FREEMAN COMPANIES

LAND DEVELOPMENT
ENGINEERING DESIGN
CONSTRUCTION SERVICES

Date: February 23, 2024

To: Dionys Quezada
Anand Seshadri, P.E.
CHA

From: Allison M. McCauliffe, P.E.
Christopher J. Tonzi, P.E.
Freeman Cos., LLC.

Subject: Subsurface Conditions
State Project No. 0134-0153
Route 190 over Abandoned Culvert
Stafford, Connecticut

File No.: 2017-0802.41

Introduction

A subsurface exploration program was completed in the vicinity of the abandoned culvert under Route 190, located in Stafford, Connecticut, as shown on Figure 1, Project Location Plan. The purpose of the program is to evaluate the water levels within the culvert to determine if the levels within the culvert are from groundwater or another source. It is assumed that this culvert is the abandoned tailrace of the mill that was previously located on Square Pond Brook, nearby. The following memorandum presents the results of the subsurface exploration program and the groundwater data collected from the program.

Subsurface Explorations

Four test borings B-1(OW) through B-3A(OW) were completed by New England Boring Contractors, inc. of Glastonbury, Connecticut from January 3 to January 9, 2024. Borings were completed with 4 inch flush joint casing to depths ranging from 9 feet to 30.5 feet below the existing ground surface. Two borings, B-3 and B-3A(OW) were drilled thru the culvert in an effort to determine the water level within the culvert.

Standard Penetration Tests (SPTs) were taken semi-continuously to 10 feet and at maximum 5 foot intervals thereafter. Borings were terminated at predetermined depths in natural soils and backfilled with cuttings upon completion. Test boring logs are attached and locations are shown on Figure 2, Subsurface Exploration Location Plan.

Laboratory Testing

Grain size analyses (ASTM D422) were performed on six representative soil samples recovered from the borings to aid in determining engineering properties. One sample was used in permeability testing (ASTM D5084).

Laboratory testing was conducted by Geotesting Express, Inc., of Acton, Massachusetts. Results of laboratory testing are attached.

Subsurface Conditions

The subsurface conditions encountered in the explorations generally consist of Miscellaneous Fill, Silty Sand, Sandy Gravel, Gravelly Sand, overlying Glacial Till. Subsurface conditions are known only at the boring locations and may differ significantly between borings. The generalized subsurface conditions are as follows. See Table 1, attached, for boring specific data.

Thickness of Deposit (feet)	Generalized Description
0.3	ASPHALT/TOPSOIL
1.7 to 6.7	MISCELLANEOUS FILL – Loose to very dense, gray and black to gray brown to brown, coarse to fine SAND, some to little gravel, little to trace silt.
0 to 2	SILTY SAND – loose to dense, brown to gray, coarse to fine SAND, little to some silt, roots (B-3 Only). Borings B-2 and B-3 only.
Greater than 1	SANDY GRAVEL – Dense to very dense, gray to red, coarse to fine GRAVEL, some coarse to fine sand, little silt, varying to coarse to fine GRAVEL and coarse to fine SAND, little silt. Borings B-3 and B-3A (OW) only
19 to 21	GRAVELLY SAND – Very dense, gray, coarse to fine SAND, some to and coarse to fine gravel, trace to little silt.
Greater than 5.5	GLACIAL TILL – Very dense, gray, coarse to fine SAND, some coarse to fine gravel, little silt. Borings B-1 and B-2 only.

Groundwater

Groundwater was encountered in the borings at approximately 6 feet to 7 feet below ground surface, corresponding to Elevation 524 to Elevation 523 feet at the time of drilling. See Table 1, attached, for boring specific data. Additional groundwater measurements were taken in the monitoring wells on February 9, 2024. Groundwater level measurements were made during or immediately following drilling and may not represent static conditions, except for those measured in groundwater monitoring wells. Groundwater levels will fluctuate with season, precipitation, nearby construction activities, and other conditions.

Permeability testing was completed on a sample taken during the subsurface exploration. The results indicate that the soil at a depth of 5 feet to 7 feet below existing ground surface has a permeability of approximately $2x10^{-4}$ cm/sec. This indicates that the material is not a free draining material and that it is at the lower end of permeability of a sand.

Water levels outside of and within the culvert were generally the same, varying by 1 foot or less, which indicates that the water level in the culvert is likely groundwater and not water from another source, such as directly from the nearby Square Pond Brook. However, the water level will be influenced by that body of water. It appears that this culvert was once the tailrace for the former Mill located on the brook.

Closure

This memorandum was prepared based on available information and from information gathered during the subface exploration program and on limited information on the nature of the existing structure. Our professional services for this project have been performed in accordance with generally accepted engineering practices. No warranty, express or implied, is made.

Attachments

Table 1
Figures 1 and 2
Test Boring Logs
Laboratory Testing

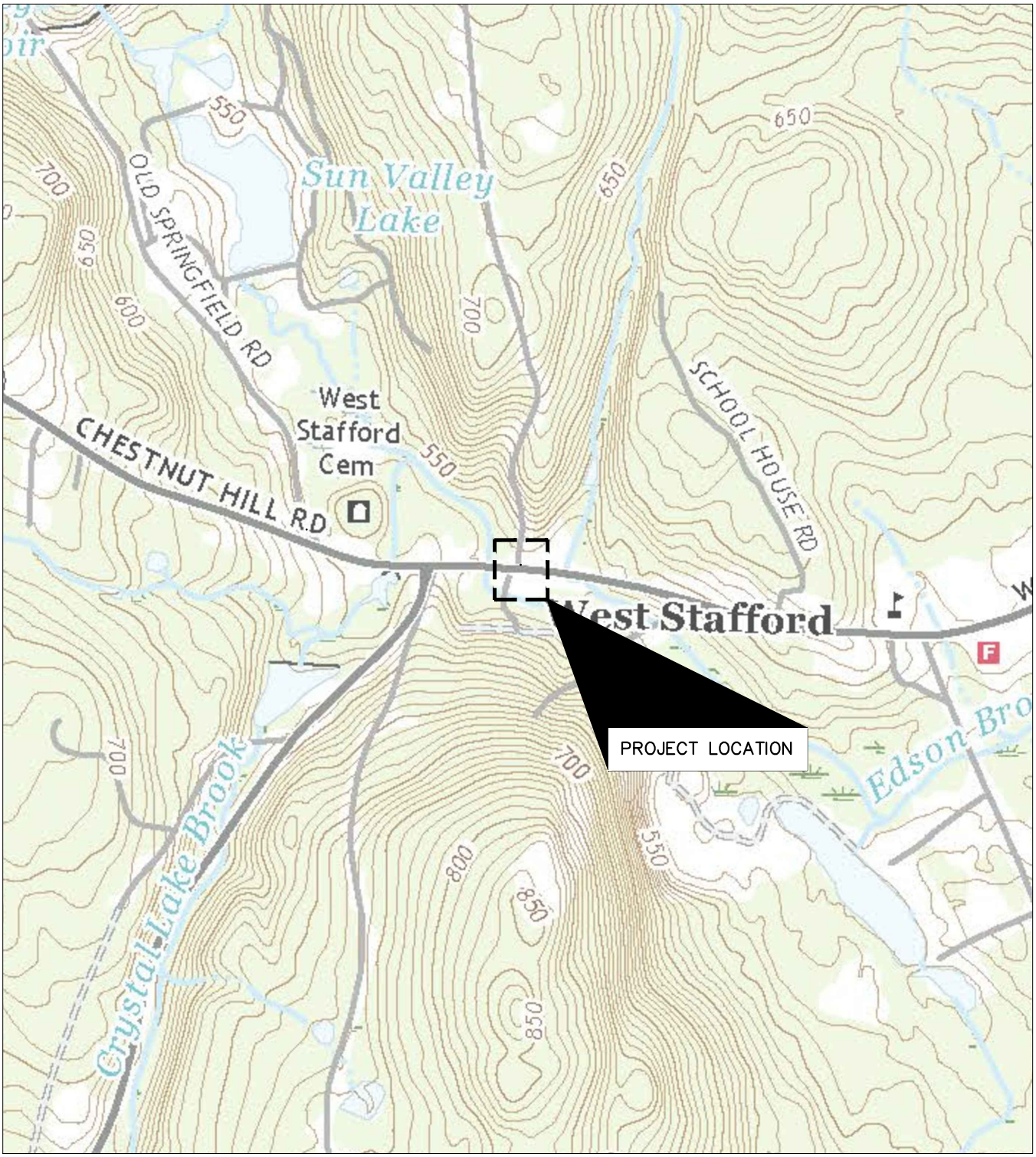
SPN: 0134-0153
Route 190 over Abandoned Culvert
Route 190 - Stafford, Connecticut

