

Appendix N Geotechnical Testing Results

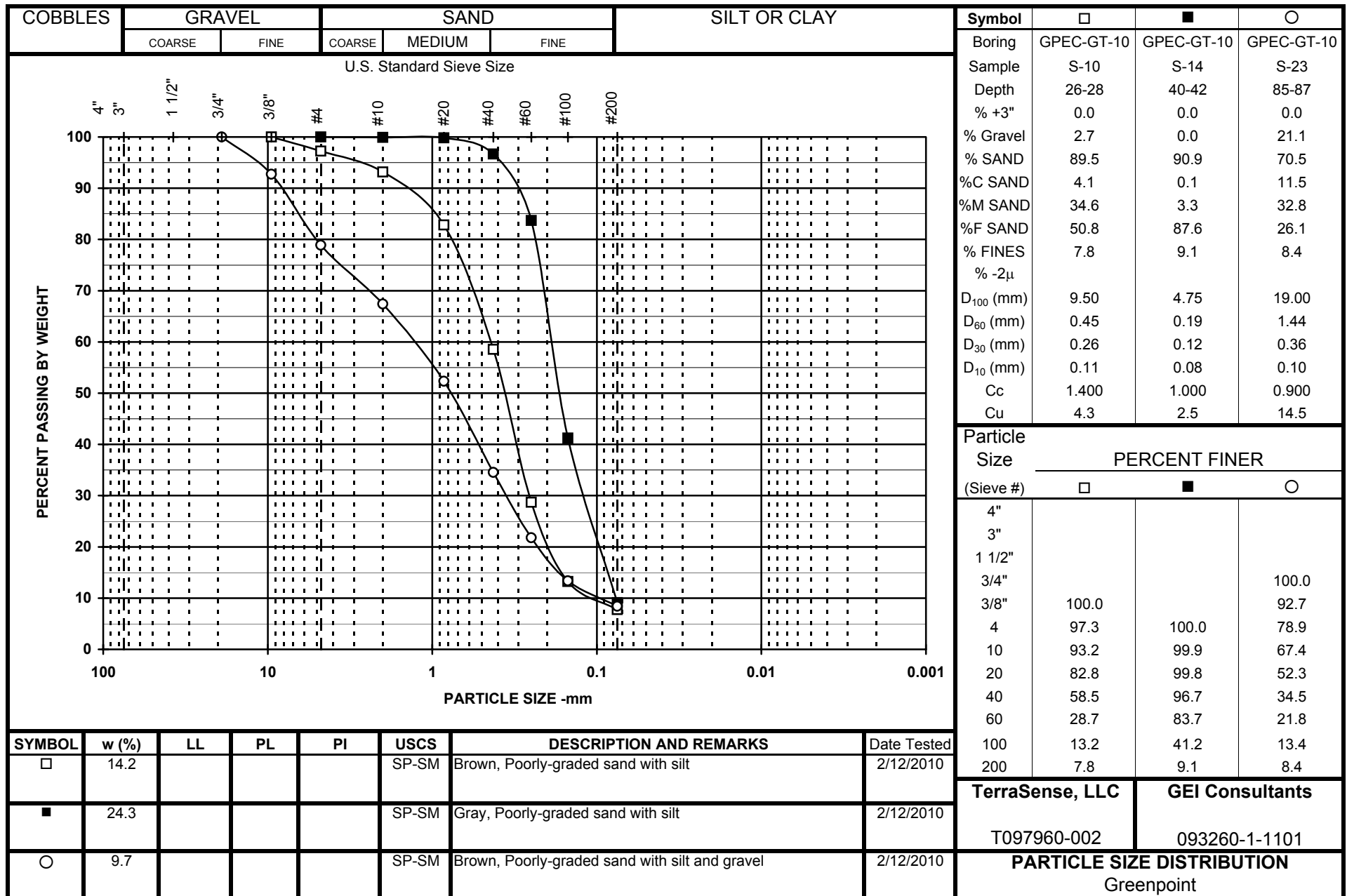
GEI Consultants #093260-1-1101
Greenpoint
LABORATORY TESTING DATA SUMMARY

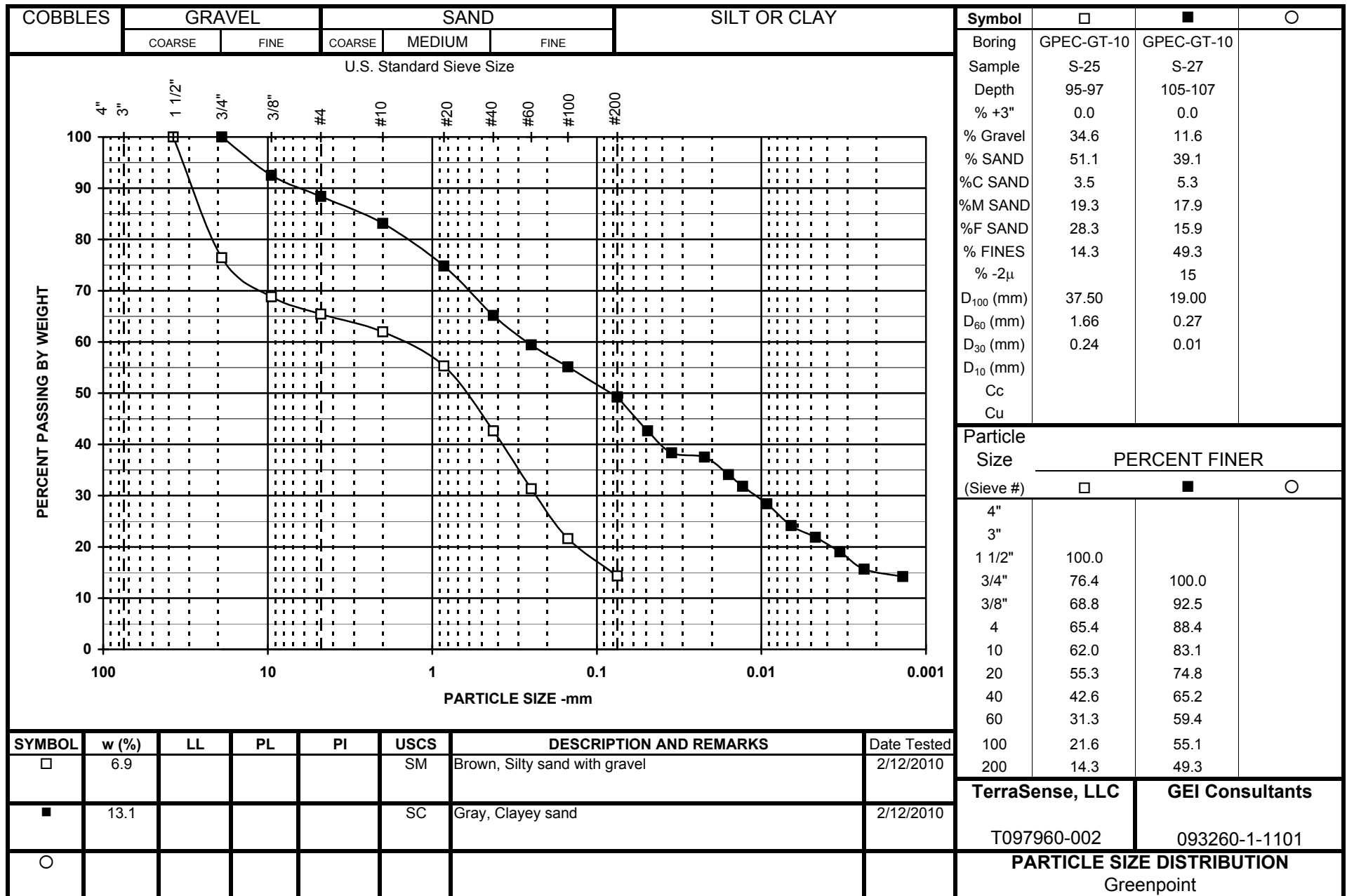
BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS									REMARKS
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO % MINUS 2 µm (%)	ORGANIC CONTENT (burnoff) (%)	TOTAL UNIT WEIGHT (pcf)	
GPEC-GT-1	U-2	47-49									115.0	
GPEC-GT-1	U-2	47.65	36.3									
GPEC-GT-1	U-2	48.2	33.5									
GPEC-GT-1	U-2C	48.45	36.8	39	26	13	ML					
GPEC-GT-1	U-2	48.75	36.2									
GPEC-GT-3	S-8	25-27	57.8	69	39	30	MH					
GPEC-GT-3	S-10	30-32	33.4	47	34	13	ML					
GPEC-GT-4	U-1	26-28					PT				105.1	
GPEC-GT-4	U-1	26.5	72.3				PT					
GPEC-GT-4	U-1	27.05	51.7				PT					
GPEC-GT-4	U-1C	27.3	54.5				PT			7.9		
GPEC-GT-4	U-1	27.6	17.9				OL					
GPEC-GT-4	S-11	35-37	20.0	24	15	9	SC	45.2				
GPEC-GT-7	S-16	45-47	8.1				SP	3.3				
GPEC-GT-8	S-7	20-22	152.3				PT			38.0		
GPEC-GT-8	S-10	30-32	29.8	40	23	17	CL					
GPEC-GT-10	S-10	26-28	14.2				SP-SM	7.8				
GPEC-GT-10	U-1	30-32									122.9	
GPEC-GT-10	U-1	30.4	27.4									
GPEC-GT-10	U-1B	30.65	26.9	32	28	4	ML					
GPEC-GT-10	U-1	30.95	30.4									
GPEC-GT-10	S-14	40-42	24.3				SP-SM	9.1				
GPEC-GT-10	S-23	85-87	9.7				SP-SM	8.4				
GPEC-GT-10	S-25	95-97	6.9				SM	14.3				
GPEC-GT-10	S-27	105-107	13.1				SC	49.3	15			
GPEC-GT-12	S-9	25-27	18.5				SP	1.4				
GPEC-GT-12	S-10	30-32	21.2				SP	3.2				
GPEC-GT-12	S-11	35-37	16.8				SP	4.1				

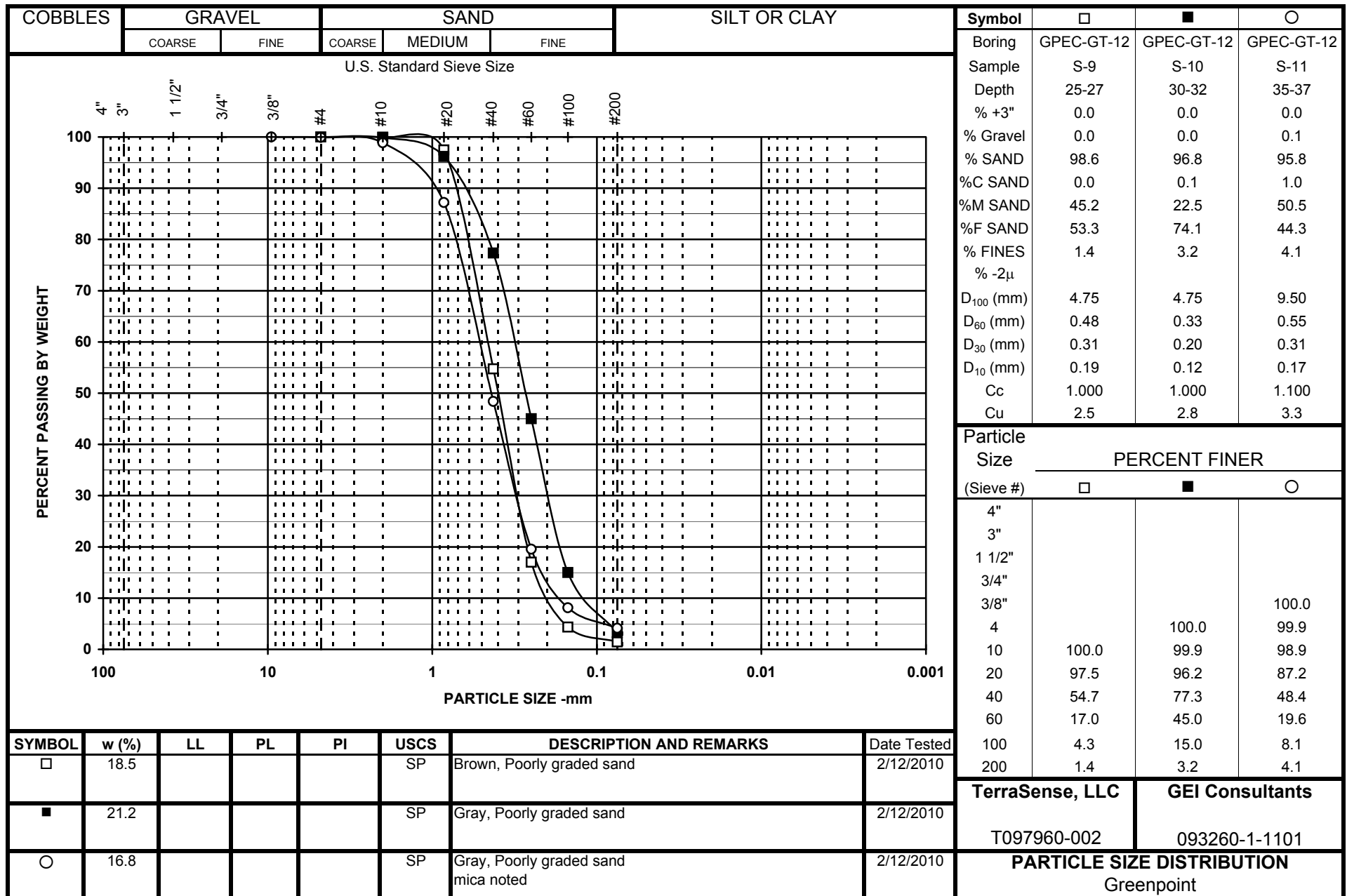
GEI Consultants #093260-1-1101
Greenpoint
LABORATORY TESTING DATA SUMMARY

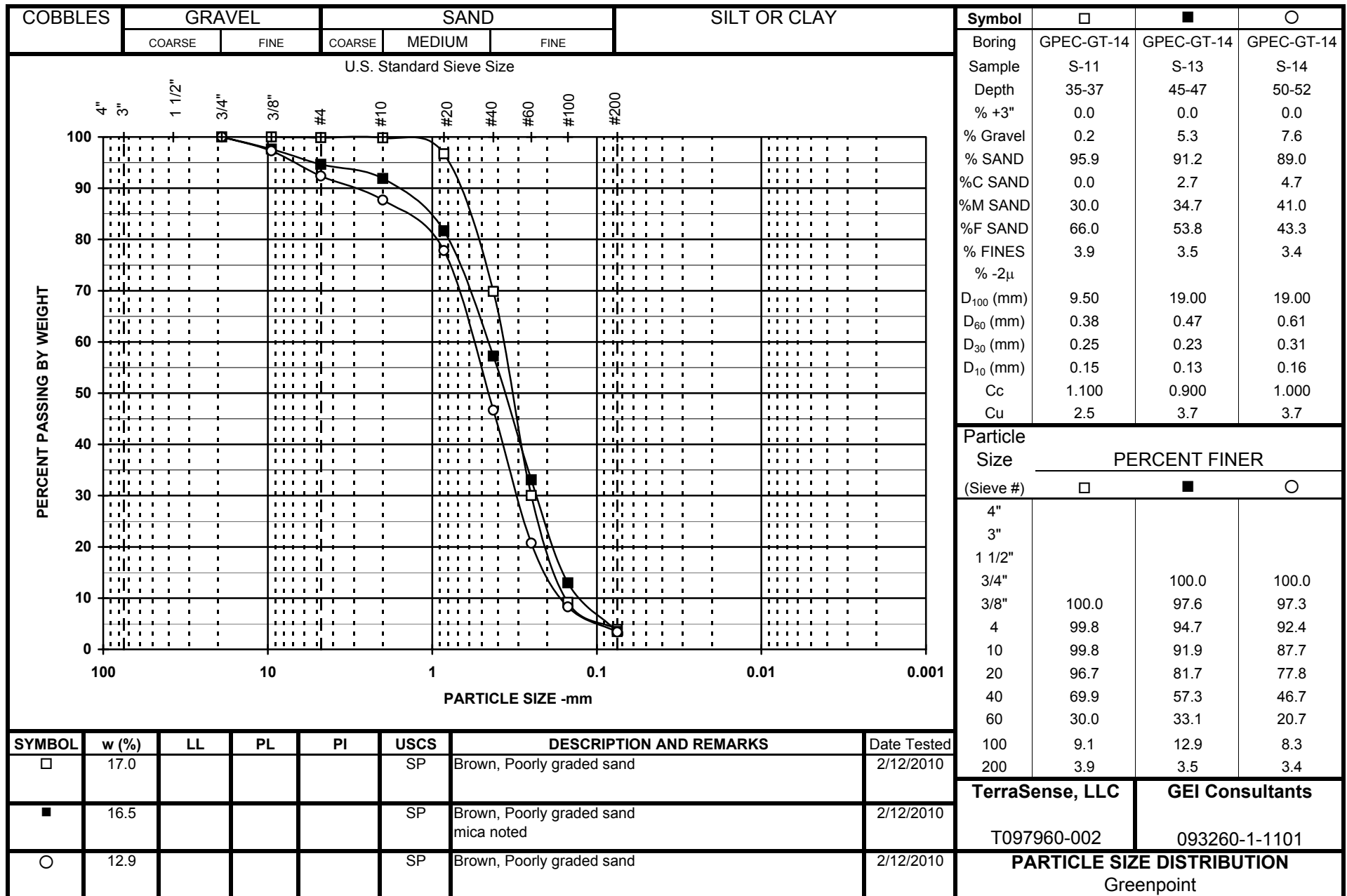
BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS									REMARKS
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO % MINUS 2 µm (%)	ORGANIC CONTENT (burnoff) (%)	TOTAL UNIT WEIGHT (pcf)	
GPEC-GT-14	S-11	35-37	17.0				SP	3.9				
GPEC-GT-14	S-13	45-47	16.5				SP	3.5				
GPEC-GT-14	S-14	50-52	12.9				SP	3.4				
GPEC-GT-16	S-9	25-27	42.7	54	28	26	CH					
GPEC-GT-16	S-10	30-32	27.0	30	22	8	CL					
GPEC-GT-16	S-15	55-57	20.6				SP	4.7				
GPEC-GT-16	S-16	60-62	13.8				SW	3.2				
GPEC-GT-16	S-18	70-72	13.8				SP-SM	6.8				
GPEC-GT-16	S-22	80-82	12.5				SW-SM	10.5				
GPEC-GT-16	S-25	95-97	19.0	35	16	19	CL	60.4				
GPEC-GT-18	S-10	25-27	36.9	40	26	14	ML					
GPEC-GT-18	U-1	32-34									117.0	
GPEC-GT-18	U-1	32.35	46.3									
GPEC-GT-18	U-1	32.9	34.9									
GPEC-GT-18	U-1B	33.15	28.5	32	22	10	CL	96.7	14			
GPEC-GT-18	U-1	33.45	25.2									
GPEC-GT-18	S-13	35-37	28.2	32	22	10	CL	91.3				
GPEC-GT-18	S-16	47-49	16.5				SP	2.3				
GPEC-GT-20	S-9	16-18	16.6				SP	2.5				
GPEC-GT-20	S-10	20-22	32.6	43	24	19	CL	98.4				
GPEC-GT-20	U-1	27-29									114.4	
GPEC-GT-20	U-1	27.5	33.5									
GPEC-GT-20	U-1	28.05	35.5									
GPEC-GT-20	U-1C	28.3	33.5	54	25	29	CH					
GPEC-GT-20	U-1	28.6	39.1									
GPEC-GT-20	S-15	40-42	30.1				ML	91.8	13			
GPEC-GT-22	S-8	14-16	33.7	47	26	21	CL	93.4				
GPEC-GT-22	S-11	30-32	29.8				ML	91.2				
GPEC-GT-22	S-13	40-42	18.9				SM	15.2				

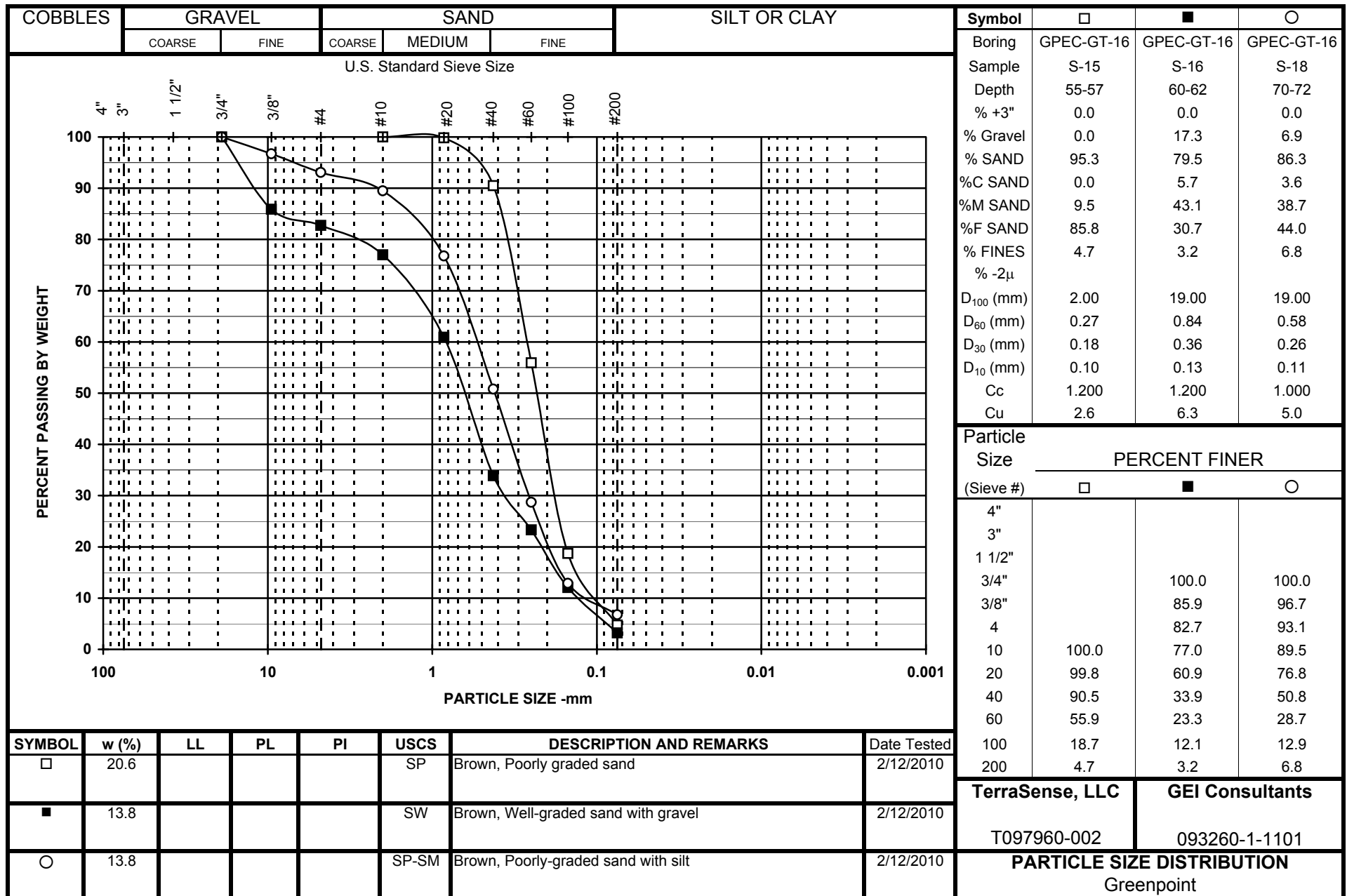
Note: (1) USCS symbol based on visual observation and Sieve and Atterberg limits reported.

