACK Type: N/A Interval: N/A SCREEN
SOIL/SAPROLITE (M1): White, Tan, and Black, Silty, Medium to Fine SAND With Manganese Staining	- 25					Diameter: 2" Type: 0.010 Slotted Sch. 40 PVC Interval: 73.5 to 78.5 ft bls
SOIL/SAPROLITE (M1): White, Tan, and Black, Micaceous, Slightly Sandy, SILT	-30					FILTER PACK BENTONITE CEMENT GROUT CUTTINGS / BACKFILL STATIC WATER LEVEL TOC TOP OF CASING GS GROUND SURFACE BS BENTONITE SEAL FP FILTER PACK TOP OF SCREEN TOP OF SCREEN TO TOTAL DEPTH CG CEMENT GROUT

9751 Southern Pine Blvd. Charlotte, North Carolina **COMPLETION REPORT OF** WELL No. M-30R

Sheet 1 of 3

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

GROUND SURFACE ELEVATION:

LOGGED BY: 733.8

CHECKED BY: Courtney Wither

STRATA ELEVATION (ft.) **WELL** LEGEND DEPTH (ft.) SYMBOL DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS DESCRIPTION (See Page 1) 35 SOIL/SAPROLITE (M1): Greenish-Black, Tan, and White, Micaceous, Clayey, SILT With Manganese Staining (continued) SOIL/SAPROLITE (M1): Greenish-Black and Tan, Micaceous, Slightly Sandy, SILT With Manganese Staining and White, Medium to Fine Sand Lenses WEATHERED ROCK (M2): When Sampled Becomes Greenish-Black and Tan, Micaceous, Silty, Medium to Fine SAND With Manganese Staining 70.00 663.80 PARTIALLY WEATHERED/FRACTURED ROCK (WF): LEGEND 72.10 661.70 Medium-Grained 661.50 72.30 GRANITE, Intensely FILTER PACK TOC 660.30 TOP OF CASING 73.50 Fractured, With GS **GROUND SURFACE** Intermittent Soil **BENTONITE** BS BENTONITE SEAL 75 Seams FP FILTER PACK **CEMENT GROUT TSC** TOP OF SCREEN **CUTTINGS / BACKFILL BSC BOTTOM OF SCREEN** MNSLOG.GPJ 78.00 655.80 **TOTAL DEPTH** TD ▼ STATIC WATER LEVEL CEMENT GROUT 78.50 655.30 CG



9751 Southern Pine Blvd. Charlotte, North Carolina

COMPLETION REPORT OF WELL No. M-30R

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

ect

GROUND SURFACE ELEVATION:

LOGGED BY: 733.8

CHECKED BY: Courtney Wither

PROJECT LOCATION: Huntersville, North Carolina

STRATA ELEVATION (ft.) **WELL** DEPTH (ft.) LEGEND SYMBOL DEPTH (ft.) **DETAILS** WELL CONSTRUCTION DETAILS **DESCRIPTION** (See Page 1) SOUND ROCK (D): 80,30 653.50 - 80 Medium-Grained 17/ **QUARTZ DIORITE** 17/ With Intermittent Fine-Grained **DIORITE** and Possible Volcanic 1 77 57 Intrusion; Moderately - 85 to intensely Fractured (continued) 12 89.55 644.25 **LEGEND** MNSLOG.GPJ S&ME.GDT 3/26/08 TOP OF CASING GROUND SURFACE FILTER PACK TOC GS BENTONITE BS **BENTONITE SEAL** FILTER PACK TOP OF SCREEN FP **CEMENT GROUT** TSC **CUTTINGS / BACKFILL BSC BOTTOM OF SCREEN TOTAL DEPTH** TD ▼ STATIC WATER LEVEL **CEMENT GROUT** CG



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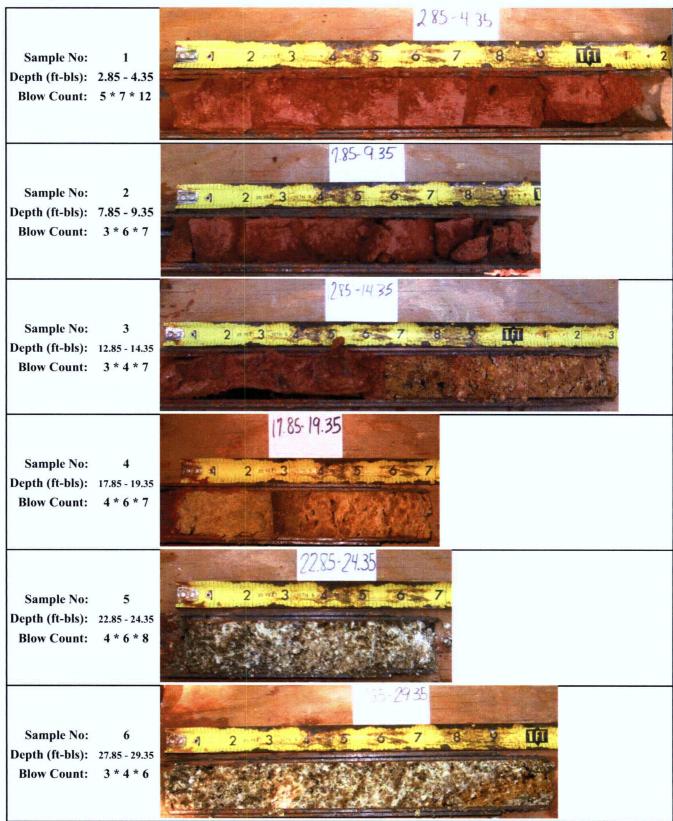
COMPLETION REPORT OF WELL No. M-30R

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724

Boring Number: M-30R



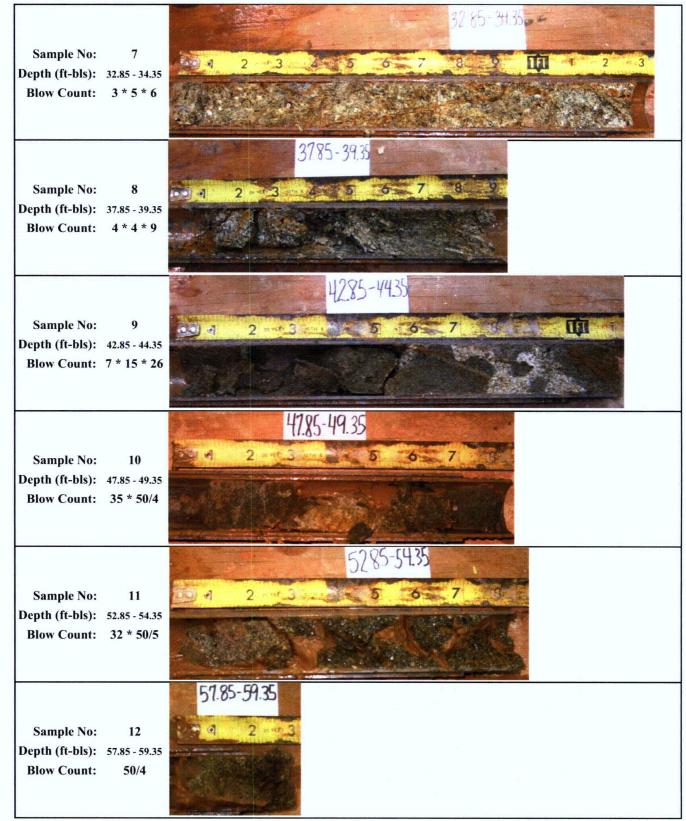


McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724

Boring Number:

M-30R



McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



Boring Number: M-30R

Sample No: 13 Depth (ft-bls): 62.85 - 64.35 **Blow Count:** 50/4 Sample No: Depth (ft-bls): 67.85 - 69.35 **Blow Count:** 50/2

ROCK CORE PICTURES

McGuire Nuclear Station - Groundwater Protection Project

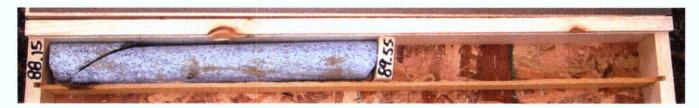
S&ME Project No: 1264-06-724

Core Location: M-30R









CLASSIFICATION:

69.7' to 76.15' Medium Grained Granite

76.15' to 77.8' Medium Grained Quartz Diorite

77.8' to 79.4' Fine Grained Diorite

79.4' to 81.8' Medium Grained Quartz Diorite

81.8' to 82.65' Volcanic Intrusion (?)

82.65' to 84.55' Medium Grained Quartz Diorite

84.55' - 86.15' Fine Grained Diorite

86.15' to 89.55' Medium Grained Quartz Diorite

CALCULATION OF PERMEABILITY BY THE FALLING HEAD METHOD SEN (Open Hole in Uniform Material)



Site Name:

MNS - GWPP

Date:

5/14/2007

Boring I.D.

M-30R

38.7' to 41.7'

(Soil/Saprolite)

Test Interval: Total Depth of Hole:

41.7 ft bls

1271.34 cm

Length of Open Hole:

3 ft

Transformation Ratio m=

1

91.46 cm

Performed by:

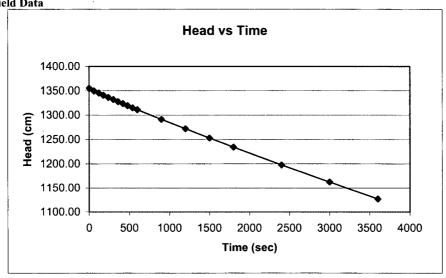
Julie Petersen

Time (sec)	Head (cm)	Permeability (cm/sec)		<u>Calculations</u>
0	1355.46	•		(21)
60	1349.85	1.74E-05	$\ d^2 \ $	$\cdot \ln \left(\frac{2mL}{L} \right)$
120	1345.61	1.32E-05		H_1 for $\frac{m^2}{D}$
180	1341.04	1.43E-05	$K_h = \frac{1}{2}$	$\frac{1}{2} \cdot \ln \frac{D}{1}$
240	1336.62	1.39E-05	$\ \cdot \ \cdot \ $ 8 · 1	$L \cdot (t_2 - t_1) \stackrel{\text{def}}{=} H_2$
300	1332.26	1.37E-05		
360	1328.08	1.32E-05	Where:	
420	1323.87	1.33E-05	K _h	is the Horizontal Coefficient of Permeability (cm/sec)
480	1319.66	1.34E-05	H_1	is the Piezometric Head for time; t = t _i (cm)
540	1315.27	1.40E-05	H_2	is the Piezometric Head for time; $t = t_2$ (cm)
600	1311.49	1.21E-05	D	is the Diameter of the Standpipe (cm)
900	1291.59	1.29E-05	d	is the diameter of the Open Length (cm),
1200	1272.16	1.27E-05	m	is the Transformation Ratio, Where
1500	1253.14	1.27E-05		$m = \sqrt{K_h/K_y}$
1800	1234.39	1.27E-05		K_{v} is the Vertical Permeability
2400	1197.96	1.26E-05	L	is the Open Length of Hole (cm)
3000	1162.44	1.27E-05		
3600	1127.10	1.30E-05	Spreadsheet as	ssumes 3" ID Pipe; NQ Hole, OD = 3"

MEAN PERMEABILITY (cm/sec)

1.34E-05





CALCULATION OF PERMEABILITY BY THE FALLING HEAD METHOD (Open Hole in Uniform Material)



Site Name:

MNS - GWPP

Date:

5/16/2007

Boring I.D.

M-30R

(Partially Weathered/Fractured Rock)

Test Interval: **Total Depth of Hole:** 70.15 to 74.35 74.35 ft bls

2266.77 cm

Length of Open Hole:

4.2 ft

Transformation Ratio m=

128.05 cm

Performed by:

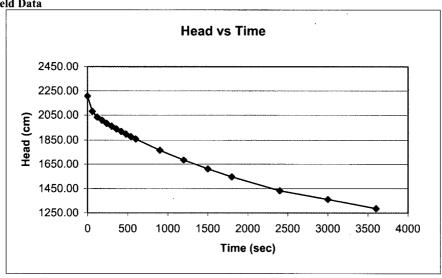
Julie Petersen

Time (sec)	Head (cm)	Permeability (cm/sec)		Calculations
0	2207.93			(2.1)
60	2081.52	1.96E-04	d^2	$\cdot \ln \left(\frac{2mL}{mL_{M}} \right)$
120	2035.46	7.43E-05		$H_1 \mid \frac{m}{D} \rangle 4 \mid \frac{m}{D} $
180	2009.33	4.29E-05	$ K_h = \frac{1}{2}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
240	1984.70	4.10E-05	8 · 1	$L \cdot (t_2 - t_1) = H_2$
300	1961.34	3.93E-05	L	
360	1940.03	3.63E-05	Where:	
420	1919.66	3.50E-05	K _h	is the Horizontal Coefficient of Permeability (cm/sec)
480	1899.02	3.59E-05	H_1	is the Piezometric Head for time; $t = t_1$ (cm)
540	1878.90	3.54E-05	H ₂	is the Piezometric Head for time; $t = t_2$ (cm)
600	1859.27	3.49E-05	D	is the Diameter of the Standpipe (cm)
900	1767.16	3.37E-05	d	is the diameter of the Open Length (cm),
1200	1685.03	3.16E-05	m	is the Transformation Ratio, Where
1500	1611.71	2.95E-05		$m = \sqrt{K_h/K_y}$ K _h is the Horizontal Permeability
1800	1545.91	2.77E-05		K_{ν} is the Vertical Permeability
2400	1432.99	2.52E-05	L	is the Open Length of Hole (cm)
3000	1362.87	1.67E-05		
3600	1286.46	1.92E-05	Spreadsheet as	ssumes 3" ID Pipe; NQ Hole, OD = 3"

MEAN PERMEABILITY (cm/sec)

4.44E-05





Calculation of Permeability By The Rising Head Method (Slug Test)



Site Name:

MNS-GWPP

Test Date:

5/23/2007

Test Date.

> 1 20 D

Well Label: Aquifer Thickness: M-30R 40.62 feet

Screen Length:

- 6

Casing Radius:

5. feet1. Inches

Effective Radius:

1.5 Inches

Effective Kaulus.