Table 1
Summary of Subsurface Data

Boring No.	Ground Surface El. [1]	Depth (ft.)	Thickness (ft.)						Groundwater (ATD)		
			Asphalt / Topsoil	Misc. Fill	Silty Sand	Sandy Gravel	Gravelly Sand	Glacial Till	Date	Depth (ft.)	Elevation
B-1 (OW)	530	30.5	0.3	6.0	--	--	19.0	>5.5	ATD	7.0	523.0
									1/18/2024	7.0	523.0
									2/9/2024	5.7	524.3
B-2	530	31	0.3	1.7	2.0	--	21.0	>6	ATD	6.0	524.0
B-3	530	9	0.3	6.7	1.0	>1	--	--	ATD	6.0	524.0
B-3A (OW)	530	17	0.3	8.7	--	>8	--	--	ATD	6.0	524.0
									1/18/2024	6.0	524.0
									2/9/2024	5.0	525.0

Notes:

1. Ground surface elevations are approximate and based upon elevations from the available topographic mapping on the site.
2. Groundwater levels were measured during drilling acitivities and may not represent stabilized conditions, except those noted in the monitoring wells.
3. ">" - Greater Than "--" - Not Encountered
   "ATD" - At Time of Drilling



USGS QUADRANGLE MAP
STAFFORD SPRINGS, CT
DATE 2021

FREEMAN COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES
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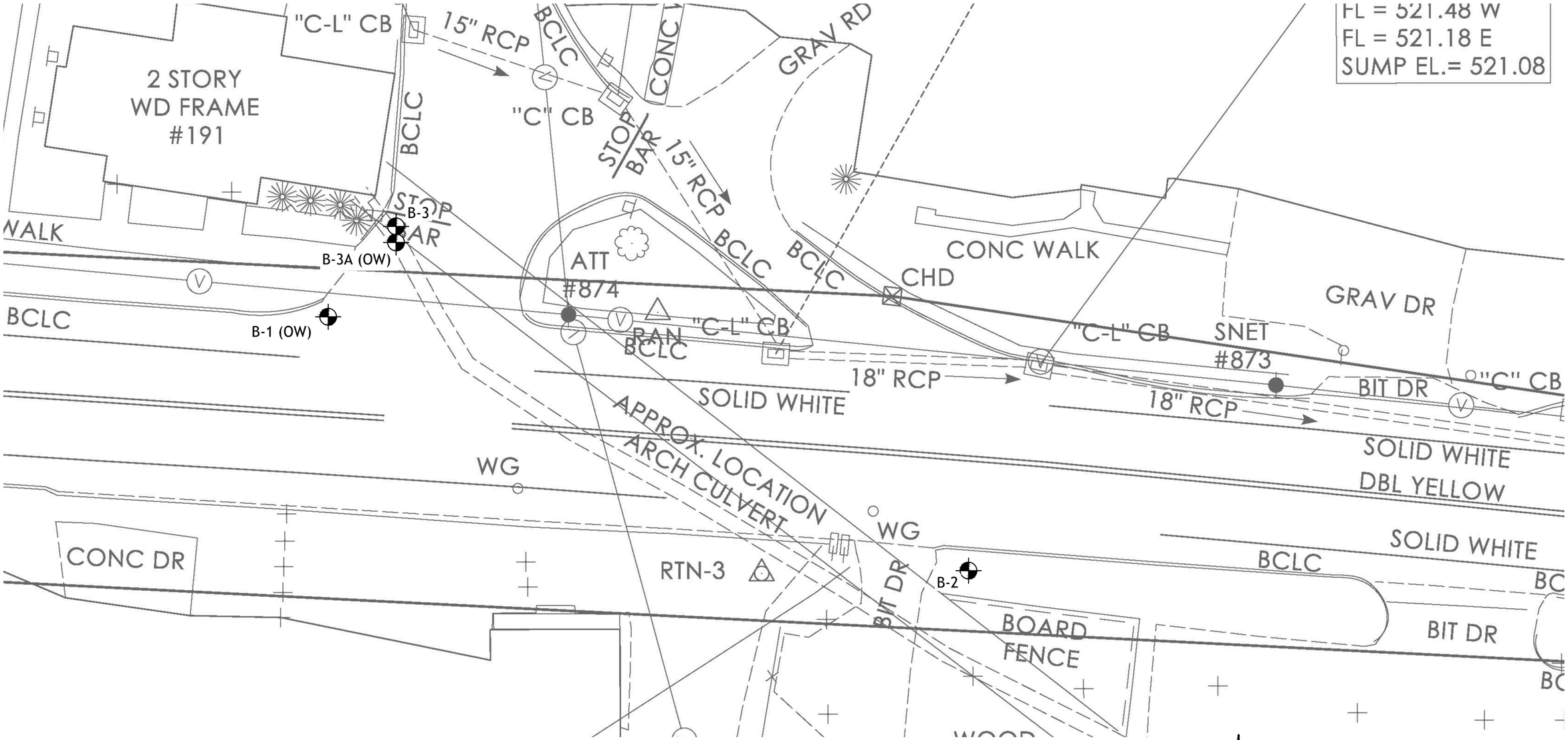
SITE LOCATION MAP

REMOVAL OF ABANDONED STONE ARCH CULVERT -
WEST STAFFORD ROAD (ROUTE 190)
STATE PROJECT No. 0134-0153
STAFFORD, CONNECTICUT

DRAFTED:	T.T.
CHECKED:	C.T.
APPROVED:	A.M.
SCALED:	1"=1000'
PROJECT NO.:	2017-0802.41
DATE:	01/18/2024

SHEET NO.