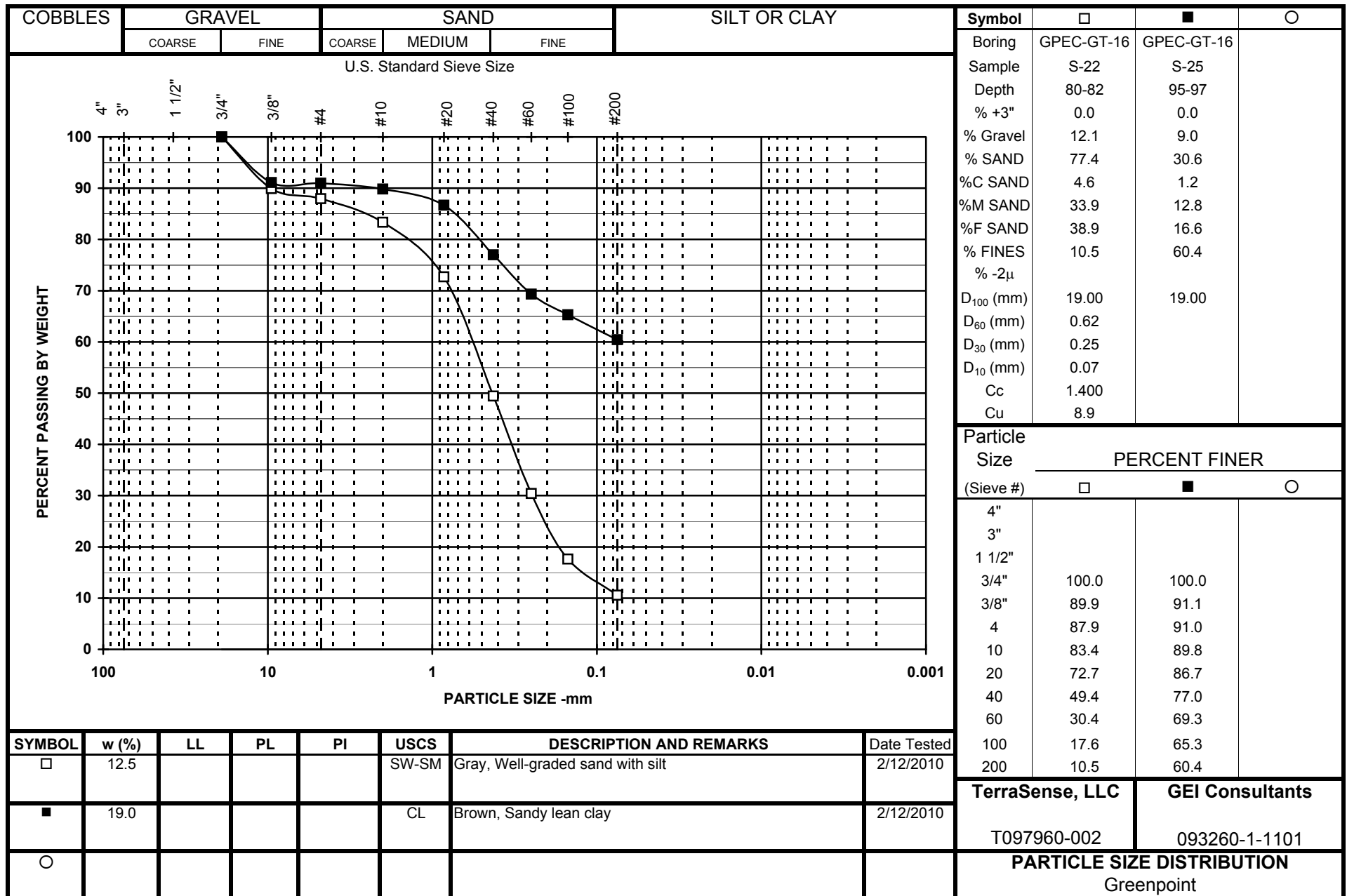


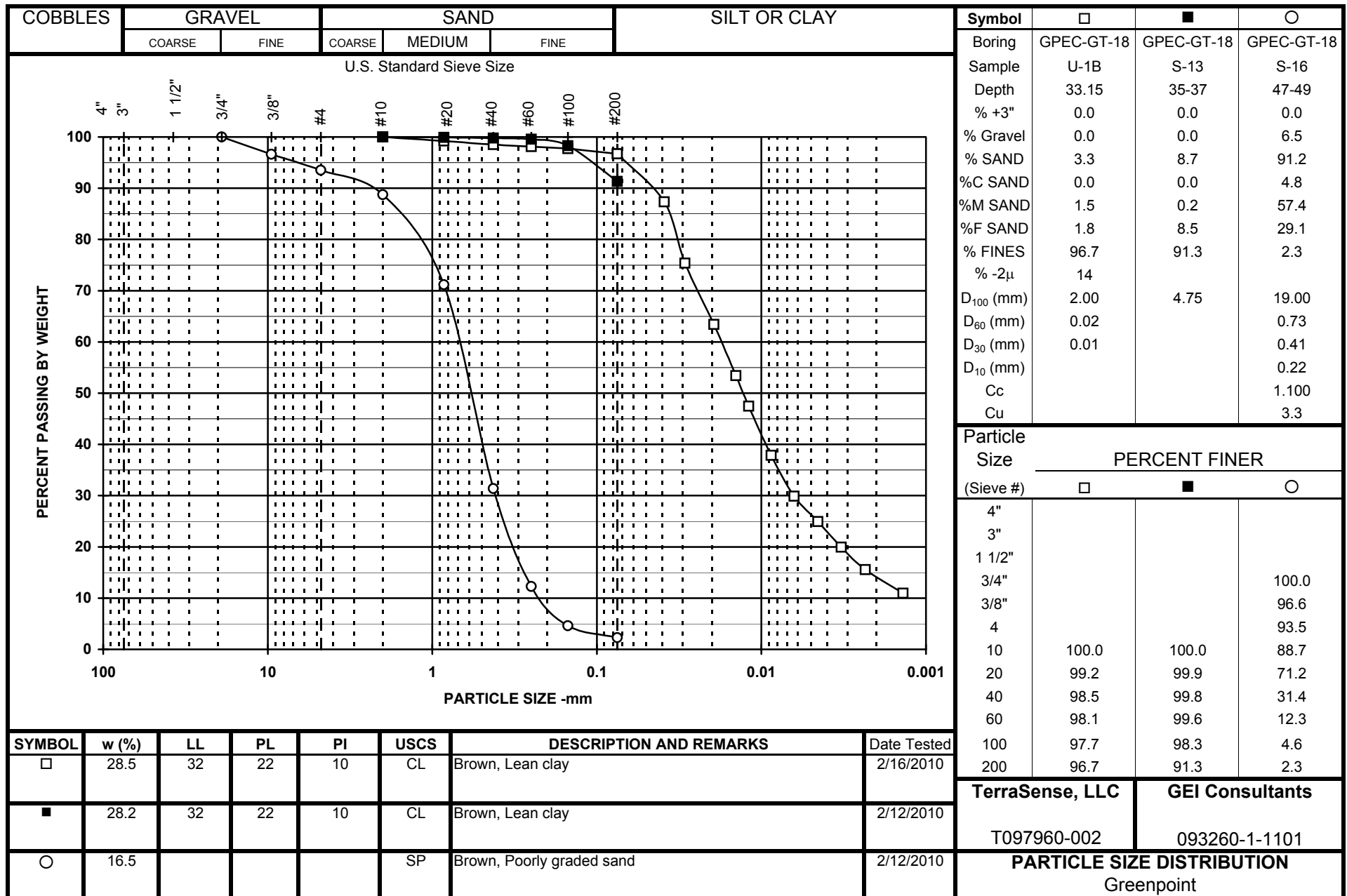


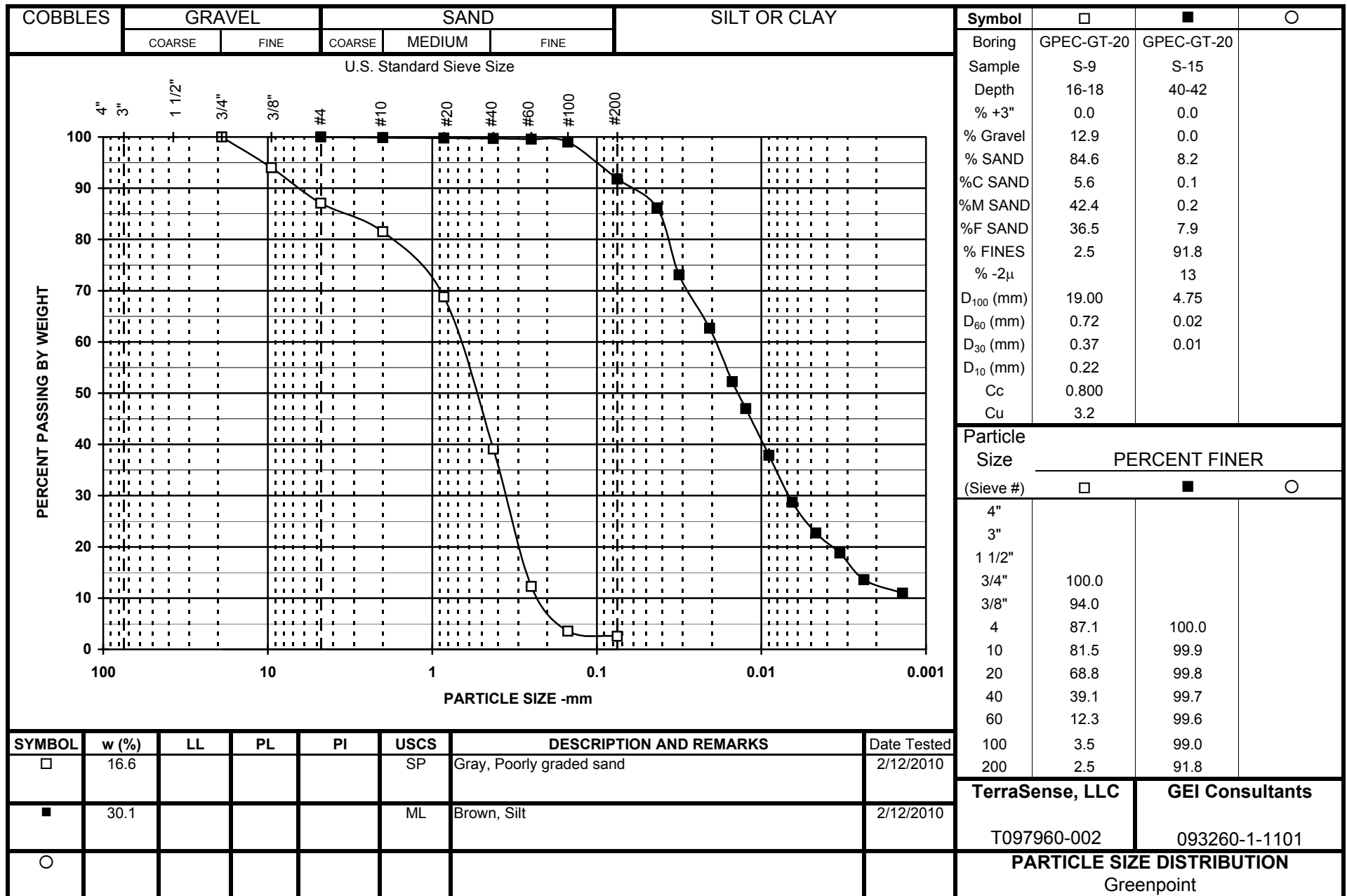


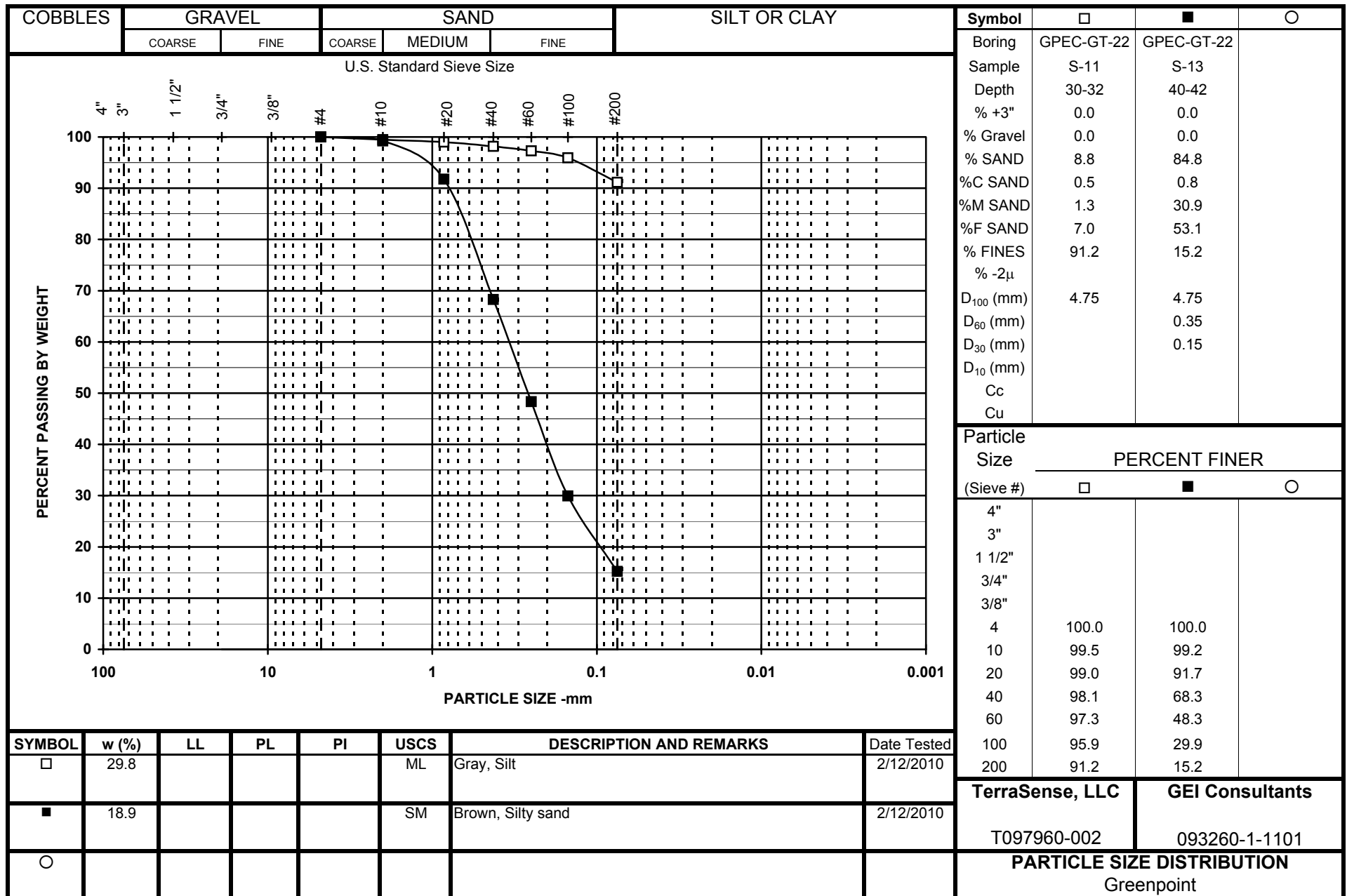












GEI Consultants #093260-1-1101
Greenpoint
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS					REMARKS
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	
GT-1	S-17	55-57	33.1	43	23	20	CL	
GT-8	S-11	35-37	39.8	45	27	18	ML	
GT-20	S-14	35-37	35.6	53	26	27	CH	
GT-20	S-16	45-47	45.3	57	29	28	CH	

Note: (1) USCS symbol based on visual observation and Atterberg limits reported.

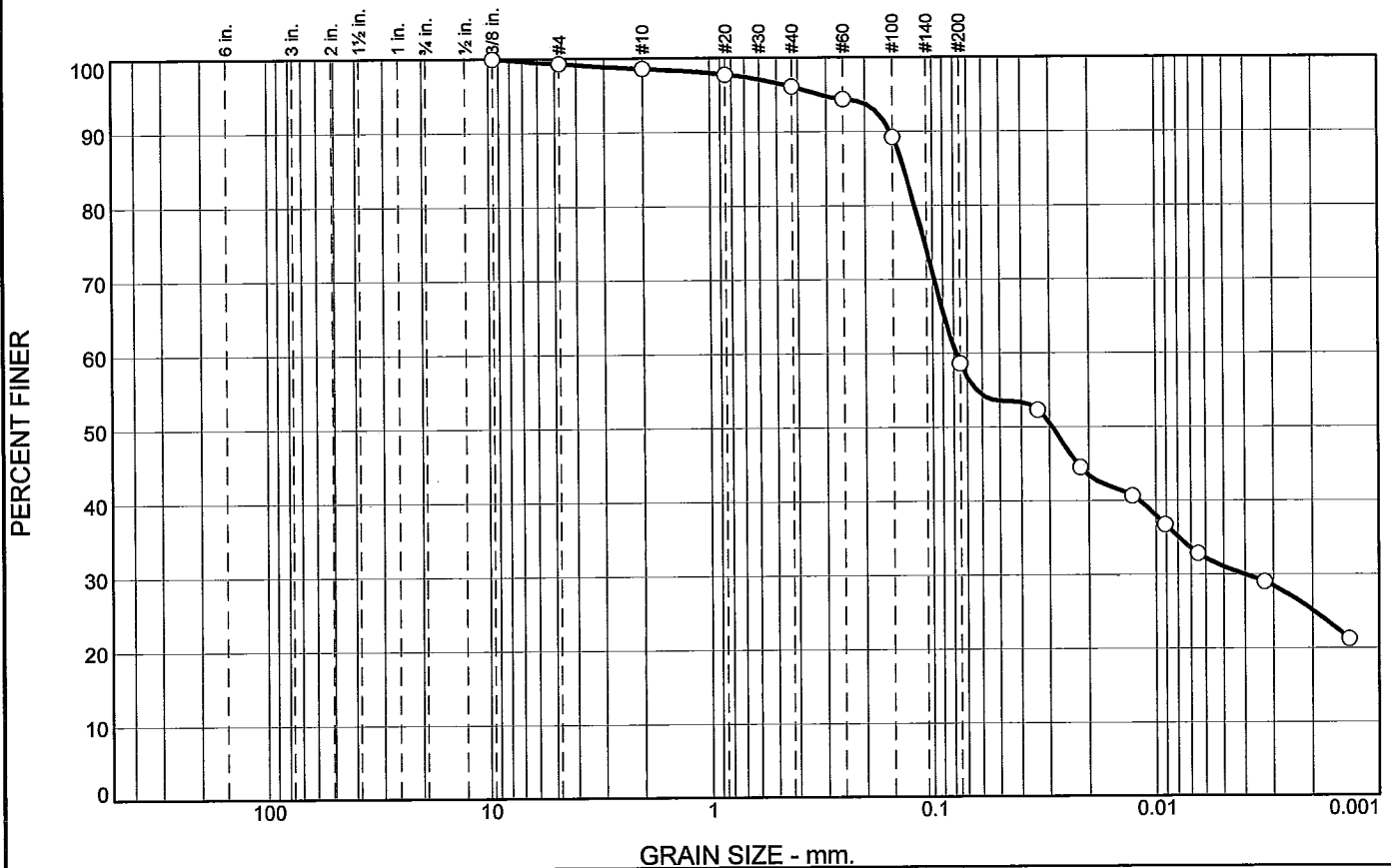
INVENTORY LIST

Client: GEI
Project: Barrier Wall

Job No: 10LS2201.01

JLT Bucket ID	Label on Bucket Lid
GEI-1	GPEC-SB-113 (131-135) Clay
GEI-2	GPEC-SB-114 (80-109) Sand
GEI-3	GPEC-SB-105 (45-60) SW-093260-1-1101
GEI-4	GPEC-SB-113 (100-125) Sand 74-7119
GEI-5	GPEC-SB-102 (65-80) SW/SP Upper Sand Unit
GEI-6	GPEC-SB-106 (40-60) SW/SM Upper Sand Unit
GEI-7	GPEC-SB-103 (40-50) Sand Gravel
GEI-8	GPEC-SB-114 (109-115) Clay/Sandy Clay
GEI-9	GPEC-SB-113 (50-55) Clay/Silt/Sand
GEI-10	GPEC-SB-113 (125-130) Sand
GEI-11	GPEC-SB-114 (67-80) Sand
GEI-12	GPEC-SB-104 (37-75) Sand
Coolers (2)	
GEI-C1	GPEC-MW-01R 7/28/10 Container 1
	GPEC-MW-01R 7/28/10 Container 2
GEI-C2	GPEC-MW-2D 7/28/10 1 Large Container

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.7	0.7	2.5	37.5	27.5	31.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	99.3		
#10	98.6		
#20	97.8		
#40	96.1		
#60	94.4		
#100	89.2		
#200	58.6		

* (no specification provided)

<u>Material Description</u>		
Clay / Sandy Clay		
<u>Atterberg Limits</u>		
PL= 26	LL= 34	PI= 8
<u>Coefficients</u>		
D ₉₀ = 0.1541	D ₈₅ = 0.1335	D ₆₀ = 0.0783
D ₅₀ = 0.0291	D ₃₀ = 0.0040	D ₁₅ =
D ₁₀ =	C _u =	C _c =
<u>Classification</u>		
USCS= ML	AASHTO=	
<u>Remarks</u>		
As-Rec'd M/C = 20.8%		

Location: DSM Wall

Sample Number: GPEC-SB-114

Depth: 109-115

Date: 09/03/2010

JLT Laboratories, Inc.

Canonsburg, PA

Client: GEI Consultants

Project: DSM Wall

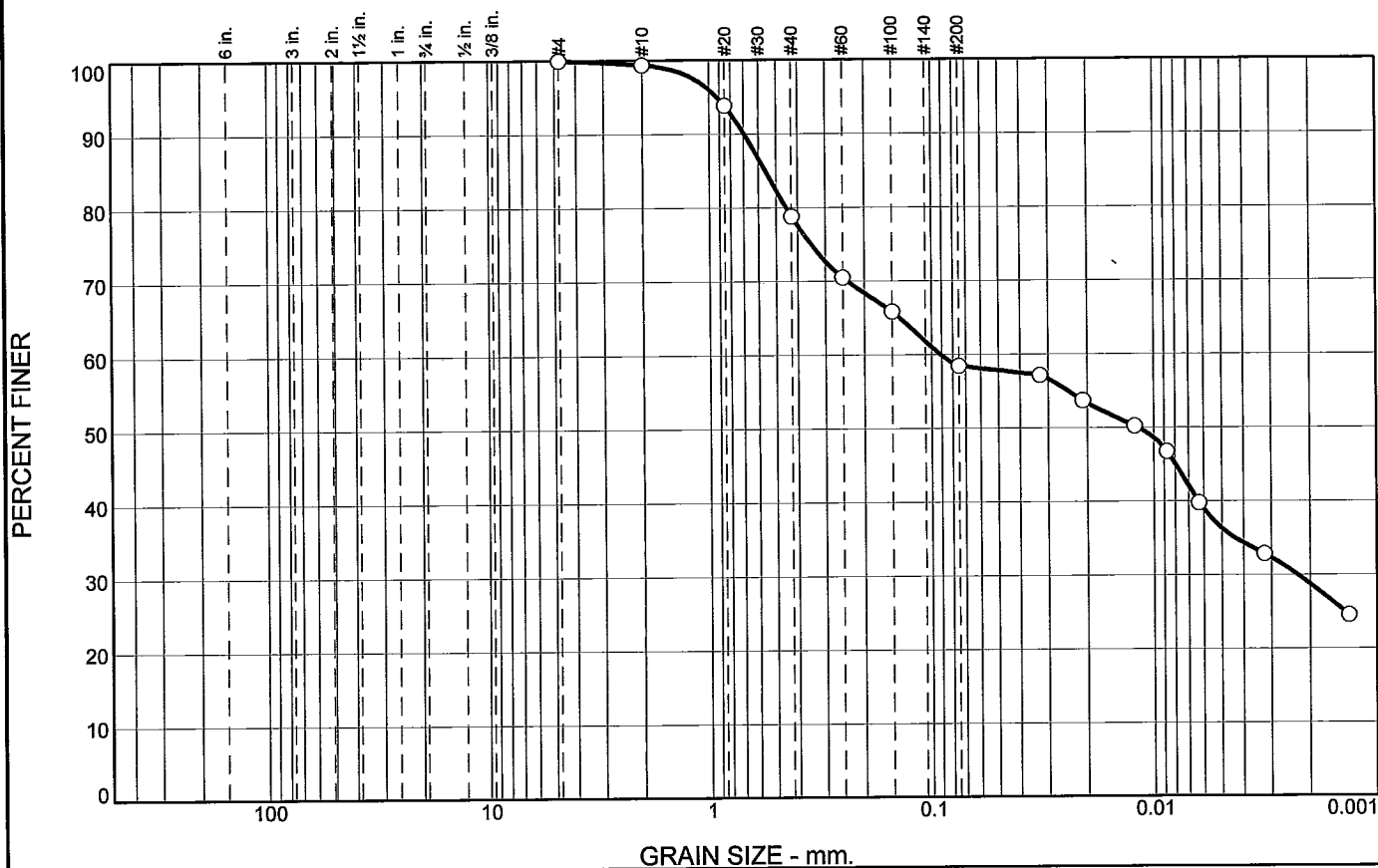
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.6	20.6	20.3	22.1	36.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.4		
#20	93.9		
#40	78.8		
#60	70.5		
#100	65.8		
#200	58.5		

* (no specification provided)

Material Description

Clay

PL= 26 **Atterberg Limits** LL= 36 PI= 10

Coefficients

D₉₀= 0.6957 D₈₅= 0.5592 D₆₀= 0.0905
D₅₀= 0.0118 D₃₀= 0.0023 D₁₅=
D₁₀= C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

As-Rec'd M/C = 16.9%

Location: DSM Wall

Sample Number: GPEC-SB-113

Depth: 131-135

Date: 09/03/2010

JLT Laboratories, Inc.

Canonsburg, PA

Client: GEI Consultants

Project: DSM Wall

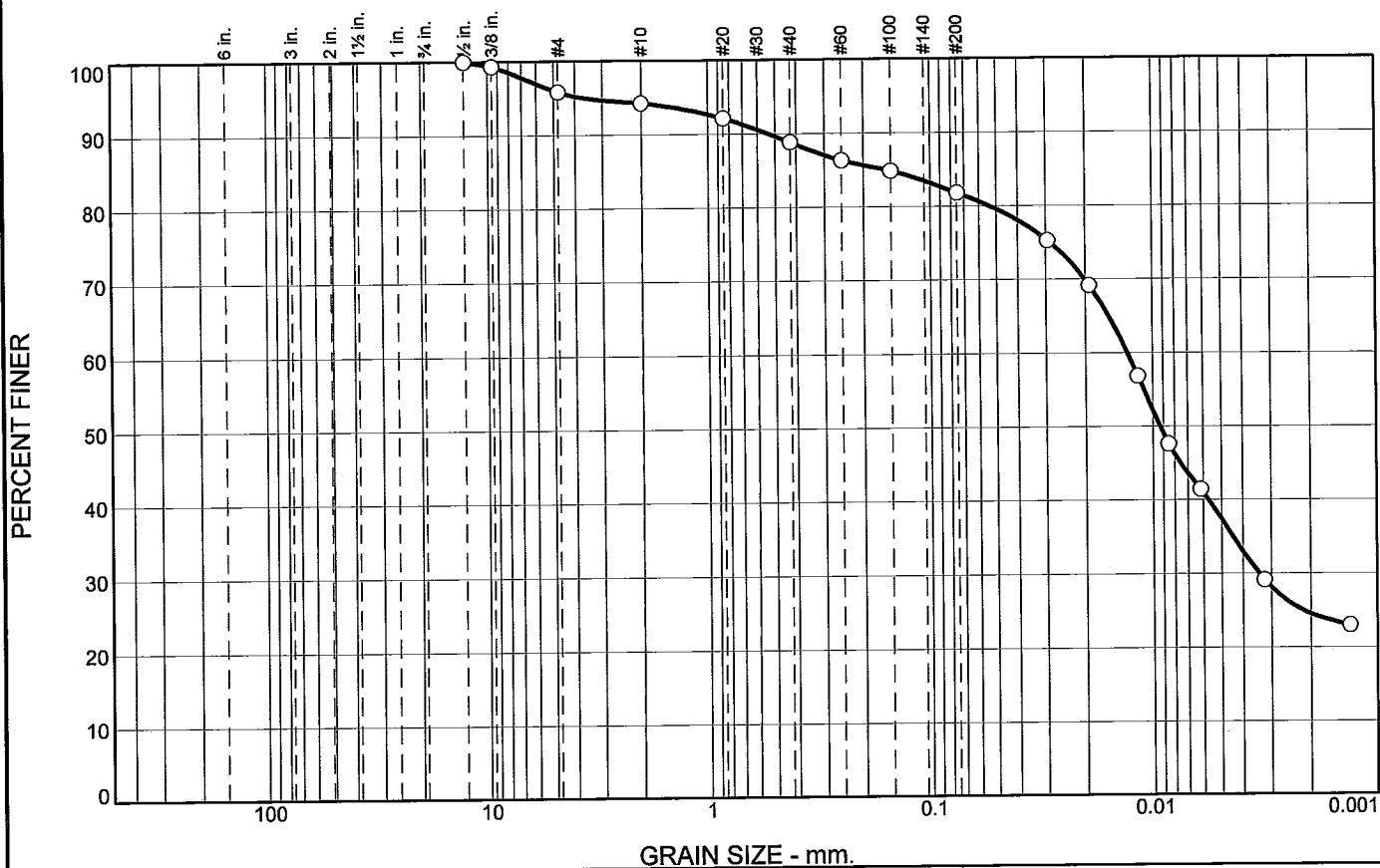
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.1	1.7	5.4	7.0	44.3	37.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.50	100.0		
0.375	99.3		
#4	95.9		
#10	94.2		
#20	92.1		
#40	88.8		
#60	86.3		
#100	84.8		
#200	81.8		

* (no specification provided)

<u>Material Description</u>		
Clay / Silt / Sand		
<u>Atterberg Limits</u>		
PL= 22	LL= 27	PI= 5
<u>Coefficients</u>		
D ₉₀ = 0.5329	D ₈₅ = 0.1577	D ₆₀ = 0.0130
D ₅₀ = 0.0093	D ₃₀ = 0.0034	D ₁₅ =
D ₁₀ =	C _u =	C _c =
<u>Classification</u>		
USCS= CL-ML	AASHTO=	
<u>Remarks</u>		
As-Rec'd M/C = 34.8%		

Location: DSM Wall

Sample Number: GPEC-SB-113

Depth: 50-55

Date: 09/03/2010

JLT Laboratories, Inc.