1.5 menes

Static Water Level:

42.88 feet

Water Table to Screen Bottom:

35.62 feet

Anisotropy Ratio:

1

Time Adjustment:

0. Seconds

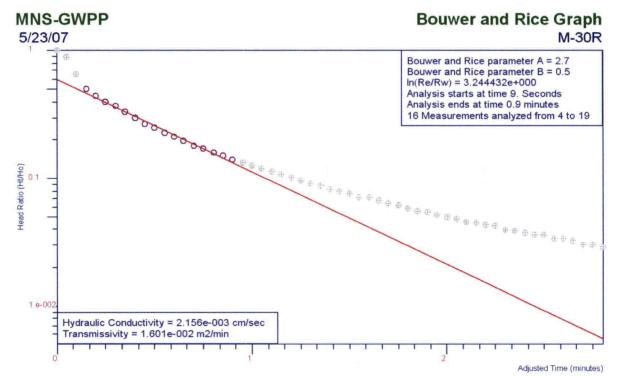
Test starts with trial 0

There are 57 time and drawdown measurements

Maximum head is 1.71 feet

Minimum head is 0. feet

Calculation by Bouwer and Rice Graphical Method



Analysis by Julie Petersen of S&ME, Inc.

Ho is 1.71 feet at 0. Seconds

PERMEABILITY

2.16E-03 cm/sec

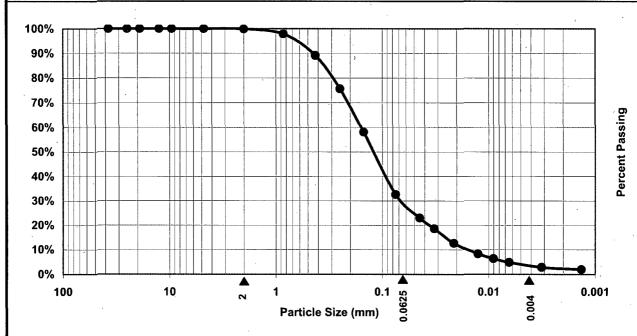
PARTICLE SIZE ANALYSIS OF SOILS FOR USE IN FETTER AND BEAR DIAGRAMS

 Boring No.:
 Sample No.:
 Depth:

 M-30R
 SS-11
 52.85 to 54.35 ft bls

Sample Description:

Greenish-Black, and Tan, Silty, Fine to Medium Sand With Mica



	,	> 2 mm	2 mm - 0.0625 mm	0.0625 mm - 0.004 mm	<0.004 mm
From Graph:		% Gravel	% Sand	% Silt	% Clay
_		0.1%	70.5%	26.0%	3.4%
Adjusted for Calculations		0%	71%	26%	3%

Notes:

Grain size distribution taken from grain size with hydrometer data located in Appendix II. Gravel, sand, silt and clay sizes based on Wentworth Scale.

S&ME Project:

McGuire Nuclear Station - GWPP

S&ME Project No.:

1264-06-724



FETTER AND BEAR DIAGRAMS

S&ME PROJECT: McGuire Nuclear Station - GWPP

S&ME PROJECT NO.: 1264-06-724



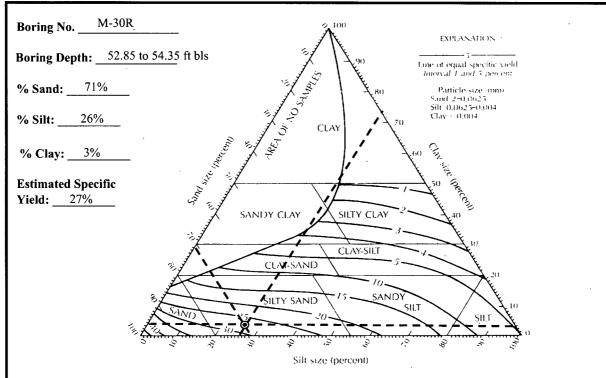
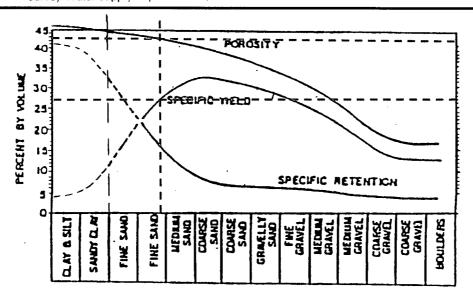


FIGURE 4.11 Textural classification triangle for unconsolidated materials showing the relation between particle size and specific yield. Source: A. I. Johnson, U.S. Geological Survey Water-Supply Paper 1662-D, 1967.



Estimated Porosity: 42.5%

Variation of Porosity, Specific Yield, and Specific Retention with Grain Size (after Bear, 1972)



S&ME, Inc. 9751 Southern Pine Blvd. Charlotte, North Carolina Telephone: 704-523-4726 Fax: 704-525-3953

1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

Project: MNS - Groundwater Protection Project Boring No. M-31 Huntersville, North Carolina 1264-06-724 Location: Number: Sheet No. 1 of 2 Justin Millwood, NC Driller: Boring Depth (ft): 50.8 Elevation (ft): 771.1 Date Drilled: 11/28/07 Cert. No. 3439 Logged By: Courtney Withers Water Level: Stabilized Water Level at 31.36 ft bls Drilling Method: 41/4" H.S.A. Well Penetration Resistance (Blows/Foot) Elev. Depth Lith-Material Description (Feet) (Feet) ology Construction SOIL/SAPROLITE (M1): Reddish-Brown, Micaceous, Clayey, SILT - 770 SOIL/SAPROLITE (M1): Red and Yellow, Very Micaceous, Silty, Fine SAND 765 10 - 760 SOIL/SAPROLITE (M1): White, Tan, and Reddish-Orange, Very Micaceous, Silty, Medium to Fine SAND With Manganese Staining -755 -750 30RING LOG WITH WELL MNSLOG.GPJ LAGWGN01.GDT 3/26/08 30 SOIL/SAPROLITE (M1): Brown and White, Very Ţ Micaceous, Coarse to Fine Sandy, SILT With Manganese Staining; White Coarse to Fine Sand Lense From 34.75 ft to 34.90 ft bls



S&ME, Inc. 9751 Southern Pine Blvd. Charlotte, North Carolina Telephone: 704-523-4726 Fax: 704-525-3953

1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

Project: MNS - Groundwater Protection Project Boring No. M-31 Huntersville, North Carolina 1264-06-724 Location: Number: Sheet No. 2 of 2 Driller: Justin Millwood, NC Boring Depth (ft): 50.8 Elevation (ft): Date Drilled: 11/28/07 771.1 Cert. No. 3439 Logged By: Courtney Withers Water Level: Stabilized Water Level at 31.36 ft bls Drilling Method: 41/4" H.S.A. Well Penetration Resistance (Blows/Foot) Elev. Lith-Depth Material Description (Feet) (Feet) ology Construction 14 735 730 SOIL/SAPROLITE (M1): White, Silty, Medium to Fine SAND SOIL/SAPROLITE (M1): Dark Brown and Light Brown, 725 Very Micaceous, Silty, Fine SAND With Manganese Staining SOIL/SAPROLITE (M1): White, Brown, and Orange, Very Micaceous, Silty, Medium to Fine SAND With Manganese Staining 50 SOIL/SAPROLITE (M1): Brown and Orange, Very Micaceous, Silty, Fine SAND With Manganese Staining Boring Terminated at 50.80 ft bls BORING LOG WITH WELL MNSLOG.GPJ LAGWGNO1.GDT 3/26/08

COMPLETION REPORT OF WELL No. M-31

DRILLING CONTRACTOR: S&ME, inc.

DRILLING METHOD: 41/4" H.S.A.

DATE DRILLED: 11/28/07

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

WATER LEVEL: Stabilized Water Level at

31.36 ft bls

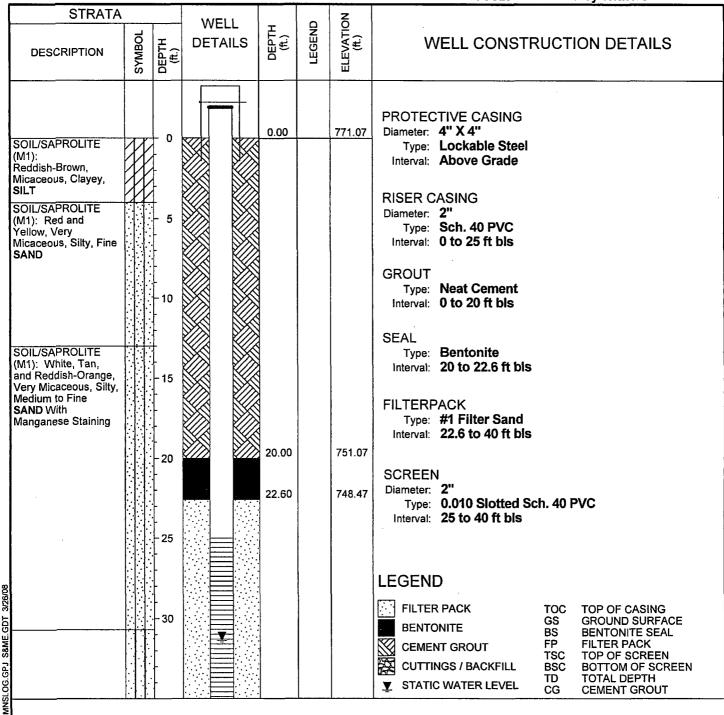
LATITUDE: 35 25 49.36

LONGITUDE: 80 56 27.32

TOP OF CASING ELEVATION: 773.54

DATUM: MSL

LOGGED BY: Courtney Withers





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COMPLETION REPORT OF WELL No. M-31

Sheet 1 of 2

PROJECT: MNS - Groundwater Protection Project GROUND SURFACE ELEVATION:

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

LOGGED BY: **771.1**

CHECKED BY: Courtney Wither

STRATA			WELL)	N	
DESCRIPTION	SYMBOL	DEPTH (ft.)		DЕРТН (ft.)	TEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
							(See Page 1)
SOIL/SAPROLITE (M1): Brown and White, Very Micaceous, Coarse to Fine Sandy, SILT With Manganese Staining; White Coarse to Fine Sand Lense From 34.75 ft to 34.90 ft bls (continued)		-40		39.50 40.00		731.57 731.07	
SOIL/SAPROLITE (M1): White, Silty, Medium to Fine SAND SOIL/SAPROLITE (M1): Dark Brown and Light Brown, Very Micaceous, Silty, Fine SAND With Manganese Staining SOIL/SAPROLITE (M1): White, Brown, and Orange, Very Micaceous, Silty, Medium to Fine SAND With Manganese Staining SOIL/SAPROLITE (M1): Brown and Orange, Very Micaceous, Silty, Fine SAND With Manganese Staining SOIL/SAPROLITE (M1): Brown and Orange, Very Micaceous, Silty, Fine SAND With Manganese Staining		45		50.80		720.27	
NSLOG.GPJ S&ME.GDT 3/26/08							LEGEND FILTER PACK GS GROUND SURFACE BENTONITE BS BENTONITE SEAL CEMENT GROUT FP FILTER PACK TSC TOP OF SCREEN TOCOMORPHIC TO TOTAL DEPTH CG CEMENT GROUT TO TOTAL DEPTH CG CEMENT GROUT

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724

Boring Number:

M-31

Sample No:

Depth (ft-bls): 9.3 - 10.8

Blow Count: 3 * 2 * 2

Sample No:

2

Depth (ft-bls): 14.3 - 15.8

Blow Count: 4 * 2 * 3

2 26 FEET 3 10TH & 4 100THS FT 5

Sample No:

Depth (ft-bls): 19.3 - 20.8

Blow Count: 2 * 3 * 4

Sample No:

Depth (ft-bls): 24.3 - 25.8

Blow Count: 2 * 3 * 4

Sample No:

Depth (ft-bls): 29.3 - 30.8

Blow Count: 2 * 2 * 3



Sample No:

Depth (ft-bls): 34.3 - 35.8

Blow Count: 4 * 6 * 8

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



Boring Number:

M-31

Sample No: 7

Depth (ft-bls): 39.3 - 40.8

Blow Count: 6 * 5 * 8

39.3'-40.8'

Sample No: 8

Depth (ft-bls): 44.3 - 45.8

Blow Count: 4 * 9 * 19 | 14 3 - 45.8

Sample No: 9

Depth (ft-bls): 49.3 - 50.8

Blow Count: 16 * 28 * 22

CALCULATION OF PERMEABILITY BY THE FALLING HEAD METHOD (Open Hole in Uniform Material)



Site Name:

MNS - GWPP

Date:

11/28/2007

Boring I.D.

M-31

Test Interval:

35' to 38'

(Soil/Saprolite)

Total Depth of Hole:

38 ft bls

1158.54 cm

Length of Open Hole:

3 ft

91.46 cm

Transformation Ratio m=

1

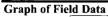
Performed by:

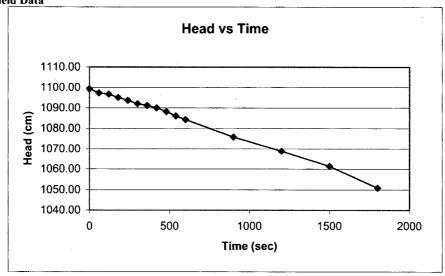
Courtney Withers

Time (sec)	Head (cm)	Permeability (cm/sec)		<u>Calculations</u>
0	1099.33			(2.1)
60	1097.32	7.70E-06	d^2	$\cdot \ln \left(\frac{2mL}{L} \right)$
120	1096.74	2.22E-06	"	$H_1 = \frac{m}{D} A$
180	1095.09	6.31E-06	$ K_h = \frac{1}{2}$	$\frac{\langle D \rangle}{\langle D \rangle} \cdot \ln \frac{D}{2}$
240	1093.66	5.50E-06	" 8· <i>I</i>	$L \cdot (t_2 - t_1) \qquad H_2$
300	1091.98	6.45E-06		
360	1091.16	3.17E-06	Where:	
420	1089.97	4.58E-06	K _h	is the Horizontal Coefficient of Permeability (cm/sec)
480	1088.26	6.59E-06	H ₁	is the Piezometric Head for time; $t = t_1$ (cm)
540	1086.07	8.49E-06	H ₂	is the Piezometric Head for time; $t = t_2$ (cm)
600	1084.39	6.50E-06	D	is the Diameter of the Standpipe (cm)
900	1075.88	6.62E-06	d	is the diameter of the Open Length (cm),
1200	1068.84	5.52E-06	m	is the Transformation Ratio, Where
1500	1061.37	5.90E-06		$m = \sqrt{K_b/K_w}$ K _h is the Horizontal Permeability
1800	1050.88	8.35E-06		K_{v} is the Vertical Permeability
			L	is the Open Length of Hole (cm)
			Spreadsheet as	ssumes 3" ID Pipe; NQ Hole, OD = 3"

MEAN PERMEABILITY (cm/sec)

5.99E-06





Calculation of Permeability By The Rising Head Method (Slug Test)



Site Name: MNS-GWPP **Test Date:** 12/11/2007 Well Label: M-31**Aquifer Thickness:** 13.64 feet Screen Length: 15. feet **Casing Radius:** 1. Inches **Effective Radius:** 3. Inches **Gravel Pack Porosity:** 30.00% **Corrected Casing Radius:** 1.844 Inches **Static Water Level:** 31.36 feet Water Table to Screen Bottom: 8.64 feet **Anisotropy Ratio:**

Time Adjustment: 0. Seconds

Test starts with trial 0

There are 54 time and drawdown measurements

Maximum head is 2.2 feet Minimum head is 0. feet

Calculation by Bouwer and Rice Graphical Method

MNS-GWPP **Bouwer and Rice Graph** 12/11/07 Bouwer and Rice parameter A = 2.522 Bouwer and Rice parameter B = 0.4746 In(Re/Rw) = 2.657951e+000 Gravel Pack Porosity: = 30. % Corrected Casing Radius: = 1.844 Inches Analysis starts at time 39. Seconds Analysis ends at time 2.5 minutes 23 Measurements analyzed from 14 to 36 Head Ratio (Ht/Ho) 1.e-002 Hydraulic Conductivity = 1.121e-003 cm/sec Transmissivity = 4.026 meters2/day 1.0 1.5 2.0 2.5 3.0 4.5 5.0 6.5 7.0 9.0 Adjusted Time (minutes)

Analysis by Julie Petersen of S&ME, Inc.