FIGURE 1



LEGEND:

⌖	B-1	TEST BORINGS
	OW	OBSERVATION WELL

NOTES:

1. BASE PLAN PROVIDED CHA
2. BORING LOCATIONS WERE MARKED BY CHA
3. REFER TO THE TEXT AND APPENDICES FOR ADDITIONAL INFORMATION

GRAPHIC SCALE
40 20 0 40
SCALE IN FEET

SUBSURFACE EXPLORATION LOCATION PLAN

REMOVAL OF ABANDONED STONE ARCH CULVERT -
WEST STAFFORD ROAD (ROUTE 190)
STATE PROJECT No. 0134-0153
STAFFORD SPRINGS, CONNECTICUT

FREEMAN COMPANIES
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FAX:(860)986-7161
ELEVATE YOUR EXPECTATIONS

No.	Date	Description
REVISIONS		

DRAWN:	T.T.
CHECKED:	C.T.
APPROVED:	A.M.
SCALE:	1"=40'
PROJECT NO.:	2017-0802.41
DATE:	01/18/2024

SHEET NO.

FIGURE 2

Driller:	R. Posa	**Connecticut DOT Boring Log Format**		Hole No.:	B-1 (OW)
Inspector:	T. Ta	Town:	Stafford	Stat./Offset:	
Engineer:	A. McCauliffe	Project No.:	0134-0153	Northing:	914487
Start Date:	1-4-24	Route No.:	Route 190	Easting:	1107215
Finish Date:	1-4-24	Bridge No.:	Abandoned Culvert	Surface Elevation:	530
Project Description:	West Stafford Road (Route 190) - Removal of Abandoned Stone Arch Culvert				
Casing Size/Type:	4-in. Casing	Sampler Type/Size:	1-3/8 inch ID	Core Barrel Type:	
Hammer Wt.:	300lb Fall: 30in.	Hammer Wt.:	140lb Fall: 30in.		
Groundwater Observations:	7 ATD, 7, 1/18/2024, 5.7 after 2/9/2024 hours				

Depth (ft)	Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
		SAMPLES						
0						Pave. Struct.	Asphalt 4"	530
	S-1	30 33 16 14	24	12		Misc. Fill	Gray and black c-f SAND, little c-f gravel, trace silt	
	S-2	10 15 12 9	24	8			Gray and black c-f SAND,and c-f gravel, trace silt	
5							Top 6" - brown c-f SAND, little c-f gravel, little silt	525
	S-3	4 9 11 13	24	10		Gravelly Sand	Bottom 4" - gray c-f SAND, some c-f gravel, trace silt	
	S-4	12 12 50/3"	15	6			Brown c-f SAND, little m-f gravel, little silt (petroleum odor)	
	S-5	34 52 61	18	12			Gray brown c-f SAND and c-f GRAVEL, little silt	
10								520
15								515
	S-6	13 36 29 30	24	12			Gray brown c-f SAND and c-f GRAVEL, little silt	
20								510
	S-7	10 13 17 40	24	12			Gray c-f SAND, some c-f gravel, trace silt	
25								505

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 30.5ft Rock: ft	NOTES:	Sheet 1 of 2
No. of Soil Samples: 9 No. of Core Runs: 0		SM-001-M REV. 1/02

Driller:	R. Posa	**Connecticut DOT Boring Log Format**		Hole No.:	B-1 (OW)
Inspector:	T. Ta	Town:	Stafford	Stat./Offset:	
Engineer:	A. McCauliffe	Project No.:	0134-0153	Northing:	914487
Start Date:	1-4-24	Route No.:	Route 190	Easting:	1107215
Finish Date:	1-4-24	Bridge No.:	Abandoned Culvert	Surface Elevation:	530
Project Description:	West Stafford Road (Route 190) - Removal of Abandoned Stone Arch Culvert				
Casing Size/Type:	4-in. Casing	Sampler Type/Size:	1-3/8 inch ID	Core Barrel Type:	
Hammer Wt.:	300lb Fall: 30in.	Hammer Wt.:	140lb Fall: 30in.		
Groundwater Observations:	7 ATD, 7 1/18/2024, 5.7 after 2/9/2024 hours				

Depth (ft)	SAMPLES: Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
25	S-8	23 34 39 42	24	10		Glacial Till	Gray brown c-f SAND, some c-f gravel, little silt	505
30	S-9	75	6	3			Gray brown c-f SAND, some c-f gravel, little silt	500
							END OF BORING 30.5ft	
35								495
40								490
45								485
50								480

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 30.5ft Rock: ft	NOTES:	Sheet 2 of 2
No. of Soil Samples: 9 No. of Core Runs: 0		SM-001-M REV. 1/02

Driller:	M. St. John	**Connecticut DOT Boring Log Format**		Hole No.:	B-2
Inspector:	T. Ta	Town:	Stafford	Stat./Offset:	
Engineer:	A. McCauliffe	Project No.:	0134-0153	Northing:	914440
Start Date:	1-9-24	Route No.:	Route 190	Easting:	1107349
Finish Date:	1-9-24	Bridge No.:	Abandoned Culvert	Surface Elevation:	530

Project Description: West Stafford Road (Route 190) - Removal of Abandoned Stone Arch Culvert

Casing Size/Type: 4-in. Casing	Sampler Type/Size: 1-3/8 inch ID	Core Barrel Type:
Hammer Wt.: 300lb Fall: 30in.	Hammer Wt.: 140lb Fall: 30in.	

Groundwater Observations: 6 ATD

Depth (ft)	Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0	S-1	1 3 1 2	24	16		Topsoil	Topsoil 3"	530
						Misc. Fill	Brown c-f sand, m-f gravel, trace silt	
	S-2	2 2 3 2	24	18		Silty Sand	Brown c-f SAND, little silt, trace f gravel	
5						Gravelly Sand		525
	S-3	2 1 2 2	24	10			Brown c-f SAND, and m-f gravel, trace silt	
	S-4	2 7 9 14	24	12			Brown c-f SAND, little m-f gravel, little silt	
10	S-5	50/4"	4	3			Gray brown c-f SAND and c-f GRAVEL, trace silt	520
15	S-6	16 38 49 27	24	12			Gray c-f SAND, and c-f gravel, little silt	515
20	S-7	45 100	12	8			Gray c-f GRAVEL, and c-f sand, little silt	510
25								505

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 31ft Rock: ft	NOTES:	Sheet 1 of 2
No. of Soil Samples: 9 No. of Core Runs: 0		SM-001-M REV. 1/02

Driller:	M. St. John	**Connecticut DOT Boring Log Format**		Hole No.:	B-2
Inspector:	T. Ta	Town:	Stafford	Stat./Offset:	
Engineer:	A. McCauliffe	Project No.:	0134-0153	Northing:	914440
Start Date:	1-9-24	Route No.:	Route 190	Easting:	1107349
Finish Date:	1-9-24	Bridge No.:	Abandoned Culvert	Surface Elevation:	530

Project Description: West Stafford Road (Route 190) - Removal of Abandoned Stone Arch Culvert

Casing Size/Type: 4-in. Casing	Sampler Type/Size: 1-3/8 inch ID	Core Barrel Type:
Hammer Wt.: 300lb Fall: 30in.	Hammer Wt.: 140lb Fall: 30in.	