Canonsburg, PA

Client: GEI Consultants

Project: DSM Wall

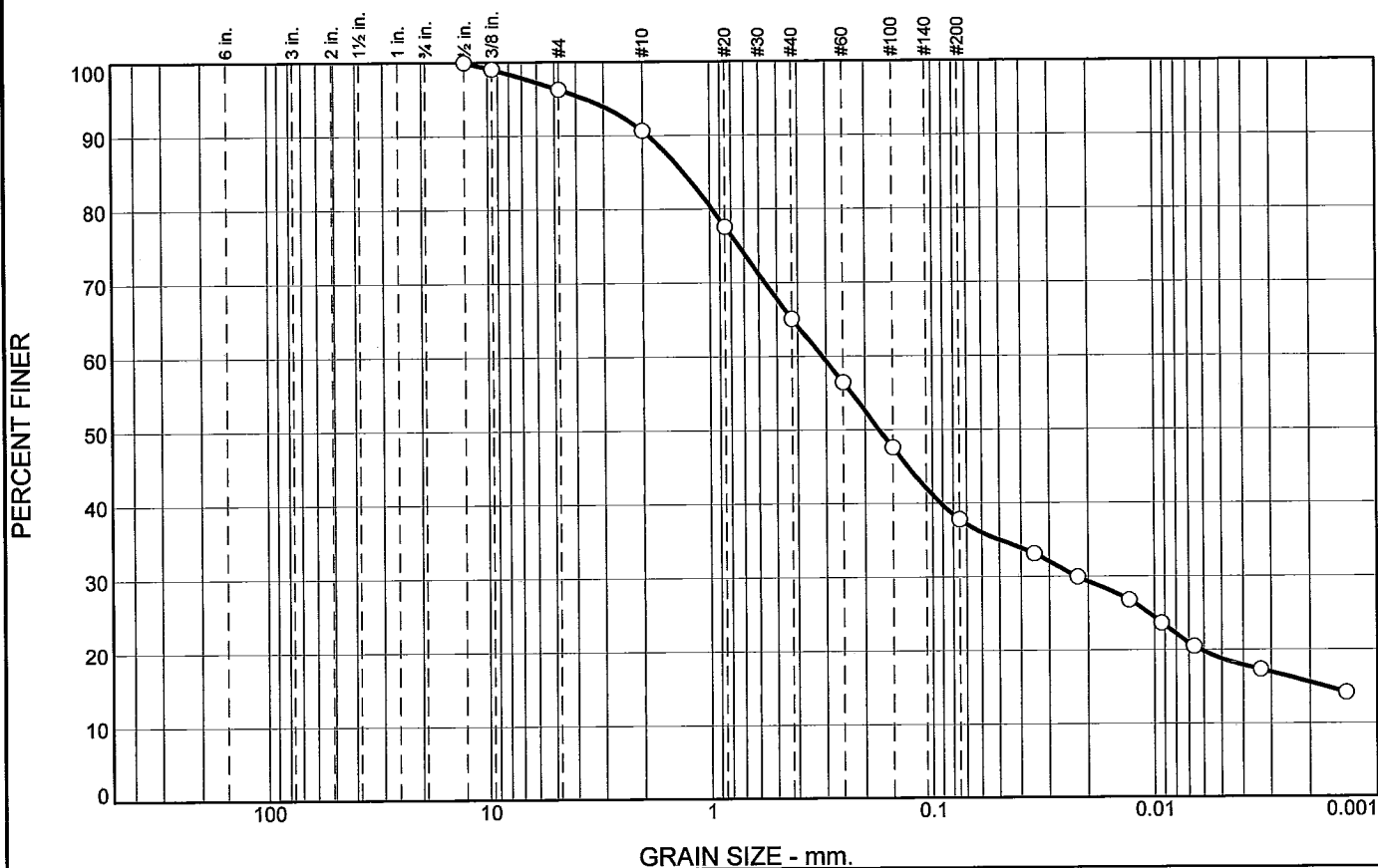
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.7	5.7	25.5	27.3	19.0	18.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.50	100.0		
0.375	99.1		
#4	96.3		
#10	90.6		
#20	77.6		
#40	65.1		
#60	56.4		
#100	47.6		
#200	37.8		

* (no specification provided)

Material Description		
Fill		
PL= NP	<u>Atterberg Limits</u> LL= NP	PI= NP
D ₉₀ = 1.8890	<u>Coefficients</u> D ₈₅ = 1.3128	D ₆₀ = 0.3112
D ₅₀ = 0.1724	D ₃₀ = 0.0223	D ₁₅ = 0.0017
D ₁₀ =	C _u =	C _c =
<u>Classification</u> USCS= SM AASHTO=		
<u>Remarks</u> As-Rec'd M/C = 25.3%		

Location: DSM Wall

Sample Number: GPEC-SB-105

Depth: 20-24

Date: 09/03/2010

JLT Laboratories, Inc.

Canonsburg, PA

Client: GEI Consultants

Project: DSM Wall

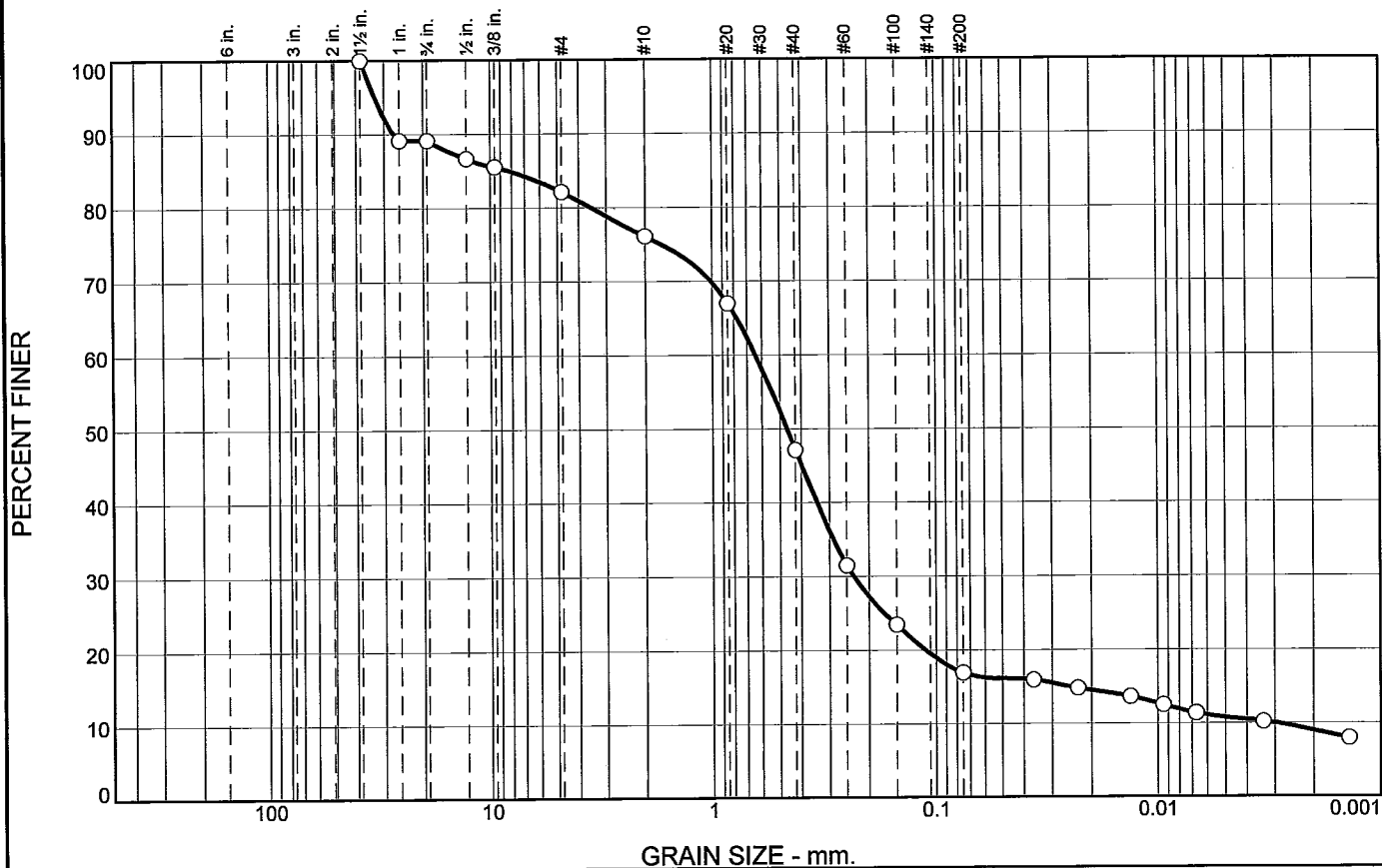
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.9	7.0	6.0	29.0	30.2	6.1	10.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
1.00	89.1		
0.75	89.1		
0.50	86.7		
0.375	85.5		
#4	82.1		
#10	76.1		
#20	67.0		
#40	47.1		
#60	31.5		
#100	23.4		
#200	16.9		

* (no specification provided)

Material Description		
Sand		
PL= NP		
LL= NP		
PI= NP		
Coefficients		
D ₉₀ = 27.1458	D ₈₅ = 8.2288	D ₆₀ = 0.6408
D ₅₀ = 0.4638	D ₃₀ = 0.2330	D ₁₅ = 0.0248
D ₁₀ = 0.0030	C _u = 214.12	C _c = 28.31
Classification		
USCS= SM		
AASHTO=		
Remarks		
As-Rec'd M/C = 14.5%		

Location: DSM Wall

Sample Number: GPEC-SB-114

Depth: 67-80

Date: 09/03/2010

JLT Laboratories, Inc.

Canonsburg, PA

Client: GEI Consultants

Project: DSM Wall

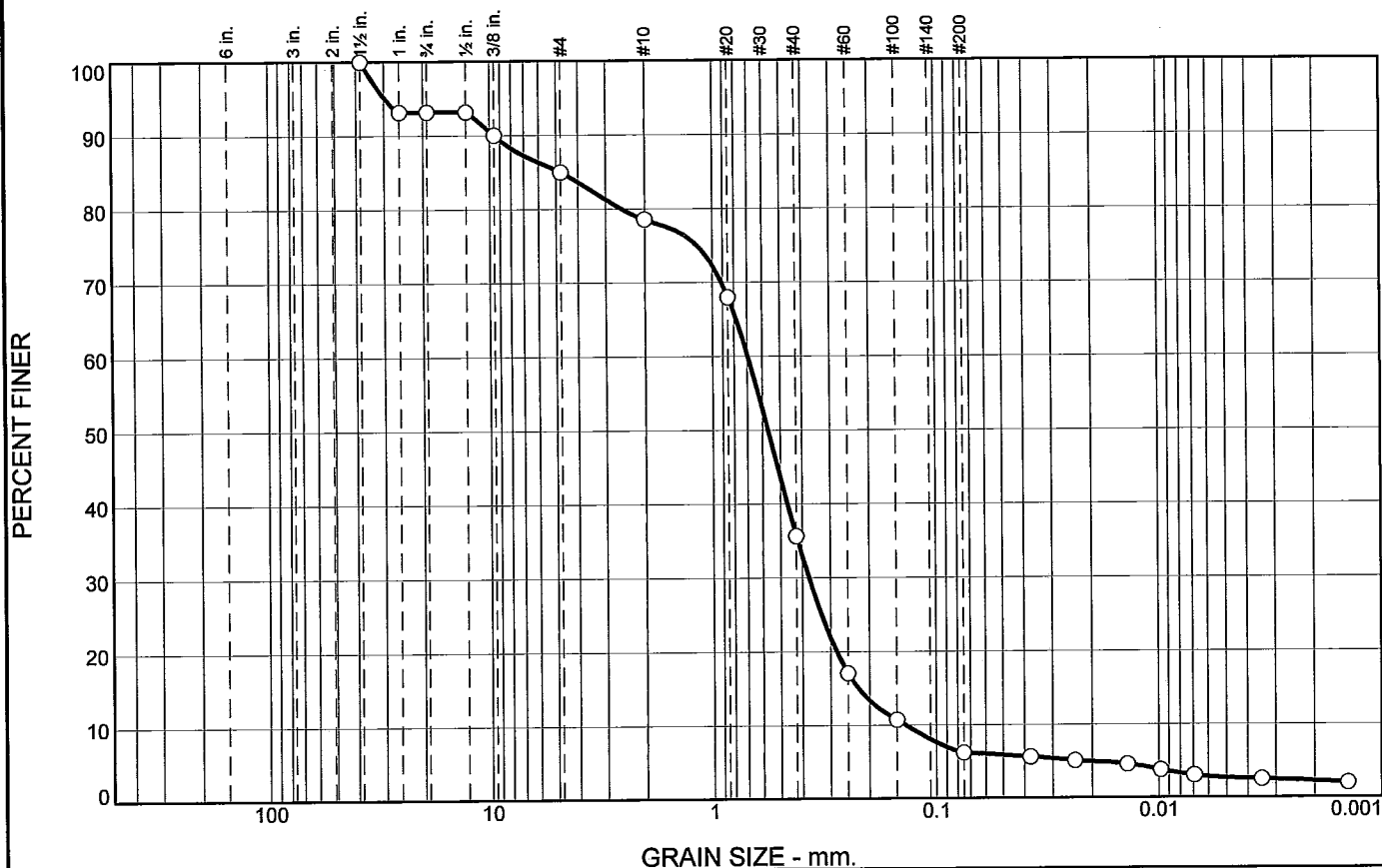
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.8	8.2	6.5	42.9	29.4	3.5	2.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
1.00	93.2		
0.75	93.2		
0.50	93.2		
0.375	90.0		
#4	85.0		
#10	78.5		
#20	68.0		
#40	35.6		
#60	17.1		
#100	10.7		
#200	6.2		

* (no specification provided)

<u>Material Description</u>		
Sand		
	<u>Atterberg Limits</u>	
PL=	LL=	PI=
	<u>Coefficients</u>	
D ₉₀ = 9.5500	D ₈₅ = 4.7723	D ₆₀ = 0.6956
D ₅₀ = 0.5665	D ₃₀ = 0.3741	D ₁₅ = 0.2241
D ₁₀ = 0.1367	C _u = 5.09	C _c = 1.47
	<u>Classification</u>	
USCS= SW-SM	AASHTO=	
	<u>Remarks</u>	
As-Rec'd M/C = 19.4%		

Location: DSM Wall
Sample Number: GPEC-SB-113

Depth: 100-125

Date: 09/03/2010

JLT Laboratories, Inc.

Client: GEI Consultants
Project: DSM Wall

Canonsburg, PA

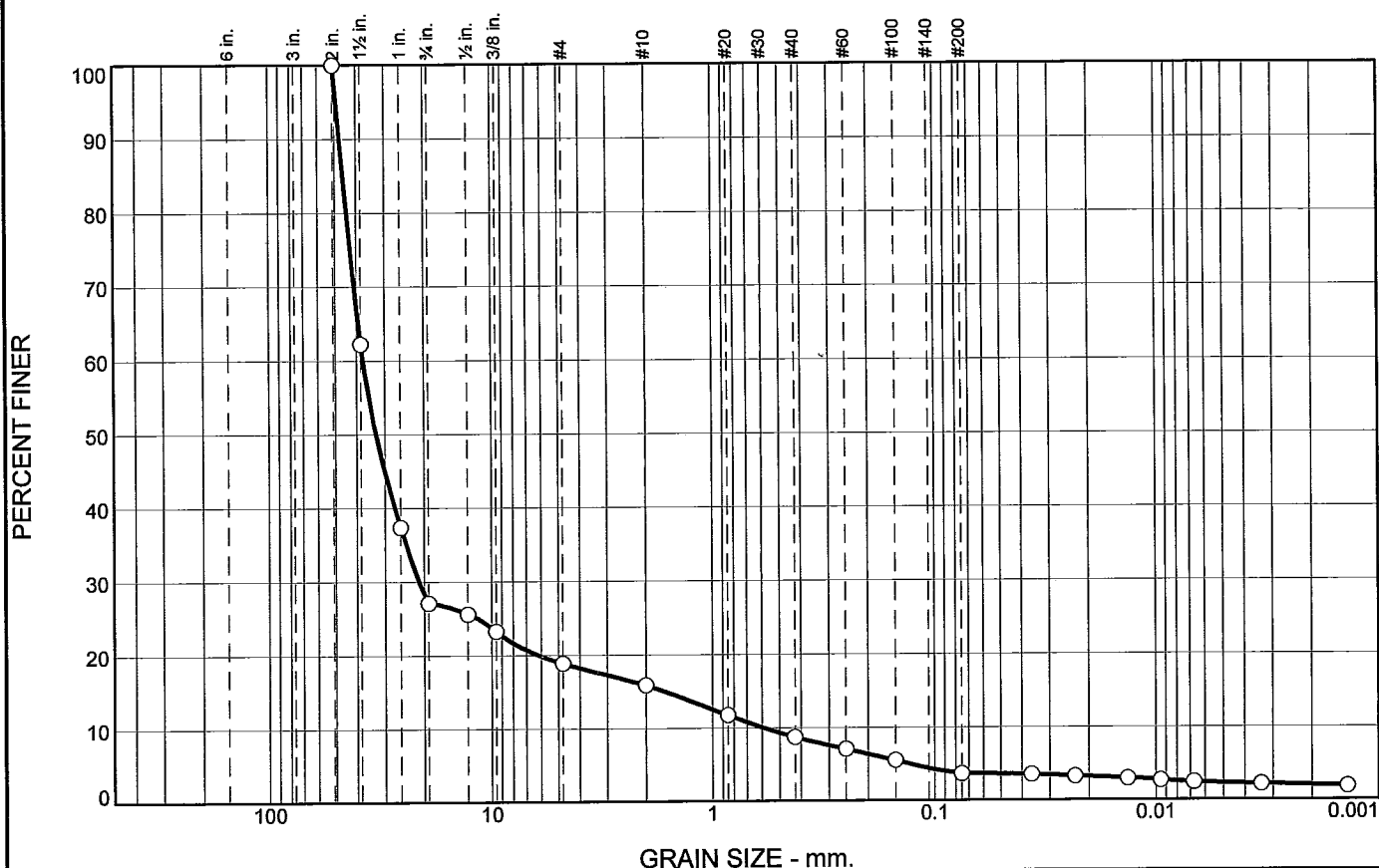
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	72.9	8.2	3.0	7.2	5.0	1.4	2.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2.00	100.0		
1.50	62.2		
1.00	37.4		
0.75	27.1		
0.50	25.6		
0.375	23.2		
#4	18.9		
#10	15.9		
#20	11.7		
#40	8.7		
#60	7.1		
#100	5.5		
#200	3.7		

* (no specification provided)

Material Description		
Fill		
Atterberg Limits		
PL=	LL=	PI=
Coefficients		
D ₉₀ = 47.4192	D ₈₅ = 45.7785	D ₆₀ = 37.2494
D ₅₀ = 32.8152	D ₃₀ = 21.1131	D ₁₅ = 1.6377
D ₁₀ = 0.5835	C _u = 63.84	C _c = 20.51
Classification		
USCS= GP	AASHTO=	
Remarks		
As-Rec'd M/C = 19.3%		

Location: DSM Wall

Sample Number: GPEC-SB-106

Depth: 10-15

Date: 09/03/2010

JLT Laboratories, Inc.

Canonsburg, PA

Client: GEI Consultants

Project: DSM Wall

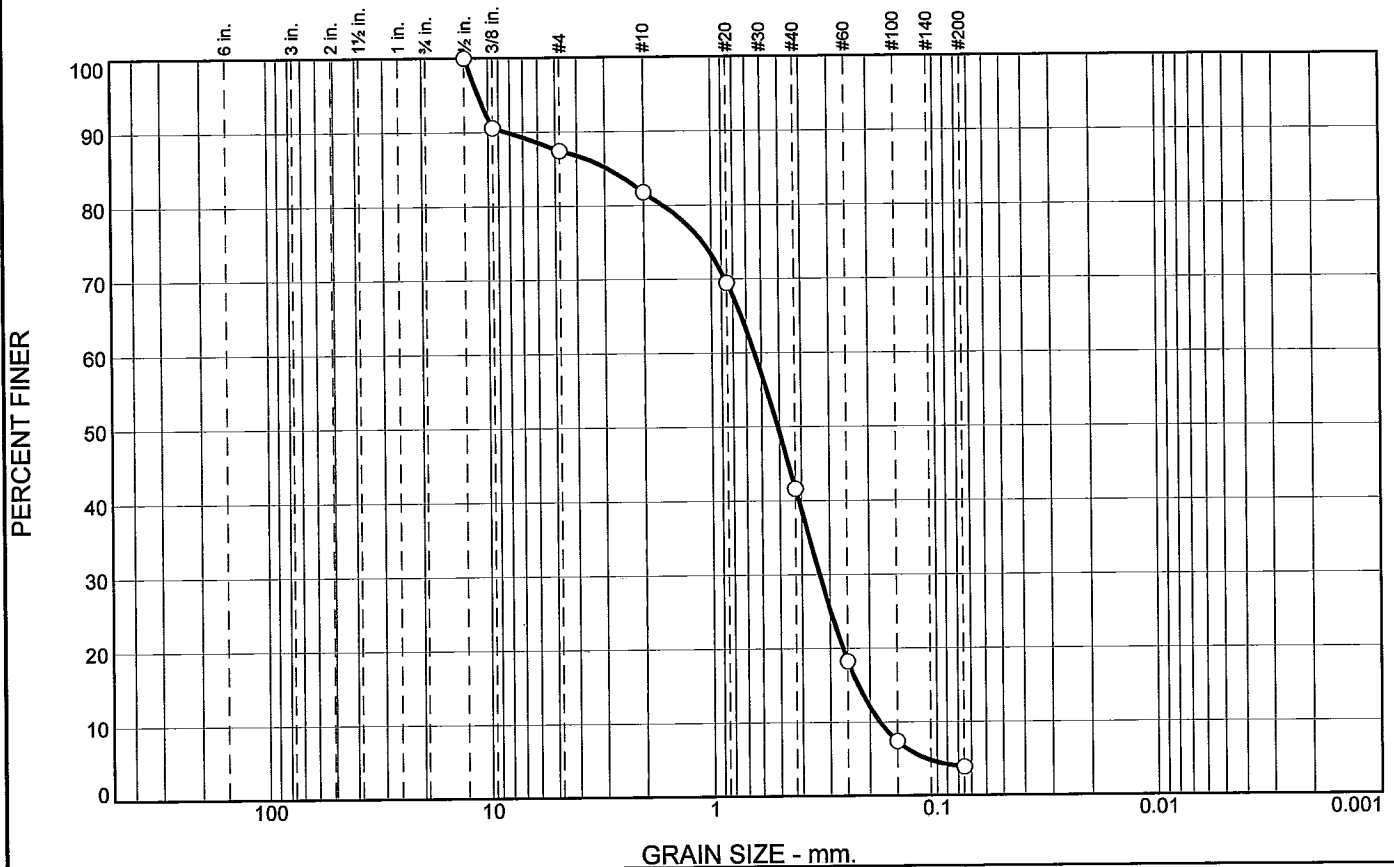
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	12.6	5.7	40.1	37.7	3.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.50	100.0		
0.375	90.5		
#4	87.4		
#10	81.7		
#20	69.5		
#40	41.6		
#60	18.2		
#100	7.4		
#200	3.9		

* (no specification provided)

Material Description		
Upper Sand Unit (MW 102D)		
Atterberg Limits PL= LL= PI= Coefficients D₉₀= 8.2519 D₈₅= 2.8964 D₆₀= 0.6429 D₅₀= 0.5084 D₃₀= 0.3332 D₁₅= 0.2253 D₁₀= 0.1802 C_u= 3.57 C_c= 0.96 Classification USCS= SP AASHTO= Remarks As-Rec'd M/C = 21.7%		

Location: DSM Wall

Sample Number: GPEC-SB-102

Depth: 65-80

Date: 09/03/2010

JLT Laboratories, Inc.

Canonsburg, PA

Client: GEI Consultants

Project: DSM Wall

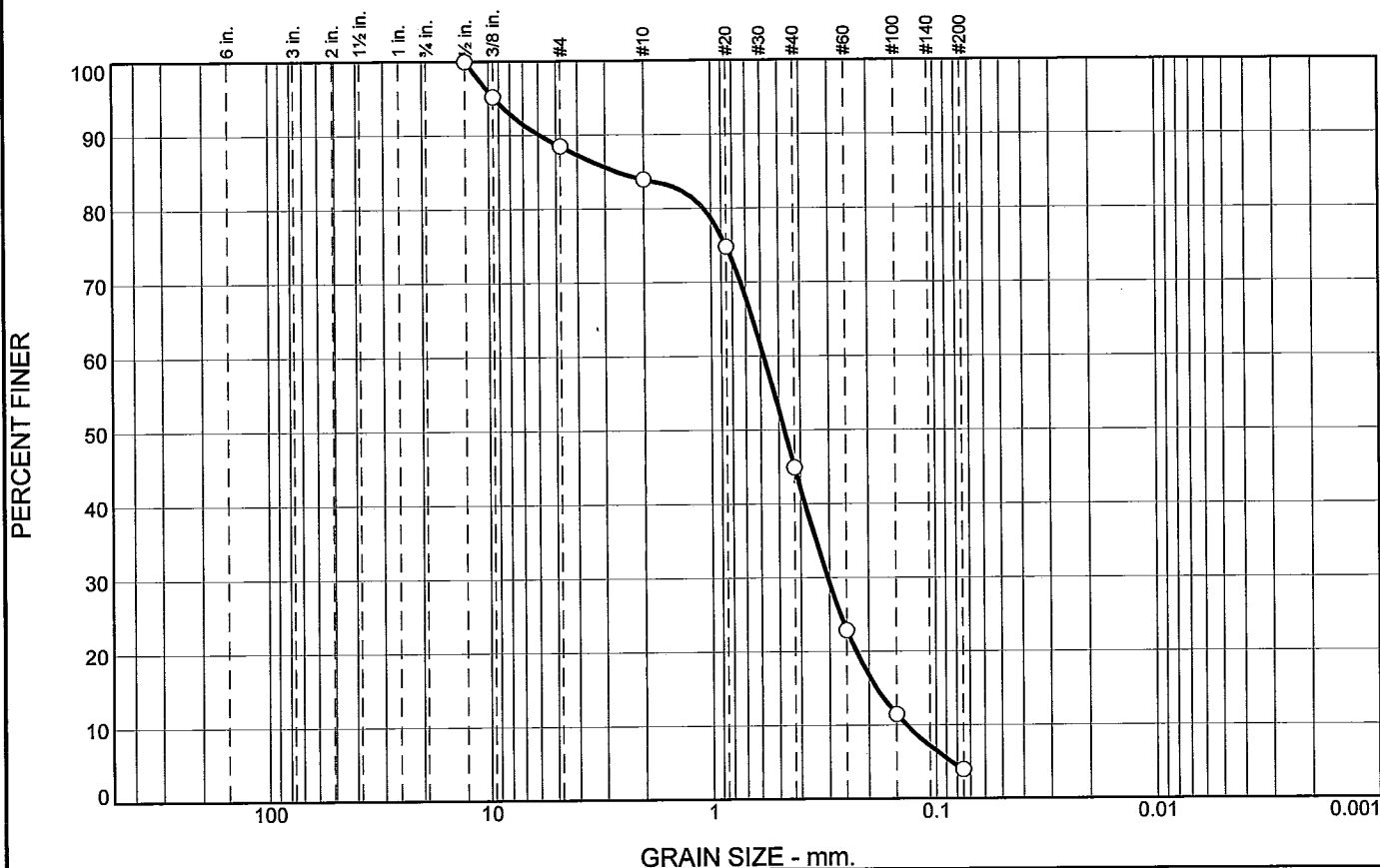
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	11.5	4.6	39.0	40.9	4.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.50	100.0		
0.375	95.2		
#4	88.5		
#10	83.9		
#20	74.8		
#40	44.9		
#60	22.8		
#100	11.5		
#200	4.0		

* (no specification provided)

Material Description		
Sand		
PL=	Atterberg Limits LL= PI=	
Coefficients D ₉₀ = 5.8802 D ₈₅ = 2.6441 D ₆₀ = 0.5817 D ₅₀ = 0.4721 D ₃₀ = 0.3045 D ₁₅ = 0.1840 D ₁₀ = 0.1354 C _u = 4.30 C _c = 1.18		
Classification USCS= SP AASHTO=		
Remarks As-Rec'd M/C = 22.3%		

Location: DSM Wall

Sample Number: GPEC-SB-105

Depth: 45-65

Date: 09/03/2010

JLT Laboratories, Inc.