Ho is 2.2 feet at 0. Seconds

PERMEABILITY

1.12 x 10⁻⁰³ cm/sec



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1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. 1.D. SAMPLER 1 FT.

Project: MNS - Groundwater Protection Project Boring No. M-32 1264-06-724 Location: Huntersville, North Carolina Number: Sheet No. 1 of 2 Driller: Jay Little, NC Cert No. Boring Depth (ft): 60.4 Elevation (ft): 790.1 Date Drilled: 5/3/07 Logged By: Julie Petersen Water Level: Stabilized Water Level at 51.11 ft bls Drilling Method: Mud Rotary Well Penetration Resistance (Blows/Foot) Depth Lith-Elev. Material Description (Feet) (Feet) ology Construction 100 SOIL/SAPROLITE (M1): Red, Slightly Micaceous, Fine Sandy, Clayey, SILT 785 SOIL/SAPROLITE (M1): Tan and Red Mottled, Silty, Fine SAND With Manganese Staining 780 SOIL/SAPROLITE (M1): Reddish-Tan, Clayey, Fine SAND With Manganese Staining 775 SOIL/SAPROLITE (M1): Brown and White, Silty, Medium to Fine SAND With Mica and Manganese Staining 770 SOIL/SAPROLITE (M1): Gray, Silty, Fine SAND With Manganese Staining BORING LOG WITH WELL MNSLOG.GPJ LAGWGN01.GDT 765 10 SOIL/SAPROLITE (M1): Red, Silty, Fine SAND With 760 Manganese Staining and Pyrite SOIL/SAPROLITE (M1): Gray, Silty, Fine SAND With Manganese Staining



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1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO

ENGINEERING • TESTING ENVIRONMENTAL SERVICES Fax: 704-525-3953 DRIVE 1.4 IN. I.D. SAMPLER 1 FT. Project: MNS - Groundwater Protection Project Boring No. M-32 Huntersville, North Carolina 1264-06-724 Location: Number: Sheet No. 2 of 2 Jay Little, NC Cert No. Driller: Boring Depth (ft): 60.4 Elevation (ft): Date Drilled: 5/3/07 790.1 Logged By: Julie Petersen Water Level: Stabilized Water Level at 51.11 ft bls Drilling Method: Mud Rotary Well Penetration Resistance (Blows/Foot) Elev. Depth Lith-Material Description (Feet) (Feet) ology Construction SOIL/SAPROLITE (M1): Grayish-Tan, Silty, Fine SAND 14 750 SOIL/SAPROLITE (M1): Gray, Tan, and White, Silty, Medium to Fine SAND With Intermittent, Coarse Sand 21 745 SOIL/SAPROLITE (M1): Red and Tan, Slightly Clayey, Silty, Fine SAND With Manganese Staining 21 740 Ţ SOIL/SAPROLITE (M1): Brownish-Gray, Slightly Sandy, SILT With Manganese Staining 55 WEATHERED ROCK (M2): When Sampled Becomes Black and White, Silty, Medium to Fine SAND With Mica 50/ 5 BORING LOG WITH WELL MNSLOG.GPJ LAGWGN01.GDT 730 Roller Cone Refusal at 60.40 ft bls

COMPLETION REPORT OF WELL No. M-32

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

WATER LEVEL: Stabilized Water Level at

51.11 ft bis

LATITUDE: 35 25 39.75

LONGITUDE: 80 56 36.66

DRILLING CONTRACTOR: S&ME, Inc.

TOP OF CASING ELEVATION: 793.11

DRILLING METHOD: Mud Rotary

DATE DRILLED: 5/3/07

DATUM: MSL

LOGGED BY: Julie Petersen

STRATA					7	· .
DESCRIPTION	SYMBOL	WELL DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
			0.00		700.42	PROTECTIVE CASING Diameter: 4" X 4"
SOIL/SAPROLITE (M1): Red, Slightly Micaceous, Fine Sandy, Clayey, SILT	T '		0.00		790.13	Type: Lockable Steel Interval: Above Grade
SOIL/SAPROLITE	:					RISER CASING Diameter: 2" Type: Sch. 40 PVC Interval: 0 to 40 ft bis
(M1): Tan and Red Mottled, Silty, Fine SAND With Manganese Staining	- 10					GROUT Type: Neat Cement Interval: 0 to 35 ft bis
SOIL/SAPROLITE (M1): Reddish-Tan, Clayey, Fine SAND With Manganese Staining	15					SEAL Type: Bentonite Interval: 35 to 37 ft bls
SOIL/SAPROLITE (M1): Brown and White, Silty, Medium to Fine SAND With	- 20					FILTERPACK Type: #1 Filter Sand Interval: 37 to 56 ft bis
Mica and Manganese Staining SOIL/SAPROLITE						SCREEN Diameter: 2" Type: 0.010 Slotted Sch. 40 PVC Interval: 40 to 55 ft bls
(M1): Gray, Silty, Fine SAND With Manganese Staining	25					
SOIL/SAPROLITE (M1): Red, Silty, Fine SAND With Manganese Staining and Pyrite	30					LEGEND FILTER PACK FILTER PACK GS GROUND SURFACE BS BENTONITE BS CEMENT GROUT FP FILTER PACK TSC TOP OF CASING GS GROUND SURFACE BS BENTONITE SEAL FP FILTER PACK TSC TOP OF SCREEN BS BOTTOM OF SCREEN
and Pyrite			35.00		755.13	▼ STATIC WATER LEVEL CG CEMENT GROUT

9751 Southern Pine Blvd. Charlotte, North Carolina

COMPLETION REPORT OF WELL No. M-32

Sheet 1 of 2

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

GROUND SURFACE ELEVATION:

LOGGED BY: 790.1

CHECKED BY: Julie Petersen

STRATA ELEVATION (ft.) WELL LEGEND DEPTH (ft.) SYMBOL WELL CONSTRUCTION DETAILS **DETAILS** DESCRIPTION (See Page 1) 35 SOIL/SAPROLITE (M1): Gray, Silty, 37.00 753.13 Fine SAND With Manganese Staining (continued) SOIL/SAPROLITE (M1): Grayish-Tan, · | 40 Silty, Fine SAND SOIL/SAPROLITE (M1): Gray, Tan, and White, Silty, Medium to Fine SAND With Intermittent, Coarse Sand Seams SOIL/SAPROLITE (M1): Red and Tan, Slightly Clayey, Silty, Fine SAND With 50 Manganese Staining SOIL/SAPROLITE (M1): Brownish-Gray, 735.63 54.50 Slightly Sandy, SILT 55.00 735.13 55 With Manganese 56.00 734.13 Staining WEATHERED ROCK (M2): When Sampled Becomes Black and White, Silty, Medium to Fine SAND With 60 60.40 729.73 Mica **LEGEND** FILTER PACK TOC TOP OF CASING **GROUND SURFACE** GS BENTONITE BS BENTONITE SEAL FP FILTER PACK **CEMENT GROUT** TSC TOP OF SCREEN **CUTTINGS / BACKFILL BOTTOM OF SCREEN BSC** TD TOTAL DEPTH ▼ STATIC WATER LEVEL CEMENT GROUT



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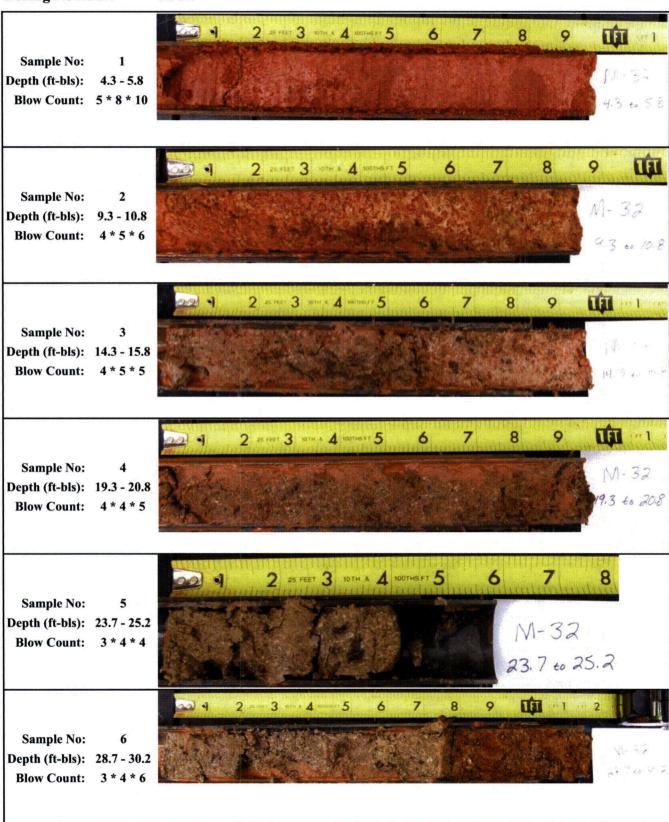
COMPLETION REPORT OF WELL No. M-32

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



Boring Number: M-32



McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



Boring Number:

M-32



Sample No: 8

Depth (ft-bls): 38.7 - 40.2

Blow Count: 6 * 6 * 8



Sample No: 9
Depth (ft-bls): 43.7 - 45.2

Blow Count: 11 * 12 * 9



Sample No: 10 Depth (ft-bls): 48.7 - 50.2

Blow Count: 7 * 9 * 12



Sample No: 11

Depth (ft-bls): 54.3 - 55.8

Blow Count: 6 * 15 * 37



Sample No: 12 Depth (ft-bls): 58.7 - 60.2

Blow Count: 22 * 16 * 50/5



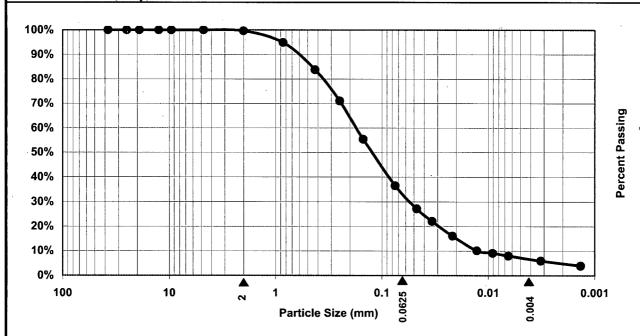
PARTICLE SIZE ANALYSIS OF SOILS FOR USE IN FETTER AND BEAR DIAGRAMS

 Boring No.:
 Sample No.:
 Depth:

 M-32
 SS-12
 59.3 to 60.8 ft bls

Sample Description:

Black and White, Silty, Fine to Medium Sand With Mica



	> 2 mm	2 mm - 0.0625 mm	0.0625 mm - 0.004 mm	<0.004 mm
From Graph:	% Gravel	% Sand	% Silt	% Clay
	0.4%	66.4%	26.7%	6.5%
Adjusted for Calculations	: 0%	67%	27%	7%

Notes:

Grain size distribution taken from grain size with hydrometer data located in Appendix II. Gravel, sand, silt and clay sizes based on Wentworth Scale.

S&ME Project:

McGuire Nuclear Station - GWPP

S&ME Project No.:

1264-06-724



FETTER AND BEAR DIAGRAMS

S&ME PROJECT: McGuire Nuclear Station - GWPP

S&ME PROJECT NO.: 1264-06-724



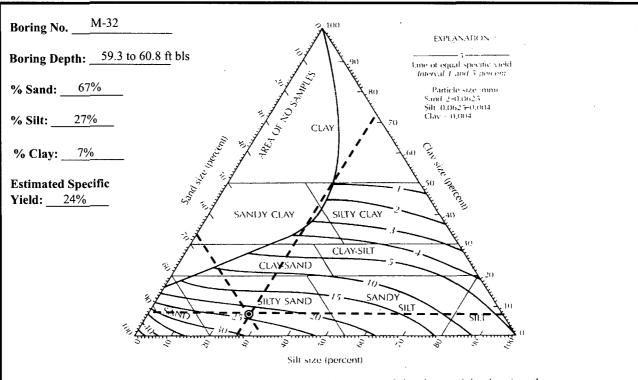
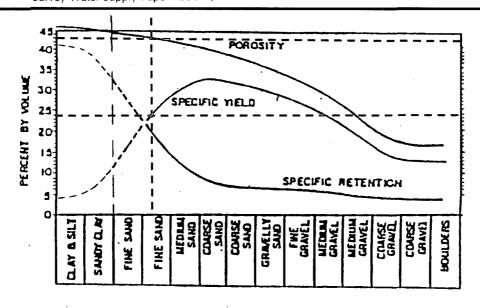


FIGURE 4.11 Textural classification triangle for unconsolidated materials showing the relation between particle size and specific yield. Source: A. I. Johnson, U.S. Geological Survey Water-Supply Paper 1662-D, 1967.