Groundwater Observations: 6 ATD

Depth (ft)	SAMPLES: Sample Type/No.	SAMPLES: Blows on Sampler per 6 inches	SAMPLES: Pen. (in.)	SAMPLES: Rec. (in.)	SAMPLES: RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
25	S-8	77 64 55 60	24	14		Glacial Till	Gray c-f SAND, and c-f gravel, little silt	505
30	S-9	65 79	12	6			Gray c-f SAND, and c-f gravel, little silt	500
							END OF BORING 31ft	
35								495
40								490
45								485
50								480

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 31ft Rock: ft	NOTES:	Sheet 2 of 2
No. of Soil Samples: 9 No. of Core Runs: 0		SM-001-M REV. 1/02

Driller:	R. Posa	**Connecticut DOT Boring Log Format**		Hole No.:	B-3
Inspector:	T. Ta	Town:	Stafford	Stat./Offset:	
Engineer:	A. McCauliffe	Project No.:	0134-0153	Northing:	914505
Start Date:	1-3-24	Route No.:	Route 190	Easting:	1107232
Finish Date:	1-3-24	Bridge No.:	Abandoned Culvert	Surface Elevation:	530

Project Description: West Stafford Road (Route 190) - Removal of Abandoned Stone Arch Culvert

Casing Size/Type: 4-in. Casing	Sampler Type/Size: 1-3/8 inch ID	Core Barrel Type:
Hammer Wt.: 300lb Fall: 30in.	Hammer Wt.: 140lb Fall: 30in.	

Groundwater Observations: 6 ATD

Depth (ft)	SAMPLES: Sample Type/No.	SAMPLES: Blows on Sampler per 6 inches	SAMPLES: Pen. (in.)	SAMPLES: Rec. (in.)	SAMPLES: RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0						Pave. Struct.	Asphalt 4"	530
	S-1	16 16 15 14	24	16		Misc Fill	Gray brown c-f SAND, some c-f gravel, trace silt	
	S-2	8 20 19 13	24	10			Gray brown c-f SAND, little c-f gravel, trace silt (quartz cobble at tip)	
5	S-3	68 43 34 7	24	6			Recovered flat gravel chips	525
	S-4	13 11 24 26	24	4		Silty Sand	Top 1" - Gray f-SAND, some silt (roots)	
						Sandy Gravel	Bottom 3" - Red brown c-f GRAVEL, little sand, trace silt	
10							END OF BORING 9ft	520
15								515
20								510
25								505

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 9ft Rock: ft	NOTES:	Sheet 1 of 1
No. of Soil Samples: 4 No. of Core Runs: 0		SM-001-M REV. 1/02

Driller:	R. Posa	**Connecticut DOT Boring Log Format**		Hole No.:	B-3A (OW)
Inspector:	T. Ta	Town:	Stafford	Stat./Offset:	
Engineer:	A. McCauliffe	Project No.:	0134-0153	Northing:	914502
Start Date:	1-3-24	Route No.:	Route 190	Easting:	1107230
Finish Date:	1-3-24	Bridge No.:	Abandoned Culvert	Surface Elevation:	530
Project Description:	West Stafford Road (Route 190) - Removal of Abandoned Stone Arch Culvert				
Casing Size/Type:	4-in. Casing	Sampler Type/Size:	1-3/8 inch ID	Core Barrel Type:	
Hammer Wt.:	300lb Fall: 30in.	Hammer Wt.:	140lb Fall: 30in.		
Groundwater Observations:	6 ATD, 6 1/18/2024, 5.0 after 2/9/2024 hours				

Depth (ft)	SAMPLES Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0						Pave. Struct.		530
						Misc Fill	Boring offset 3ft south. Refer to Boring B-3 for more information	
						Stone Culvert	Hard grinding from 4ft to 5ft (probable stone culvert top)	
5						Open Void		525
							2ft open void from 5ft to 7ft	
	S-1	8 11 15 14	24	6		Misc Wash Fill	Dark gray c-f SAND, little m-f gravel, little silt	
10	S-2	10 4 10 11	24	10		Sandy Gravel	Gray brown c-f GRAVEL, little c-f sand, trace silt (orange-brown at tip)	520
	S-3	16 15 33 50/2"	20	16			Top 10" - brown c-f SAND, trace silt	
							Bottom 6" - gray c-f GRAVEL, some c-f sand, little silt	
15	S-4	27 54 41 50	24	8			Gray c-f GRAVEL and c-f SAND, little silt	515
							END OF BORING 17ft	
20								510
25								505

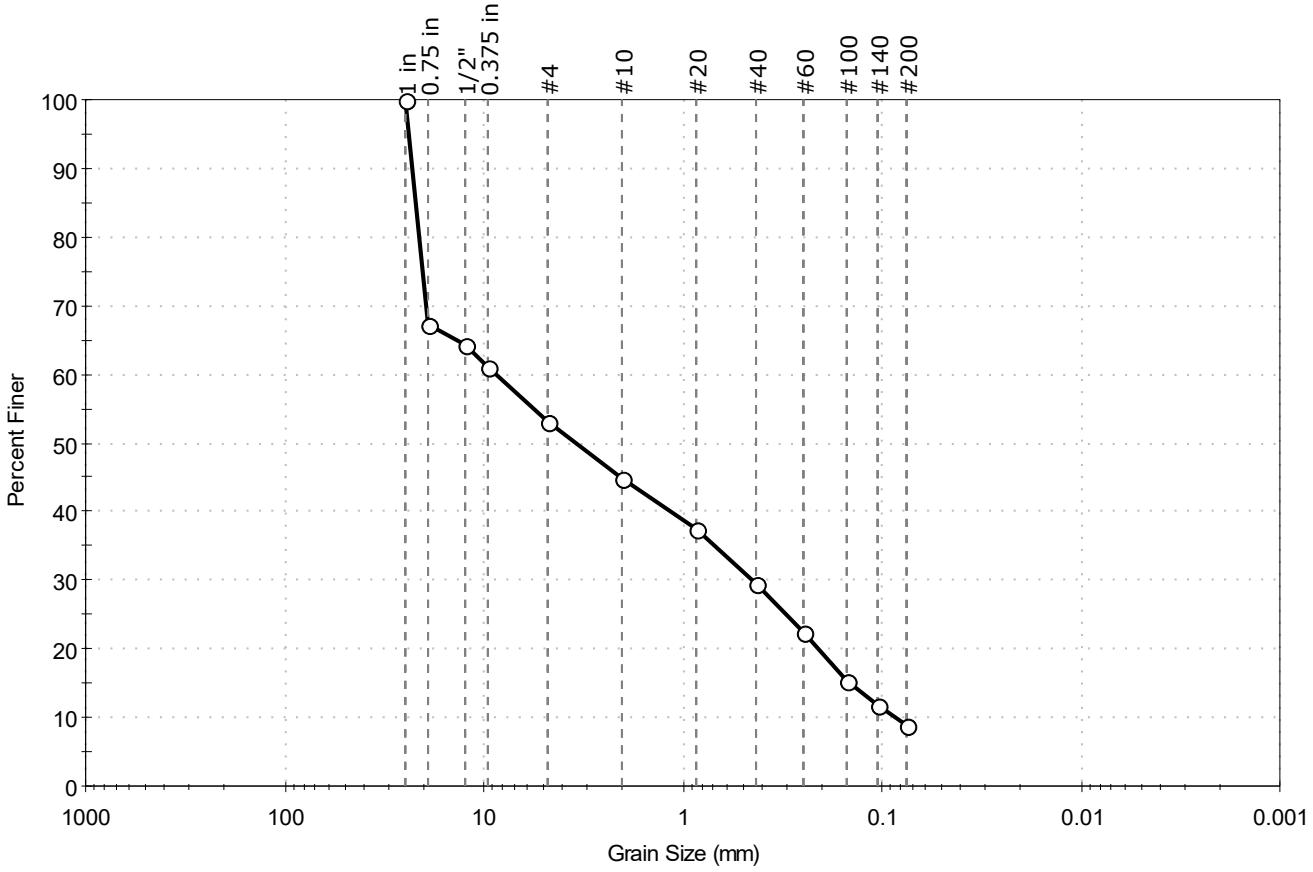
Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 17ft Rock: ft	NOTES:	Sheet 1 of 1
No. of Soil Samples: 4 No. of Core Runs: 0		SM-001-M REV. 1/02