Canonsburg, PA

Client: GEI Consultants

Project: DSM Wall

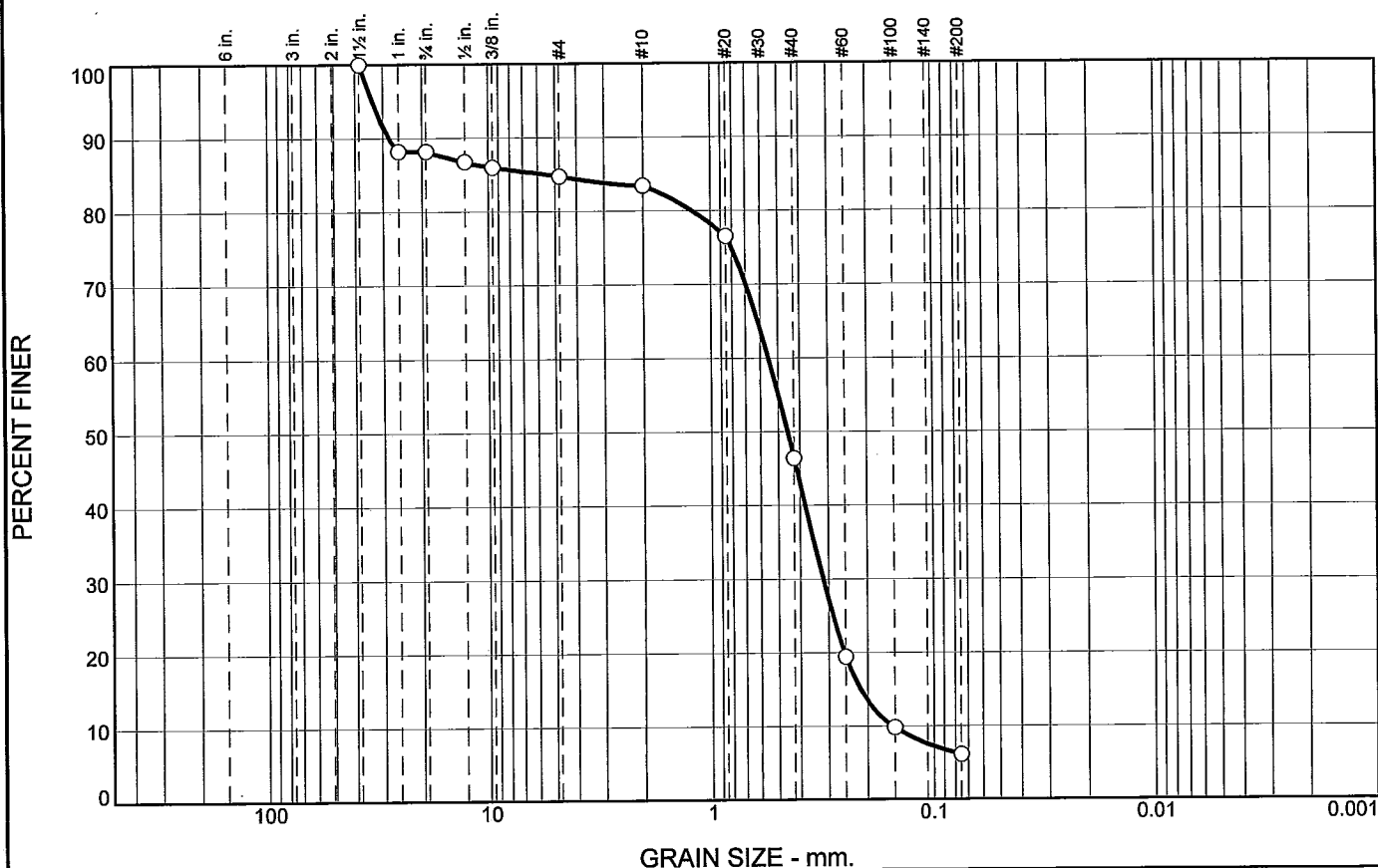
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.8	3.5	1.3	37.0	40.3	6.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
1.00	88.2		
0.75	88.2		
0.50	86.7		
0.375	86.0		
#4	84.7		
#10	83.4		
#20	76.5		
#40	46.4		
#60	19.4		
#100	9.8		
#200	6.1		

* (no specification provided)

Material Description

Sand Widely Graded

Atterberg Limits

PL=

LL=

PI=

Coefficients

D₉₀= 28.2334

D₈₅= 5.5985

D₆₀= 0.5517

D₅₀= 0.4541

D₃₀= 0.3162

D₁₅= 0.2150

D₁₀= 0.1532

C_u= 3.60

C_c= 1.18

Classification

USCS= SW-SM

AASHTO=

Remarks

As-Rec'd M/C = 19.7%

Location: DSM Wall

Sample Number: GPEC-SB-114

Depth: 80-109

Date: 09/03/2010

JLT Laboratories, Inc.

Client: GEI Consultants

Project: DSM Wall

Canonsburg, PA

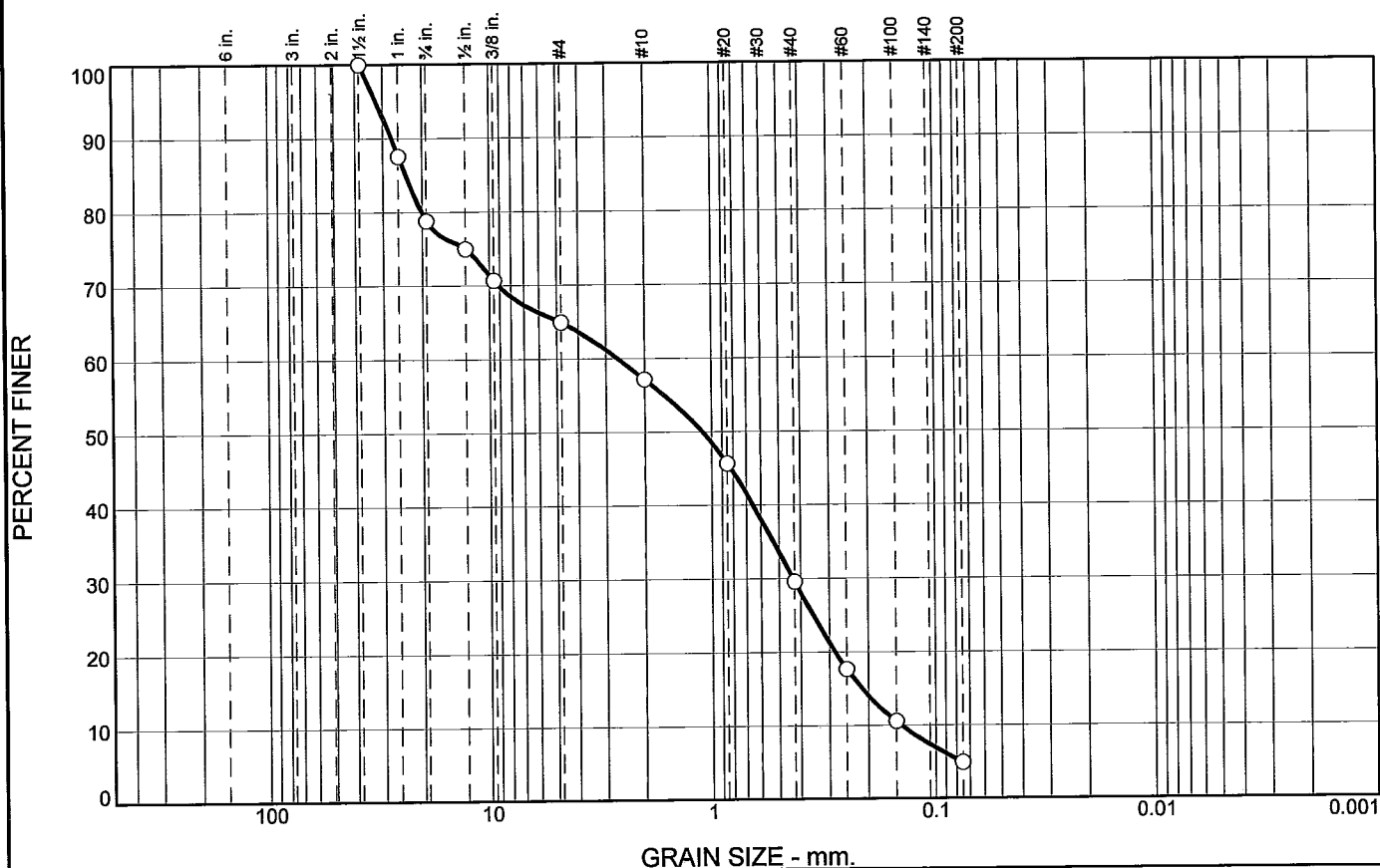
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	21.2	13.9	7.7	27.6	24.7	4.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
1.00	87.5		
0.75	78.8		
0.50	75.0		
0.375	70.7		
#4	64.9		
#10	57.2		
#20	45.7		
#40	29.6		
#60	17.7		
#100	10.5		
#200	4.9		

* (no specification provided)

Material Description		
Fill		
PL=	Atterberg Limits LL=	PI=
Coefficients		
D ₉₀ = 27.3901	D ₈₅ = 23.5980	D ₆₀ = 2.6413
D ₅₀ = 1.1000	D ₃₀ = 0.4327	D ₁₅ = 0.2133
D ₁₀ = 0.1423	C _u = 18.56	C _c = 0.50
Classification		
USCS= SW	AASHTO=	
Remarks		
As-Rec'd M/C = 21.6%		

Location: DSM Wall
Sample Number: GPEC-SB-103

Depth: 10-30

Date: 09/03/2010

JLT Laboratories, Inc.

Client: GEI Consultants
Project: DSM Wall

Canonsburg, PA

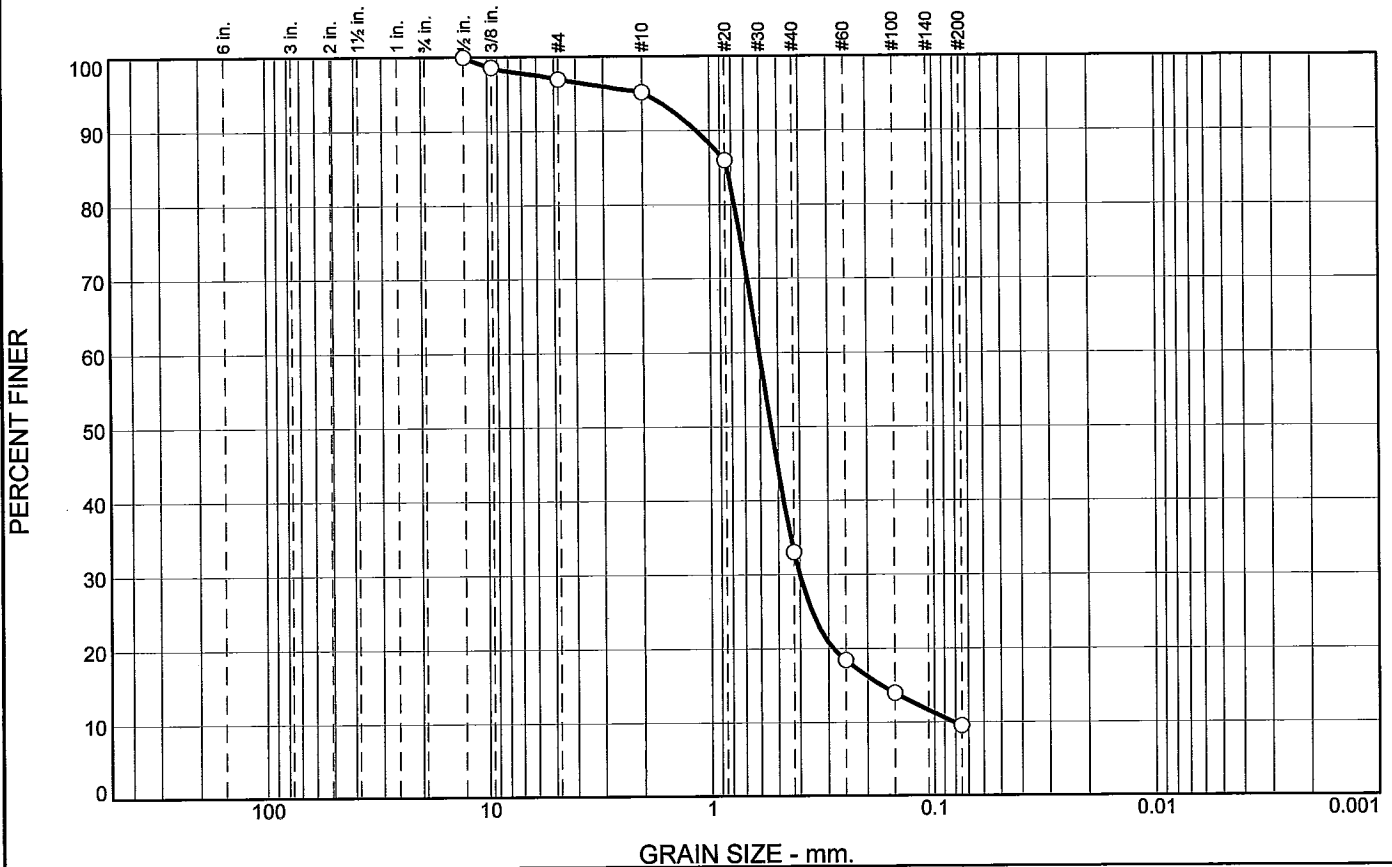
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.0	1.8	62.1	23.6	9.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.50	100.0		
0.375	98.6		
#4	97.0		
#10	95.2		
#20	86.0		
#40	33.1		
#60	18.4		
#100	14.0		
#200	9.5		

* (no specification provided)

Material Description

Sand

PL= **Atterberg Limits** LL= PI=

Coefficients

D₉₀= 1.1436 D₈₅= 0.8359 D₆₀= 0.6031
D₅₀= 0.5364 D₃₀= 0.4013 D₁₅= 0.1722
D₁₀= 0.0814 C_u= 7.41 C_c= 3.28

Classification

USCS= SW-SM AASHTO=

Remarks

As-Rec'd M/C = 16.8%

Location: DSM Wall

Sample Number: GPEC-SB-113

Depth: 125-130

Date: 09/03/2010

JLT Laboratories, Inc.

Canonsburg, PA

Client: GEI Consultants

Project: DSM Wall

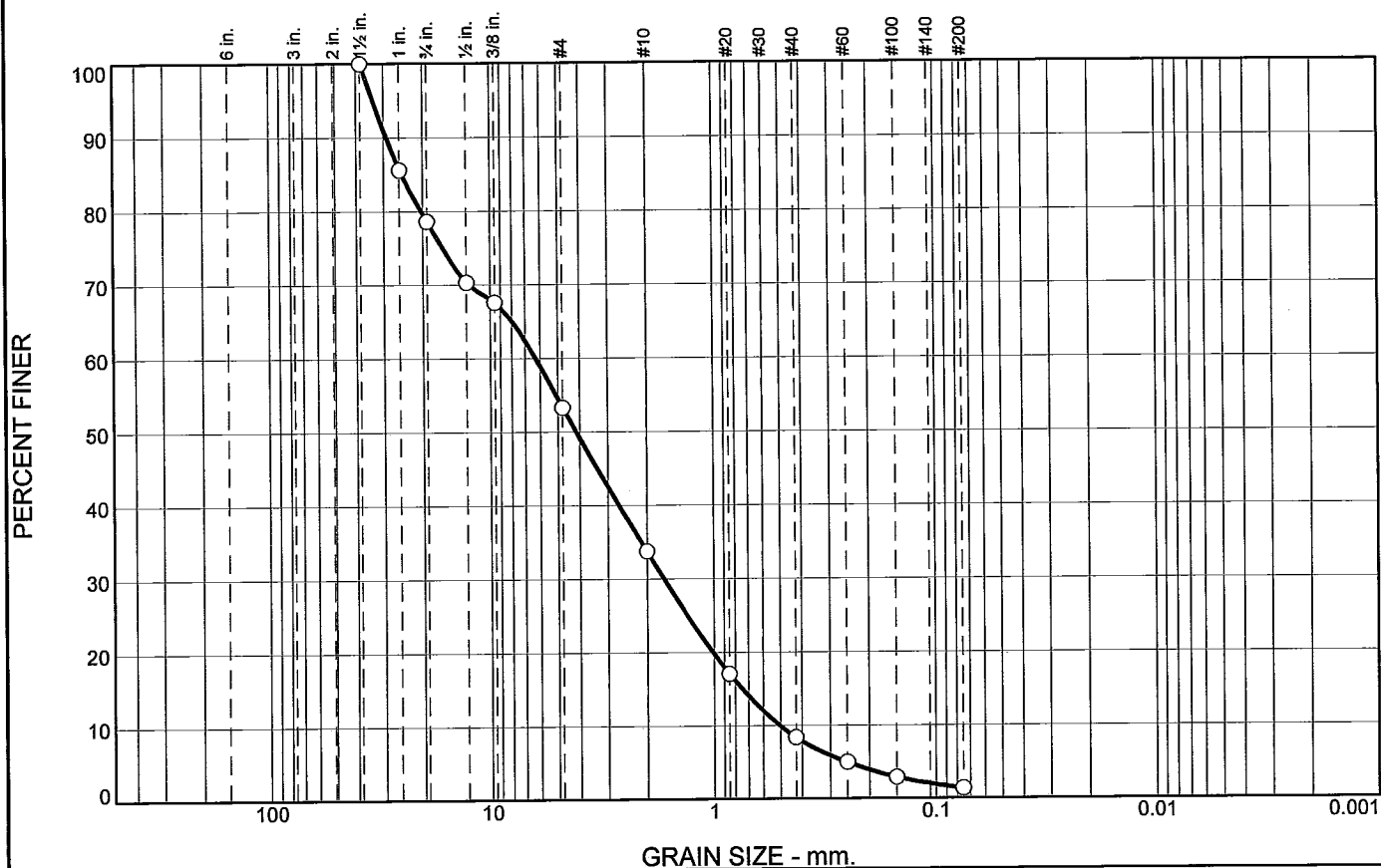
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	21.4	25.3	19.5	25.4	7.0	1.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
1.00	85.6		
0.75	78.6		
0.50	70.3		
0.375	67.6		
#4	53.3		
#10	33.8		
#20	17.1		
#40	8.4		
#60	5.0		
#100	2.9		
#200	1.4		

* (no specification provided)

Material Description

Sand / Gravel

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₉₀= 29.2044 D₈₅= 24.8989 D₆₀= 6.2667
 D₅₀= 4.1417 D₃₀= 1.6753 D₁₅= 0.7448
 D₁₀= 0.5031 C_u= 12.46 C_c= 0.89

Classification
 USCS= SW AASHTO=

Remarks

As-Rec'd M/C = 16.6%

Location: DSM Wall

Sample Number: GPEC-SB-103

Depth: 40-50

Date: 09/03/2010

JLT Laboratories, Inc.

Canonsburg, PA

Client: GEI Consultants

Project: DSM Wall

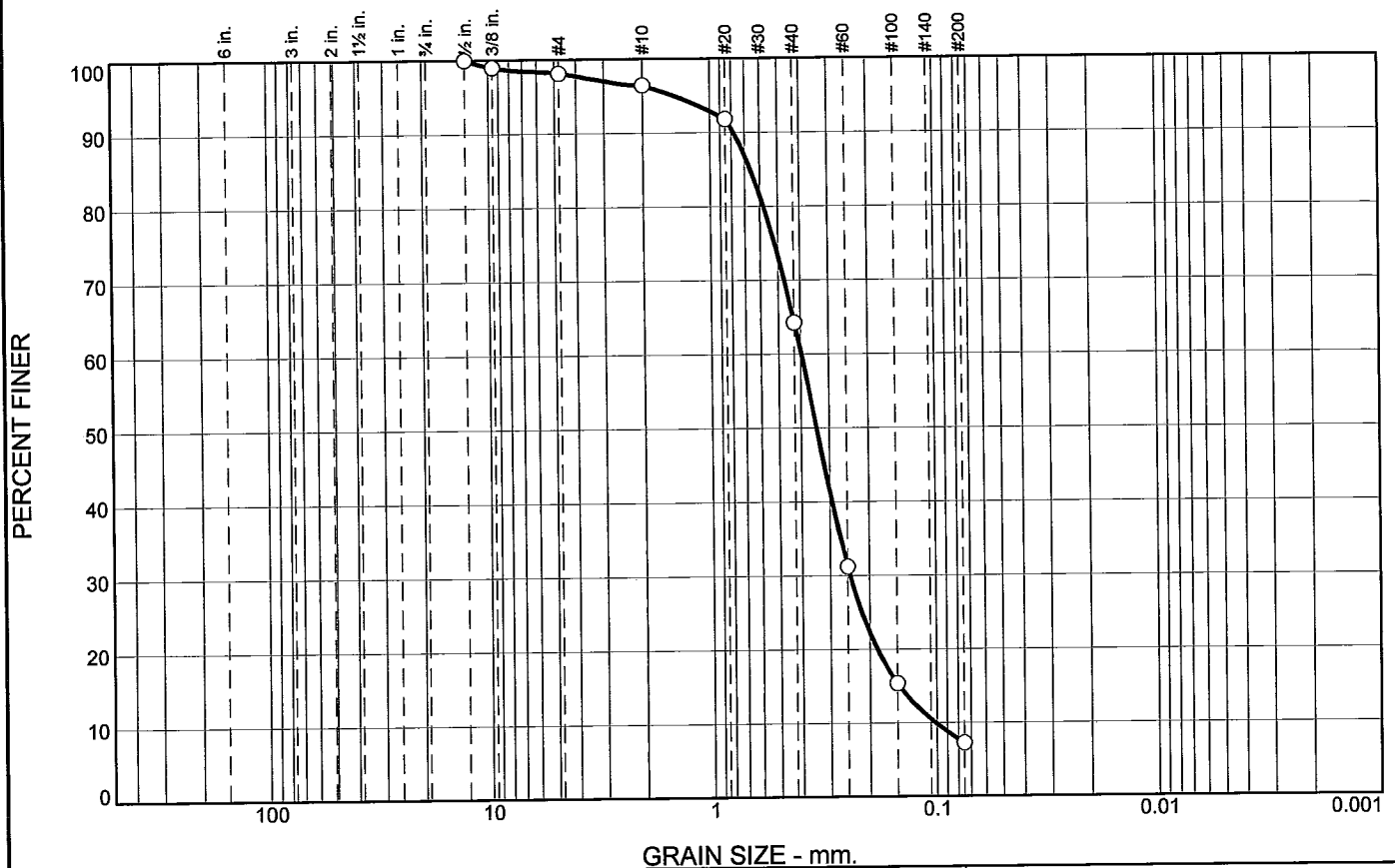
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.9	1.7	32.1	57.0	7.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.50	100.0		
0.375	99.0		
#4	98.1		
#10	96.4		
#20	91.8		
#40	64.3		
#60	31.2		
#100	15.4		
#200	7.3		

* (no specification provided)

Material Description

Sand

PL= **Atterberg Limits** LL= PI=

Coefficients

D₉₀= 0.7829 D₈₅= 0.6601 D₆₀= 0.3968
D₅₀= 0.3407 D₃₀= 0.2439 D₁₅= 0.1470
D₁₀= 0.1012 C_u= 3.92 C_c= 1.48

Classification

USCS= SW-SM AASHTO=

Remarks

As-Rec'd M/C = 19.3%

Location: DSM Wall

Sample Number: GPEC-SB-109

Depth: 37-75

Date: 09/03/2010

JLT Laboratories, Inc.

Canonsburg, PA

Client: GEI Consultants

Project: DSM Wall

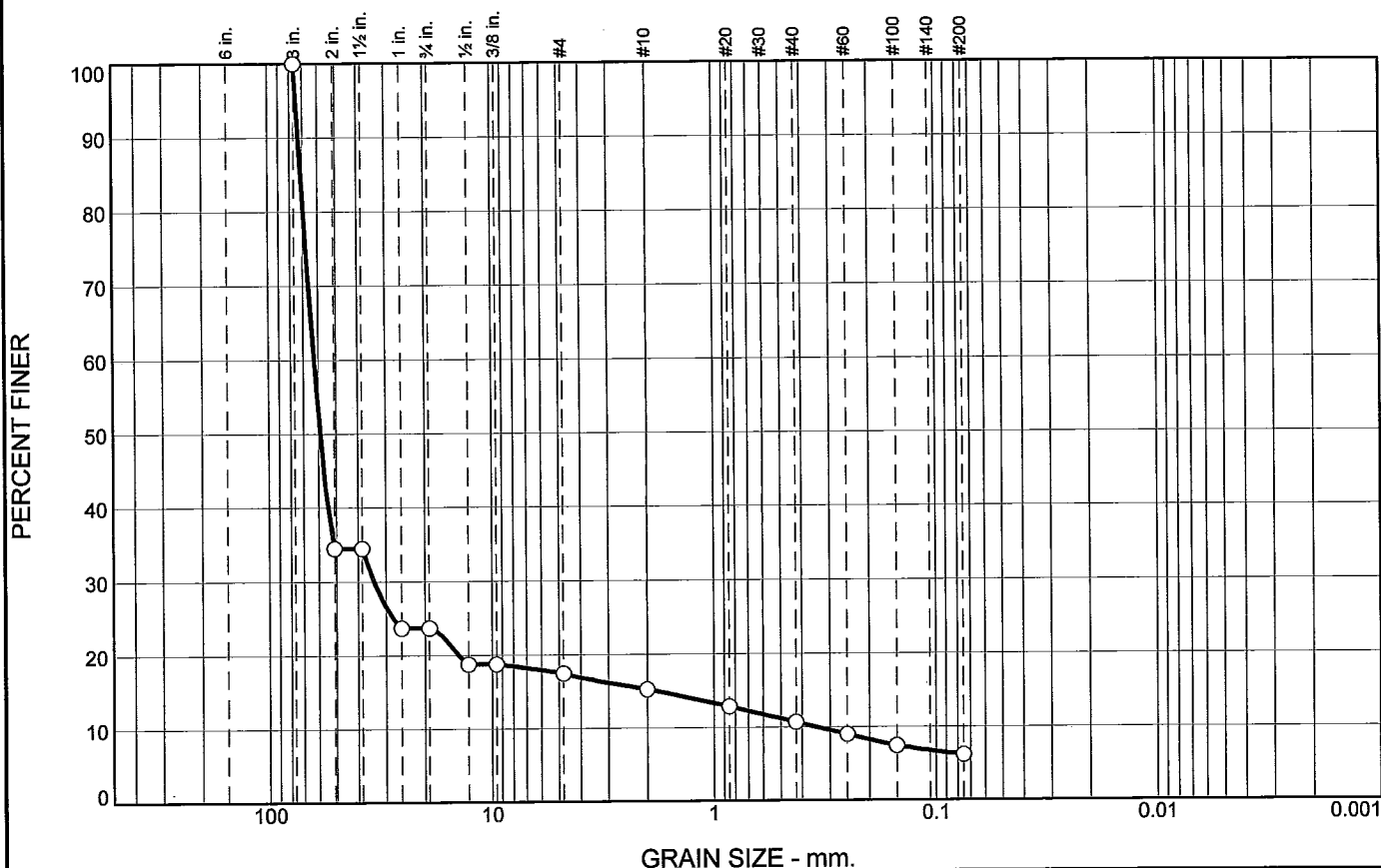
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	76.3	6.2	2.3	4.5	4.5	6.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3.00	100.0		
2.00	34.5		
1.50	34.5		
1.00	23.7		
0.75	23.7		
0.50	18.8		
0.375	18.8		
#4	17.5		
#10	15.2		
#20	12.9		
#40	10.7		
#60	9.0		
#100	7.4		
#200	6.2		

* (no specification provided)

<u>Material Description</u>		
Fill		
<u>Atterberg Limits</u>		
PL=	LL=	PI=
<u>Coefficients</u>		
D ₉₀ = 72.7050	D ₈₅ = 70.9971	D ₆₀ = 62.4584
D ₅₀ = 58.7484	D ₃₀ = 33.8207	D ₁₅ = 1.8174
D ₁₀ = 0.3425	C _u = 182.39	C _c = 53.48
<u>Classification</u>		
USCS= GW-GM	AASHTO=	
<u>Remarks</u>		
As-Rec'd M/C = 17.1%		

Location: DSM Wall

Sample Number: GPEC-SB-104

Depth: 5-34

Date: 09/03/2010

JLT Laboratories, Inc.

