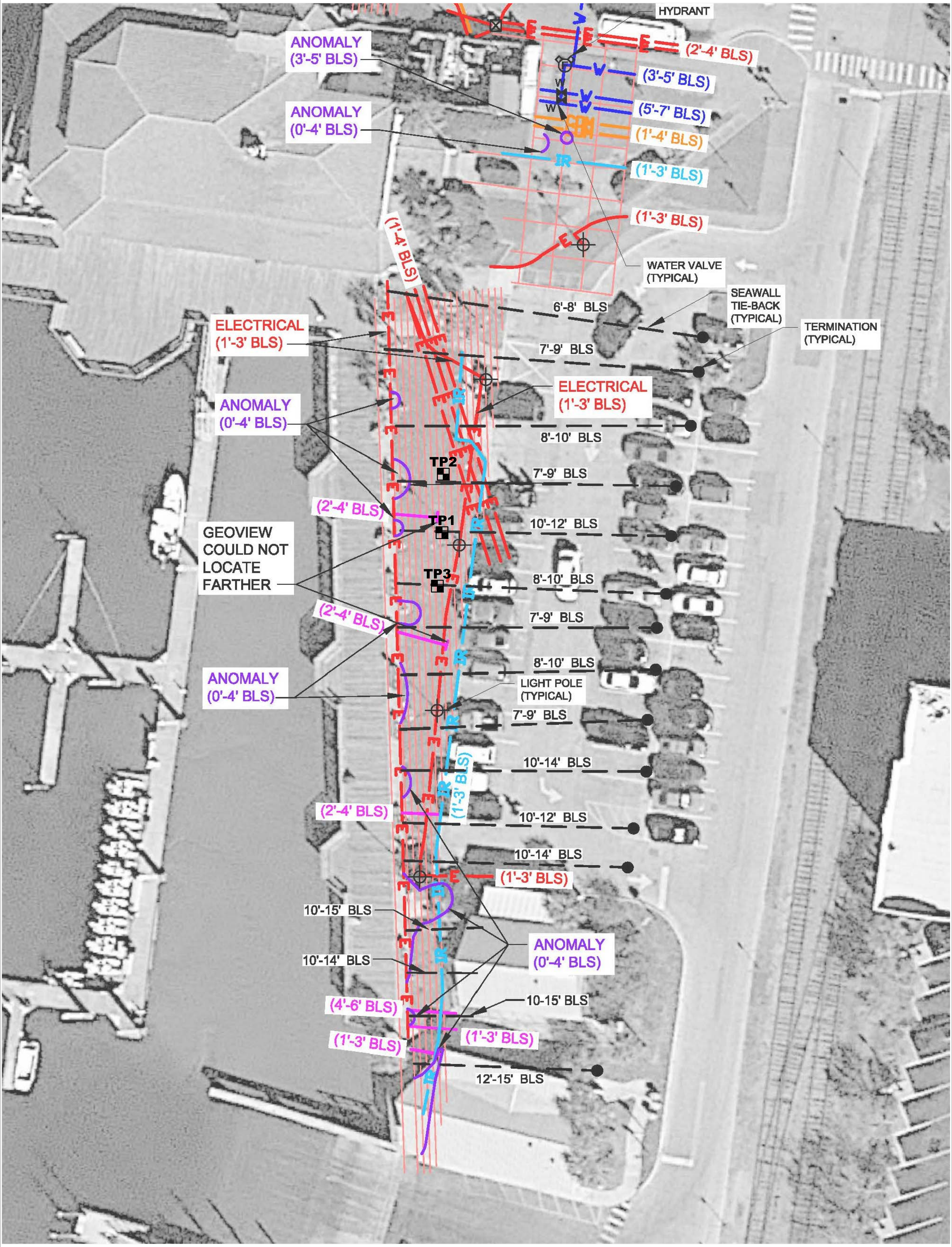
Field Exploration Plan
FHB RIVERFRONT

178 FRONT STREET, FERNANDINA BEACH, FLORIDA

PASSERO ASSOCIATES

ENGINEER	DS05
SCALE	1 " = 200 '
PROJECT NO.	35:29978
SHEET	FIGURE 2
DATE	3/31/2020



LEGEND

■ Approximate Location of Auger Boring

ECS Florida, LLC

Geotechnical ▪ Construction Materials ▪ Environmental ▪ Facilities
7064 Davis Creek Road, Jacksonville, FL 32256
T: (904) 880-0960 • F: (904) 880-0970
www.ecslimited.com