Client:	Freeman Companies, LLC				
Project:	0134-153 RT190 ov Abandoned Culvert				
Location:	Stafford, CT			Project No:	GTX-318492
Boring ID:	B-1 (OW)	Sample Type:	Bag	Tested By:	ckg
Sample ID:	S-2	Test Date:	01/31/24	Checked By:	ank
Depth :	2.5-4.5	Test Id:	756113		
Test Comment:	---				
Visual Description:	Moist, dark gray sandy gravel with silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	46.9	44.2	8.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	67		
1/2"	12.50	64		
0.375 in	9.50	61		
#4	4.75	53		
#10	2.00	45		
#20	0.85	37		
#40	0.42	29		
#60	0.25	22		
#100	0.15	15		
#140	0.11	12		
#200	0.075	8.9		

Coefficients

D_{85} = 22.0534 mm	D_{30} = 0.4472 mm
D_{60} = 8.7139 mm	D_{15} = 0.1442 mm
D_{50} = 3.4472 mm	D_{10} = 0.0855 mm
C_u = 101.917	C_c = 0.268

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (1))

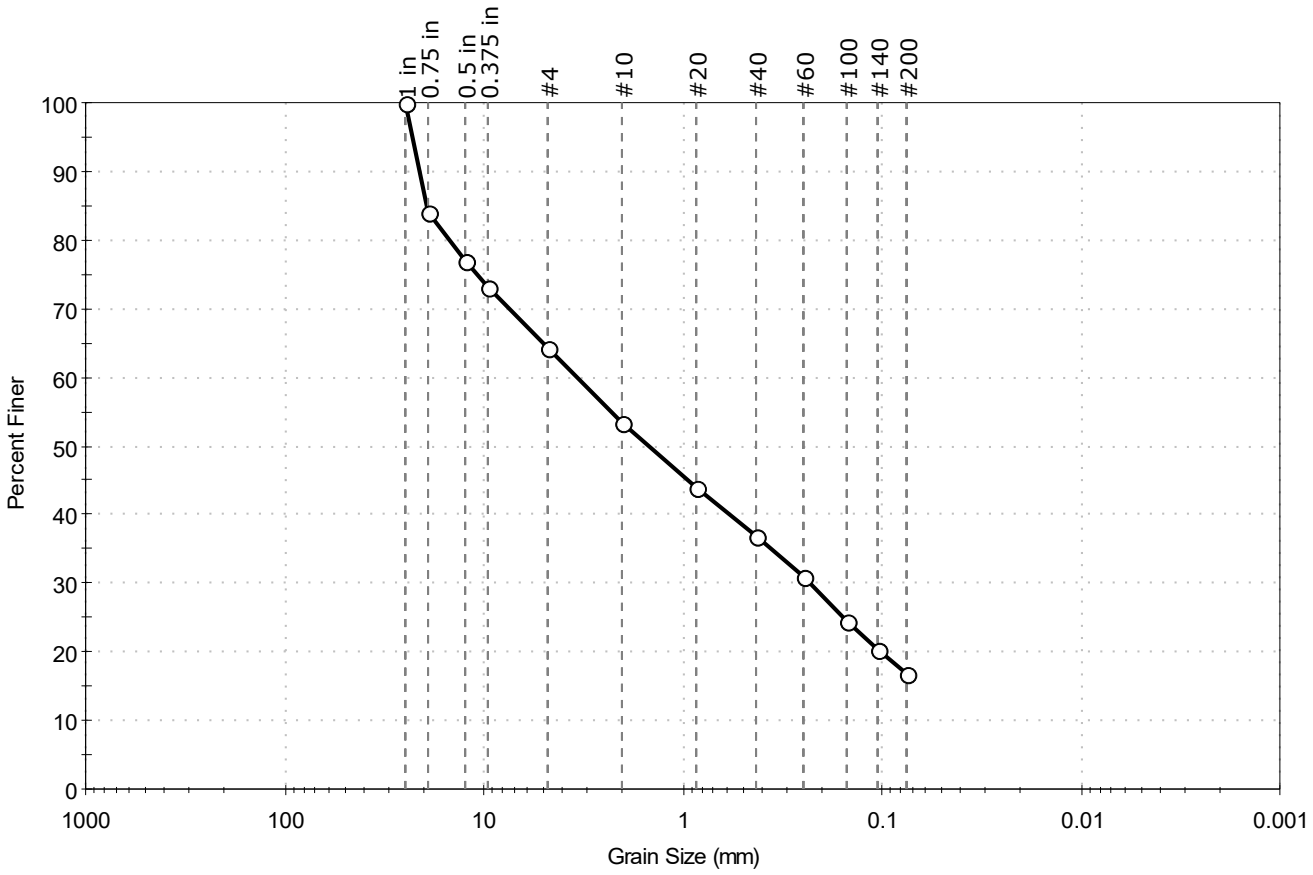
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Freeman Companies, LLC				
Project:	0134-153 RT190 ov Abandoned Culvert				
Location:	Stafford, CT			Project No:	GTX-318492
Boring ID:	B-1 (OW)	Sample Type:	Bag	Tested By:	ckg
Sample ID:	S-5	Test Date:	01/30/24	Checked By:	ank
Depth :	9-11	Test Id:	756114		
Test Comment:	---				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	35.8	47.5	16.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	84		
0.5 in	12.50	77		
0.375 in	9.50	73		
#4	4.75	64		
#10	2.00	53		
#20	0.85	44		
#40	0.42	37		
#60	0.25	31		
#100	0.15	24		
#140	0.11	20		
#200	0.075	17		

Coefficients

D_{85} = 19.3110 mm	D_{30} = 0.2295 mm
D_{60} = 3.4067 mm	D_{15} = N/A
D_{50} = 1.4790 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