Canonsburg, PA

Client: GEI Consultants

Project: DSM Wall

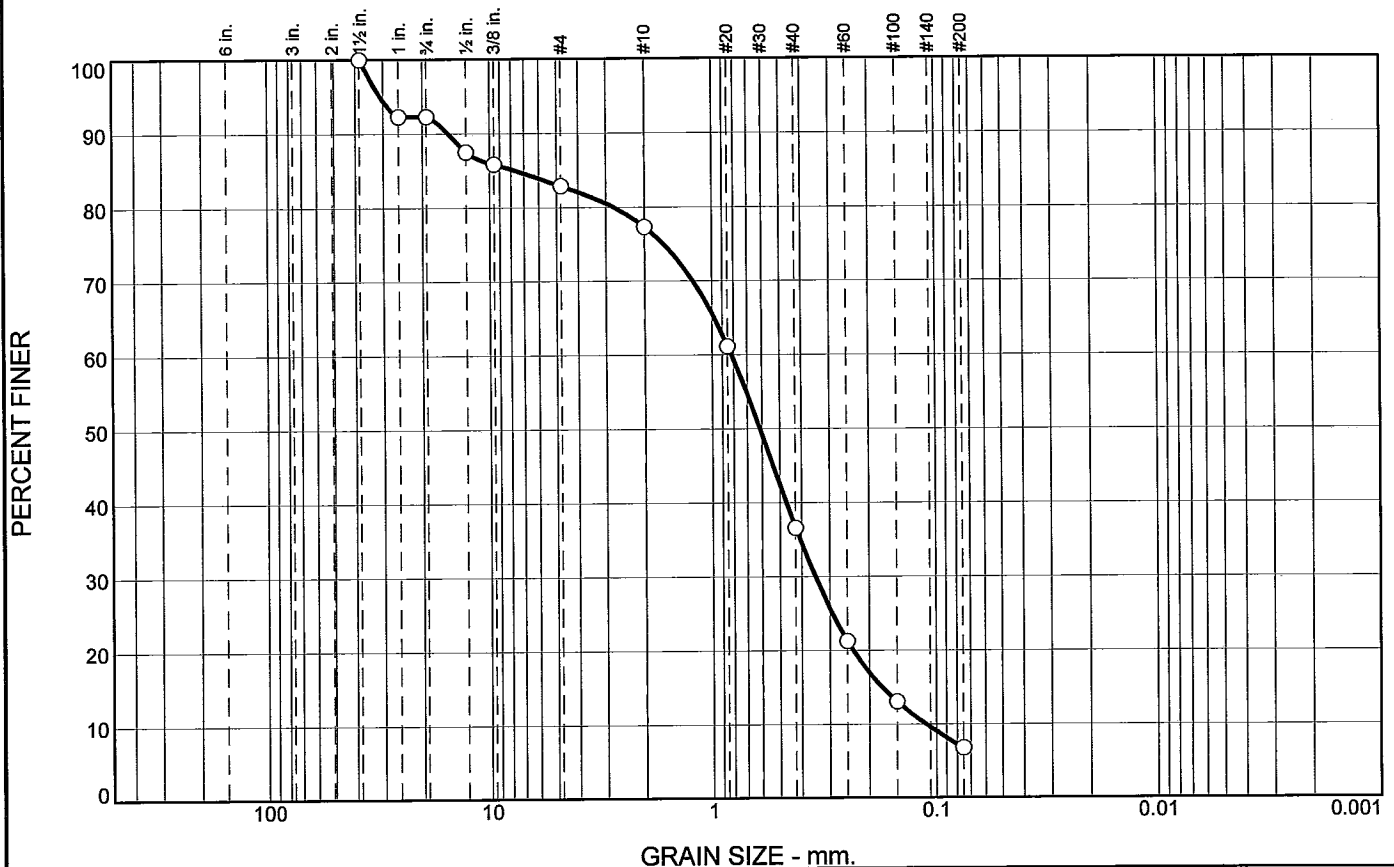
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	7.7	9.4	5.6	40.7	29.8	6.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
1.00	92.3		
0.75	92.3		
0.50	87.5		
0.375	85.8		
#4	82.9		
#10	77.3		
#20	61.1		
#40	36.6		
#60	21.2		
#100	13.1		
#200	6.8		

* (no specification provided)

Material Description		
Upper Sand Unit		
Atterberg Limits PL= LL= PI=		
Coefficients D₉₀= 15.2922 D₅₀= 0.6128 D₁₀= 0.1109		
C_u= 7.39 D₈₅= 7.6487 D₃₀= 0.3475		
D₆₀= 0.8193 D₁₅= 0.1748 C_c= 1.33		
Classification USCS= SW-SM AASHTO=		
Remarks As-Rec'd M/C = 19.2%		

Location: DSM Wall
Sample Number: GPEC-SB-106

Depth: 40-60

Date: 09/03/2010

JLT Laboratories, Inc.

Client: GEI Consultants
Project: DSM Wall

Canonsburg, PA

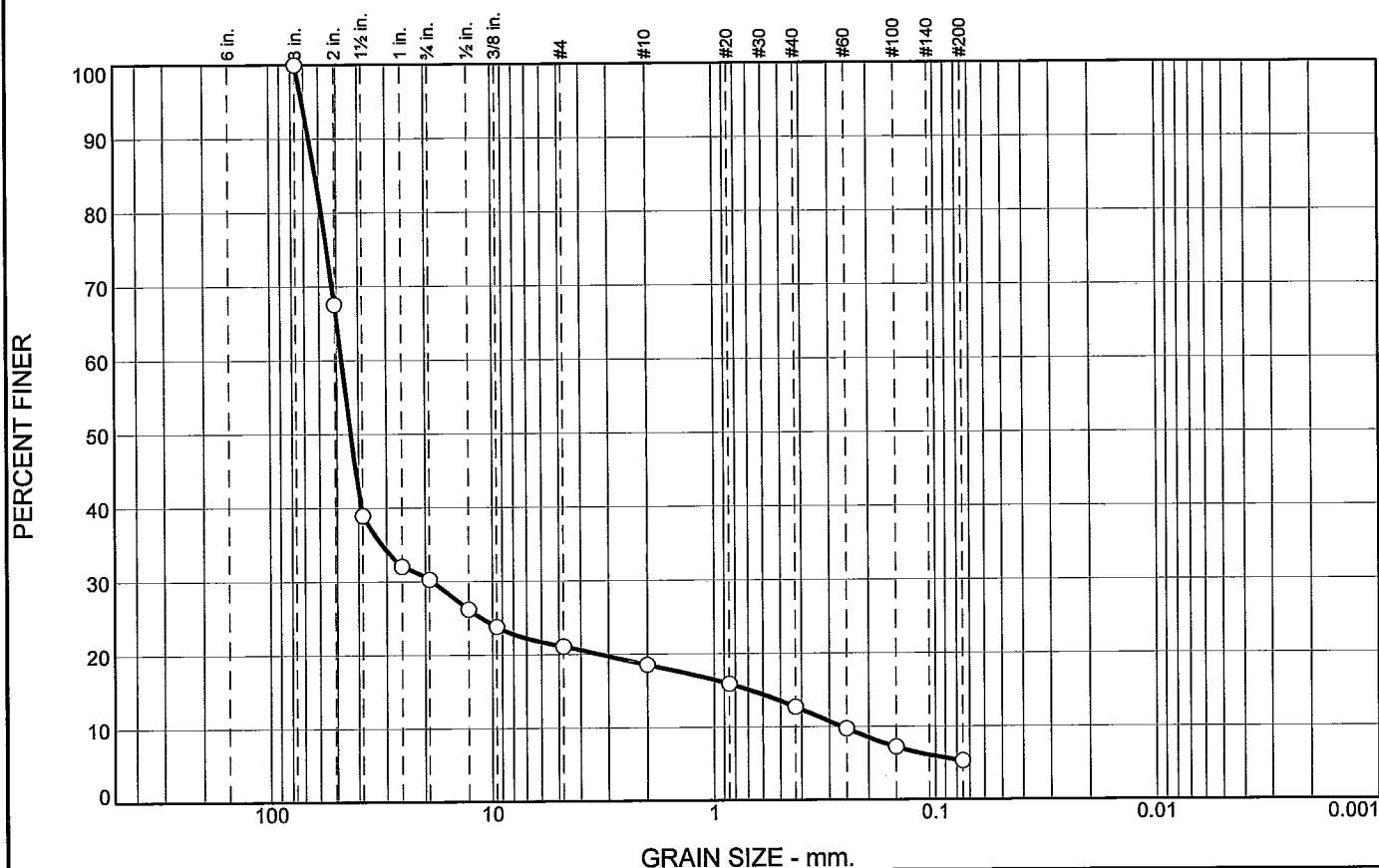
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	69.7	9.2	2.6	5.8	7.4	5.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3.00	100.0		
2.00	67.5		
1.50	38.9		
1.00	32.1		
0.75	30.3		
0.50	26.2		
0.375	23.8		
#4	21.1		
#10	18.5		
#20	15.9		
#40	12.7		
#60	9.7		
#100	7.2		
#200	5.3		

* (no specification provided)

Material Description

Fill Rip Rap

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₉₀= 66.0697 D₈₅= 61.8203 D₆₀= 47.3593
 D₅₀= 43.1783 D₃₀= 18.5098 D₁₅= 0.6817
 D₁₀= 0.2630 C_u= 180.07 C_c= 27.51

Classification
 USCS= GW-GM AASHTO=

Remarks
 As-Rec'd M/C = 4.1%

Location: DSM Wall

Sample Number: GPEC-SB-105

Depth: 24-35

Date: 09/03/2010

JLT Laboratories, Inc.

Canonsburg, PA

Client: GEI Consultants

Project: DSM Wall

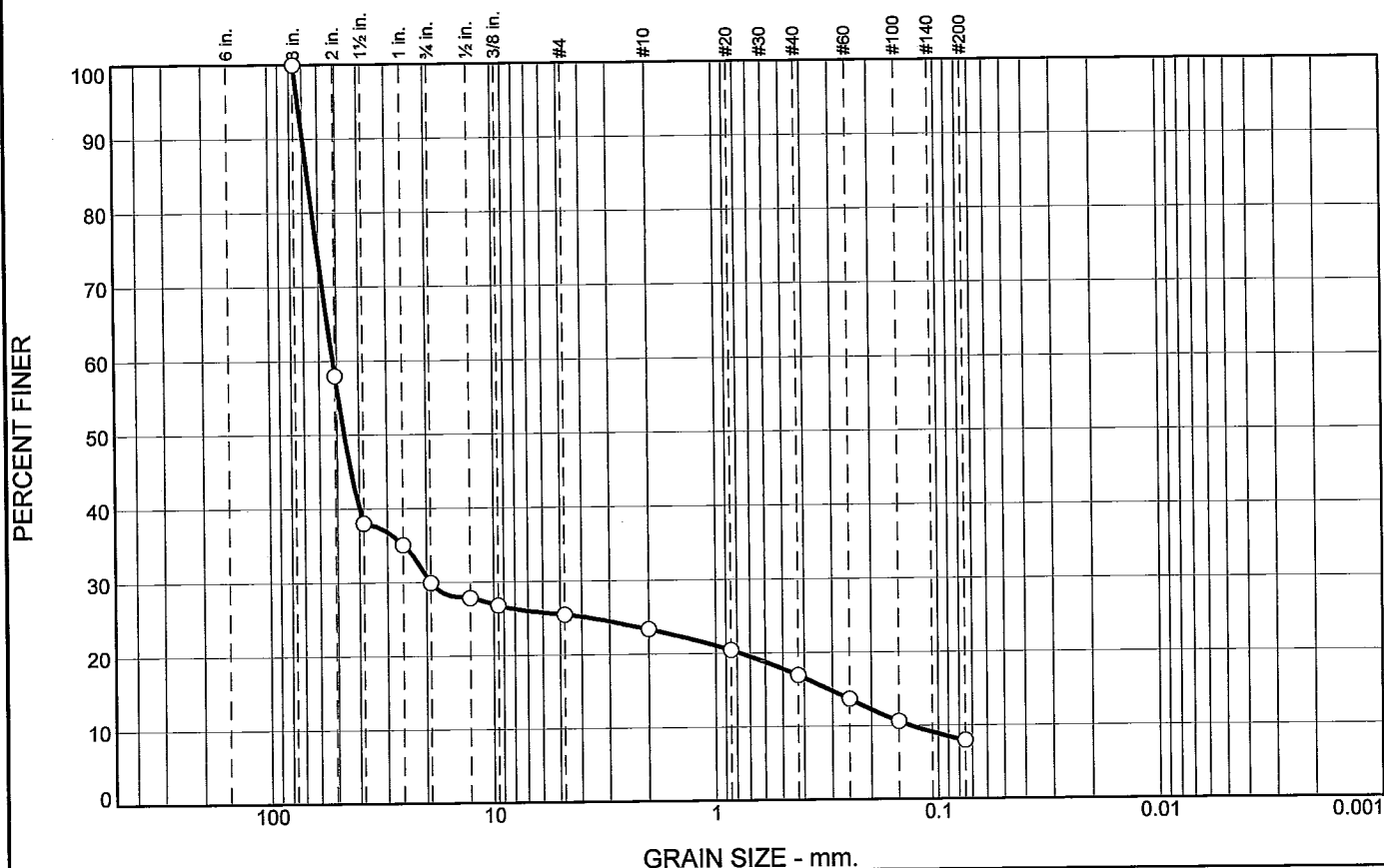
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	70.1	4.4	2.1	6.5	9.0	7.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3.00	100.0		
2.00	58.0		
1.50	38.0		
1.00	35.1		
0.75	29.9		
0.50	27.9		
0.375	26.8		
#4	25.5		
#10	23.4		
#20	20.4		
#40	16.9		
#60	13.7		
#100	10.6		
#200	7.9		

* (no specification provided)

Material Description

Rip Rap

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₉₀= 69.5319 D₈₅= 66.3882 D₆₀= 51.9159
 D₅₀= 46.3393 D₃₀= 19.1161 D₁₅= 0.3094
 D₁₀= 0.1324 C_u= 392.03 C_c= 53.15

Classification
 USCS= GW-GM AASHTO=

Remarks
 As-Rec'd M/C = 5.9%

Location: DSM Wall
 Sample Number: GPEC-SB-106

Depth: 25-35

Date: 09/03/2010

JLT Laboratories, Inc.

Client: GEI Consultants
 Project: DSM Wall

Canonsburg, PA

Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

MEMORANDUM

TO: SEAN DIBARTOLO
GEI CONSULTANTS

October 20, 2010
10LS2202.02

FROM: JACK BOSCHUK

RE: DSM UPDATE

We reviewed all of the bucket samples and the profiles you provided. We found two zones:

Zone 1 - Sand Layers (Relatively Clean Sand)
Zone 2 - Sand & Gravel Layer

However, the quantity of material in the buckets was limited for trial mixes.

For the sand layer we combined the following buckets:

- 1.) GPEC-SB-102
- 2.) GPEC-SB-114
- 3.) GPEC-SB-113

For the Sand & Gravel layers we only had one bucket (GPEC-SB-103).

The most typical method for reducing the permeability of permeable sand via DSM mixing is to inject a bentonite slurry. This reduces permeability but does not increase strength of the layer. It can also loosen the layer under the DSM pressures and mixing operations. To increase strength, the option is to inject cement (either Portland cement, Slag cement or a combination of the two cement types). However, cement alone does not reduce permeability as well as bentonite. Thus, we researched and evaluated the use of a cement-bentonite slurry to reduce permeability and improve strength.

Factors effecting the selection of our trial mixes were as follows:

- 1.) Bentonite costs are generally twice the cost of cement on a per ton basis.
- 2.) Cement and Slag cement are roughly the same cost on a per ton basis.
- 3.) Cement hardens fast but does not significantly improve permeability.
- 4.) Slag cement cures at a much slower rate but also contributes to reducing permeability.

Based on these factors we concluded the following:

- 1.) Use a mixture of Portland cement and Slag cement at a ratio of 1 part Portland cement to 4 parts of Slag cement.
- 2.) Reduce the quantity of bentonite by about one half to save material costs.

This reduces the cost of bentonite and also increases strength. The Slag cement also contributes to decreasing permeability as it cures.

Using the composite sand sample we prepared the following 4 mixes:

CMP-C05-B3 = 5% Cement & 3% Bentonite by Dry Weight of Soil
CMP-C07.5-B3 = 7.5% Cement % & 3% Bentonite by Dry Weight of Soil
CMP-C07.5-B4.5 = 7.5% Cement & 4.5% Bentonite by Dry Weight of Soil
CMP-C05-B5 = 5% Cement & 5% Bentonite by Dry Weight of Soil

For the sand and gravel sample we prepared the following 3 mixes:

SG-C06-B3 = 6% Cement & 3% Bentonite by Dry Weight of Soil
SG-C08-B6 = 8% Cement & 6% Bentonite by Dry Weight of Soil
SG-C03-B3 = 3% Cement % 3% Bentonite by Dry Weight of Soil

The cement consisted of a mixture of 20% Portland cement and 80% Slag cement. This is a mixture that can be supplied by vendors. The bentonite was HydroGel 90. The cement and bentonite were prepared as a slurry (1:1 ratio) and mixed with the soil. Each mix provided five 3"x6" test cylinders.

All of the mixes cured very well with no significant shrinkage, free water or cracks. The following mixes were selected and are running for permeability testing:

Sand Mixes

CMP-C05-B3
CMP-C07.5-B3

Sand & Gravel Mix

SG-C03-B3

These mixes used the least amount of bentonite. If they achieve a permeability of less than 1×10^{-7} cm/sec no other mixes will be tested.

UNCONFINED COMPRESSION TESTS

D-1633



Client : GEI Consultants
Project ID : Greenpoint DSM Wall

Job No. : 10LS2202.01
Report Date : 10/21/2010
Perf'd By : RL
Chk'd By : JBJr

Sample Type : Sand Composite
Mix Date : 10/13/2010
Test Date : 10/21/2010
Age : 8 Days

Samples Capped : Yes
Test Unit : Geotest 2500
Calibration Date : May 16, 2010

Sample Size : Diameter : 3 inches
Height : 6 inches

Sample ID	Fabrication Date	Test Date	Test Age Days	Peak Load lbs	Peak Stress psi
CMP-C05-B3	10/13/2010	10/21/2010	8	686	97.0

Mix : 5 % Cement and 3 % HydroGel 90
See Mix Records for Complete documentation



Laboratories, Inc.

938 S. Central Ave, Canonsburg, Pa. 15317 Tel: 724-746-4441 Fax : 724-745-4261

UNCONFINED COMPRESSION TESTS

D-1633



Client : GEI Consultants
Project ID : Greenpoint DSM Wall

Job No. : 10LS2202.01
Report Date : 10/21/2010
Perf'd By : RL
Chk'd By : JBJr

Sample Type : Sand Composite
Mix Date : 10/13/2010
Test Date : 10/21/2010
Age : 8 Days

Samples Capped : Yes
Test Unit : Geotest 2500
Calibration Date : May 16, 2010

Sample Size : Diameter : 3 inches
Height : 6 inches

Sample ID	Fabrication Date	Test Date	Test Age Days	Peak Load lbs	Peak Stress psi
CMP-C07.5-B3	10/13/2010	10/21/2010	8	996	140.9

Mix : 7.5 % Cement and 3 % HydroGel 90
See Mix Records for Complete documentation



Laboratories, Inc.

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UNCONFINED COMPRESSION TESTS
D-1633



Client : GEI Consultants
Project ID : Greenpoint DSM Wall

Job No. : 10LS2202.01
Report Date : 10/21/2010
Perf'd By : RL
Chk'd By : JBJr

Sample Type : Sand Composite
Mix Date : 10/15/2010
Test Date : 10/21/2010
Age : 6 Days

Samples Capped : Yes
Test Unit : Geotest 2500
Calibration Date : May 16, 2010

Sample Size : Diameter : 3 inches
Height : 6 inches

Sample ID	Fabrication Date	Test Date	Test Age Days	Peak Load lbs	Peak Stress psi
SG-C03-B3	10/15/2010	10/21/2010	6	410	58.0

Mix : 3 % Cement and 3 % HydroGel 90
See Mix Records for Complete documentation



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MEMORANDUM

TO: SEAN DIBARTOLO
GEI CONSULTANTS

October 28, 2010
10LS2202.02

FROM: JACK BOSCHUK

RE: DSM TRIAL MIXES

Attached are the results of Permeability testing performed on three (3) trial mixes:

Sand Composite	Sand Composite	Sand & Gravel Composite
CMP-C05-B3	CMP-C7.5-B3	SG-C03-B3
5% Cement	7.5% Cement	3% Cement
3% Bentonite	3% Bentonite	3% Bentonite
1.97×10^{-7} cm / sec	1.8×10^{-7} cm / sec	2.19×10^{-7} cm / sec

As you can see, the cement slightly helps Permeability with only 3% Bentonite. However, none of these trial mixes achieved a Permeability of less than 1×10^{-7} cm / sec/ Tomorrow, we are going to setup the following three (3) samples for Permeability:

Sand Composite	Sand & Gravel Composite	Sand & Gravel Composite
CMP-C05-B-5	SG-C06-B3	SG-C08-B6
5% Cement	6% Cement	8% Cement
5% Bentonite	3% Bentonite	6% Bentonite

Right now, it appears the Sand Composite or Sand & Gravel samples react similarly to the cement and Bentonite additives. The results of the next three (3) tests should provide sufficient data to select a design mix applicable to both sand and the sand-gravel materials.

**SUMMARY OF FLEX WALL PERMEABILITY
TEST RESULTS**
ASTM D-5084 (Method A)



Client : GEI Consultants	Date : 10/28/2010
Project Location : Green Point DSM Wall	Job No. : 10LS2202.02
Sample ID : CMP-C05-B3	Tested By : RL
Fabrication Date : 10/13/2010	Checked By : JB
Age at Start : 7 Days	
Composite Sand Sample, 5% Cement and 3% Bentonite	Spec. Gravity : 2.67 Assumed

Physical Property Data

Initial Height (in) : 5.98	Final Height (in) : 5.98
Initial Diameter (in) : 3.00	Final Diameter (in) : 3.00
Initial Wet Weight (g) : 1350.00	Final Wet Weight (g) : 1357.70
Wet Density (pcf) : 121.66	Wet Density (pcf) : 122.36
Moisture Content % : 26.92	Moisture Content % : 27.65
Dry Density (pcf) : 95.86	Dry Density (pcf) : 95.85
Initial Void Ratio : 0.7381	Final Void Ratio : 0.7382
Saturation , % : 97.4	Saturation , % : 100.0

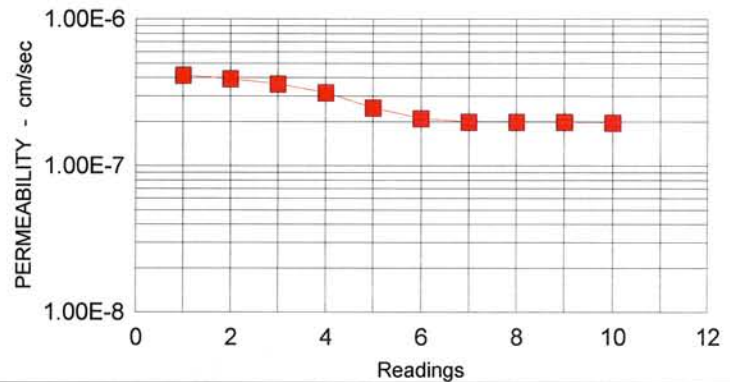
Test Parameters

Fluid : De-Aired Water	Effective
Cell Pressure (psi) : 65.00	Confining Pressure (psi) : 10
Head Water (psi) : 57.70	Gradient : 24.94
Tail Water (psi) : 52.30	

Permeability Input Data

Last Data Point

Flow, Q (cc)	:	15.50
Length, L (in)	:	5.98
Area, A (sqin)	:	7.07
Head, h (psi)	:	5.40
Time, t (min)	:	1140.00
Temp, T (Deg C)	:	20.4



Computed Permeability

PERMEABILITY, K = 1.97E-007 (cm/sec) at 20 Degrees C

**SUMMARY OF FLEX WALL PERMEABILITY
TEST RESULTS**
ASTM D-5084 (Method A)



Client : GEI Consultants	Date : 10/28/2010
Project Location : Green Point DSM Wall	Job No. : 10LS2202.02
Sample ID : CMP-C07.5-B3	Tested By : RL
Fabrication Date : 10/13/2010	Checked By : JB
Age at Start : 7 Days	
Composite Sand Sample, 7.5 % Cement and 3 % Bentonite	Spec. Gravity : 2.68 Assumed

Physical Property Data

Initial Height (in) : 6.00	Final Height (in) : 6.00
Initial Diameter (in) : 3.00	Final Diameter (in) : 3.00
Initial Wet Weight (g) : 1375.70	Final Wet Weight (g) : 1381.20
Wet Density (pcf) : 123.46	Wet Density (pcf) : 123.95
Moisture Content % : 25.62	Moisture Content % : 26.10
Dry Density (pcf) : 98.28	Dry Density (pcf) : 98.30
Initial Void Ratio : 0.6984	Final Void Ratio : 0.6981
Saturation , % : 98.1	Saturation , % : 100.0

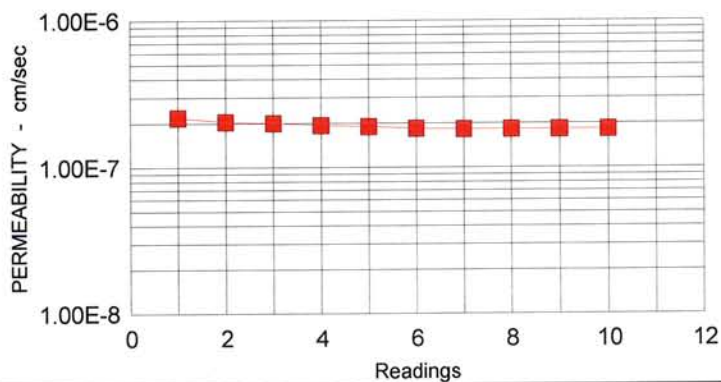
Test Parameters

Fluid : De-Aired Water	Effective
Cell Pressure (psi) : 65.00	Confining Pressure (psi) : 10
Head Water (psi) : 57.70	Gradient : 24.84
Tail Water (psi) : 52.30	

Permeability Input Data

Last Data Point

Flow, Q (cc) :	14.20	
Length, L (in) :	6.00	
Area, A (sqin) :	7.07	
Head, h (psi) :	5.40	
Time, t (min) :	1148.00	
Temp, T (Deg C) :	20.4	



Computed Permeability

PERMEABILITY, K = 1.80E-007 (cm/sec) at 20 Degrees C

**SUMMARY OF FLEX WALL PERMEABILITY
TEST RESULTS**
ASTM D-5084 (Method A)



Client : GEI Consultants	Date : 10/28/2010
Project Location : Green Point DSM Wall	Job No. : 10LS2202.02
Sample ID : SG-C03-B3	Tested By : RL
Fabrication Date : 10/15/2010	Checked By : JB
Age at Start : 6 Days	
Sand/Gravel Sample, 3% Cement and 3% Bentonite	Spec. Gravity : 2.68 Assumed

Physical Property Data

Initial Height (in) : 6.00	Final Height (in) : 6.00
Initial Diameter (in) : 3.00	Final Diameter (in) : 3.00
Initial Wet Weight (g) : 1395.10	Final Wet Weight (g) : 1400.90
Wet Density (pcf) : 125.20	Wet Density (pcf) : 125.72
Moisture Content % : 23.83	Moisture Content % : 24.31
Dry Density (pcf) : 101.11	Dry Density (pcf) : 101.14
Initial Void Ratio : 0.6509	Final Void Ratio : 0.6504
Saturation , % : 97.9	Saturation , % : 100.0

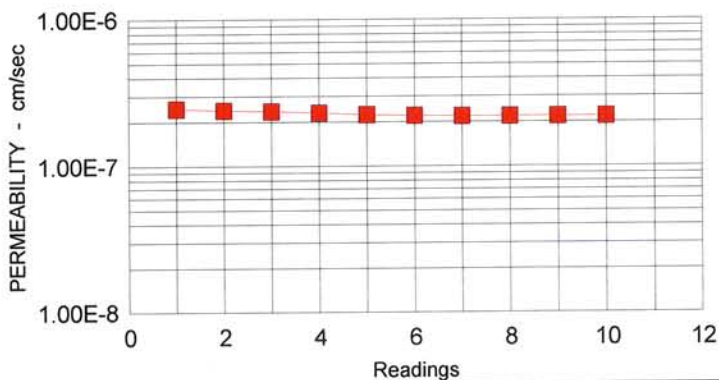
Test Parameters

Fluid : De-Aired Water	Effective
Cell Pressure (psi) : 65.00	Confining Pressure (psi) : 10
Head Water (psi) : 57.70	Gradient : 24.84
Tail Water (psi) : 52.30	