Estimated Porosity: 43%

Variation of Porosity, Specific Yield, and Specific Retention with Grain Size (after Bear, 1972)



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1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

Project: MNS - Groundwater Protection Project Boring No. M-33 Location: Huntersville, North Carolina Number: 1264-06-724 Sheet No. 1 of 2 49.8 Elevation (ft): Driller: Jay Little, NC Cert No. Boring Depth (ft): 771.8 Date Drilled: 5/11/07 Logged By: Julie Petersen Water Level: Stabilized Water Level at 27.52 ft bls Drilling Method: Mud Rotary Well Penetration Resistance (Blows/Foot) Lith-Elev. Depth Material Description (Feet) (Feet) ology Construction 100 SOIL/SAPROLITE (M1): Red, Silty, CLAY - 770 17 765 SOIL/SAPROLITE (M1): Reddish-Tan, Slightly Clayey, Fine Sandy, SILT With Manganese Staining SOIL/SAPROLITE (M1): Red, Silty, CLAY 13 SOIL/SAPROLITE (M1): Reddish-Tan, Slightly Clayey, 10 Fine Sandy, SILT With Manganese Staining 760 SOIL/SAPROLITE (M1): Reddish-Tan to Yellowish-Tan, Slightly Micaceous, Fine Sandy, SILT With Manganese Staining 755 SOIL/SAPROLITE (M1): Tan, Micaceous, Fine Sandy, SILT With Iron and Manganese Banding 20 750 SOIL/SAPROLITE (M1): Reddish-Tan, Clayey, Fine Sandy, SILT With Manganese Staining BORING LOG WITH WELL MNSLOG, GPJ LAGWGN01.GDT 25 745 SOIL/SAPROLITE (M1): Gray, Micaceous, Slightly **T** Clayey, Fine Sandy, SILT With Manganese Staining 740 SOIL/SAPROLITE (M1): Reddish-Tan, Slightly Clayey, Fine Sandy, SILT With Manganese Staining



S&ME, Inc. 9751 Southern Pine Blvd. Charlotte, North Carolina Telephone: 704-523-4726 Fax: 704-525-3953

1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. 1.D. SAMPLER 1 FT.

Project: MNS - Groundwater Protection Project Boring No. M-33 Location: Huntersville, North Carolina Number: 1264-06-724 Sheet No. 2 of 2 Boring Depth (ft): 49.8 Elevation (ft): Driller: Jay Little, NC Cert No. 771.8 Date Drilled: 5/11/07 Logged By: Julie Petersen Water Level: Stabilized Water Level at 27.52 ft bls Drilling Method: Mud Rotary Well Penetration Resistance (Blows/Foot) Elev. Depth Lith-Material Description (Feet) (Feet) ology Construction 100 SOIL/SAPROLITE (M1): Gray and White, Fine Sandy, **SILT** With Manganese Staining 735 SOIL/SAPROLITE (M1): Gray, Brown, and White, Silty, Medium to Fine SAND With Iron and Manganese Staining (Granitic) 15 730 41 -725 50/ WEATHERED ROCK (M2): When Sampled Becomes Gray, Brown, and White, Silty, Medium to Fine SAND With Iron and Manganese Staining (Granitic) Boring Terminated at 49.80 ft bls BORING LOG WITH WELL MNSLOG.GPJ LAGWGN01.GDT 3/26/08

COMPLETION REPORT OF WELL No. M-33

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

WATER LEVEL: Stabilized Water Level at

27.52 ft bls

LATITUDE: 35 25 42.39

LONGITUDE: 80 56 23.61

DRILLING CONTRACTOR: S&ME, Inc.

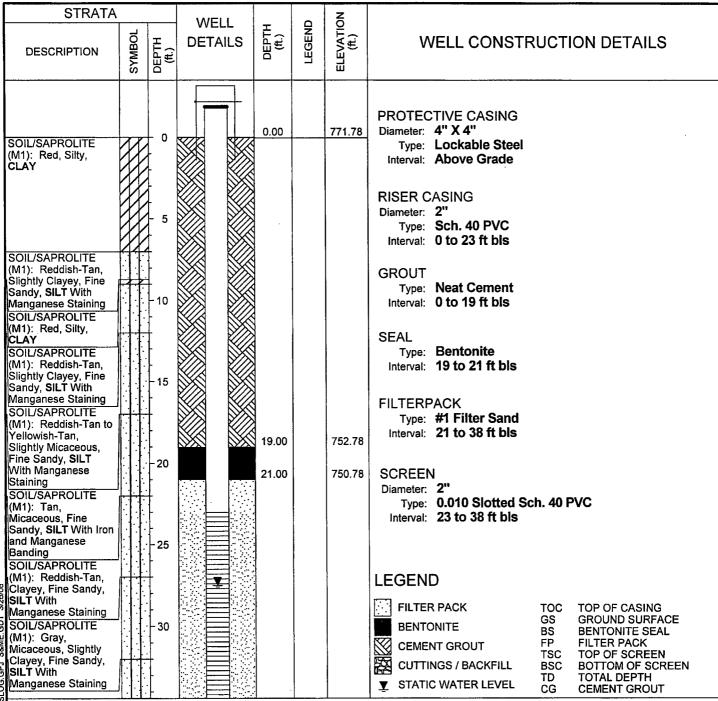
DATE DRILLED: 5/11/07

DRILLING METHOD: Mud Rotary

TOP OF CASING ELEVATION: 774.83

DATUM: MSL

LOGGED BY: Julie Petersen





9751 Southern Pine Blvd. Charlotte, North Carolina **COMPLETION REPORT OF** WELL No. M-33

PROJECT: MNS - Groundwater Protection Project PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

GROUND SURFACE ELEVATION:

LOGGED BY: **771.8**

CHECKED BY: Julie Petersen

STRATA						7	
DESCRIPTION	SYMBOL	DEPTH (ft.)	WELL DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
							(See Page 1)
SOIL/SAPROLITE (M1): Reddish-Tan, Slightly Clayey, Fine Sandy, SILT With Manganese Staining SOIL/SAPROLITE (M1): Gray and White, Fine Sandy, SILT With Manganese Staining SOIL/SAPROLITE (M1): Gray, Brown, and White, Silty,		-35		37.50 38.00		734.28 733.78	
Medium to Fine SAND With Iron and Manganese Staining (Granitic) WEATHERED ROCK (M2): When Sampled Becomes Gray, Brown, and White, Silty, Medium to Fine		45 		49.80		721.98	
SAND With Iron and Manganese Staining (Granitic)							
							LEGEND
ANSLOG.GPJ S&ME.GDT 3/26/08							FILTER PACK BENTONITE BENTONITE CEMENT GROUT CUTTINGS / BACKFILL STATIC WATER LEVEL TOC TOP OF CASING GS GROUND SURFACE BS BENTONITE SEAL FP FILTER PACK TOP OF SCREEN BSC BOTTOM OF SCREEN TO TOTAL DEPTH CEMENT GROUT



9751 Southern Pine Blvd. Charlotte, North Carolina

COMPLETION REPORT OF WELL No. M-33

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



Boring Number:

M-33

Sample No: 1
Depth (ft-bls): 3.3 - 4.8

Blow Count: 5 * 7 * 10



Sample No:

2

Depth (ft-bls): 8.3 - 9.8

Blow Count: 5 * 6 * 7



Sample No:

3

Depth (ft-bls): 13.3 - 14.8

Blow Count: 3 * 3 * 5

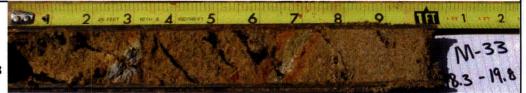


Sample No:

4

Depth (ft-bls): 18.3 - 19.8

Blow Count: 2 * 3 * 4



Sample No:

5

Depth (ft-bls): 23.3 - 24.8

Blow Count: 3 * 3 * 4



Sample No: 6

Depth (ft-bls): 28.3 - 29.8

Blow Count: 1 * 2 * 2



McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



Boring Number:

M-33

Sample No: 7

Depth (ft-bls): 33.3 - 34.8

Blow Count: 3 * 4 * 7



Sample No:

8

Depth (ft-bls): 38.3 - 39.8

Blow Count: 4 * 6 * 9



Sample No:

9

Depth (ft-bls): 43.3 - 44.8

Blow Count: 13 * 18 * 23



Sample No: 10 Depth (ft-bls): 48.3 - 49.8

Blow Count: 33 * 45 * 50/4



Calculation of Permeability By The Rising Head Method (Slug Test)



Site Name:

MNS-GWPP

Test Date:

5/21/2007

Well Label:

M-33

Aquifer Thickness:

15.5 feet

Screen Length:

Casing Radius:

15. feet

Effective Radius:

1. Inches

Gravel Pack Porosity:

3. Inches

Corrected Casing Radius:

30.00%

Static Water Level:

1.844 Inches

27.5 feet

Water Table to Screen Bottom:

10.5 feet

Anisotropy Ratio:

Time Adjustment:

0. Seconds

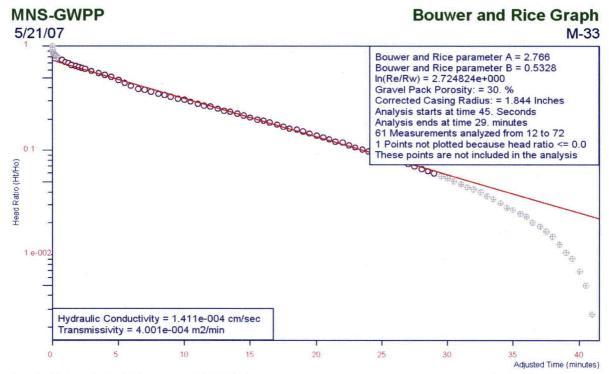
Test starts with trial 0

There are 97 time and drawdown measurements

Maximum head is 3.369 feet

Minimum head is 0. feet

Calculation by Bouwer and Rice Graphical Method



Analysis by Julie Petersen of S&ME, Inc.

Ho is 3.369 feet at 0. Seconds

PERMEABILITY

1.41E-04 cm/sec



S&ME, Inc. 9751 Southern Pine Blvd. Charlotte, North Carolina Telephone: 704-523-4726

1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO

Fax: 704-525-3953 DRIVE 1.4 IN. I.D. SAMPLER 1 FT. Project: MNS - Groundwater Protection Project Boring No. M-34R 1264-06-724 Location: Huntersville, North Carolina Number: Sheet No. 1 of 2 Jay Little, NC Cert No. Boring Depth (ft): 65.0 Elevation (ft): 800.7 Driller: Date Drilled: 5/14/07 Logged By: Julie Petersen Water Level: Stabilized Water Level at 42.40 ft bls Drilling Method: Mud Rotary Well Penetration Resistance (Blows/Foot) Elev. Depth Lith-Material Description (Feet) (Feet) ology Construction SOIL/SAPROLITE (M1): Reddish-Purple, Micaceous, 800 Silty, Medium to Fine SAND With Manganese Banding 12 795 SOIL/SAPROLITE (M1): White, Micaceous, Silty, 790 Medium to Fine SAND With Manganese Banding SOIL/SAPROLITE (M1): Orange, Fine Sandy, SILT With Manganese Banding and Intermittent, Red and White, Coarse Sand Seams 785 780 BORING LOG WITH WELL MNSLOG GPJ LAGWGN01.GDT 3/26/08 775 SOIL/SAPROLITE (M1): Gray and White, Micaceous, Silty, Medium to Fine SAND With Manganese Staining



1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

	NC Cert No. Date Dril 2.40 ft bls Drilling N	Sheet No. 2 of 2 lled: 5/14/07 Method: Mud Rotary netration Resistance (Blows/Foot) 50 >>>
Logged By: Julie Petersen Elev. (Feet) Depth (Feet) Ology Material Description WEATHERED ROCK (M2): When Sampled Becomes Gray and White, Silty, Coarse to Fine SAND Roller Cone Refusal at 42.40 ft bis PARTIALLY WEATHERED/FRACTURED ROCK (WF): Fine-Grained GRANITE, Intensely Fractured PARTIALLY WEATHERED/FRACTURED ROCK (WF): Fine-Grained GRANITE, Intensely Fractured PARTIALLY WEATHERED/FRACTURED ROCK (WF): Fine-Grained GRANITE, Intensely Fractured PARTIALLY WEATHERED/FRACTURED ROCK (WF): Fine-Grained GRANITE, Intensely Fractured PARTIALLY WEATHERED/FRACTURED ROCK (WF): Fine-Grained QUARTZ DIORITE, Intensely Fractured SOUND ROCK (D): Fine-Grained QUARTZ DIORITE, Moderately to Intensely Fractured SOUND ROCK (D): Fine-Grained GRANITE, Moderately Fractured SOUND ROCK (D): Fine-Grained GRANITE, Moderately Fractured	Well Pendonstruction 19 50/4	Method: Mud Rotary netration Resistance (Blows/Foot
Elev. (Feet) Cepth (Feet) ology Material Description Con WEATHERED ROCK (M2): When Sampled Becomes Gray and White, Silty, Coarse to Fine SAND Roller Cone Refusal at 42.40 ft bls + + + + PARTIALLY WEATHERED/FRACTURED ROCK (WF): Fine-Grained GRANITE, Intensely Fractured PARTIALLY WEATHERED/FRACTURED ROCK (WF): Fine-Grained GRANITE, Intensely Fractured PARTIALLY WEATHERED/FRACTURED ROCK (WF): Fine-Grained GRANITE, Intensely Fractured PARTIALLY WEATHERED/FRACTURED ROCK (WF): Fine-Grained QUARTZ DIORITE, Intensely Fractured - 750	Well Pen 0 19 19 50/4	netration Resistance (Blows/Foot
WEATHERED ROCK (M2): When Sampled Becomes Gray and White, Silty, Coarse to Fine SAND	construction 0 19 50/4	50
WEATHERED ROCK (M2): When Sampled Becomes Gray and White, Silty, Coarse to Fine SAND Roller Cone Refusal at 42.40 ft bls PARTIALLY WEATHERED/FRACTURED ROCK (WF): Fine-Grained GRANITE, Intensely Fractured PARTIALLY WEATHERED/FRACTURED ROCK (WF): Fine-Grained QUARTZ DIORITE, Intensely Fractured PARTIALLY WEATHERED/FRACTURED ROCK (WF): Fine-Grained GRANITE, Intensely Fractured PARTIALLY WEATHERED/FRACTURED ROCK (WF): Fine-Grained QUARTZ DIORITE, Intensely Fractured SOUND ROCK (D): Fine-Grained QUARTZ DIORITE, Moderately to Intensely Fractured SOUND ROCK (D): Fine-Grained GRANITE, Moderately Fractured	19 50/4 4	
SOUND ROCK (D): Fine-Grained QUARTZ DIORITE, Moderately Fractured with Ductile Shear Zone from 62.1' to 63.5' Boring Terminated at 65.00 ft bls	Bill point (BB)	