Test Pit and Geophysical Location Plan

FHB Riverfront

Fernandina Beach, Florida

Date: 03/31/20	Project No.: 35-29978	Figure 3

Graphical Scale

0' 30' 60'

JAS - 35-29978

APPENDIX A – Field Operations

Subsurface Soil Profiles
Soil Boring Logs
Field Exploration Procedures
Key to Soil Classification

SOIL CLASSIFICATION LEGEND

GW - WELL GRADED GRAVEL
GM - SILTY GRAVEL
GP - POORLY GRADED GRAVEL
GC - CLAYEY GRAVEL
SW - WELL GRADED SAND
ML - LOW PLASTICITY SILT
ST - SHELBY TUBE
CL - LOW PLASTICITY CLAY
MH - HIGH PLASTICITY SILT
SM - SILTY SAND
RC - ROCK CORE
SP - POORLY GRADED SAND
SC - CLAYEY SAND
CH - HIGH PLASTICITY CLAY
PM - PRESSURE METER
OH - HIGH PLASTICITY ORGANIC SILTS AND CLAYS
OL - LOW PLASTICITY ORGANIC SILTS AND CLAY
PT - PEAT

NOTE: NUMBERS IMMEDIATELY TO THE LEFT OF THE BORING PROFILE ARE SPT-N VALUES.