Permeability Input Data

Last Data Point

Flow, Q (cc)	:	17.20
Length, L (in)	:	6.00
Area, A (sqin)	:	7.07
Head, h (psi)	:	5.40
Time, t (min)	:	1140.00
Temp, T (Deg C)	:	20.4



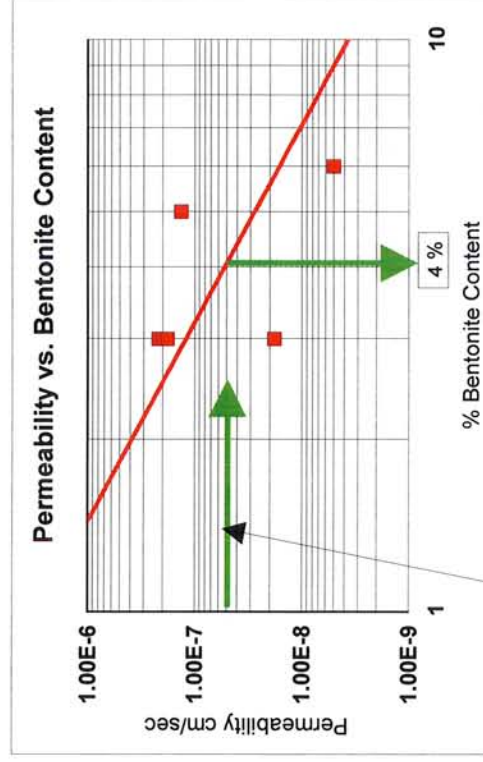
Computed Permeability

PERMEABILITY, K = 2.19E-007 (cm/sec) at 20 Degrees C

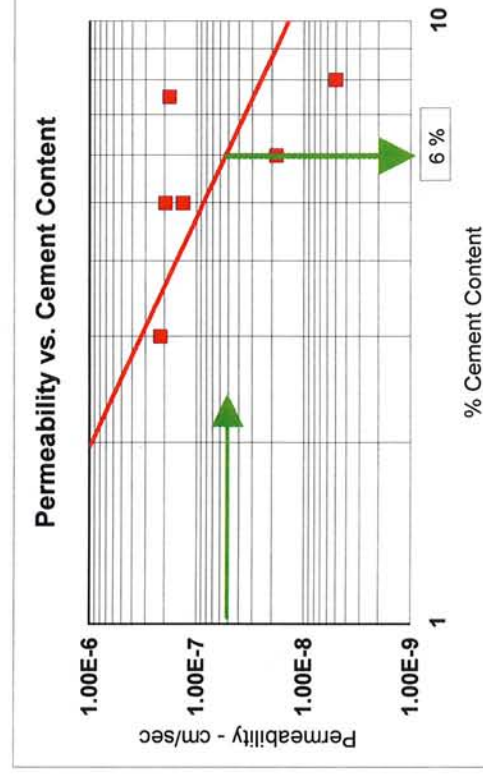
Sample Mix ID		Sand and Gravel Composite Sample			Composite Sand Sample		
Cement Content	% by Weight	SG-C03-B3	SG-C06-B3	SG-C08-B6	CMP-C05-B3	CMP-C07.5-B3	CMP-C05-B5
Bentonite Content	% by Weight	3	6	8	5	7.5	5
Permeability	cm/sec	2.19x10 ⁻⁷	1.82x10 ⁻⁸	5.08x10 ⁻⁹	1.97x10 ⁻⁷	1.8x10 ⁻⁷	1.35x10 ⁻⁷

Bentonite	Permeability
3	2.19E-007
3	1.82E-008
6	5.08E-009
3	1.97E-007
3	1.8E-007
5	1.35E-007

Cement	Permeability
3	2.19E-007
6	1.82E-008
8	5.08E-009
5	1.97E-007
7.5	1.8E-007
5	1.35E-007



Target Design Value = 5×10^{-8} cm/sec



Potential Common Design Mix : 6% Cement and 4 % Bentonite
Cement mix consists of 20% Portland Cement and 80% Slag Cement

**SUMMARY OF FLEX WALL PERMEABILITY
TEST RESULTS**
ASTM D-5084 (Method A)



Client : GEI Consultants	Date : 10/28/2010
Project Location : Green Point DSM Wall	Job No. : 10LS2202.02
Sample ID : SG-C03-B3	Tested By : RL
Fabrication Date : 10/15/2010	Checked By : JB
Age at Start : 6 Days	
Sand/Gravel Sample, 3% Cement and 3% Bentonite	Spec. Gravity : 2.68 Assumed

Physical Property Data

Initial Height (in) : 6.00	Final Height (in) : 6.00
Initial Diameter (in) : 3.00	Final Diameter (in) : 3.00
Initial Wet Weight (g) : 1395.10	Final Wet Weight (g) : 1400.90
Wet Density (pcf) : 125.20	Wet Density (pcf) : 125.72
Moisture Content % : 23.83	Moisture Content % : 24.31
Dry Density (pcf) : 101.11	Dry Density (pcf) : 101.14
Initial Void Ratio : 0.6509	Final Void Ratio : 0.6504
Saturation , % : 97.9	Saturation , % : 100.0

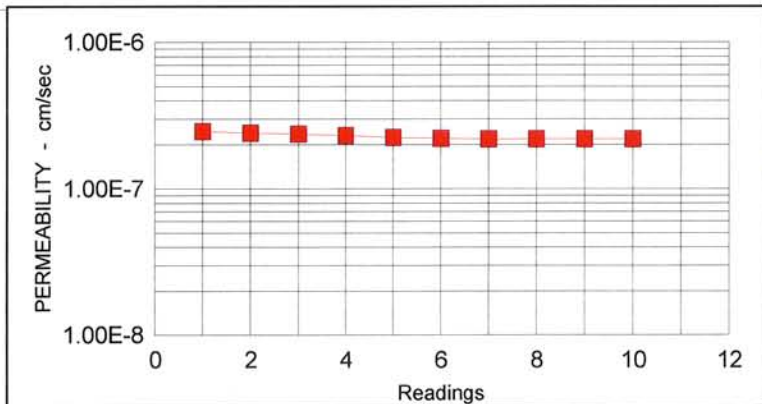
Test Parameters

Fluid : De-Aired Water	Effective
Cell Pressure (psi) : 65.00	Confining Pressure (psi) : 10
Head Water (psi) : 57.70	Gradient : 24.84
Tail Water (psi) : 52.30	

Permeability Input Data

Last Data Point

Flow, Q (cc)	:	17.20
Length, L (in)	:	6.00
Area, A (sqin)	:	7.07
Head, h (psi)	:	5.40
Time, t (min)	:	1140.00
Temp, T (Deg C)	:	20.4



Computed Permeability

PERMEABILITY, K = 2.19E-007 (cm/sec) at 20 Degrees C

**SUMMARY OF FLEX WALL PERMEABILITY
TEST RESULTS**
ASTM D-5084 (Method A)



Client : GEI Consultants	Date : 11/03/2010
Project Location : Green Point DSM Wall	Job No. : 10LS2202.02
Sample ID : SG-C06-B3	Tested By : RL
Fabrication Date : 10/13/2010	Checked By : JB
Age at Start : 16 Day	
Sand/Gravel Sample, 6% Cement and 3% Bentonite	Spec. Gravity : 2.68 Assumed

Physical Property Data

Initial Height (in) : 6.00	Final Height (in) : 6.00
Initial Diameter (in) : 3.00	Final Diameter (in) : 3.00
Initial Wet Weight (g) : 1331.40	Final Wet Weight (g) : 1341.10
Wet Density (pcf) : 119.49	Wet Density (pcf) : 120.36
Moisture Content % : 29.19	Moisture Content % : 30.06
Dry Density (pcf) : 92.49	Dry Density (pcf) : 92.54
Initial Void Ratio : 0.8048	Final Void Ratio : 0.8038
Saturation , % : 97.0	Saturation , % : 100.0

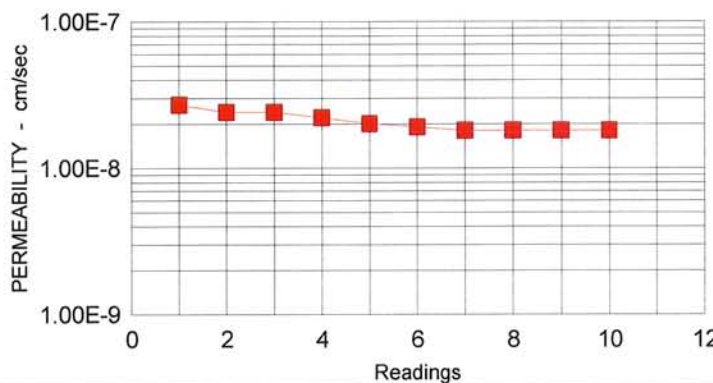
Test Parameters

Fluid : De-Aired Water	Effective
Cell Pressure (psi) : 65.00	Confining Pressure (psi) : 10
Head Water (psi) : 57.70	Gradient : 24.84
Tail Water (psi) : 52.30	

Permeability Input Data

Last Data Point

Flow, Q (cc)	:	1.80
Length, L (in)	:	6.00
Area, A (sqin)	:	7.07
Head, h (psi)	:	5.40
Time, t (min)	:	1440.00
Temp, T (Deg C)	:	20.4



Computed Permeability

PERMEABILITY, K = 1.82E-008 (cm/sec) at 20 Degrees C

**SUMMARY OF FLEX WALL PERMEABILITY
TEST RESULTS**
ASTM D-5084 (Method A)



Client : GEI Consultants	Date : 11/03/2010
Project Location : Green Point DSM Wall	Job No. : 10LS2202.02
Sample ID : SG-C08-B6	Tested By : RL
Fabrication Date : 10/13/2010	Checked By : JB
Age at Start : 16 Day	
Sand/Gravel Sample, 8% Cement and 6% Bentonite	Spec. Gravity : 2.68 Assumed

Physical Property Data

Initial Height (in) : 5.96	Final Height (in) : 5.96
Initial Diameter (in) : 2.98	Final Diameter (in) : 2.98
Initial Wet Weight (g) : 1295.70	Final Wet Weight (g) : 1299.80
Wet Density (pcf) : 118.64	Wet Density (pcf) : 119.01
Moisture Content % : 13.21	Moisture Content % : 31.62
Dry Density (pcf) : 104.80	Dry Density (pcf) : 90.42
Initial Void Ratio : 0.5928	Final Void Ratio : 0.8460
Saturation , % : 59.6	Saturation , % : 100.0

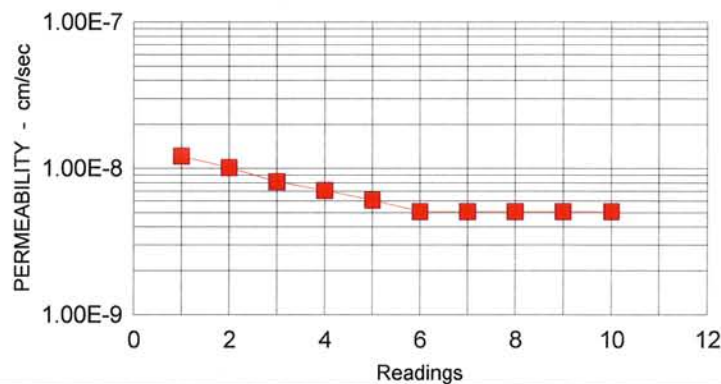
Test Parameters

Fluid : De-Aired Water	Effective
Cell Pressure (psi) : 65.00	Confining Pressure (psi) : 10
Head Water (psi) : 57.70	Gradient : 25.01
Tail Water (psi) : 52.30	

Permeability Input Data

Last Data Point

Flow, Q (cc)	:	0.50
Length, L (in)	:	5.96
Area, A (sqin)	:	6.97
Head, h (psi)	:	5.40
Time, t (min)	:	1440.00
Temp, T (Deg C)	:	20.4



Computed Permeability

PERMEABILITY, K = 5.08E-009 (cm/sec) at 20 Degrees C

**SUMMARY OF FLEX WALL PERMEABILITY
TEST RESULTS**
ASTM D-5084 (Method A)



Client	: GEI Consultants	Date	: 10/28/2010
Project Location	: Green Point DSM Wall	Job No.	: 10LS2202.02
Sample ID	: CMP-C05-B3	Tested By	: RL
Fabrication Date	: 10/13/2010	Checked By	: JB
Age at Start	: 7 Days		
Composite Sand Sample, 5% Cement and 3% Bentonite		Spec. Gravity	: 2.67 Assumed

Physical Property Data

Initial Height (in)	: 5.98	Final Height (in)	: 5.98
Initial Diameter (in)	: 3.00	Final Diameter (in)	: 3.00
Initial Wet Weight (g)	: 1350.00	Final Wet Weight (g)	: 1357.70
Wet Density (pcf)	: 121.66	Wet Density (pcf)	: 122.36
Moisture Content %	: 26.92	Moisture Content %	: 27.65
Dry Density (pcf)	: 95.86	Dry Density (pcf)	: 95.85
Initial Void Ratio	: 0.7381	Final Void Ratio	: 0.7382
Saturation , %	: 97.4	Saturation , %	: 100.0

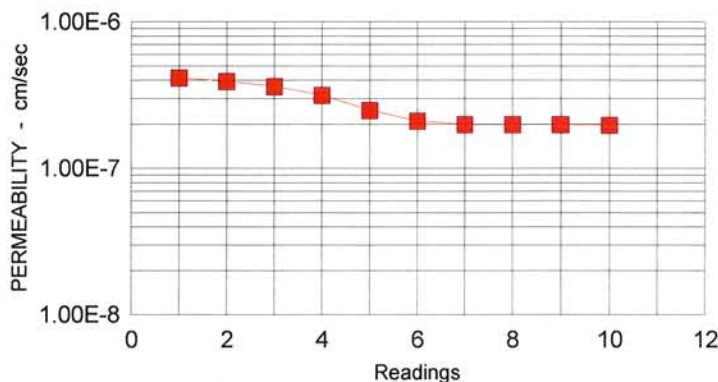
Test Parameters

Fluid	: De-Aired Water	Effective	
Cell Pressure (psi)	: 65.00	Confining Pressure (psi)	: 10
Head Water (psi)	: 57.70	Gradient	: 24.94
Tail Water (psi)	: 52.30		

Permeability Input Data

Last Data Point

Flow, Q (cc)	: 15.50
Length, L (in)	: 5.98
Area, A (sqin)	: 7.07
Head, h (psi)	: 5.40
Time, t (min)	: 1140.00
Temp, T (Deg C)	: 20.4



Computed Permeability

PERMEABILITY, K = 1.97E-007 (cm/sec) at 20 Degrees C

**SUMMARY OF FLEX WALL PERMEABILITY
TEST RESULTS**
ASTM D-5084 (Method A)



Client : GEI Consultants	Date : 10/28/2010
Project Location : Green Point DSM Wall	Job No. : 10LS2202.02
Sample ID : CMP-C07.5-B3	Tested By : RL
Fabrication Date : 10/13/2010	Checked By : JB
Age at Start : 7 Days	
Composite Sand Sample, 7.5% Cement and 3% Bentonite	Spec. Gravity : 2.68 Assumed

Physical Property Data

Initial Height (in) : 6.00	Final Height (in) : 6.00
Initial Diameter (in) : 3.00	Final Diameter (in) : 3.00
Initial Wet Weight (g) : 1375.70	Final Wet Weight (g) : 1381.20
Wet Density (pcf) : 123.46	Wet Density (pcf) : 123.95
Moisture Content % : 25.62	Moisture Content % : 26.10
Dry Density (pcf) : 98.28	Dry Density (pcf) : 98.30
Initial Void Ratio : 0.6984	Final Void Ratio : 0.6981
Saturation , % : 98.1	Saturation , % : 100.0

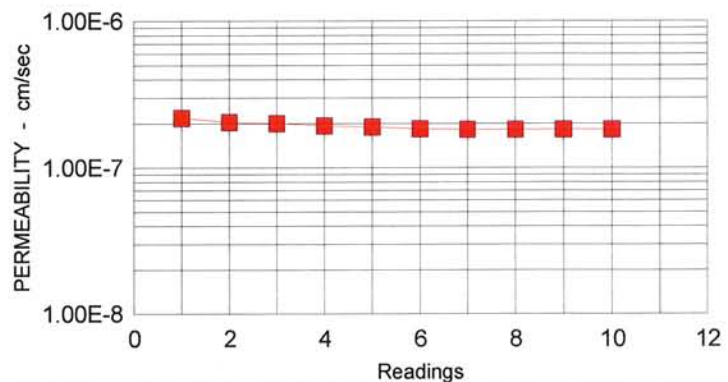
Test Parameters

Fluid : De-Aired Water	Effective
Cell Pressure (psi) : 65.00	Confining Pressure (psi) : 10
Head Water (psi) : 57.70	Gradient : 24.84
Tail Water (psi) : 52.30	

Permeability Input Data

Last Data Point

Flow, Q (cc)	:	14.20
Length, L (in)	:	6.00
Area, A (sqin)	:	7.07
Head, h (psi)	:	5.40
Time, t (min)	:	1148.00
Temp, T (Deg C)	:	20.4



Computed Permeability

PERMEABILITY, K = 1.80E-007 (cm/sec) at 20 Degrees C

**SUMMARY OF FLEX WALL PERMEABILITY
TEST RESULTS
ASTM D-5084 (Method A)**



Client : GEI Consultants	Date : 11/03/2010
Project Location : Green Point DSM Wall	Job No. : 10LS2202.02
Sample ID : CMP-C05-B5	Tested By : RL
Fabrication Date : 10/13/2010	Checked By : JB
Age at Start : 16 Day	
Sand/Gravel Sample, 5% Cement and 5% Bentonite	Spec. Gravity : 2.68 Assumed

Physical Property Data

Initial Height (in) : 5.97	Final Height (in) : 5.97
Initial Diameter (in) : 3.00	Final Diameter (in) : 3.00
Initial Wet Weight (g) : 1409.60	Final Wet Weight (g) : 1412.70
Wet Density (pcf) : 127.05	Wet Density (pcf) : 127.33
Moisture Content % : 22.49	Moisture Content % : 22.76
Dry Density (pcf) : 103.73	Dry Density (pcf) : 103.73
Initial Void Ratio : 0.6092	Final Void Ratio : 0.6092
Saturation , % : 98.7	Saturation , % : 99.9

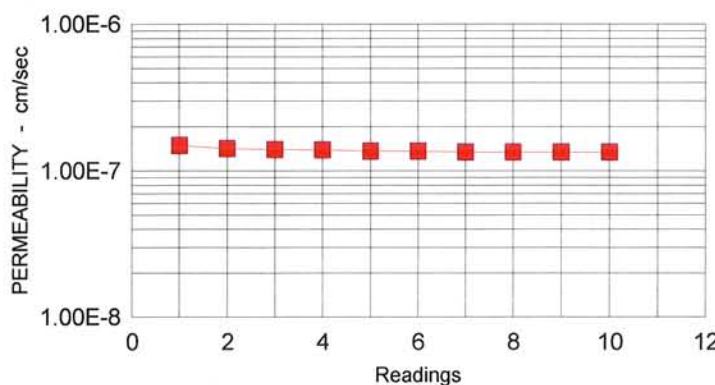
Test Parameters

Fluid : De-Aired Water	Effective
Cell Pressure (psi) : 65.00	Confining Pressure (psi) : 10
Head Water (psi) : 57.70	Gradient : 24.95
Tail Water (psi) : 52.30	

Permeability Input Data

Last Data Point

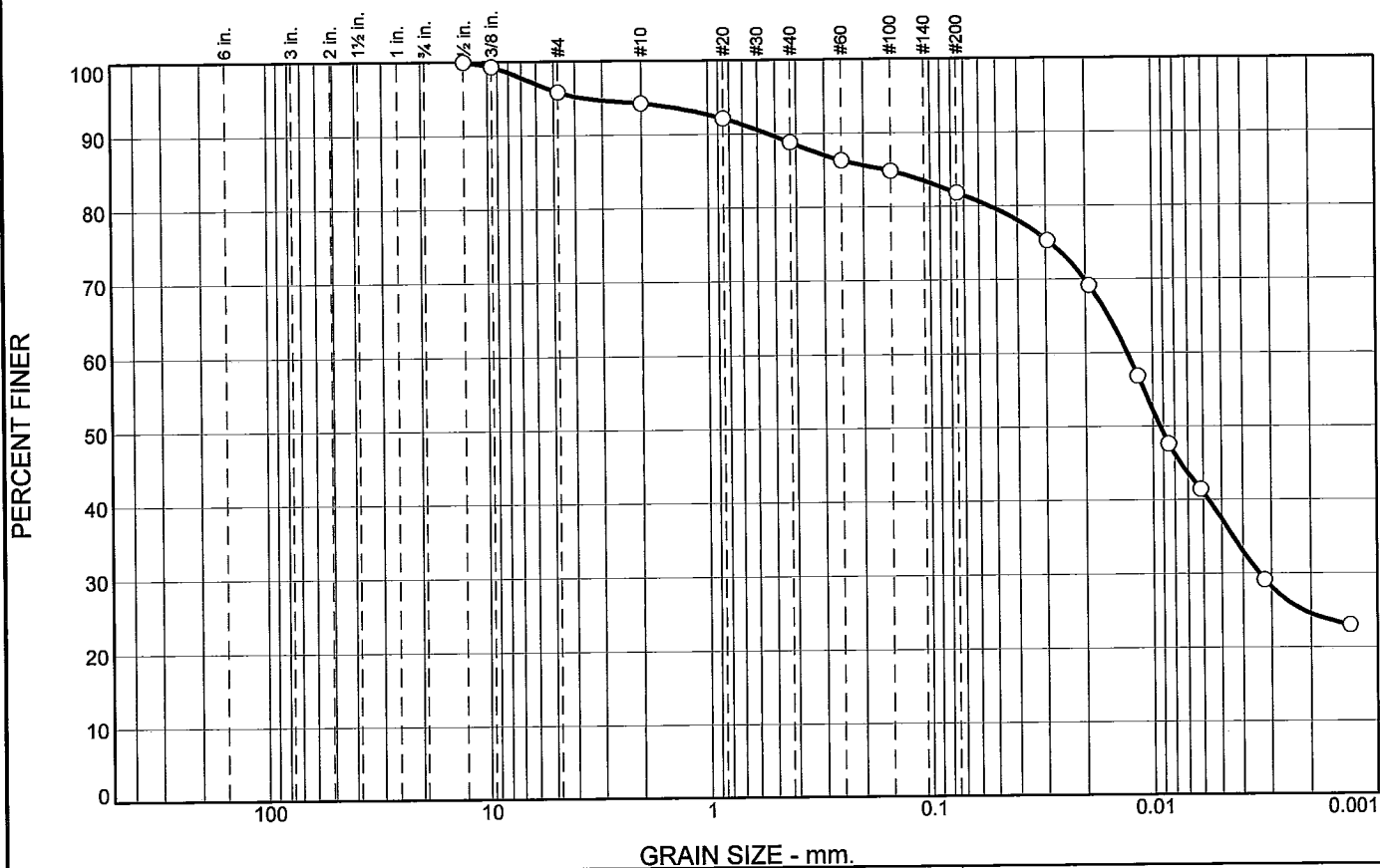
Flow, Q (cc)	:	13.40
Length, L (in)	:	5.97
Area, A (sqin)	:	7.07
Head, h (psi)	:	5.40
Time, t (min)	:	1440.00
Temp, T (Deg C)	:	20.4



Computed Permeability

PERMEABILITY, K = 1.35E-007 (cm/sec) at 20 Degrees C

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.1	1.7	5.4	7.0	44.3	37.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.50	100.0		
0.375	99.3		
#4	95.9		
#10	94.2		
#20	92.1		
#40	88.8		
#60	86.3		
#100	84.8		
#200	81.8		

* (no specification provided)

Material Description

Clay / Silt / Sand

Atterberg Limits
 PL= 22 LL= 27 PI= 5
Coefficients
 D₉₀= 0.5329 D₈₅= 0.1577 D₆₀= 0.0130
 D₅₀= 0.0093 D₃₀= 0.0034 D₁₅=
 D₁₀= C_u= C_c=

Classification
 USCS= CL-ML AASHTO=

Remarks

As-Rec'd M/C = 34.8%

Location: DSM Wall
 Sample Number: GPEC-SB-113

Depth: 50-55

Date: 09/03/2010

JLT Laboratories, Inc.

Canonsburg, PA

Client: GEI Consultants
 Project: DSM Wall

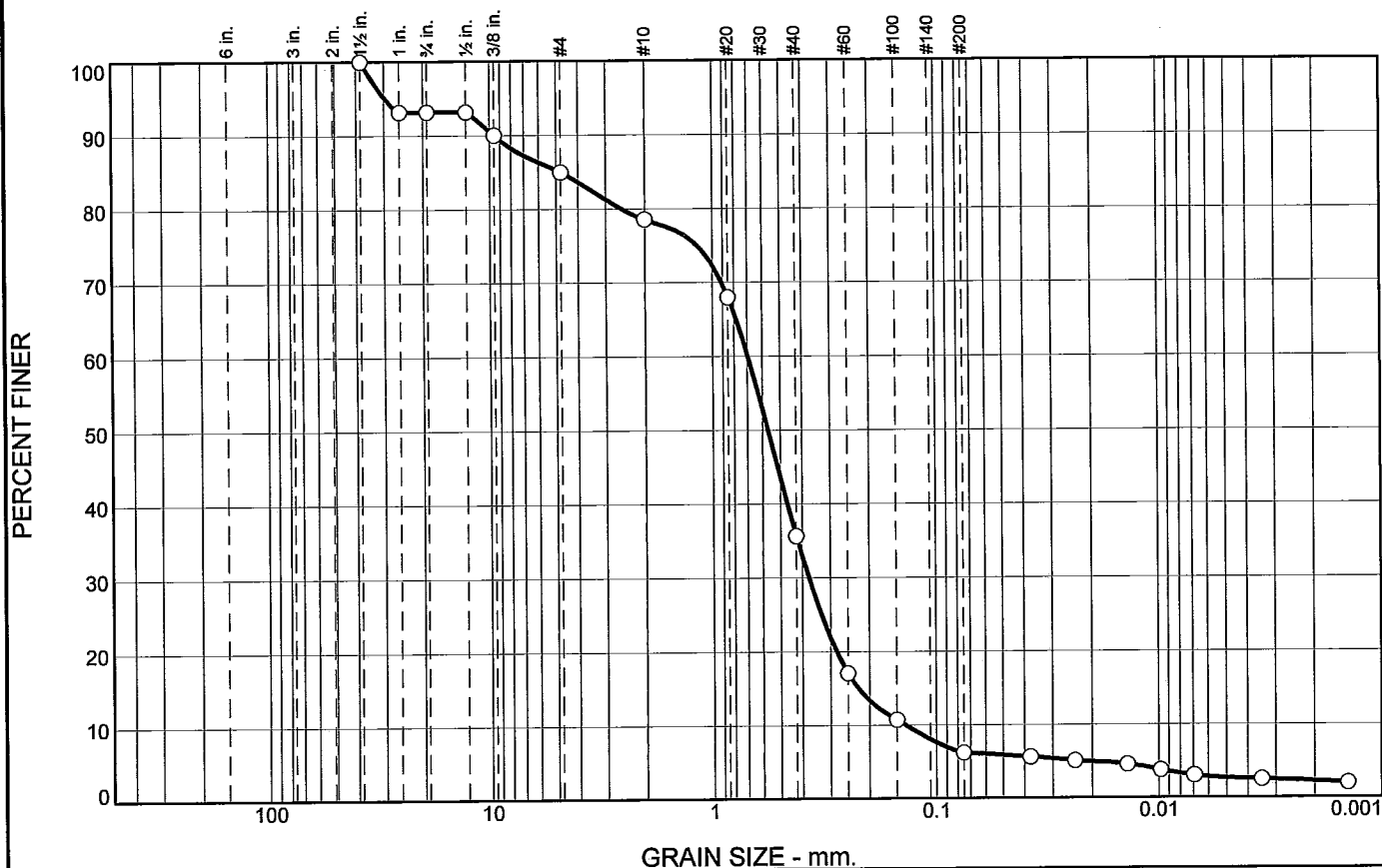
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.8	8.2	6.5	42.9	29.4	3.5	2.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
1.00	93.2		
0.75	93.2		
0.50	93.2		
0.375	90.0		
#4	85.0		
#10	78.5		
#20	68.0		
#40	35.6		
#60	17.1		
#100	10.7		
#200	6.2		

* (no specification provided)

Material Description

Sand

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₉₀= 9.5500 D₈₅= 4.7723 D₆₀= 0.6956
 D₅₀= 0.5665 D₃₀= 0.3741 D₁₅= 0.2241
 D₁₀= 0.1367 C_u= 5.09 C_c= 1.47

Classification
 USCS= SW-SM AASHTO=

Remarks

As-Rec'd M/C = 19.4%

Location: DSM Wall
Sample Number: GPEC-SB-113

Depth: 100-125

Date: 09/03/2010

JLT Laboratories, Inc.