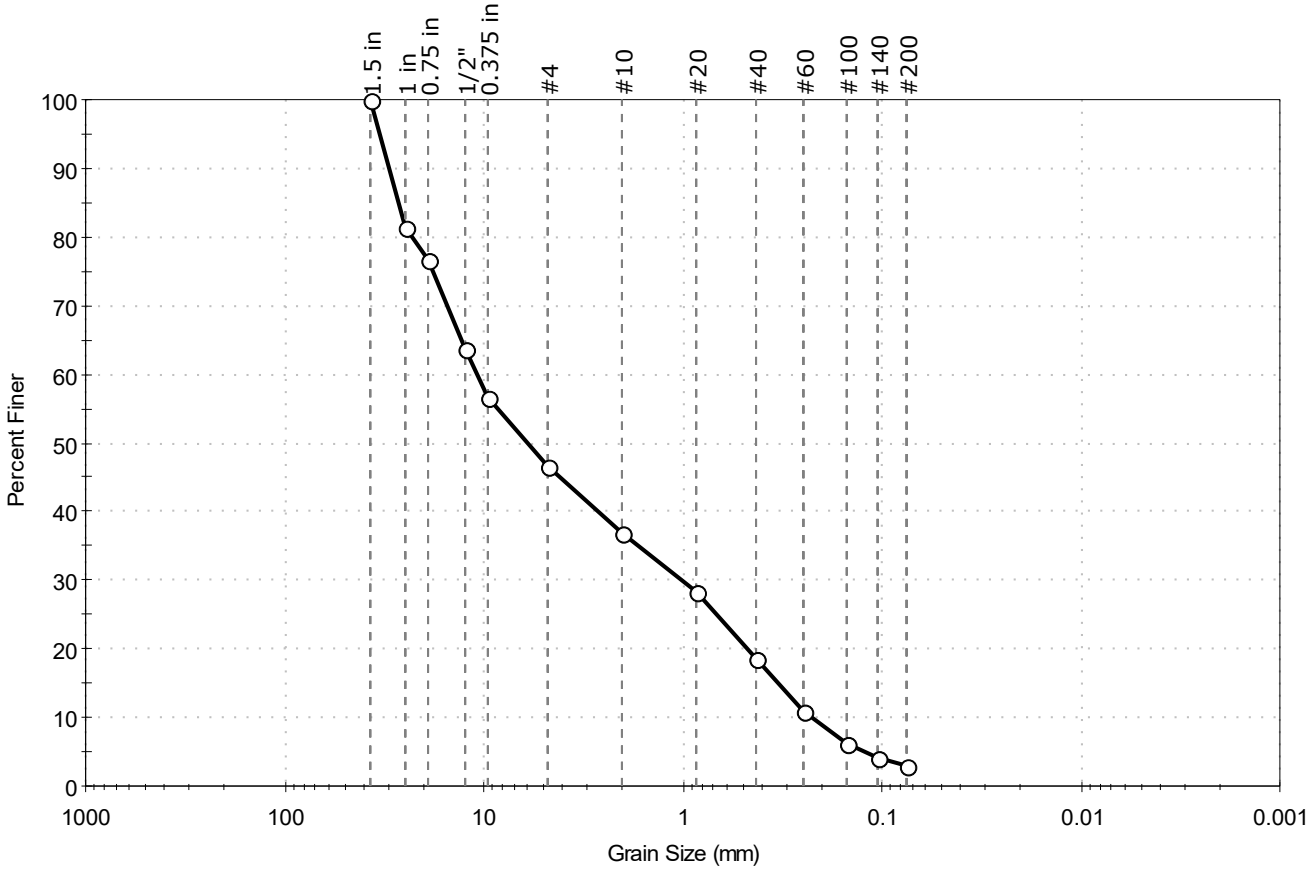
Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

GeoTesting EXPRESS

Client:	Freeman Companies, LLC				
Project:	0134-153 RT190 ov Abandoned Culvert				
Location:	Stafford, CT			Project No:	GTX-318492
Boring ID:	B-2	Sample Type:	Bag	Tested By:	ckg
Sample ID:	S-3	Test Date:	01/30/24	Checked By:	ank
Depth :	5-7	Test Id:	756115		
Test Comment:	---				
Visual Description:	Moist, dark brown gravel with sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	53.4	43.7	2.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	81		
0.75 in	19.00	77		
1/2"	12.50	64		
0.375 in	9.50	57		
#4	4.75	47		
#10	2.00	37		
#20	0.85	28		
#40	0.42	19		
#60	0.25	11		
#100	0.15	6		
#140	0.11	4		
#200	0.075	2.9		

Coefficients

D_{85} = 26.9988 mm	D_{30} = 1.0171 mm
D_{60} = 10.8018 mm	D_{15} = 0.3307 mm
D_{50} = 6.0198 mm	D_{10} = 0.2262 mm
C_u = 47.753	C_c = 0.423

Classification

ASTM — Poorly graded GRAVEL with Sand (GP)

AASHTO — Stone Fragments, Gravel and Sand (A-1-a (1))

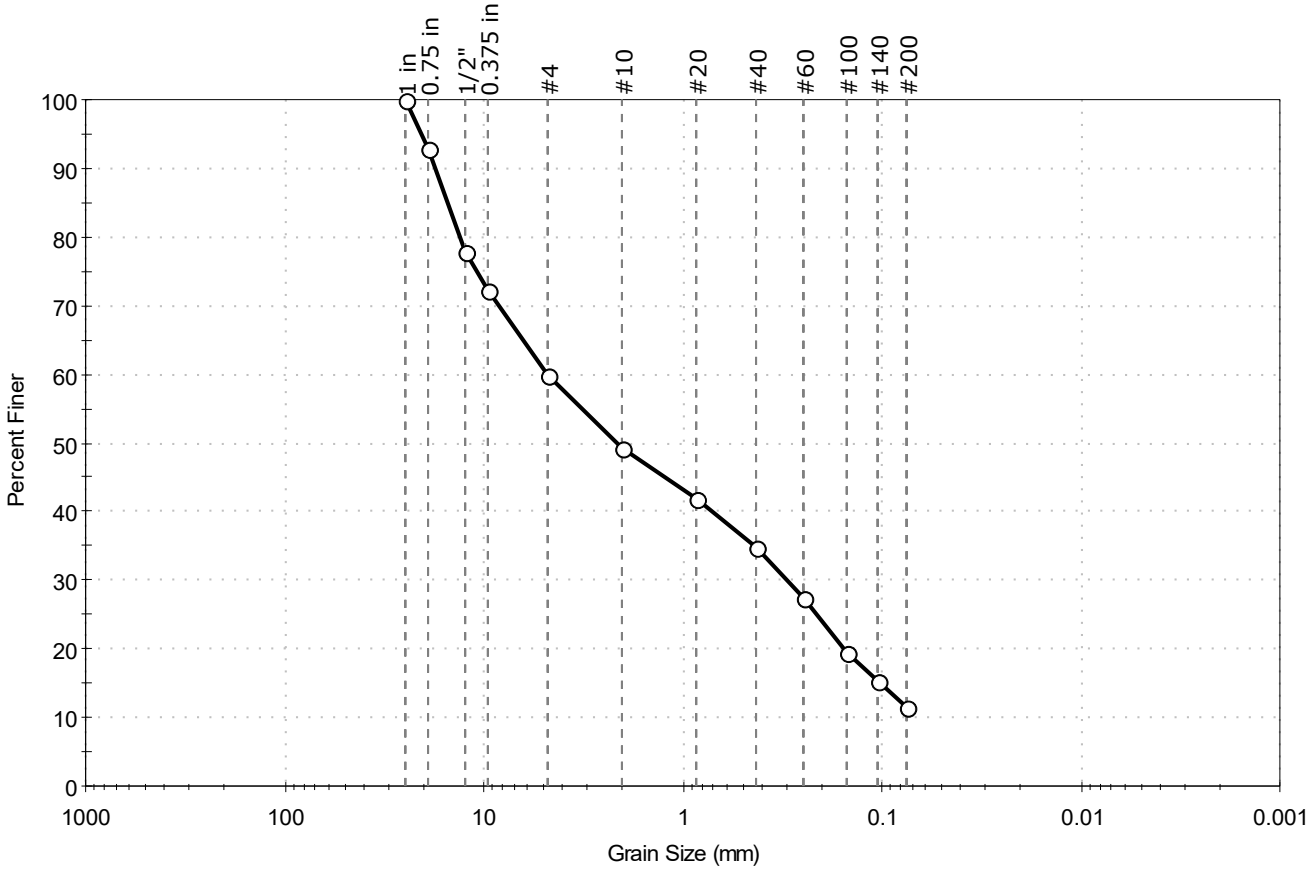
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Freeman Companies, LLC				
Project:	0134-153 RT190 ov Abandoned Culvert				
Location:	Stafford, CT			Project No:	GTX-318492
Boring ID:	B-2	Sample Type:	Bag	Tested By:	ckg
Sample ID:	S-6	Test Date:	01/30/24	Checked By:	ank
Depth :	15-17	Test Id:	756116		
Test Comment:	---				
Visual Description:	Moist, light brownish gray sand with silt and gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	40.0	48.4	11.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	93		
1/2"	12.50	78		
0.375 in	9.50	72		
#4	4.75	60		
#10	2.00	49		
#20	0.85	42		
#40	0.42	35		
#60	0.25	27		
#100	0.15	20		
#140	0.11	15		
#200	0.075	12		