WR - WEATHERED ROCK
PWR - PARTIALLY WEATHERED ROCK
FILL
POSSIBLE FILL
PROBABLE FILL

SURFACE MATERIALS

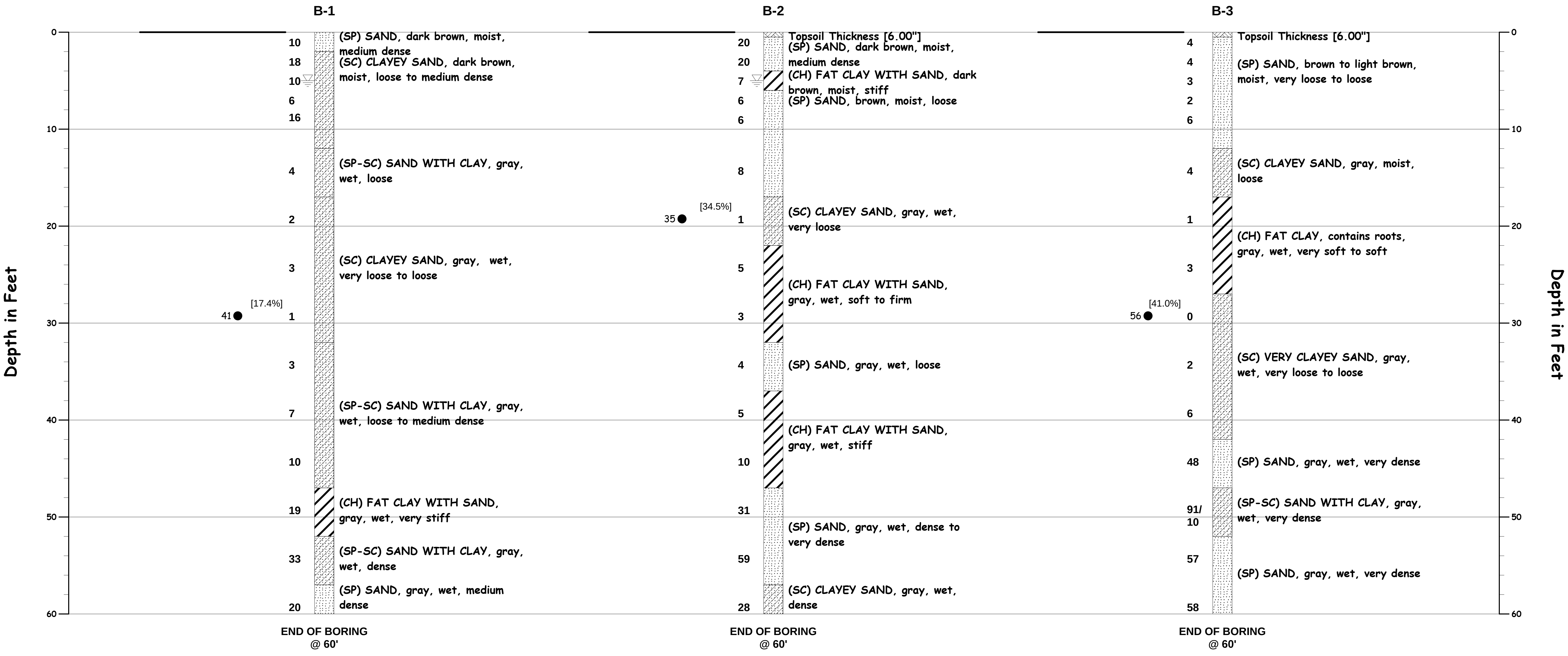
TOPSOIL
CONCRETE
ASPHALT
VOID
GRAVEL

ROCK TYPES

IGNEOUS
METAMORPHIC
SEDIMENTARY

SYMBOL LEGEND

WATER LEVEL - DURING DRILLING/SAMPLING
WATER LEVEL - SEASONAL HIGH WATER
WATER LEVEL - AFTER CASING REMOVAL
WATER LEVEL - AFTER 24 HOURS
PLASTIC LIMIT% WATER CONTENT% % PASSING #200 SIEVE [88%] LIQUID LIMIT%