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



Core Location: M-34R NQ Core Roller Cone Refusal at 42.40 ft bls 50' - 52.1' Intensely Fractured and Weathered. Horizontal Fracturing with Heavy Decomposition. 42.6' - 43.45' Fracture Zone, Horizontal to High Angle Fracturing, Moderate Weathering and Staining 52.1' to 53' Fracture Zone, Horizontal to High Angle Fracturing, Slightly Weathered with Moderate Staining. 43.45' - 44.6' Fracture Zone. Intensely Weathered and Fractured, Highly Decomposed and Discolored, with Some Core Loss. 53.6' - 53.8' Fracture Zone, Horizontal to Low Angle Fracturing, Slightly Weathered with Slight Staining. 45' End of Run #1, REC - 94%, RQD - 0% 45.1' and 45.25' Horizontal Joints, Moderate Staining 55' End of Run #3, REC - 90%, RQD - 32% 46.25' - 46.75' Fracture Zone, Horizontal to High Angle Fracturing, Moderate Staining. **EXPLANATION** Meta Gabbro Quartz Diorite Diorite 47.65' - 50' Fracture Zone, Horizontal to High Angle Fracturing, Moderate to Intense Weathering with Heavy 57.25' - 58.9' Highly Weathered and Intensely Fractured Zone. Staining and Some Core Loss Highly Decomposed and Heavily Stained. Horizontal to High Granite Angle Fracturing. Core Loss 8.9' - 59.1' Fracture Zone, Horizontal to High Angle Fracturing 50' End of Run #2, REC - 95%, RQD - 46% Intense Fracturing with Slight Staining Fractures 50' - 52.1' Intensely Fractured and Weathered. Horizontal End of Run Fracturing with Heavy Decomposition. Contact 59.4' - 60' High Angle Joint, Moderate Staining Healed Joint 60' End of Run #4, REC - 100%, RQD - 54%

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



EXPLANATION

Meta Gabbro

Quartz Diorite

Diorite

Granite
Core Loss

Intense Fracturing

Fractures

End of Run

Contact

Healed Joint

Core Location: M-34R 62.1' - 63.5' Ductile Shear Zone with Low Angle to Horizontal Fracturing. No Staining. 63 63.85' Low Angle Joint. No Staining. 64' Low Angle Joint. No Staining. 64.25' - 64.4' Fracture Zone. Horizontal to Vertical Fracturing. 64.6' Low Angle Joint. No Staining. 65' End of Run #5, REC - 100%, RQD - 71% Coring Terminated at 65.0 ft bls

COMPLETION REPORT OF WELL No. M-34R

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

WATER LEVEL: Stabilized Water Level at

42.40 ft bls

LATITUDE: 35 25 56.43

DRILLING CONTRACTOR: S&ME, Inc.

LONGITUDE: 80 56 26.64

DRILLING METHOD: Mud Rotary

DATE DRILLED: 5/14/07

TOP OF CASING ELEVATION: 803.67

DATUM: MSL

LOGGED BY: Julie Petersen

STRATA			WELL	_		NO	
DESCRIPTION	SYMBOL	DEPTH (ft.)	DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
SOIL/SAPROLITE (M1): Reddish-Purple, Micaceous, Silty, Medium to Fine SAND With Manganese Banding SOIL/SAPROLITE (M1): White, Micaceous, Silty, Medium to Fine SAND With Manganese Banding SOIL/SAPROLITE (M1): Orange, Fine Sandy, SILT With Manganese Banding and Intermittent, Red and White, Coarse Sand Seams		- 0 - 5 - 10 - 15 - 20 - 25		0.00		800.74	PROTECTIVE CASING Diameter: 4" X 4" Type: Lockable Steel Interval: Above Grade RISER CASING Diameter: 2" Type: Sch. 40 PVC Interval: 0 to 56.9 ft bls GROUT Type: Neat Cement Interval: 0 to 40 ft bls SEAL Type: K-Packer + Bentonite Interval: 40 to 56.1 ft bls FILTERPACK Type: N/A Interval: N/A SCREEN Diameter: 2" Type: 0.010 Slotted Sch. 40 PVC Interval: 56.9 to 61.9 ft bls LEGEND FILTER PACK GS GROUND SURFACE BS BENTONITE BS
MNSLOG.GPJ S&ME							CEMENT GROUT FP FILTER PACK TSC TOP OF SCREEN BSC BOTTOM OF SCREEN TD TOTAL DEPTH CG CEMENT GROUT

9751 Southern Pine Blvd. Charlotte, North Carolina

COMPLETION REPORT OF WELL No. M-34R

Sheet 1 of 2

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

GROUND SURFACE ELEVATION:

LOGGED BY: 800.7

CHECKED BY: Julie Petersen

STRATA	,		\^/=L1			Z	
DESCRIPTION	SYMBOL	DEPTH (ft.)	WELL DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
SOIL/SAPROLITE (M1): Gray and White, Micaceous, Silty, Medium to Fine SAND With Manganese Staining (continued) WEATHERED ROCK (M2): When Sampled Becomes Gray and White, Silty, Coarse to Fine SAND PARTIALLY WEATHERED/FRACT	++ 1	35	Ţ	40.00		760.74	(See Page 1)
ROCK (WF): Fine-Grained GRANITE, Intensely Fractured PARTIALLY WEATHERED/FRACT ROCK (WF): Fine-Grained QUARTZ DIORITE, Intensely Fractured PARTIALLY WEATHERED/FRACT ROCK (WF): Fine-Grained GRANITE, Intensely Fractured PARTIALLY WEATHERED/FRACT ROCK (WF): Fine-Grained CRANITE, Intensely Fractured PARTIALLY WEATHERED/FRACT ROCK (WF): Fine-Grained	57 57 57 5 7 57 57 5	- 50		55.90 56.10 56.90		744.84 744.64 743.84	
QUARTZ DIORITE, Intensely Fractured SOUND ROCK (D): Fine-Grained QUARTZ DIORITE, Moderately to Intensely Fractured SOUND ROCK (D): Fine-Grained GRANITE, Moderately Fractured SOUND ROCK (D): Fine-Grained QUARTZ DIORITE, Moderately Fractured With Ductile Shear Zone from 62.1' to 63.5'	+ + + + <u></u>	65		61.40 61.90 63.00		739.34 738.84 737.74 735.74	LEGEND FILTER PACK GS GROUND SURFACE BS BENTONITE BS BENTONITE SEAL CEMENT GROUT TSC TOP OF SCREEN TSC TOP OF SCREEN TSC TOP OF SCREEN TO OF SCREEN TO TOTAL DEPTH CG CEMENT GROUT



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COMPLETION REPORT OF WELL No. M-34R

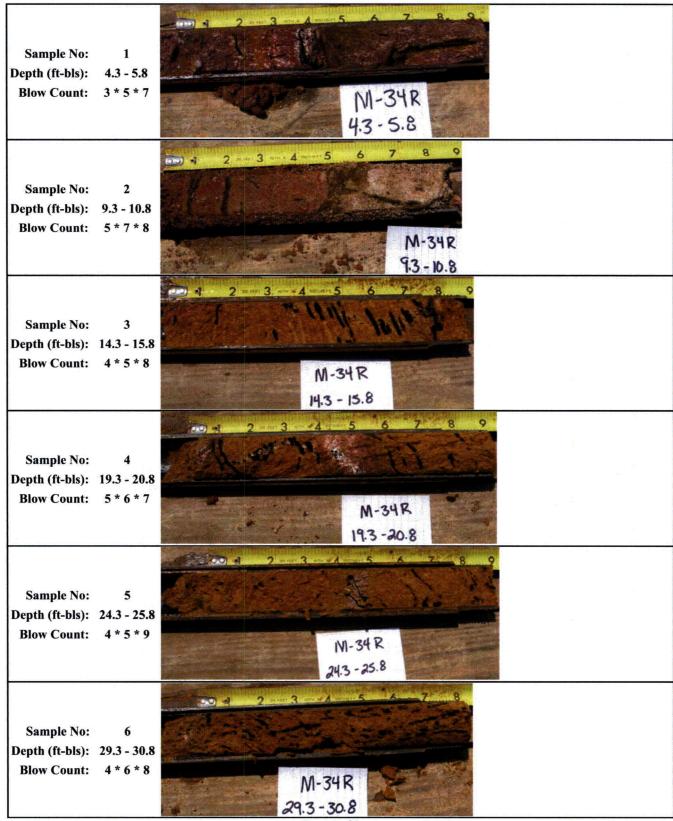
SPLIT SPOON SAMPLE PICTURES

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



M-34R



SPLIT SPOON SAMPLE PICTURES

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



Boring Number: M-34R Sample No: Depth (ft-bls): 34.3 - 35.8 Blow Count: 6 * 8 * 11 W-34R 34.3 - 35.8 Sample No: Depth (ft-bls): 39.3 - 40.8 **Blow Count:** 50/4 M-34R 39.3 - 40.8

ROCK CORE PICTURES

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724







CLASSIFICATION:

42.4' to 43.45' Fine Grained Granite

43.45' to 44.6' Medium Grained Quartz Diorite

44.6' to 45' Fine Grained Granite

45' to 58.9' Medium Grained Quartz Diorite

58.9' to 62' Fine Grained Granite

62' to 65' Medium Granied Quartz Diorite with Ductile Shear Zone from 62.1' to 63.5'

CALCULATION OF PERMEABILITY BY THE FALLING HEAD METHOD (Open Hole in Uniform Material)



Site Name:

MNS - GWPP

Date:

5/15/2007

Boring I.D.

M-34R

(Weathered/Fractured Rock)

Test Interval:

42.4 to 45

Total Depth of Hole: 45 ft

45 ft 2.6 ft 1371.95 cm

Length of Open Hole: Transformation Ratio m=

= 1

79.27 cm

Performed by:

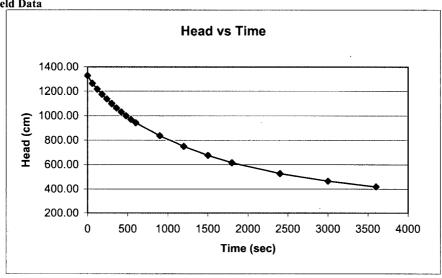
Julie Petersen

Time (sec)	Head (cm)	Permeability (cm/sec)		<u>Calculations</u>
0	1329.02			(21)
60	1264.97	2.29E-04	d^2	$\cdot \ln\left(\frac{2mL}{mL}\right)$
120	1218.32	1.74E-04	"	D H
180	1176.55	1.62E-04	$ K_{h} = $	$\frac{\langle D \rangle}{\langle D \rangle} \cdot \ln \frac{\Delta \Gamma}{2}$
240	1138.11	1.54E-04	 	$L \cdot (t_2 - t_1) \qquad H_2$
300	1100.18	1.57E-04		
360	1064.85	1.51E-04	Where:	
420	1032.20	1.44E-04	K _h	is the Horizontal Coefficient of Permeability (cm/sec)
480	1001.13	1.42E-04	H ₁	is the Piezometric Head for time; $t = t_1$ (cm)
540	971.68	1.38E-04	H_2	is the Piezometric Head for time; $t = t_2$ (cm)
600	944.60	1.31E-04	D	is the Diameter of the Standpipe (cm)
900	837.35	1.12E-04	d	is the diameter of the Open Length (cm),
1200	750.46	1.01E-04	m	is the Transformation Ratio, Where
1500	675.24	9.78E-05		$m = \sqrt{K_h/K_y}$ K _h is the Horizontal Permeability
1800	616.16	8.48E-05		K_{v} is the Vertical Permeability
2400	527.59	7.19E-05	L	is the Open Length of Hole (cm)
3000	465.64	5.79E-05		
3600	419.21	4.87E-05	Spreadsheet as	ssumes 3" ID Pipe; NQ Hole, OD = 3"

MEAN PERMEABILITY (cm/sec)

1.27E-04





CALCULATION OF PERMEABILITY BY THE FALLING HEAD METHOD



Site Name:

MNS - GWPP

Date:

5/15/2007

Boring I.D.

M-34R

(Weathered/Fractured Rock)

Test Interval:

42.4 to 50

1524.39 cm

Total Depth of Hole: Length of Open Hole:

50 ft

Transformation Ratio m=

7.6 ft

231.71 cm

Performed by:

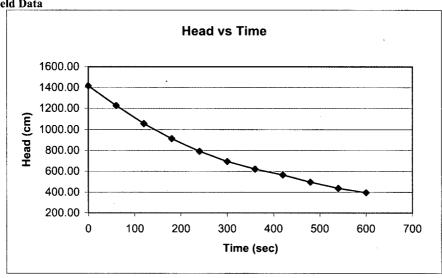
Julie Petersen

			····	
<u>Time (sec)</u>	<u>Head (cm)</u>	Permeability (cm/sec)		<u>Calculations</u>
0	1417.23			(21)
60	1227.47	3.08E-04	d^2 .	$\ln\left(\frac{2mL}{mL_{\star}}\right)$
120	1057.13	3.20E-04	"	$H_1 \mid D \mid H_2 \mid \frac{D}{D} \mid A \mid A \mid B \mid B \mid A \mid B \mid A \mid B \mid B \mid B$
180	914.48	3.11E-04	$ K_h = \frac{1}{2}$	$\frac{\langle -\rangle}{\langle -\rangle} \cdot \ln \frac{1}{ }$
240	791.40	3.10E-04	∥ " 8· <i>I</i>	$L \cdot (t_2 - t_1) = H_2$
300	694.54	2.80E-04	L	'
360	621.86	2.37E-04	Where:	
420	565.88	2.02E-04	K _h	is the Horizontal Coefficient of Permeability (cm/sec)
480	497.80	2.75E-04	H ₁	is the Piezometric Head for time; $t = t_1$ (cm)
540	439.39	2.68E-04	H_2	is the Piezometric Head for time; $t = t_2$ (cm)
600	397.96	2.12E-04	: D	is the Diameter of the Standpipe (cm)
			d	is the diameter of the Open Length (cm),
			m	is the Transformation Ratio, Where
				$m = \sqrt{K_b/K}$ K _h is the Horizontal Permeability
				$K_{\rm v}$ is the Vertical Permeability
			L	is the Open Length of Hole (cm)
			Spreadsheet ass	sumes 3" ID Pipe; NQ Hole, OD = 3"

MEAN PERMEABILITY (cm/sec)

2.72E-04

Graph of Field Data



Calculation of Permeability By The Rising Head Method (Slug Test)



Site Name:

MNS-GWPP

Test Date:

5/21/2007

Well Label:

M-34R

Aquifer Thickness:

24.5 feet

Screen Length:

- 6

Casing Radius:

5. feet

Effective Radius:

Inches
 Inches

Ci di Wi L

1.5 menes

Static Water Level:

42.4 feet

Water Table to Screen Bottom: Anisotropy Ratio:

19.5 feet

imisotropy radio.