Coefficients

D_{85} = 15.2489 mm	D_{30} = 0.2992 mm
D_{60} = 4.7727 mm	D_{15} = 0.1041 mm
D_{50} = 2.1329 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

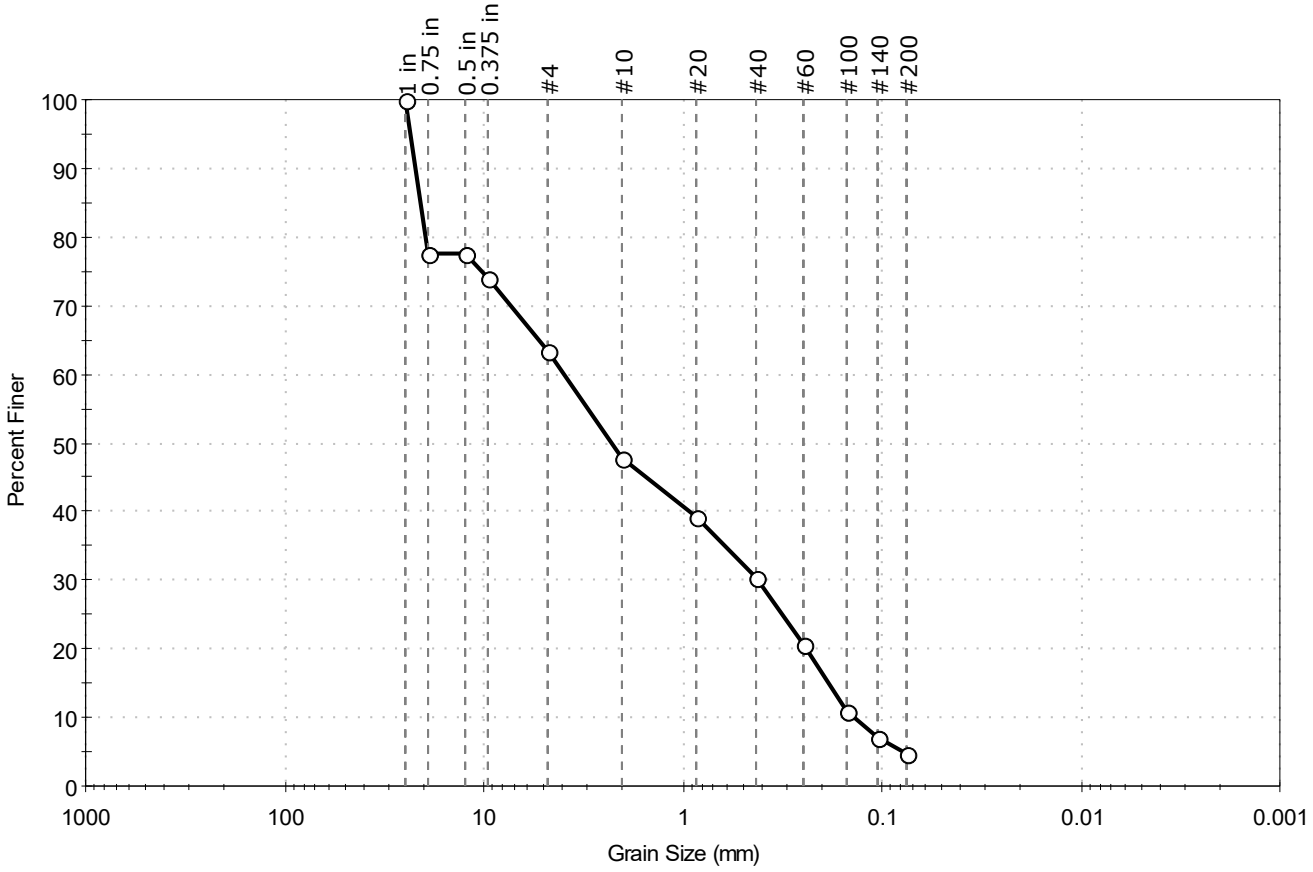
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Freeman Companies, LLC				
Project:	0134-153 RT190 ov Abandoned Culvert				
Location:	Stafford, CT			Project No:	GTX-318492
Boring ID:	B-3	Sample Type:	Bag	Tested By:	ckg
Sample ID:	S-4	Test Date:	01/30/24	Checked By:	ank
Depth :	7-9	Test Id:	756117		
Test Comment:	---				
Visual Description:	Moist, dark brown sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	36.8	58.5	4.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	78		
0.5 in	12.50	78		
0.375 in	9.50	74		
#4	4.75	63		
#10	2.00	48		
#20	0.85	39		
#40	0.42	30		
#60	0.25	21		
#100	0.15	11		
#140	0.11	7		
#200	0.075	4.7		

Coefficients

D_{85} = 20.8112 mm D_{30} = 0.4156 mm

D_{60} = 3.9564 mm D_{15} = 0.1869 mm

D_{50} = 2.2642 mm D_{10} = 0.1389 mm

C_u = 28.484 C_c = 0.314

Classification

ASTM — Poorly graded SAND with Gravel (SP)

AASHTO — Stone Fragments, Gravel and Sand (A-1-b (1))