Client: GEI Consultants
Project: DSM Wall

Canonsburg, PA

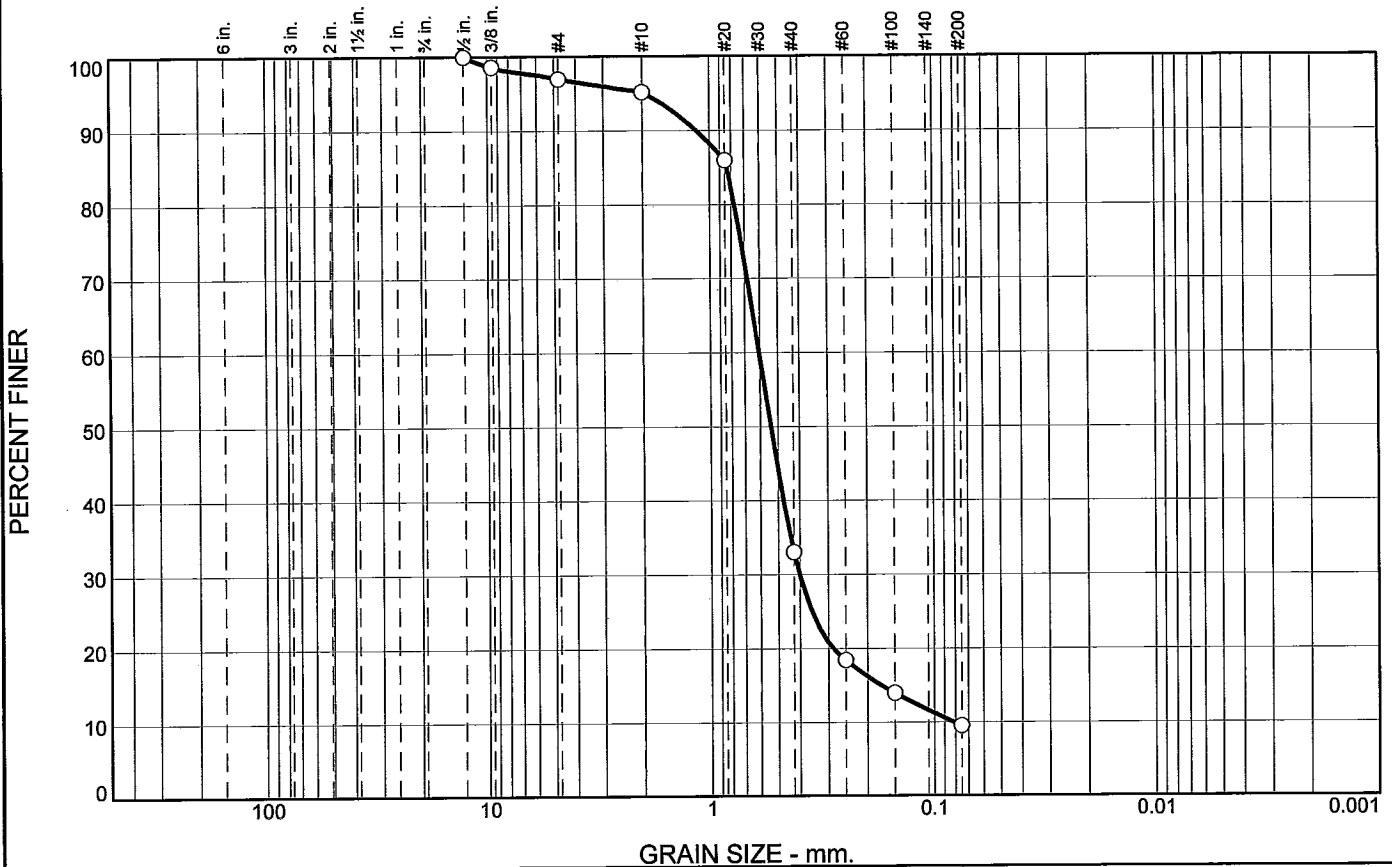
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.0	1.8	62.1	23.6	9.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.50	100.0		
0.375	98.6		
#4	97.0		
#10	95.2		
#20	86.0		
#40	33.1		
#60	18.4		
#100	14.0		
#200	9.5		

* (no specification provided)

Material Description		
Sand		
Atterberg Limits PL= LL= PI=		
Coefficients D₉₀= 1.1436 D₅₀= 0.5364 D₁₀= 0.0814		
Coefficients D₈₅= 0.8359 D₃₀= 0.4013 C_u= 7.41		
Coefficients D₆₀= 0.6031 D₁₅= 0.1722 C_c= 3.28		
Classification USCS= SW-SM AASHTO=		
Remarks As-Rec'd M/C = 16.8%		

Location: DSM Wall

Sample Number: GPEC-SB-113

Depth: 125-130

Date: 09/03/2010

JLT Laboratories, Inc.

Canonsburg, PA

Client: GEI Consultants

Project: DSM Wall

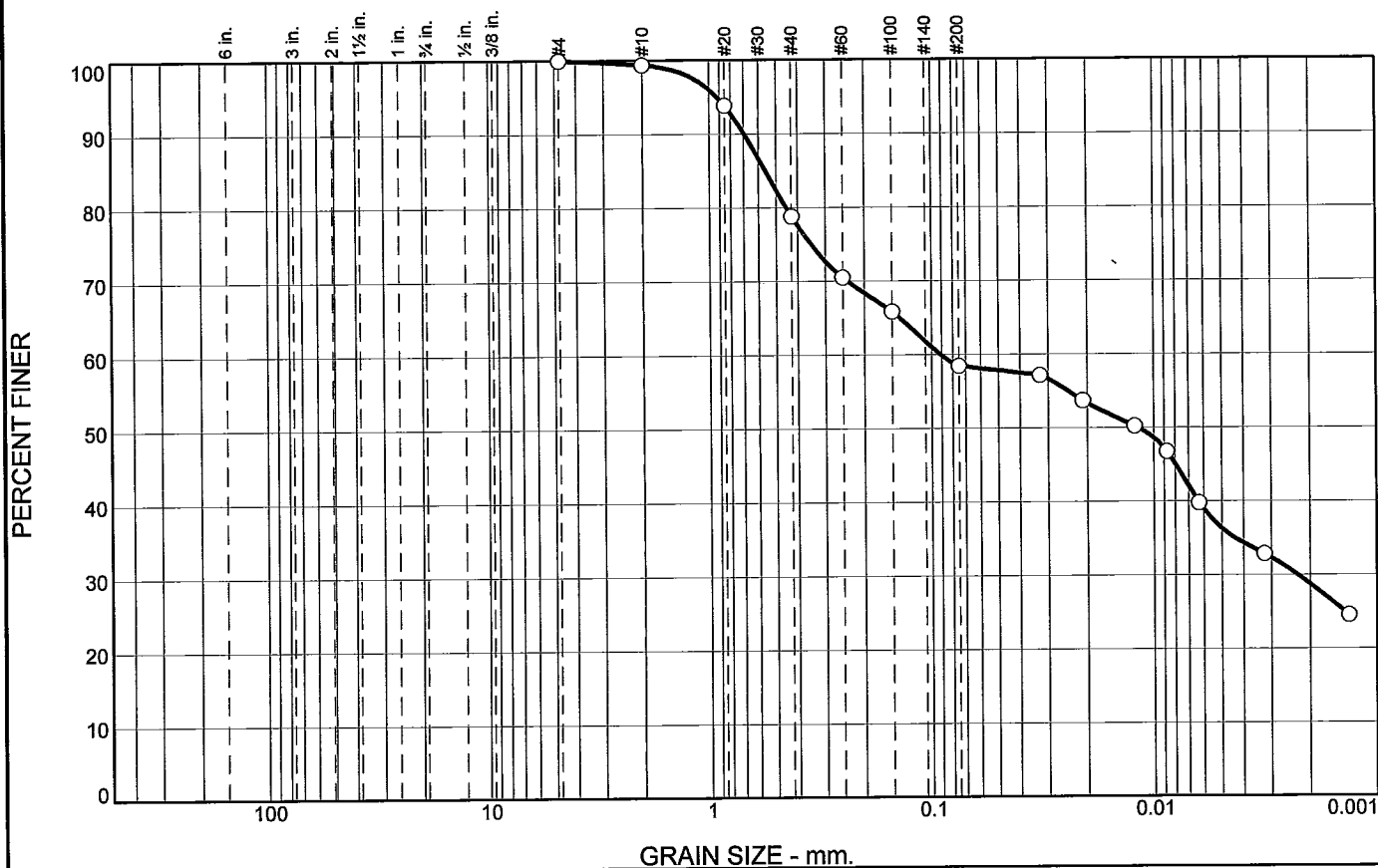
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.6	20.6	20.3	22.1	36.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.4		
#20	93.9		
#40	78.8		
#60	70.5		
#100	65.8		
#200	58.5		

* (no specification provided)

<u>Material Description</u>		
Clay		
<u>Atterberg Limits</u>		
PL= 26	LL= 36	PI= 10
<u>Coefficients</u>		
D ₉₀ = 0.6957	D ₈₅ = 0.5592	D ₆₀ = 0.0905
D ₅₀ = 0.0118	D ₃₀ = 0.0023	D ₁₅ =
D ₁₀ =	C _u =	C _c =
<u>Classification</u>		
USCS= ML	AASHTO=	
<u>Remarks</u>		
As-Rec'd M/C = 16.9%		

Location: DSM Wall

Sample Number: GPEC-SB-113

Depth: 131-135

Date: 09/03/2010

JLT Laboratories, Inc.

Canonsburg, PA

Client: GEI Consultants

Project: DSM Wall

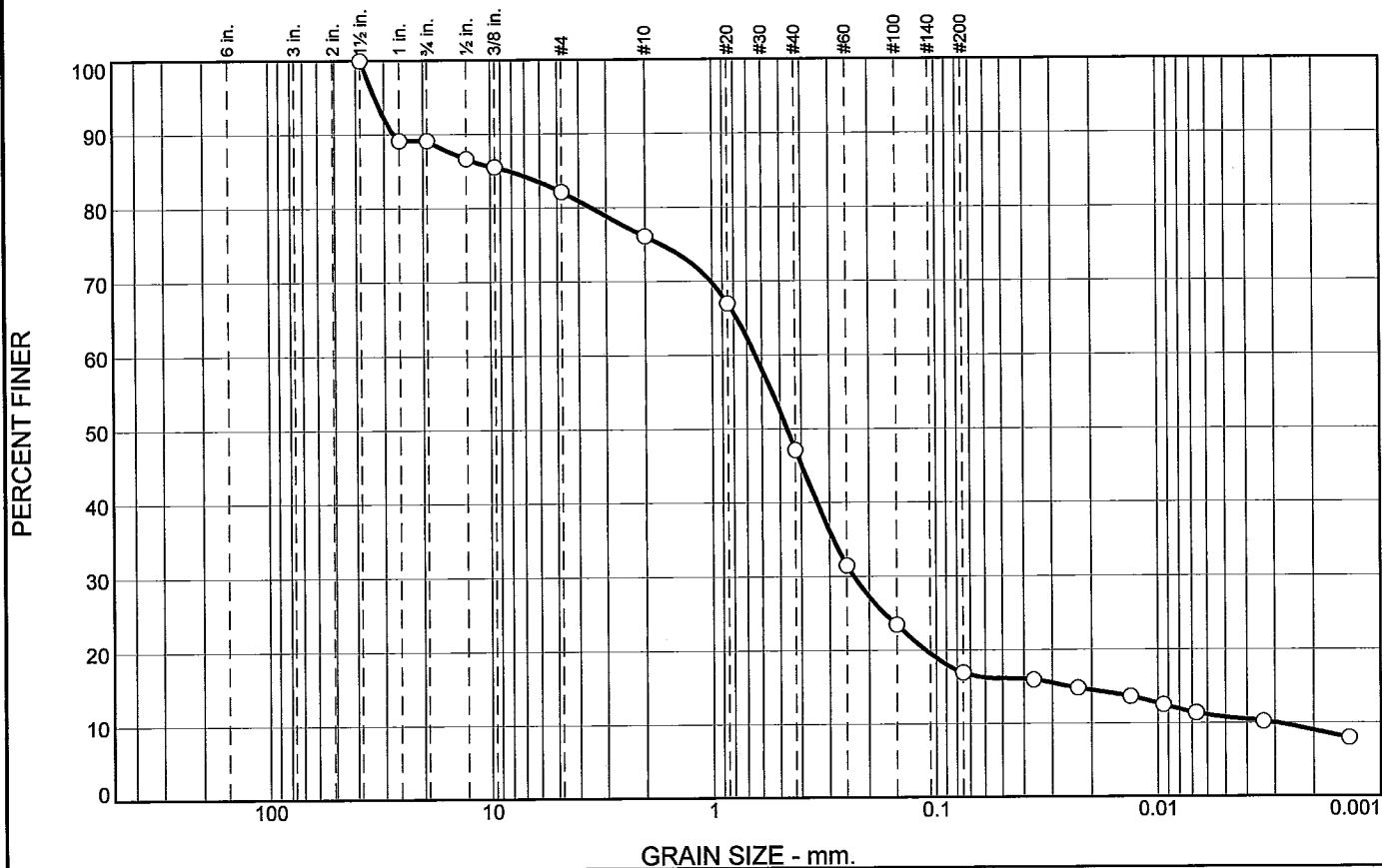
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.9	7.0	6.0	29.0	30.2	6.1	10.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
1.00	89.1		
0.75	89.1		
0.50	86.7		
0.375	85.5		
#4	82.1		
#10	76.1		
#20	67.0		
#40	47.1		
#60	31.5		
#100	23.4		
#200	16.9		

* (no specification provided)

<u>Material Description</u>		
Sand		
<u>Atterberg Limits</u>		
PL= NP	LL= NP	PI= NP
<u>Coefficients</u>		
D ₉₀ = 27.1458	D ₈₅ = 8.2288	D ₆₀ = 0.6408
D ₅₀ = 0.4638	D ₃₀ = 0.2330	D ₁₅ = 0.0248
D ₁₀ = 0.0030	C _u = 214.12	C _c = 28.31
<u>Classification</u>		
USCS= SM	AASHTO=	
<u>Remarks</u>		
As-Rec'd M/C = 14.5%		

Location: DSM Wall

Sample Number: GPEC-SB-114

Depth: 67-80

Date: 09/03/2010

JLT Laboratories, Inc.

Canonsburg, PA

Client: GEI Consultants

Project: DSM Wall

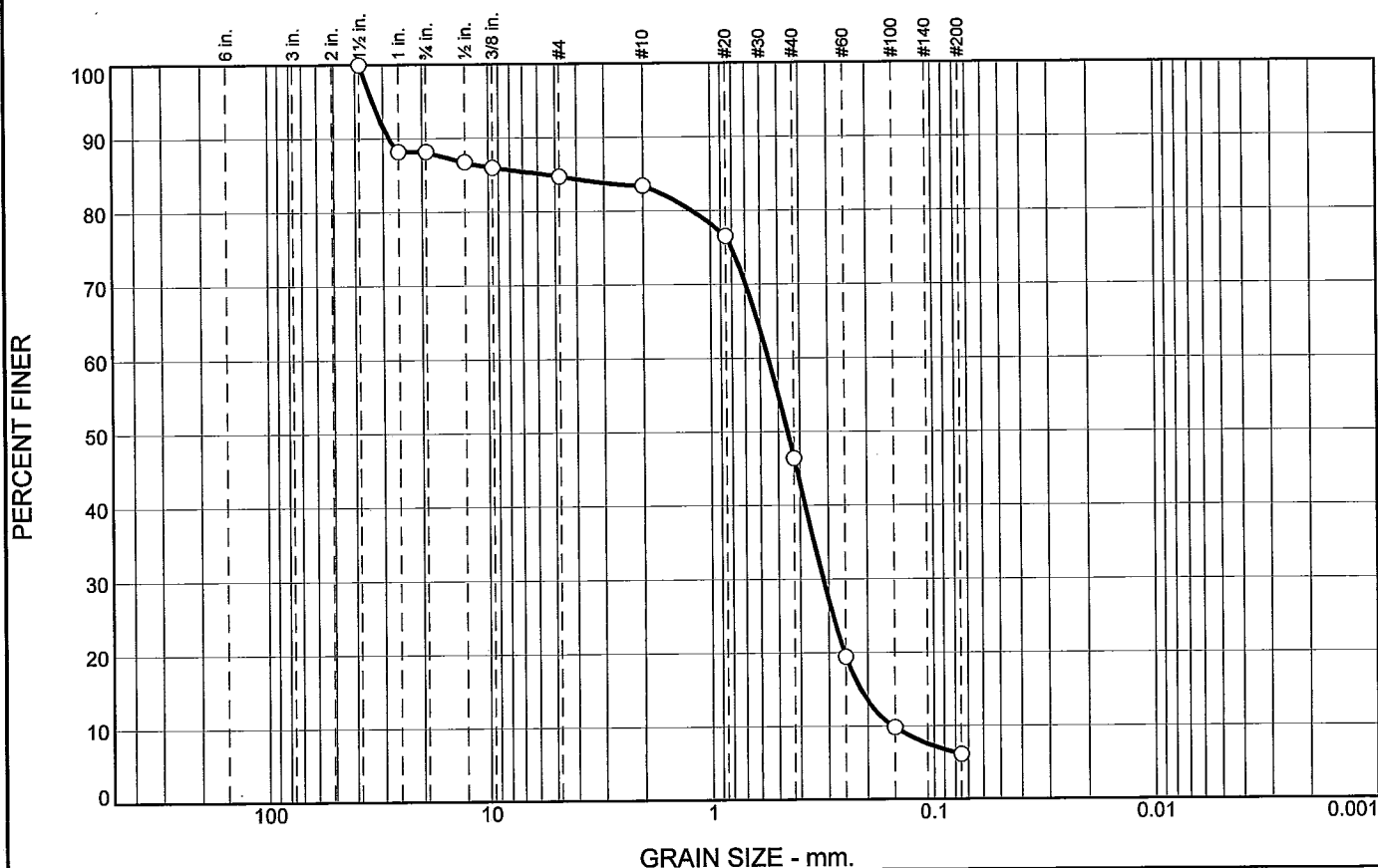
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.8	3.5	1.3	37.0	40.3	6.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.50	100.0		
1.00	88.2		
0.75	88.2		
0.50	86.7		
0.375	86.0		
#4	84.7		
#10	83.4		
#20	76.5		
#40	46.4		
#60	19.4		
#100	9.8		
#200	6.1		

* (no specification provided)

Material Description

Sand Widely Graded

Atterberg Limits

PL=

LL=

PI=

Coefficients

D₉₀= 28.2334

D₈₅= 5.5985

D₆₀= 0.5517

D₅₀= 0.4541

D₃₀= 0.3162

D₁₅= 0.2150

D₁₀= 0.1532

C_u= 3.60

C_c= 1.18

Classification

USCS= SW-SM

AASHTO=

Remarks

As-Rec'd M/C = 19.7%

Location: DSM Wall

Sample Number: GPEC-SB-114

Depth: 80-109

Date: 09/03/2010

JLT Laboratories, Inc.

Client: GEI Consultants

Project: DSM Wall

Canonsburg, PA

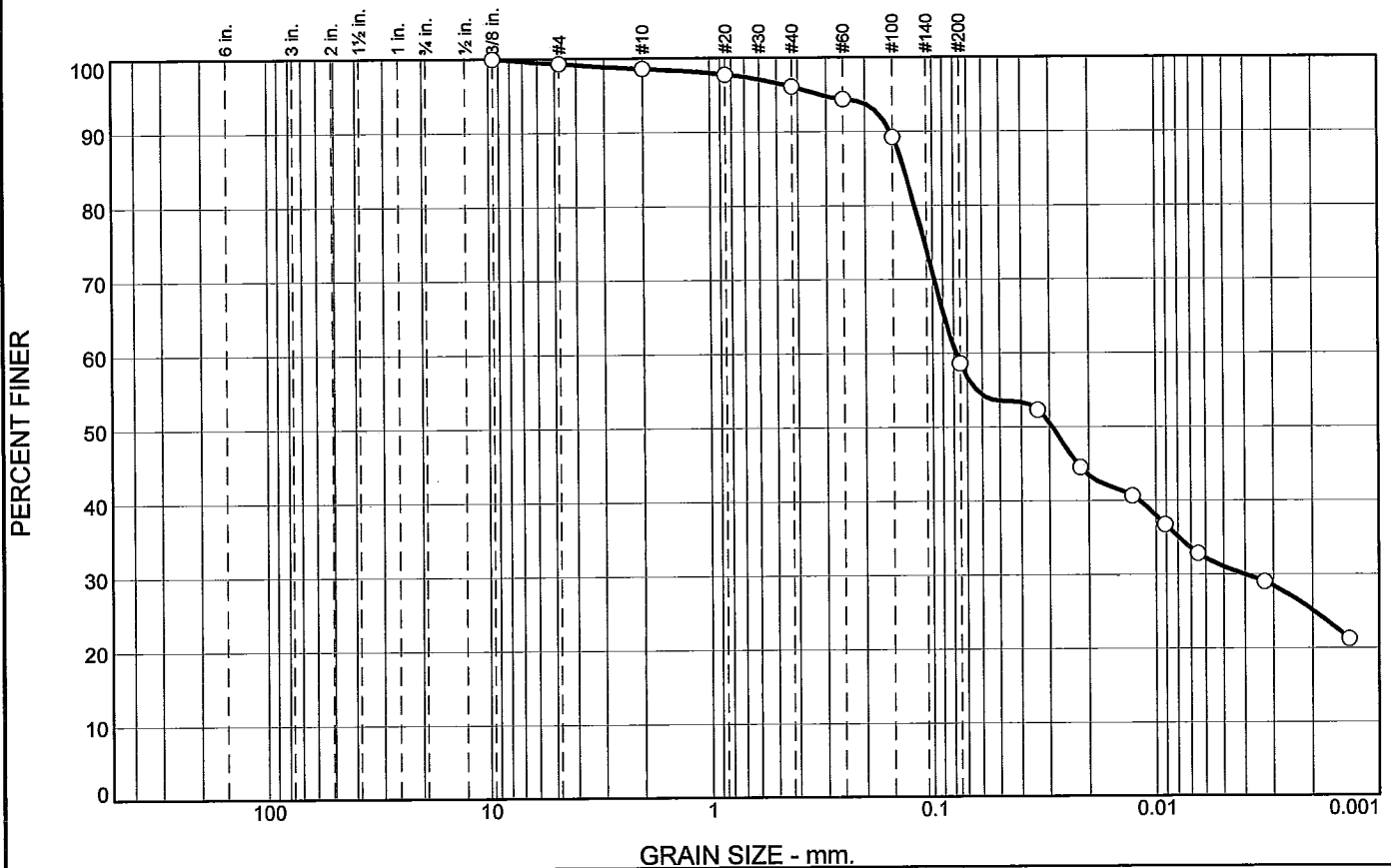
Project No: 10LS2201.01

Figure

Tested By: MS

Checked By: JB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.7	0.7	2.5	37.5	27.5	31.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	99.3		
#10	98.6		
#20	97.8		
#40	96.1		
#60	94.4		
#100	89.2		
#200	58.6		

* (no specification provided)

Material Description

Clay / Sandy Clay

Atterberg Limits

PL= 26

LL= 34

PI= 8

Coefficients

D₉₀= 0.1541

D₈₅= 0.1335

D₆₀= 0.0783

D₅₀= 0.0291

D₃₀= 0.0040

D₁₅=

D₁₀=

C_u=

C_c=

Classification

USCS= ML

AASHTO=

Remarks

As-Rec'd M/C = 20.8%

Location: DSM Wall

Sample Number: GPEC-SB-114

Depth: 109-115

Date: 09/03/2010

JLT Laboratories, Inc.