1

Time Adjustment:

0. Seconds

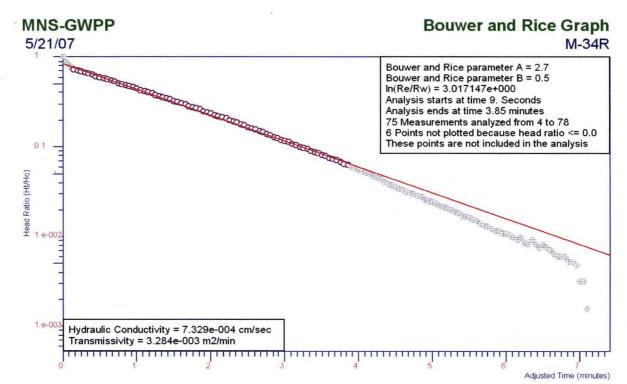
Test starts with trial 0

There are 149 time and drawdown measurements

Maximum head is 3.821 feet

Minimum head is 0. feet

Calculation by Bouwer and Rice Graphical Method



Analysis by Julie Petersen of S&ME, Inc.

Ho is 3.821 feet at 0. Seconds

PERMEABILITY

7.33E-04 cm/sec



1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

	· · · · · · · · · · · · · · · · · · ·		vater Protection	Project	<u> </u>			Bor	ing No	. M-3	4DR
Location	: Hunters	ville, No	rth Carolina			-06-724	r	5	Sheet No	. 1 of	3
Boring D	Depth (ft):	9	0.1 Elevation	(ft): 800.9	Driller: Jay Litt 2717	le, NC Cert No.	Date Dr	illed: 5/17	/07		
Logged 1	By: Julie Pete	ersen		Water Level: Sta	bilized Water Level	at 42.77 ft bls	Drilling	Method: I	Mud Ro	tary	
Elev. (Feet)	Depth Li (Feet) old	ith- ogy	Mate	rial Description		Well Construction		netration R		e (Blov	-
	10		SOIL/SAPROLIT Silty, Medium to SOIL/SAPROLIT Medium to Fine S	TE (M1): Reddish-Pur Fine SAND With Man Fine SAND With Man SAND With Manganes FE (M1): Orange, Fine Banding and Intermitte	ceous, Silty, e Banding				50		
-	<u>- </u> :1										



1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

Project:	· <u> </u>	dwater Protection					Bor	ing No.	. 141-34	₩.
Location:	Huntersville,	North Carolina			06-724			Sheet No.	2 of 3	3
Boring Do	epth (ft):	90.1 Elevation	(ft): 800.9	Driller: Jay Littl 2717	le, NC Cert No.	Date Dr	illed: 5/1	7/07		
Logged B	By: Julie Petersen		Water Level: Sta	bilized Water Level	at 42.77 ft bls	Drilling	Method:	Mud Rot	ary	
Elev. (Feet)	Depth Lith- (Feet) ology	Mate	rial Description		Well Construction]	netration 1		(Blow	
(1 cct)	(i cet) Glogy	<u> </u>	· · · · · · · · · · · · · · · · · · ·		Construction	0		<u>50</u>	T T	1
- 765 760	40		ROCK (M2): When Sa Silty, Coarse to Fine Sa							
					Ī					
-		Roller Cone Ref	usal at 44.20 ft bls							
	45 + + +		(D): Fine-Grained GR			П				
-755		Moderately Fract Fracturing	ured With Intermittent	Zones of Intense						
733	<u>_</u> _+_+_+	Tracturing								
1	-1+ + +									
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	-[+ှ+ှ+		•							
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- 750	<u> </u>									
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	55								1-1-	
- 745 -						 				
	+++++	i								
- 										
	60 - + + + + +							$\bot \bot$	1	
- 740	+++	COLD TO DOCK	(D) 1/ II (C) 1 I	OVI I DOZ						
	777		(D): Medium-Grained sely Fractured and Sho					1		
	7,7,7									
-	1,7,7	·					} }		} }	
	65 7 7 2									
- 735	1/2 X								1	
	777									
	747									
	- + + + - - + +		(D): Fine-Grained GR	ANITE,						
	+ + + V - V	Moderately Frac								



1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

Project: MNS - Groundwater Protection Project Boring No. M-34DR Location: Huntersville, North Carolina 1264-06-724 Number: Sheet No. 3 of 3 Jay Little, NC Cert No. Driller: Boring Depth (ft): 90.1 Elevation (ft): 800.9 Date Drilled: 5/17/07 Logged By: Julie Petersen Water Level: Stabilized Water Level at 42.77 ft bls Drilling Method: Mud Rotary Penetration Resistance (Blows/Foot) Well Elev. Depth Lith-Material Description (Feet) (Feet) ology Construction DIORITE, Intensely Fractured and Sheared 77. -- 730 SOUND ROCK (D): Medium-Grained QUARTZ DIORITE, Slightly to Moderately Fractured and Sheared 725 80 SOUND ROCK (D): Fine-Grained GRANITE, Slightly 720 Fractured PARTIALLY WEATHERED/FRACTURED ROCK (WF): Medium-Grained QUARTZ DIORITE, Intensely Fractured -715 SOUND ROCK (D): Fine-Grained DIORITE, Slightly Fractured Boring Terminated at 90.10 ft bls Lithologic Descriptions Obtained From M-34R BORING LOG WITH WELL MNSLOG.GPJ LAGWGN01.GDT 3/26/08

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724

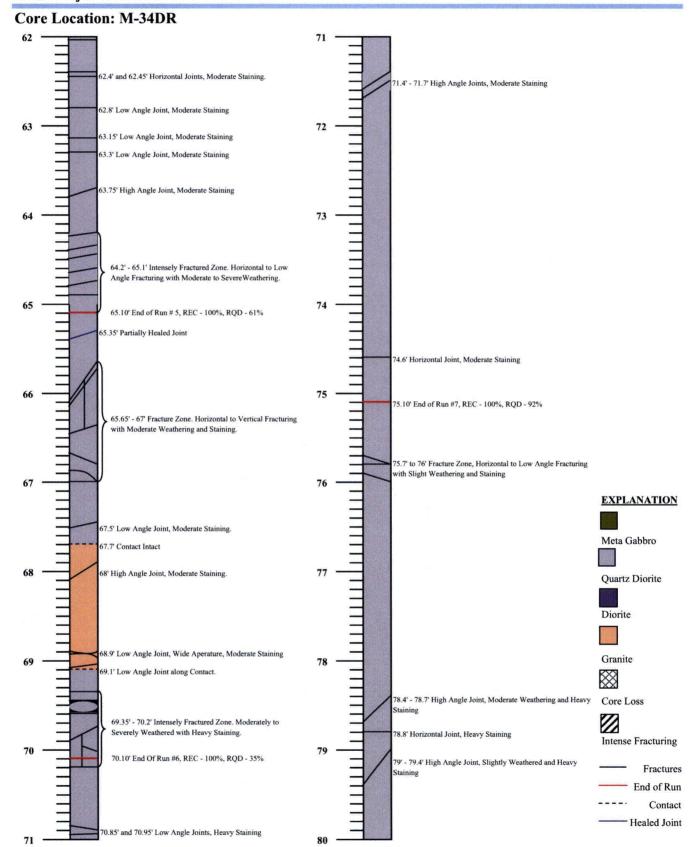


Core Location: M-34DR 53.1' Horizontal Joint, No Staining Roller Cone Refusal at 44.20 ft bls 45.10' End of Run #1, REC - 100%, RQD - 100% 53.9' - 54.7' Intensely Fractured Zone. Horizontal to Low 45.3' Low Angle Joint, No Staining Angle Fracturing with Moderate Staining 55 55.10' End of Run #3, REC - 84%, RQD - 62% 46.5' Horizontal Joint, Moderate Staining 56' Low Angle Joint, Moderate Staining 47' - 48.9' Intensely Fractured Zone. Horizontal to Vertical 56.4' - 57.6' Fracture Zone. Horizontal to High Angle Fracturing. Moderate Staining and Weathering. Fracturing with Moderate Staining. **EXPLANATION** 58.35' - 58.55' Intensely Fractured Zone. Horizontal to Low Angle Fracturing with Moderate Staining. Meta Gabbro 49.5' - 50.1' Discoloration due to weathering. 58.8' Low Angle Joint, No Staining. 50.10' End of Run #2, REC - 100%, RQD - 50% Quartz Diorite Diorite 50.1' - 51.6' Moderately Severe Weathering with Core Loss and Horizontal Fracturing. Granite 60.10' End of Run #4, REC - 100%, RQD - 71% 60.55' Low Angle Joint, No Staining Core Loss 60.65' Horizontal Joint, Slight Staining 60.9' - 61' Fracturing along Contact Intense Fracturing Fractures 61.3' - 61.45' Fracture Zone. Horizontal to Low Angle Fracturing End of Run with No Staining. Contact 61.8' - 62.05' Fracture Zone. Horizontal to Low Angle Fracturing — - Healed Joint with Slight Staining. 62

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724

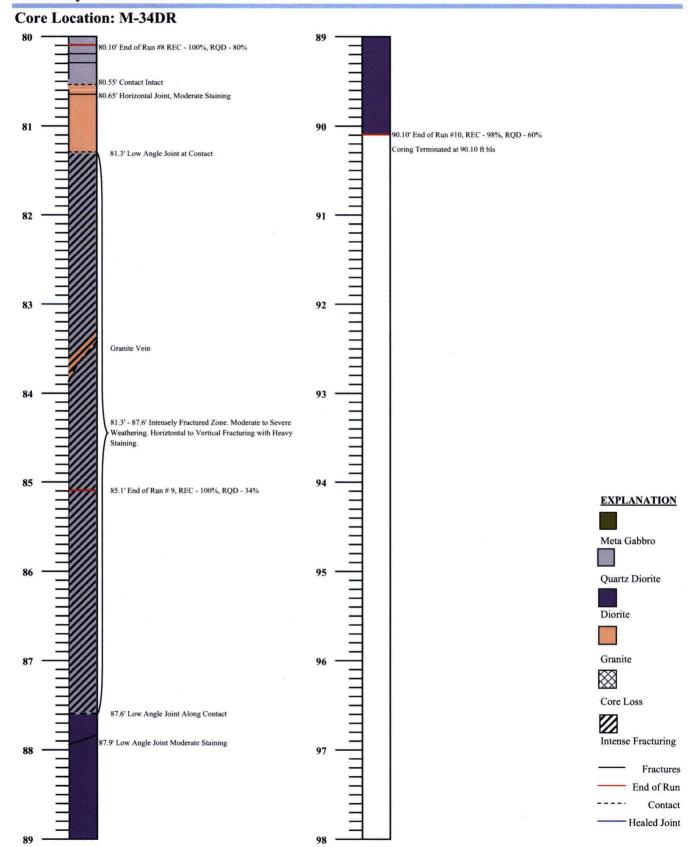




McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724





COMPLETION REPORT OF WELL No. M-34DR

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

DRILLING CONTRACTOR: S&ME, Inc.

DRILLING METHOD: Mud Rotary

DATE DRILLED: 5/17/07

PROJECT LOCATION: Huntersville, North Carolina

WATER LEVEL: Stabilized Water Level at

42.77 ft bis

LATITUDE: 35 25 56.43

LONGITUDE: 80 56 26.58

TOP OF CASING ELEVATION: 804.14

DATUM: MSL

LOGGED BY: Julie Petersen

STRATA						LOGGED BY: Julie Petersen
DESCRIPTION	SYMBOL DEPTH	WELL	DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
SOIL/SAPROLITE (M1): Reddish-Purple, Micaceous, Silty, Medium to Fine SAND With Manganese Banding SOIL/SAPROLITE (M1): White, Micaceous, Silty, Medium to Fine SAND With Manganese Banding SOIL/SAPROLITE (M1): Orange, Fine Sandy, SILT With Manganese Banding and Intermittent, Red and White, Coarse Sand Seams	-10 -15 -20		0.00		800.94	PROTECTIVE CASING Diameter: 4" X 4" Type: Lockable Steel Interval: Above Grade RISER CASING Diameter: 2" Type: Sch. 40 PVC Interval: 0 to 79.9 ft bls GROUT Type: Neat Cement Interval: 0 to 38 ft bls SEAL Type: K-Packer + Bentonite Interval: 38 to 79.3 ft bls FILTERPACK Type: N/A Interval: N/A SCREEN Diameter: 2" Type: 0.010 Slotted Sch. 40 PVC Interval: 79.9 to 89.9 ft bls LEGEND FILTER PACK BENTONITE BS GROUND SURFACE BENTONITE SEAL FILTER PACK CEMENT GROUT FP FILTER PACK TOC TOP OF CASING GS GROUND SURFACE BENTONITE SEAL FILTER PACK TOC TOP OF CASING TOP OF SCREEN BENTONITE SEAL FILTER PACK TOP OF SCREEN BOTTOM OF SCREEN BOTTOM OF SCREEN TOTAL DEPTH
O S S S S S S S S S S S S S S S S S S S						▼ STATIC WATER LEVEL CG CEMENT GROUT

S&NE

ENGINEERING: TESTING
ENVIRONMENTAL SERVICES

9751 Southern Pine Blvd. Charlotte, North Carolina COMPLETION REPORT OF WELL No. M-34DR

Sheet 1 of 3

PROJECT: MNS - Groundwater Protection Project GROUND SURFACE ELEVATION:

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

LOGGED BY: 800.9

CHECKED BY: Julie Petersen

	STRATA)A/ELI			Z	
	DESCRIPTION	SYMBOL	DEPTH (ft.)	WELL DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
								(See Page 1)
						į		
(A) S) S) S) M	OIL/SAPROLITE 11); Gray and 1/hite, Micaceous, Ilty, Medium to Fine AND With anganese Staining	RIII 7 T	- 35		38.00		762.94	
(AB Note	MEATHERED ROCK M2): When Sampled ecomes Gray and White, Silty, Coarse Fine SAND		-40	Y				
F G N V	OUND ROCK (D): ine-Grained RANITE, loderately Fractured /ith Intermittent ones of Intense	+ + + + + + + + +	45					
	racturing	+ + + + + + + +	- 50					
		+ + · + + · + + · + + · + + ·	55					
S	OUND ROCK (D):	++++	-60					
G Ir	ledium-Grained (IUARTZ DIORITE, Itensely Fractured Ind Sheared	77 77 77 77 7	65					
F G Z J G	OUND ROCK (D): ine-Grained RANITE, loderately Fractured OUND ROCK (D): ledium-Grained	+ + 64 - 64	70					LEGEND
S.GPJ S&ME.GDT 3/2	ndarrablottic, tensely Fractured and Sheared OUND ROCK (D): fledium-Grained NUARTZ DIORITE, flightly to Moderately ractured and theared	77 77 77 77 77 77 7	- 1-75 -					FILTER PACK GS GROUND SURFACE BS BENTONITE BS BENTONITE SEAL FP FILTER PACK TSC TOP OF SCREEN TOP OF SCREEN TOP OF SCREEN TOP OF SCREEN TOP OF SCREEN TOP OF SCREEN TOP OF SCREEN TOP OF SCREEN TOP OF SCREEN TOP OF SCREEN TOP OF SCREEN TOP OF SCREEN TOP OF SCREEN TOP OF SCREEN TOP OF SCREEN TOP OF SCREEN TOP OF SCREEN TOP OF CASING TOP O



9751 Southern Pine Blvd. Charlotte, North Carolina **COMPLETION REPORT OF** WELL No. M-34DR

PROJECT: MNS - Groundwater Protection Project
PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

GROUND SURFACE ELEVATION:

LOGGED BY: 800.9

CHECKED BY: Julie Petersen

			iui Ga			
					7	
	(ft.)	WELL DETAILS	ОЕРТН (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
77 + 27 77 72 77 77 77 77 77 77 77 77 77 77	80		79.10 79.30 79.90 89.40 89.90 90.10	LEGEND	721.84 721.64 721.04 711.54 711.04 710.84	WELL CONSTRUCTION DETAILS (See Page 1)
						LEGEND FILTER PACK GS GROUND SURFACE BS BENTONITE BS BENTONITE SEAL CEMENT GROUT TSC TOP OF CASING GS GROUND SURFACE BS BENTONITE SEAL FP FILTER PACK TSC TOP OF SCREEN TOP OF SCREEN TOP OF SCREEN TOP OF SCREEN TO TOTAL DEPTH TO TOTAL DEPTH CG CEMENT GROUT
	27 + 27 27 28 27 27 27 27 27 27 27 27 27 27 27 27 27	22 25 25 25 45 25 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	DETAILS DETAILS OPENIES OPE	WELL DETAILS (#) HEAD TO SAMBOR 79.10 79.10 79.30 79.90 85 85 89.40 89.90	WELL DETAILS TO THE TO	WELL DETAILS THE


9751 Southern Pine Blvd. Charlotte, North Carolina

COMPLETION REPORT OF WELL No. M-34DR

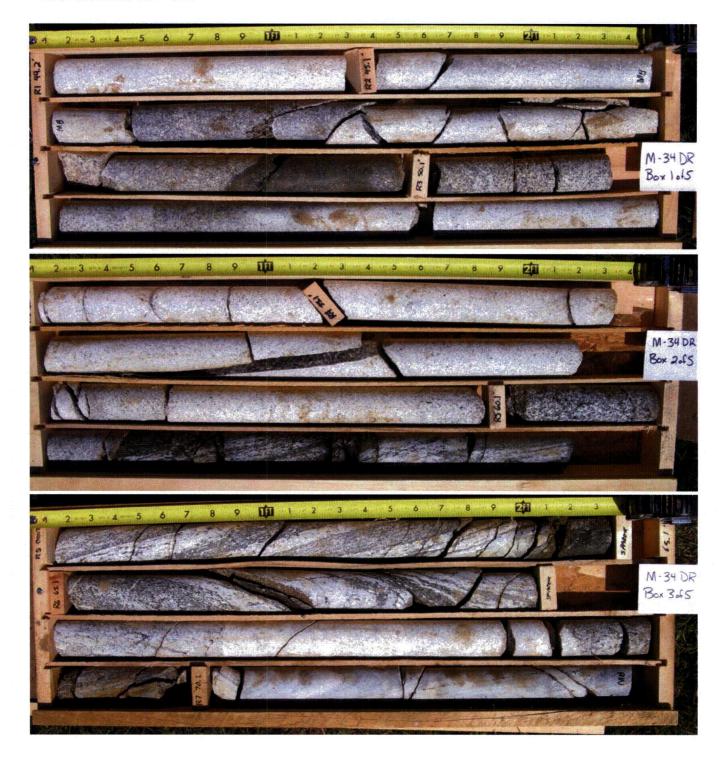
ROCK CORE PICTURES

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724

Core Location: M-34DR





ROCK CORE PICTURES

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724

Core Location: M-34DR





CLASSIFICATION:

44.2' to 60.9' Fine Grained Granite

60.9' to 67.7' Medium Grained Quartz Diorite (Shear Zone)

67.7' to 69.1' Fine Grained Granite

69.1 to 80.55' Medium Grained Quartz Diorite (Shear Zone)

80.55' 81.3' Fine Grained Granite

81.3' to 87.6' Medium Granied Quartz Diorite

87.6' to 90.1' Fine Grained Diorite

M-34 DR Box Sof5

Calculation of Permeability By The Rising Head Method (Slug Test)



Site Name: MNS-GWPP **Test Date:** 5/21/2007 Well Label: M-34DR **Aquifer Thickness:** 52.13 feet Screen Length: 10. feet **Casing Radius:** 1. Inches **Effective Radius:** 1.5 Inches 42.77 feet **Static Water Level:** Water Table to Screen Bottom: 47.13 feet

Anisotropy Ratio:

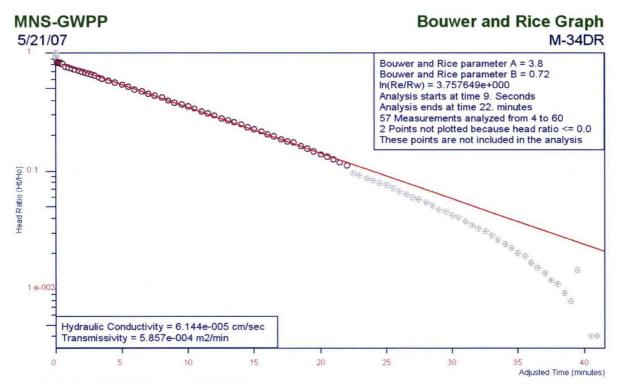
Time Adjustment: 0. Seconds

Test starts with trial 0

There are 99 time and drawdown measurements

Maximum head is 4.462 feet Minimum head is -7.e-003 feet

Calculation by Bouwer and Rice Graphical Method



Analysis by Julie Petersen of S&ME, Inc.

Ho is 4.462 feet at 0. Seconds

PERMEABILITY

6.14E-05 cm/sec



I. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. 1.D. SAMPLER 1 FT.

Project: MNS - Groundwater Protection Project Boring No. M-35 Huntersville, North Carolina 1264-06-724 Location: Number: Sheet No. 1 of 1 Driller: Justin Millwood, NC Boring Depth (ft): Elevation (ft): Date Drilled: 12/11/07 Cert. No. 3439 Logged By: Scott Dacus Water Level: Stabilized Water Level at 23.74 ft bls Drilling Method: 41/4" H.S.A. Well Penetration Resistance (Blows/Foot) Depth Lith-Elev. Material Description ology (Feet) (Feet) Construction 100 TOPSOIL SOIL/SAPROLITE (M1): Reddish-Brown, Silty, CLAY -765 15 760 25 - 755 750 SOIL/SAPROLITE (M1): Reddish-Brown Mixed With Gray, Fine Sandy, Silty, CLAY 745 Ţ BORING LOG WITH WELL MNSLOG.GPJ LAGWGN01.GDT 3/26/08 SOIL/SAPROLITE (M1): Tan and Brown, Clayey, Silty, Coarse to Fine SAND 740 18 SOIL/SAPROLITE (M1): Tan and Brown, Medium to Fine Sandy, SILT Auger Refusal at 31.10 ft bls

COMPLETION REPORT OF WELL No. M-35

DRILLING CONTRACTOR: S&ME, Inc.

DRILLING METHOD: 41/4" H.S.A.

DATE DRILLED: 12/11/07

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

WATER LEVEL: Stabilized Water Level at

23.74 ft bls

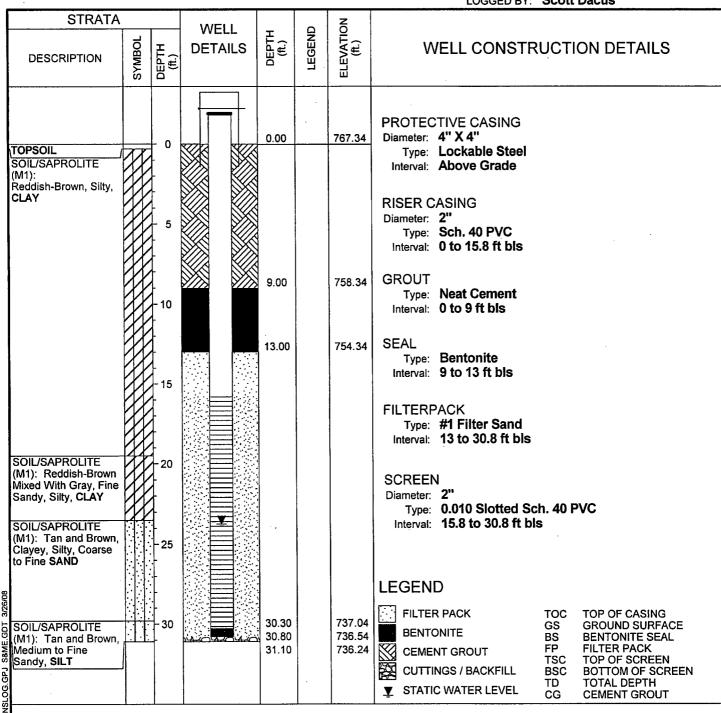
LATITUDE: 35 25 44.59

LONGITUDE: 80 56 21.47

TOP OF CASING ELEVATION: 769.81

DATUM: MSL

LOGGED BY: Scott Dacus



9751 Southern Pine Blvd. Charlotte, North Carolina

COMPLETION REPORT OF WELL No. M-35

SPLIT SPOON SAMPLE PICTURES

1

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724

Boring Number:

M-35

Sample No:

Depth (ft-bls): 3.5 - 5

Blow Count: 7 * 7 * 8

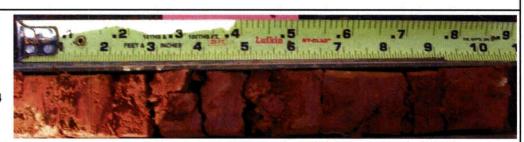


Sample No:

2

Depth (ft-bls): 8.5 - 10

Blow Count: 7 * 11 * 14



Sample No:

3

Depth (ft-bls): 13.5 - 15

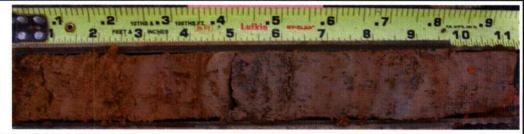
Blow Count: 3 * 3 * 5



Sample No:

Depth (ft-bls): 18.5 - 20

Blow Count: 3 * 2 * 2



Sample No:

5

Depth (ft-bls): 23.5 - 25

Blow Count: 1 * 2 * 2



Sample No:

Depth (ft-bls): 28.5 - 30

Blow Count: 2 * 4 * 14



Calculation of Permeability By The Rising Head Method (Slug Test)



Site Name:

MNS-GWPP

Test Date:

12/18/2007

Well Label:

M-35

Aquifer Thickness:

12.06 feet

Screen Length:

15. feet

Casing Radius:

1. Inches

Effective Radius:

3. Inches

Gravel Pack Porosity:

30.00%

Corrected Casing Radius:

1.844 Inches

Static Water Level:

Water Table to Screen Bottom:

23.74 feet

Anisotropy Ratio:

7.06 feet

Time Adjustment:

0. Seconds

Test starts with trial 0

Maximum head is 4.105 feet

Minimum head is 0. feet

Calculation by Bouwer and Rice Graphical Method

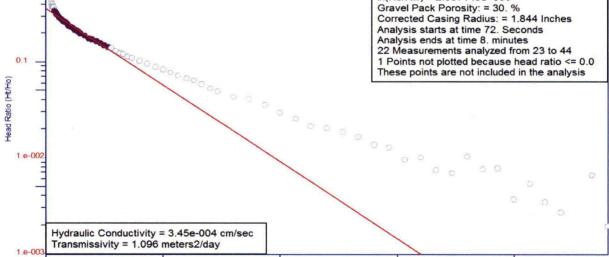
MNS-GWPP

There are 86 time and drawdown measurements

12/18/07

Bouwer and Rice parameter A = 2.313 Bouwer and Rice parameter B = 0.4351 ln(Re/Rw) = 2.567148e+000 Gravel Pack Porosity: = 30. % Corrected Casing Radius: = 1.844 Inches

Bouwer and Rice Graph



Analysis by Julie Petersen of S&ME, Inc.