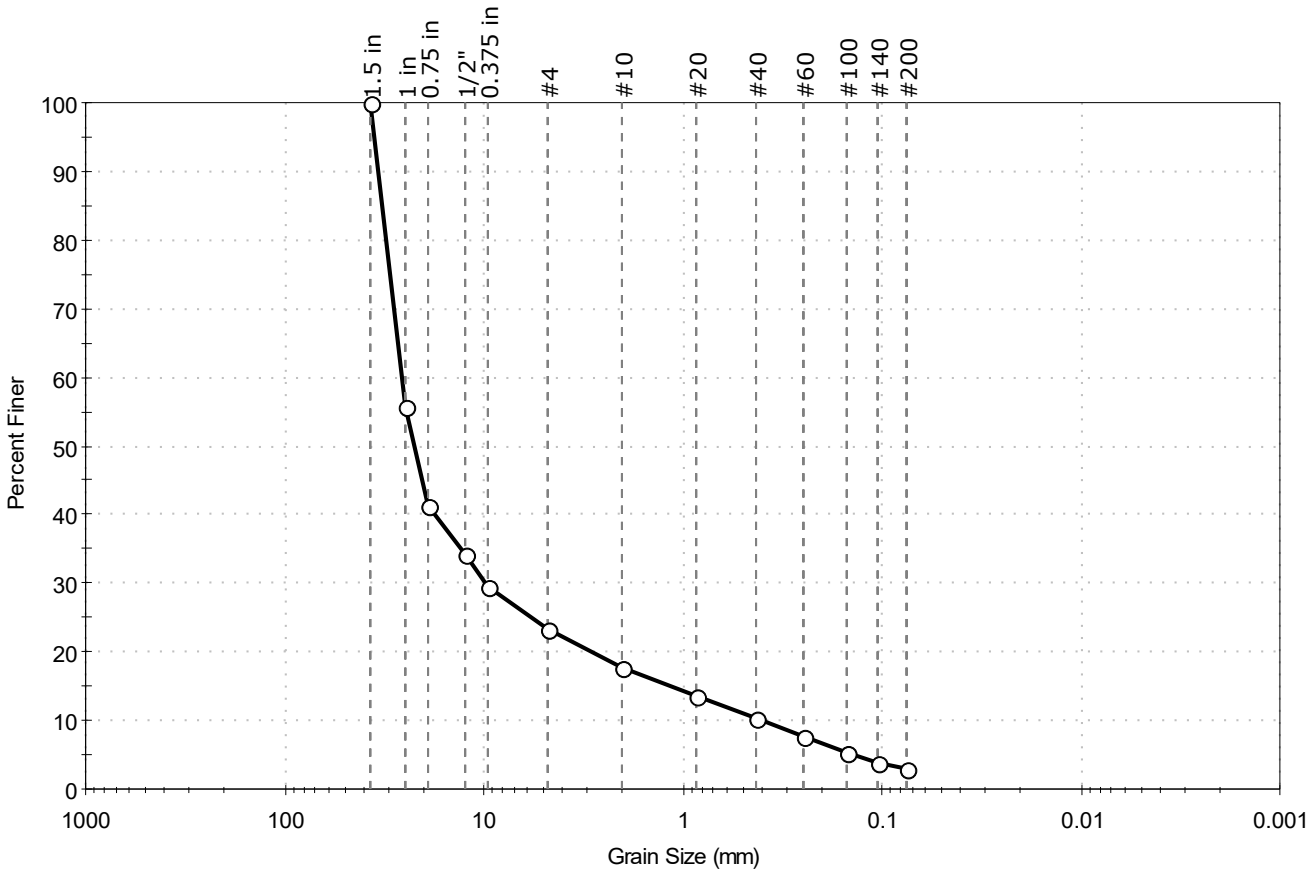
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Freeman Companies, LLC				
Project:	0134-153 RT190 ov Abandoned Culvert				
Location:	Stafford, CT			Project No:	GTX-318492
Boring ID:	B-3A (OW)	Sample Type:	Bag	Tested By:	ckg
Sample ID:	S-2	Test Date:	01/30/24	Checked By:	ank
Depth :	9-11	Test Id:	756118		
Test Comment:	---				
Visual Description:	Moist, dark brown gravel with sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	76.7	20.4	2.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	56		
0.75 in	19.00	41		
1/2"	12.50	34		
0.375 in	9.50	30		
#4	4.75	23		
#10	2.00	18		
#20	0.85	14		
#40	0.42	10		
#60	0.25	8		
#100	0.15	5		
#140	0.11	4		
#200	0.075	2.9		

Coefficients

D_{85} = 32.6850 mm	D_{30} = 9.7615 mm
D_{60} = 25.9943 mm	D_{15} = 1.1291 mm
D_{50} = 22.4156 mm	D_{10} = 0.4089 mm
C_u = 63.571	C_c = 8.965

Classification

ASTM — Poorly graded GRAVEL with Sand (GP)

AASHTO — Stone Fragments, Gravel and Sand (A-1-a (1))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Freeman Companies, LLC		
Project Name:	134-153 RTI90 ov Abandoned Culvert		
Project Location:	Stafford, CT		
GTX #:	318492		
Start Date:	2/2/2024	Tested By:	jb
End Date:	2/6/2024	Checked By:	ank
Boring #:	B-1 (OW)		
Sample #:	S-3		
Depth:	5-7		
Visual Description:	Moist, dark brown silty sand with gravel		

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter by ASTM D5084
Constant Gradient

Sample Type:	remold	Permeant Fluid:	De-aired Distilled water
Orientation:	Vertical	Cell #:	0

Sample Preparation: Compaction with heavy effort at as received moisture content. Trimmings moisture content = 1.6%

Assumed Specific Gravity: 2.65

Parameter	Initial	Final
Height, in	2.04	2.11
Diameter, in	2.86	2.88
Area, in^2	6.42	6.51
Volume, in^3	13.11	13.75
Mass, g	437.0	473.9
Bulk Density, pcf	126.8	131.1
Moisture Content, %	8.6	17.8
Dry Density, pcf	116.7	111.3
Degree of Saturation, %	55	97

B COEFFICIENT DETERMINATION

Cell Pressure, psi:	90.05	Increased Cell Pressure, psi:	95.05	Cell Pressure Increment, ps	5.00
Sample Pressure, psi:	85.05	Corresponding Sample Pressure, psi:	89.71	Sample Pressure Increment	4.66
				B Coefficient:	0.93

FLOW DATA

Date	Time, sec	Pressure, psi Cell	Inlet	Outlet	Gradient	Flow Volume, cc In	Out	Δ In	Δ Out	Temp, °C	R_t	Permeability K @ 20 °C, cm/sec
5-Feb	---	90.0	85.5	84.5	13.1	7.00	14.00	---	---	---	---	---
5-Feb	30	90.0	85.5	84.5	13.1	10.25	10.70	3.25	3.30	19.5	1.013	2.0E-04
5-Feb	----	90.0	85.5	84.5	13.1	7.00	14.00	---	---	---	---	---
5-Feb	30	90.0	85.5	84.5	13.1	10.25	10.70	3.25	3.30	19.5	1.013	2.0E-04
5-Feb	----	90.0	85.5	84.5	13.1	7.00	14.00	---	---	---	---	---
5-Feb	30	90.0	85.5	84.5	13.1	10.30	10.70	3.30	3.30	19.5	1.013	2.0E-04
5-Feb	----	90.0	85.5	84.5	13.1	7.00	14.00	---	---	---	---	---
5-Feb	30	90.0	85.5	84.5	13.1	10.25	10.70	3.25	3.30	19.5	1.013	2.0E-04

PERMEABILITY AT 20° C: 2.0x 10^{-4} cm/sec (@ 5 psi effective stress)