Client: GEI Consultants

Project: DSM Wall

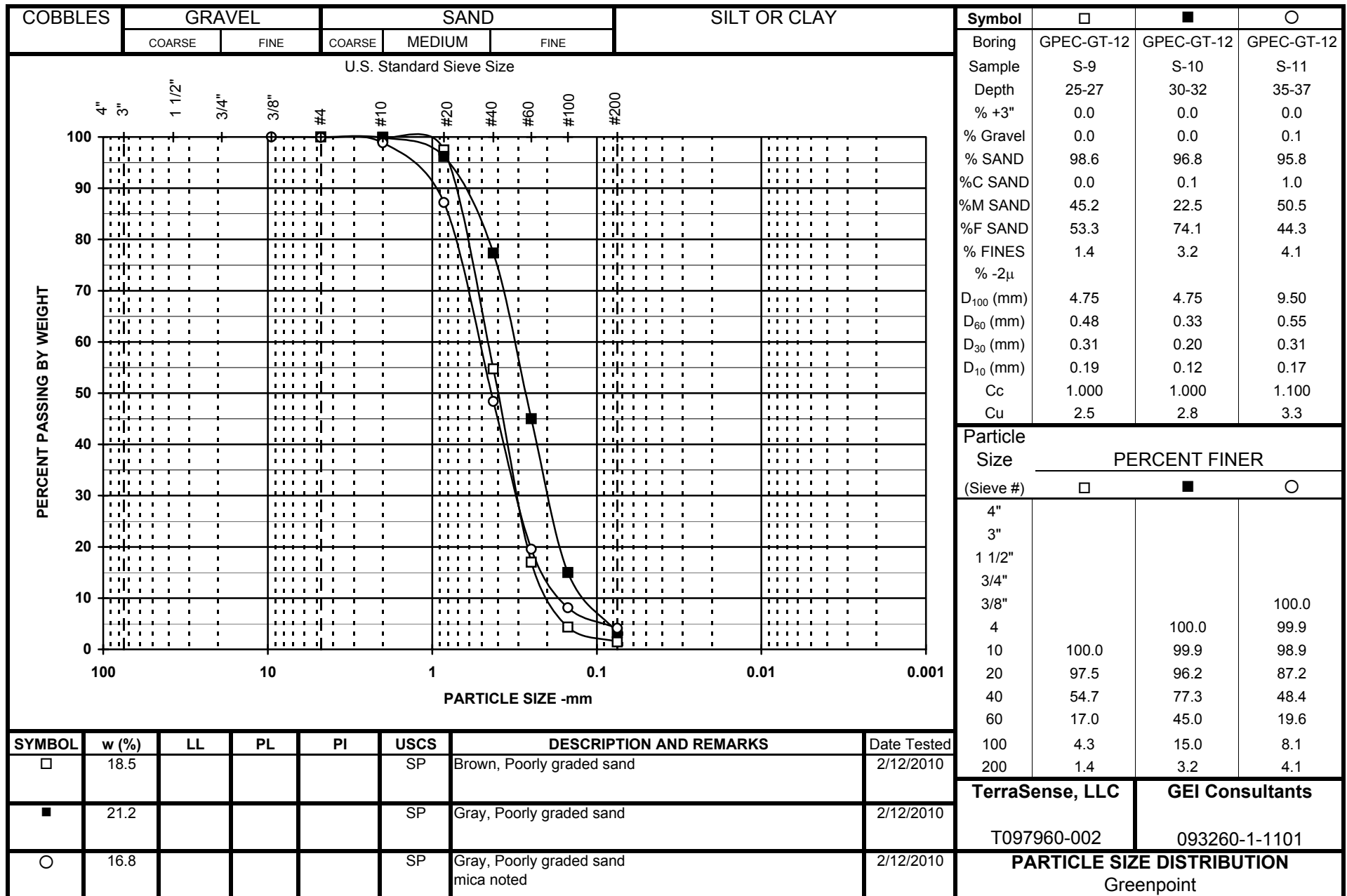
Canonsburg, PA

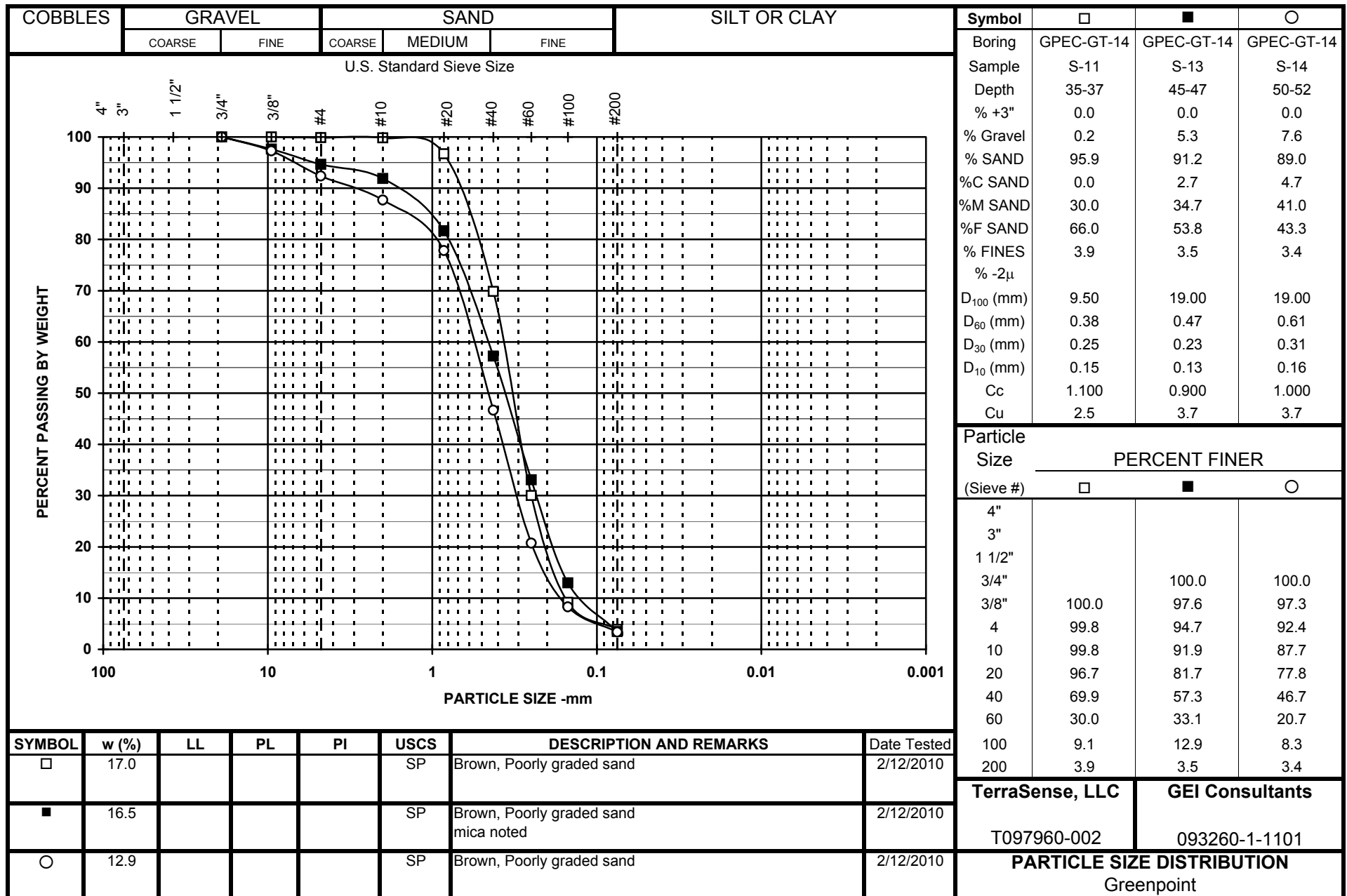
Project No: 10LS2201.01

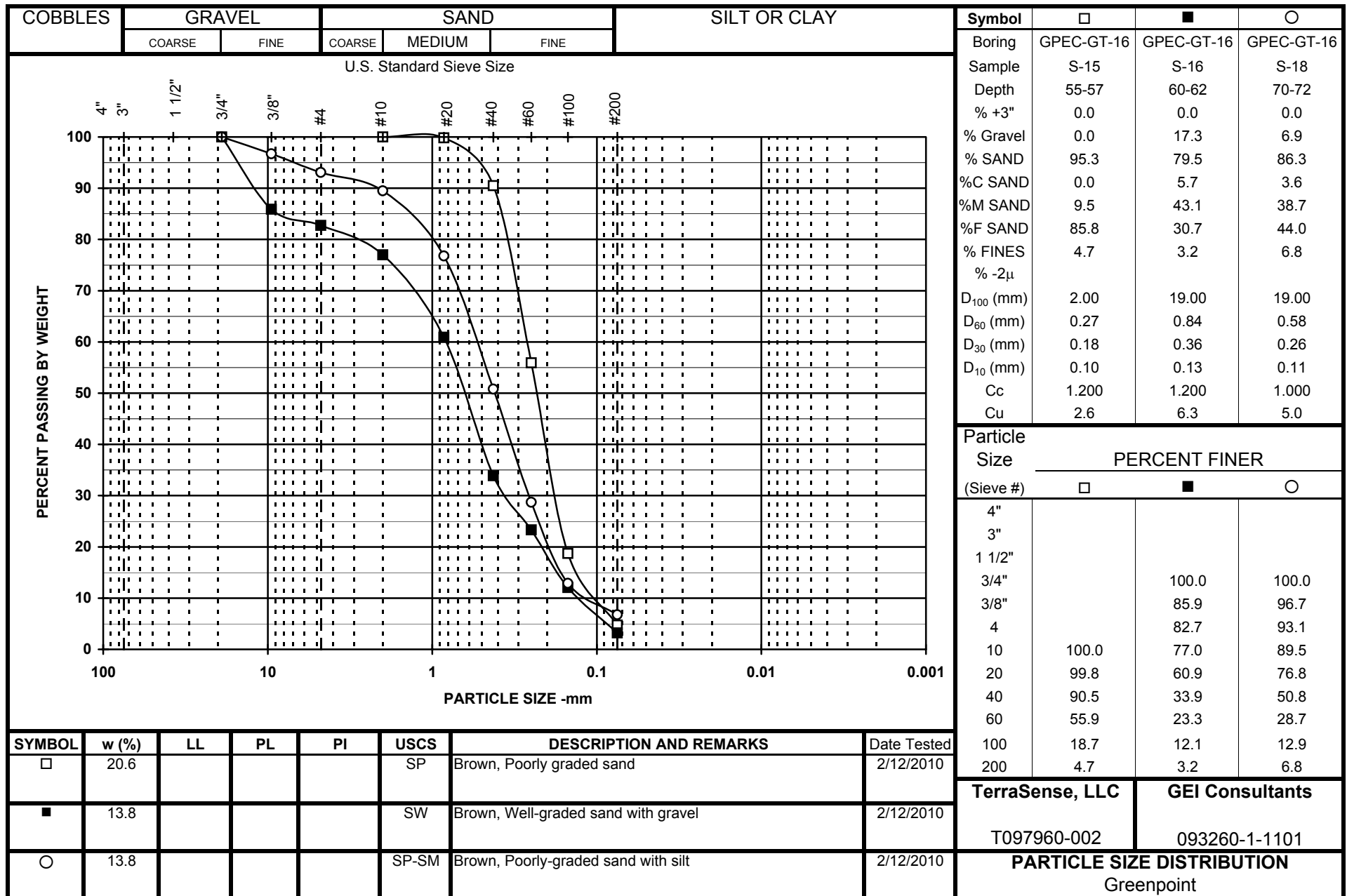
Figure

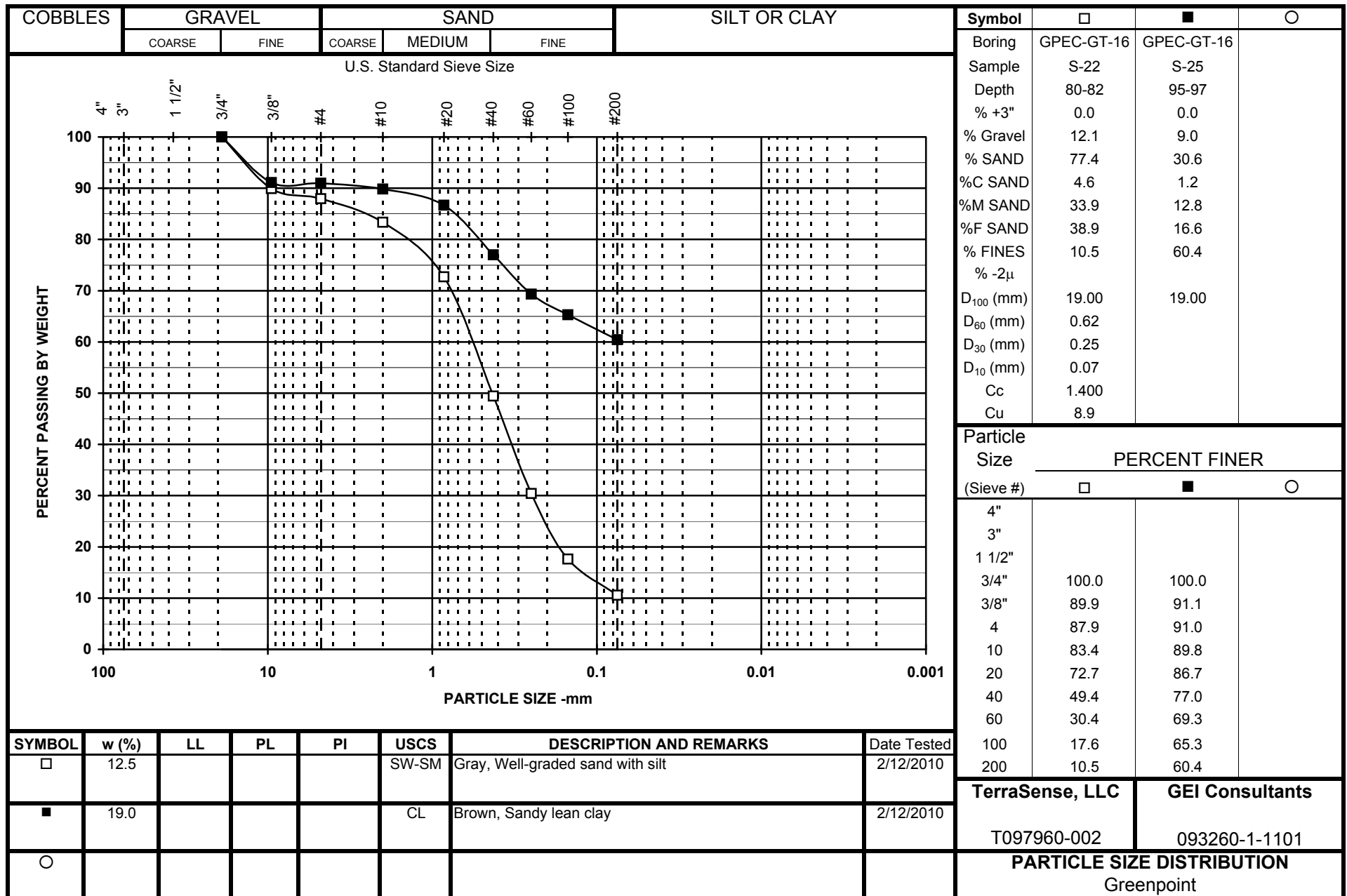
Tested By: MS

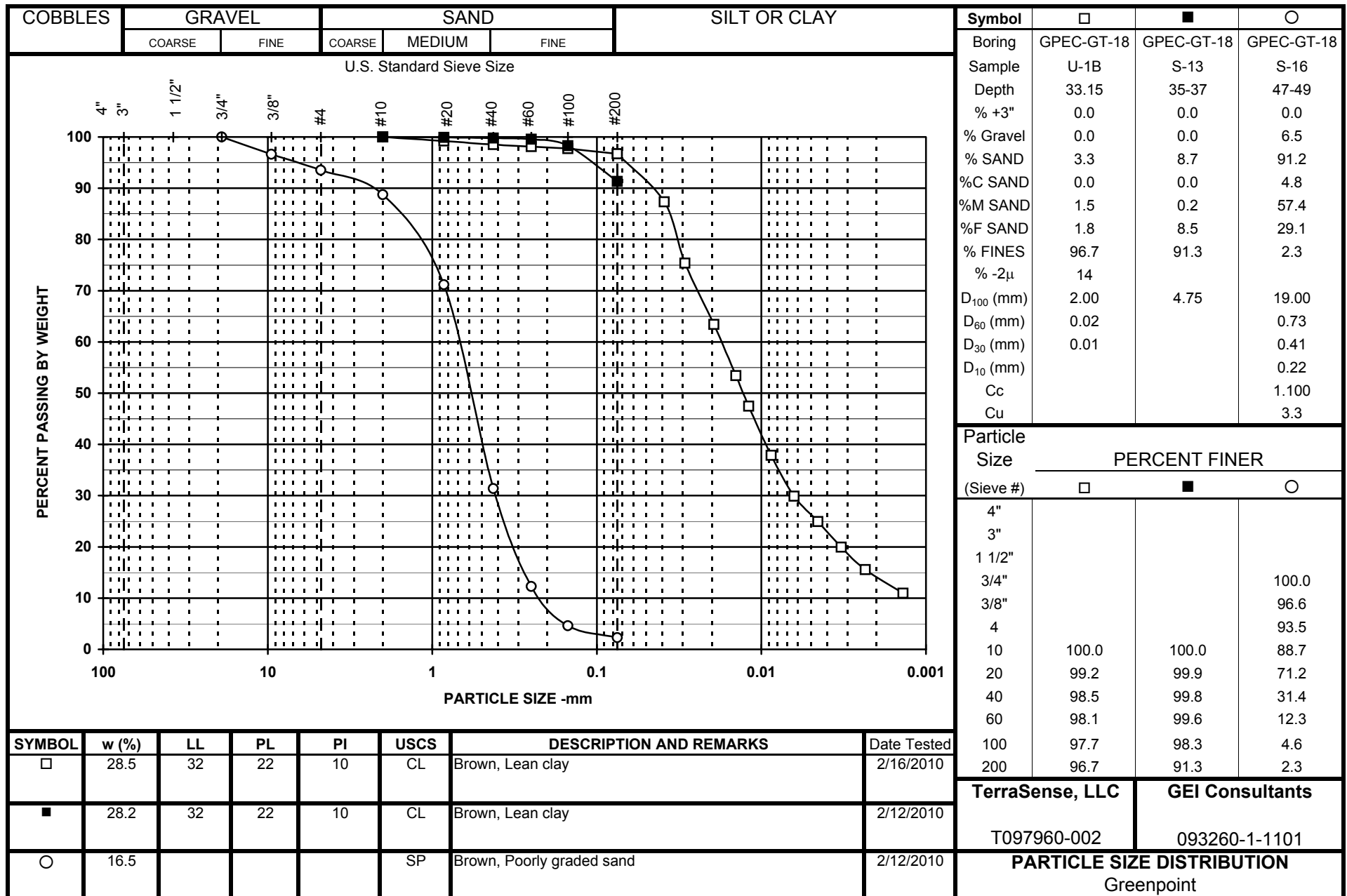
Checked By: JB

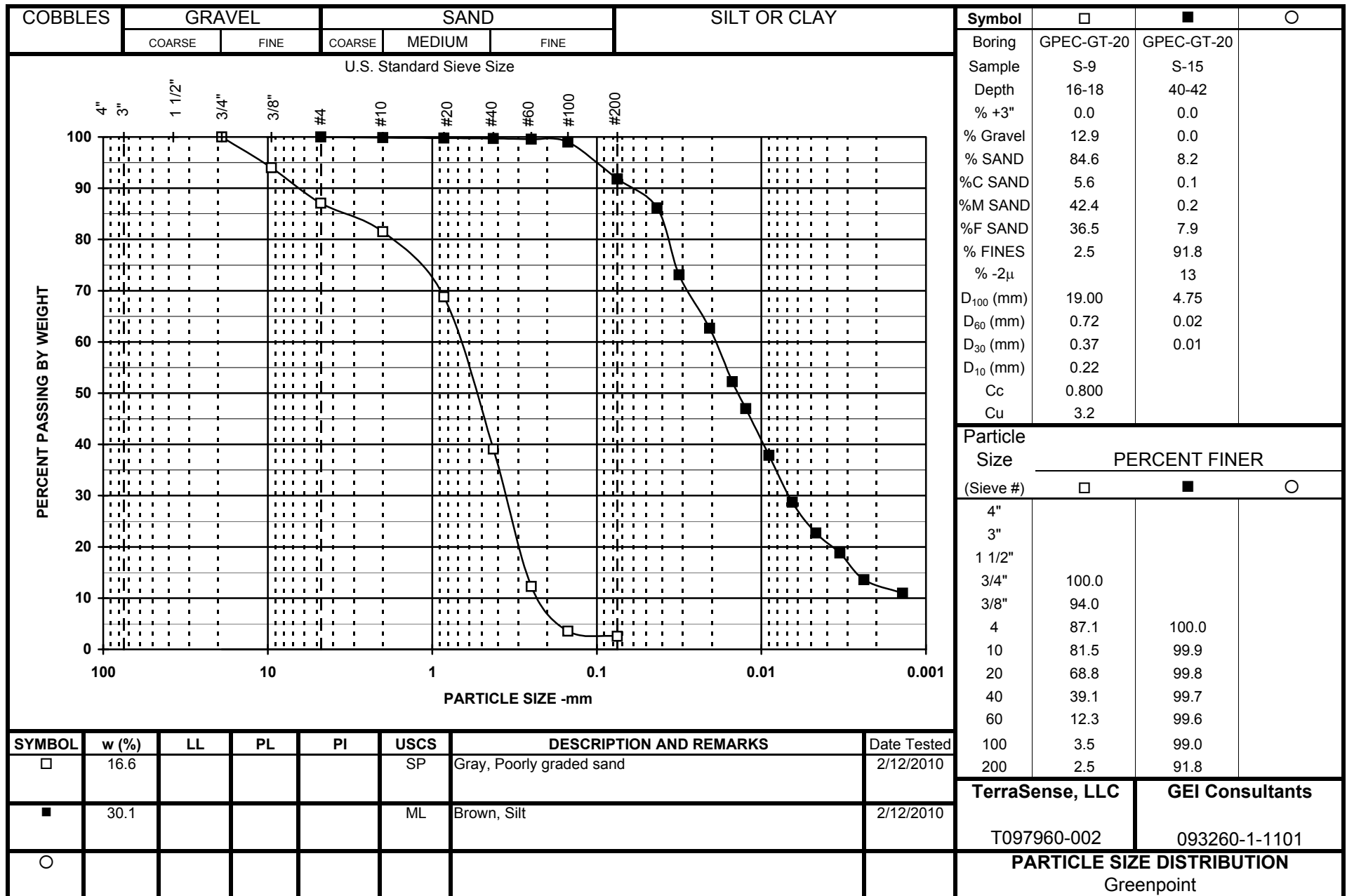












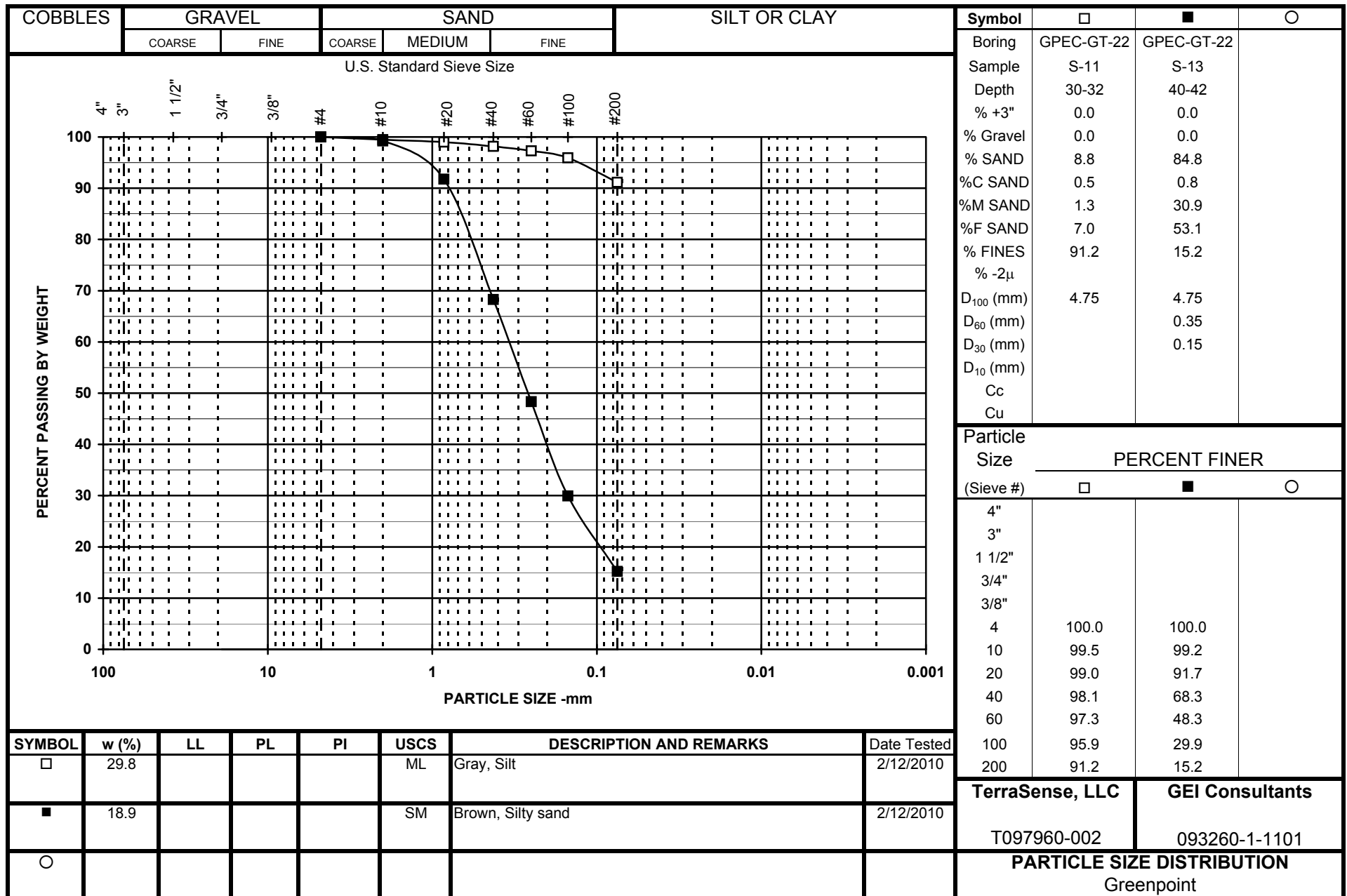


Table 1. TerraSense, LLC Laboratory Data Testing Summary 3/10/2010
Greenpoint Energy
National Grid
Brooklyn, NY

Boring No.	Sample No.	Depth (ft)	Identification Tests										Remarks
			Water content (%)	Liquid Limit	Plastic Limit	Plas. Index	USCS Symbol ⁽¹⁾	Sieve Minus No. 200 (%)	Hydro Minus 2um (%)	Organic Content (%)	Total Unit Weight (pcf)		
GPEC-GT-12	S-9	25-27	18.5				SP	1.4					
GPEC-GT-12	S-10	30-32	21.2				SP	3.2					
GPEC-GT-12	S-11	35-37	16.8				SP	4.1					
GPEC-GT-14	S-11	35-37	17.0				SP	3.9					
GPEC-GT-14	S-13	45-47	16.5				SP	3.5					
GPEC-GT-14	S-14	50-52	12.9				SP	3.4					
GPEC-GT-16	S-9	25-27	42.7	54	28	26	CH					No grain size data report associated with these Atterberg Limit test results.	
GPEC-GT-16	S-10	30-32	27.0	30	22	8	CL					No grain size data report associated with these Atterberg Limit test results.	
GPEC-GT-16	S-15	55-57	20.6				SP	4.7					
GPEC-GT-16	S-16	60-62	13.8				SW	3.2					
GPEC-GT-16	S-18	70-72	13.8				SP-SM	6.8					
GPEC-GT-16	S-22	80-82	12.5				SW-SM	10.5					
GPEC-GT-16	S-25	95-97	19.0	35	16	19	CL	60.4					
GPEC-GT-18	S-10	25-27	36.9	40	26	14	ML					No grain size data report associated with these Atterberg Limit test results.	
GPEC-GT-18	U-1	32-34								117.0		No grain size data report associated with these data. Summary testing compiled into one entry GPEC-GT-18:U1.	
GPEC-GT-18	U-1	32.35	46.3									No grain size data report associated with these data. Summary testing compiled into one entry GPEC-GT-18:U1.	
GPEC-GT-18	U-1	32.9	34.9									No grain size data report associated with these data. Summary testing compiled into one entry GPEC-GT-18:U1.	
GPEC-GT-18	U-1B	33.15	28.5	32	22	10	CL	96.7	14			Summary testing compiled into one entry GPEC-GT-18:U1.	
GPEC-GT-18	U-1	33.45	25.2									No grain size data report associated with these data. Summary testing compiled into one entry GPEC-GT-18:U1.	
GPEC-GT-18	S-13	35-37	28.2	32	22	10	CL	91.3					
GPEC-GT-18	S-16	47-49	16.5				SP	2.3					
GPEC-GT-20	S-9	16-18	16.6				SP	2.5					
GPEC-GT-20	S-10	20-22	32.6	43	24	19	CL	98.4				No grain size data report associated with these Atterberg Limit and wash sieve test results.	
GPEC-GT-20	U-1	27-29								114.4		No grain size data report associated with these data. Summary testing compiled into one entry GPEC-GT-20:U1.	
GPEC-GT-20	U-1	27.5	33.5									No grain size data report associated with these data. Summary testing compiled into one entry GPEC-GT-20:U1.	
GPEC-GT-20	U-1	28.05	35.5									No grain size data report associated with these data. Summary testing compiled into one entry GPEC-GT-20:U1.	
GPEC-GT-20	U-1C	28.3	33.5	54	25	29	CH					Summary testing compiled into one entry GPEC-GT-20:U1.	
GPEC-GT-20	U-1	28.6	39.1									No grain size data report associated with these data. Summary testing compiled into one entry GPEC-GT-20:U1.	
GPEC-GT-20	S-14	35-37	35.6	53	26	27	CH					No grain size data report associated with these Atterberg Limit test results.	
GPEC-GT-20	S-16	45-47	45.3	57	29	28	CH					No grain size data report associated with these Atterberg Limit test results.	
GPEC-GT-20	S-15	40-42	30.1				ML	91.8	13				
GPEC-GT-22	S-8	14-16	33.7	47	26	21	CL	93.4				No grain size data report associated with these Atterberg Limit and wash sieve test results.	
GPEC-GT-22	S-11	30-32	29.8				ML	91.2					
GPEC-GT-22	S-13	40-42	18.9				SM	15.2					

Notes:
¹ USCS symbol based on visual observation and Sieve and Atterberg limits reported.
Sediment data are from TerraSense report project no. T097960-002