Adjusted Time (Hours) Ho is 4.105 feet at 0. Seconds

PERMEABILITY
3.45 x 10⁻⁰⁴ cm/sec

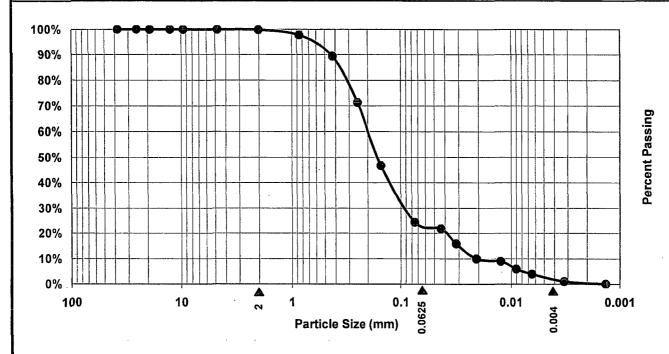
PARTICLE SIZE ANALYSIS OF SOILS FOR USE IN FETTER AND BEAR DIAGRAMS

 Boring No.:
 Sample No.:
 Depth:

 M-35
 SS-6
 28.5 to 30 ft bls

Sample Description:

Tan and Brown, Clayey, Silty, Coarse to Fine Sand



, , , ,	> 2 mm	2 mm - 0.0625 mm	0.0625 mm - 0.004 mm	<0.004 mm
From Graph:	% Gravel	% Sand	% Silt	% Clay
_	0.2%	76.3%	21.8%	1.7%
Adjusted for Calculations	0%	76%	22%	2%

Notes:

Grain size distribution taken from grain size with hydrometer data located in Appendix II. Gravel, sand, silt and clay sizes based on Wentworth Scale.

S&ME Project:

McGuire Nuclear Station - GWPP

S&ME Project No.:

1264-06-724



FETTER AND BEAR DIAGRAMS

S&ME PROJECT: McGuire Nuclear Station - GWPP

S&ME PROJECT NO.: 1264-06-724



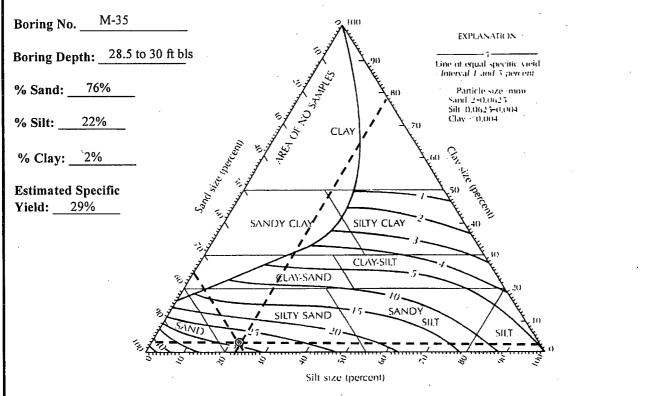
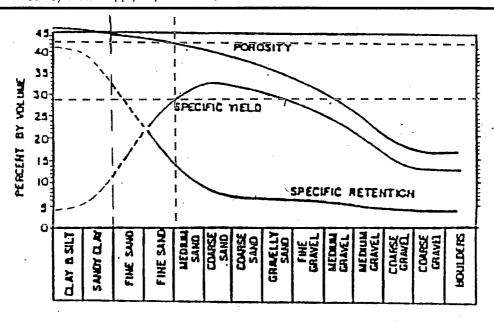


FIGURE 4.11 Textural classification triangle for unconsolidated materials showing the relation between particle size and specific yield. Source: A. I. Johnson, U.S. Geological Survey Water-Supply Paper 1662-D, 1967.



Estimated Porosity: 42.5%

Variation of Porosity, Specific Yield, and Specific Retention with Grain Size (after Bear, 1972)



1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO

DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

Project:	 	G - Groun		r Protection	Project			<u>DRIVE 1.4 IN. I.</u>	J. SAIVI	LEK		ring	No. N	1-48		
Location	: Hunt	ersville,	North	Carolina		Number:	1264-0	06-724			s	heet Ņ	o. 1 o	f. 1		
Boring D	Depth (ft):		20.2	Elevation ((ft): 760.4	Driller: Ja	y Little	, NC Cert No.	Date	Drille	d: 6/21/	07				
Logged 1	By: Court	ney Witl	ners	.	Water Level: Dry				Drilling Method: Mud Rotary							
Elev. (Feet)	Depth (Feet)	Lith- ology		Mater	ial Description			Well Construction	0	Penet	ration R	esistan 50	ce (Blo	ws/Fo	pot) 100	
- 760	_	000	GRA	VEL				N N	ŤΪ			T			100	
- - -	- - -		FILL	(F): Red an	d Yellow, Micaceous, S	SILT										
_	_	$\otimes \otimes \otimes$	GRA	VEL												
- - - 755	5	0 0 0	GIA.	Y EL												
- - - - -				(F): Reddis y, Silty, CLA	h-Brown, Micaceous, I AY	Medium to Fine	ē									
- - 750 -	10-															
- - - -			FILL	(F): Red. M	ficaceous, Clayey, Med	dium to Fine										
- 	15 —		SAN		,,,											
	20															
					usal at 20.20 ft bls iption Obtained Fron	1 M-48DR										
							·									

COMPLETION REPORT OF WELL No. M-48

DRILLING CONTRACTOR: S&ME, Inc.

DRILLING METHOD: Mud Rotary

DATE DRILLED: 6/21/07

PROJECT: MNS - Groundwater Protection Project

PROJECT NO: 1264-06-724

PROJECT LOCATION: Huntersville, North Carolina

WATER LEVEL: Dry

LATITUDE: 35 26 00.82

LONGITUDE: 80 56 51.63

TOP OF CASING ELEVATION: 760.17

DATUM: MSL

LOGGED BY: Courtney Withers

							LOGGED BY: Courtney witners
STRATA	T	I	WELL DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
DESCRIPTION	SYMBOL	DEPTH (ft.)	52771120		LEG	ELEV	WELL GONOTING OTTON BETAILS
GRAVEL FILL (F): Red and Yellow, Micaceous, SILT GRAVEL	0.0	- 0		0.00		760.39	PROTECTIVE CASING Diameter: 8" Type: Steel Flush Mount Interval: At Grade RISER CASING
	0.0	- 5		4.50		755.89	Diameter: 2" Type: Sch. 40 PVC
FILL (F): Reddish-Brown, Micaceous, Medium to Fine Sandy, Silty, CLAY		-10		6.50		753.89	Interval: 0 to 9.8 ft bls GROUT Type: Neat Cement Interval: 0 to 4.5 ft bls SEAL
FILL (F): Red, Micaceous, Clayey, Medium to Fine SAND		- 15 -		19.30		741.09	Type: Bentonite Interval: 4.5 to 6.5 ft bis FILTERPACK Type: #1 Filter Sand Interval: 6.5 to 19.8 ft bis
		- 20		19.80 20.20		740.59 740.19	SCREEN Diameter: 2" Type: 0.010 Slotted Sch. 40 PVC Interval: 9.8 to 19.8 ft bis
MNSLOG.GPJ SRME.GDJ 3Z6/08							LEGEND FILTER PACK GS GROUND SURFACE BS BENTONITE BS CEMENT GROUT TSC TOP OF CASING GROUND SURFACE BS BENTONITE SEAL FP FILTER PACK TSC TOP OF CASING GROUND SURFACE BS BENTONITE SEAL FP FILTER PACK TSC TOP OF CASING GROUND SURFACE BS BOTTONITE BSC BOTTOM OF SCREEN TO TOTAL DEPTH CEMENT GROUT

9751 Southern Pine Blvd. Charlotte, North Carolina

COMPLETION REPORT OF WELL No. M-48



1. BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.

2. PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO

DRIVE 1.4 IN. 1.D. SAMPLER 1 FT.

Project: MNS - Groundwater Protection Project										Boring No. M-48R						
Location	Location: Huntersville, North Carolina Number: 126						06-724			Sheet No. 1 of 1						
Boring Depth (ft): 35.2 Elevation (ft): 760.3 Driller:						Jay Littl 2717	ttle, NC Cert No. Date D				rilled: 6/19/07					
Logged By: Courtney Withers Water Level: Stabilized Water Level at 1							t 19.45 ft bls Drilling				Method: Mud Rotary					
Elev.	Elev. Depth Lith- (Feet) (Feet) ology Material Description									Penetration Resistance (Blows/Foot)						
— 760		O o c		•			Consu	ruction	1	Τ		50			100	
E				d Yellow, Micaceous,	SILT											
E																
F		<i>0</i> 0 d	GRAVEL													
755	5	0 0 0							-							
<u> </u>		***	FILL (F): Reddish	h-Brown, Micaceous, I	Medium to	Fine										
E	-		Sandy, Silty, CLA	ΛY												
þ																
E 750	10-								-	_	-			_	44	
F /30		****														
F	_	\ggg														
F		****														
-	15—	****	FILL (F): Red, M SAND									$\perp \! \! \perp \! \! \mid$				
- 745	_															
 		\ggg														
E	-															
E .	20—		Dallas Carra Daf					Ā							Ш	
- 740	-	V. V. V.	Roller Cone Refu	EATHRED/FRACTU	RED ROCK	(WF):	1 🕅		П							
E		1 1 1 V	Coarse-Grained Q Soil Seams, Intens													
_		177	Son Scams, mens	sely Tractured												
_		77.7														
735	25 —	777														
7 3/28	_	777						i								
- K61.G	-	77/	SOUND ROCK (DIORITE, Slight	D): Coarse-Grained Coal Coal Coal Coal Coal Coal Coal Coal	UARTZ											
1 - L		17/7	.,	•												
730 - 730	30 —	17 L V	PARTIALLY WE	1		$\ \mathbf{H}\ $						\top				
N. 20.0.		777	(WF): Coarse-Grant Intermittent Soil S													
WIN -	_	1 / V		-												
BORING LOG WITH WELL MINSLOG GFJ LAGWGNN, GDT 3/26/08		17 L L V					224									
26 W	35—		Boring Terminat	ted at 35 20 ft ble	a			******	╀┸╞			\Box			$\exists \exists$	
SING FC				ted at 35.20 it bis iptions Obtained Fro	m M-48DF	t							'			
80 F																

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724



Core Location: M-48R NQ Core toller Cone Refusal at 20.60 ft bls 29.95' - 30.0' Low Angle Joint, Heavily Discolored 30 21.1' - 21.3' High Angle Joint, Heavily Discolored 30.2' End of Run #2, REC - 100%, RQD - 84% 21.7' Horizontal Joint, Heavily Discolored 30.2' - 32.15' Intensely Fractured Zone With Moderate Discoloration on Surfaces 20.6' - 25.2' Intensely Fractured Zone With Soil Seams, Core Loss; Fracture Surfaces Heavily Discolored 32 32.1' - 32.2' Low Angle Joint, Moderately Discolored 32.35' - 32.8' High Angle Joint, Moderately Discolored 33 3.1' Horizontal Joint, Moderately Discolored 25 33.1' - 35.2' Intensely Fractured Zone With Soil Seams, Core 25.2' End of Run #1, REC - 90%, RQD - 9% Loss; Fracture Surfaces Moderately Discolored **EXPLANATION** 25.45' - 25.6' Horizontal and Vertical Joints, Heavily Discolored Meta Gabbro 35 35.2' End of Run #3, REC - 80%, RQD - 39% Coring Terminated at 35.20 ft bls Quartz Diorite 26.1' - 26.7' High Angle Joint, Heavily Discolored Diorite 26.9' - 27.0' Rock Fragments, Heavily Discolored 27.0' -27.08' Low Angle Joint, Heavily Discolored Granite 27.25' - 27.3' Low Angle Joint, Heavily Discolored Core Loss Intense Fracturing Fractures End of Run Contact - Healed Joint

COMPLETION REPORT OF WELL No. M-48R

PROJECT: MNS - Groundwater Protection Project

DRILLING CONTRACTOR: S&ME, Inc.

DRILLING METHOD: Mud Rotary

DATE DRILLED: 6/19/07

PROJECT NO: **1264-06-724**

PROJECT LOCATION: Huntersville, North Carolina

WATER LEVEL: Stabilized Water Level at

19.45 ft bls

LATITUDE: 35 26 00.79

LONGITUDE: 80 56 51.61

TOP OF CASING ELEVATION: 760.20

DATUM: MSL

LOGGED BY: Courtney Withers

					LOGGED BY: Courtney Withers				
STRATA						Z			
DESCRIPTION	SYMBOL	DEPTH (ft.)	WELL DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS		
FILL (F): Red and Yellow, Micaceous, SILT GRAVEL FILL (F): Reddish-Brown, Micaceous, Medium to Fine Sandy, Silty,	<i>O</i>	- 0		0.00		760.33	PROTECTIVE CASING Diameter: 8" Type: Steel Flush Mount Interval: At Grade RISER CASING Diameter: 2" Type: Sch. 40 PVC Interval: 0 to 29.4 ft bls		
FILL (F): Red, Micaceous, Clayey, Medium to Fine SAND		- 10 - - - 15 - - - 20	Ţ			:	GROUT Type: Neat Cement Interval: 0 to 25 ft bls SEAL Type: K-Packer + Bentonite Interval: 25 to 28.8 ft bls FILTERPACK Type: N/A Interval: N/A		
With Intermittent Soil Seams, Intensely Fractured	77 77 77 77	25		25.00		735.33	SCREEN Diameter: 2" Type: 0.010 Slotted Sch. 40 PVC Interval: 29.4 to 34.4 ft bls		
QUARTZ DIORITE, Slightly Fractured PARTIALLY WEATHERED/FRACTU	27 >7 >7 R7 >7 >7		CONTRACTOR CONTRACTOR	28.60 28.80 29.40 33.90 34.40 35.20		731.73 731.53 730.93 726.43 725.93 725.13	LEGEND FILTER PACK GS GROUND SURFACE BS BENTONITE BS CEMENT GROUT CUTTINGS / BACKFILL STATIC WATER LEVEL TOC TOP OF CASING GS GROUND SURFACE BS BENTONITE SEAL TOP OF SCREEN TOF OF SCREEN TO TOTAL DEPTH CG CEMENT GROUT		

S&ME

ENGINEERING TESTING

9751 Southern Pine Blvd. Charlotte, North Carolina COMPLETION REPORT OF WELL No. M-48R

Sheet 1 of 1

ROCK CORE PICTURES

McGuire Nuclear Station - Groundwater Protection Project

S&ME Project No: 1264-06-724

Core Location: M-48R







CLASSIFICATION:

20.60' to 35.20' Coarse-Grained Quartz Diorite