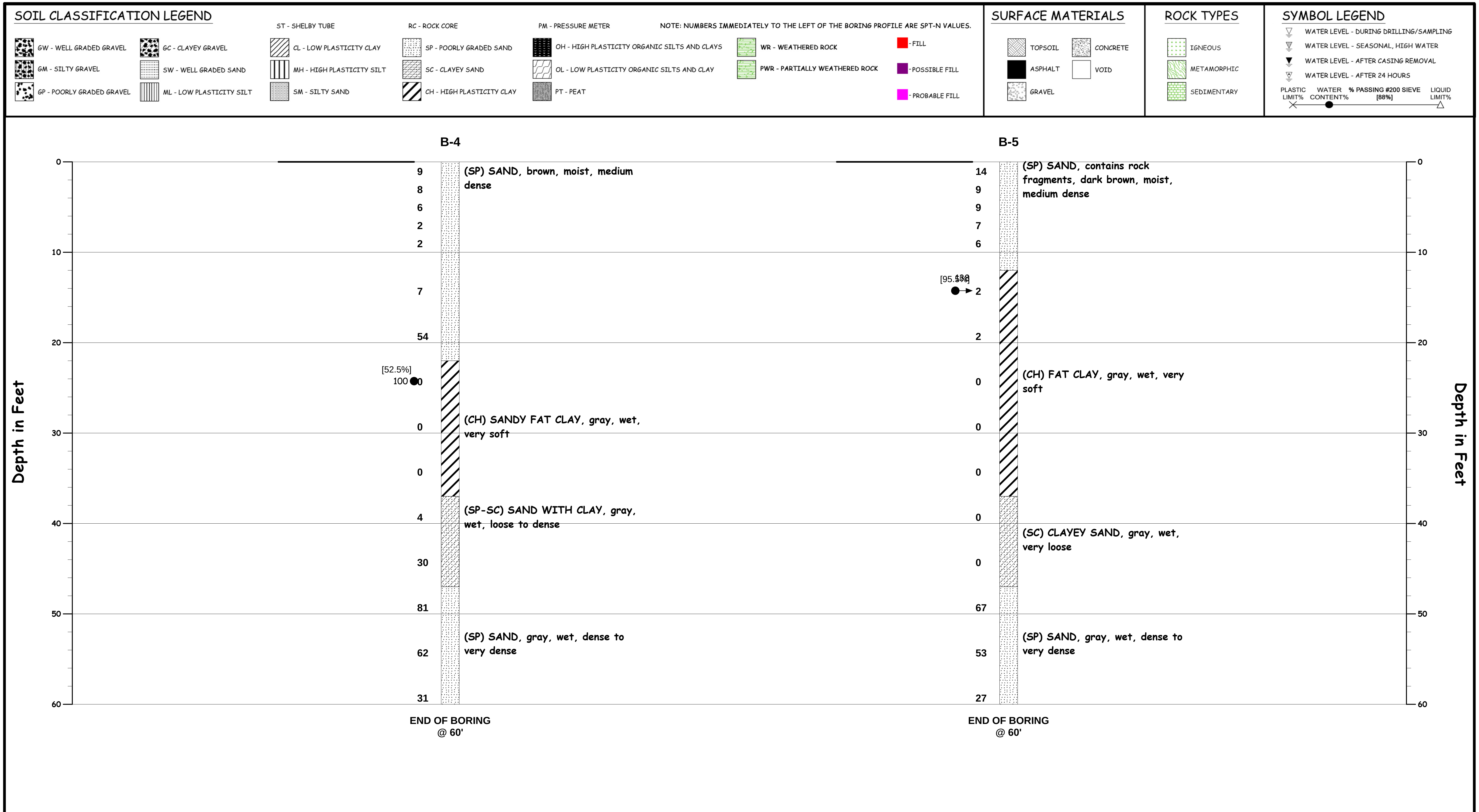


NOTES:
1 SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL REPORT FOR ADDITIONAL INFORMATION.
2 PENETRATION TEST RESISTANCE IN BLOWS PER FOOT (ASTM D1586).

Subsurface Soil Profile

FHB Riverfront
Passero Associates
178 Front Street, Fernandina Beach, Nassau County, FL

PROJECT NO.: 29978 | DATE: 3/24/2020 | VERTICAL SCALE: 1"=10'



NOTES:
1 SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL REPORT FOR ADDITIONAL INFORMATION.
2 PENETRATION TEST RESISTANCE IN BLOWS PER FOOT (ASTM D1586).

Subsurface Soil Profile

FHB Riverfront

Passero Associates

178 Front Street, Fernandina Beach, Nassau County, FL

PROJECT NO.: 29978	DATE: 3/24/2020	VERTICAL SCALE: 1"=10'

CLIENT	Job #:	BORING #	SHEET
Passero Associates	35:29978	B-1	1 OF 2

PROJECT NAME: FHB Riverfront

ARCHITECT-ENGINEER:

SITE LOCATION: 178 Front Street, Fernandina Beach, Nassau County, FL

NORTHING: | EASTING: | STATION:

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — REC.% —— 20% 40% 60% 80% 100%

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

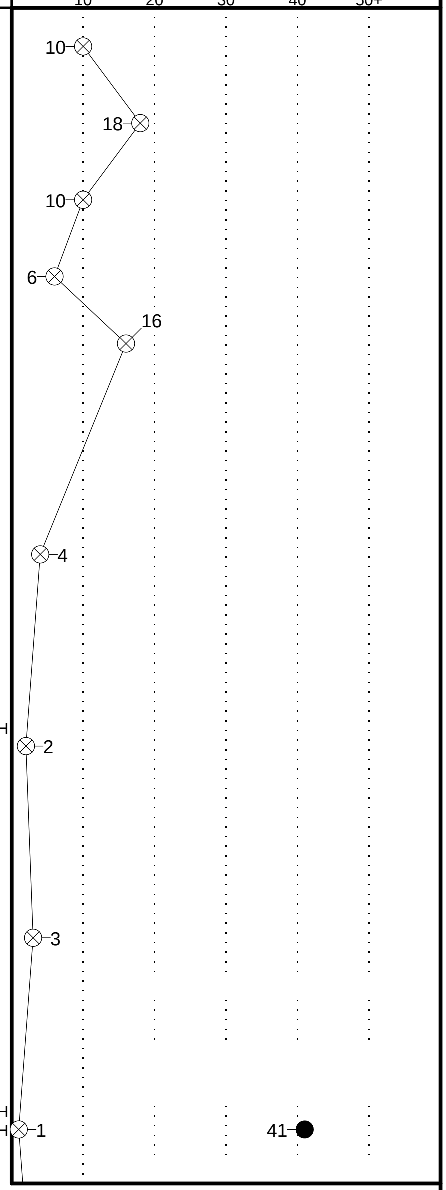
STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	24	24	(SP) SAND, dark brown, moist, medium dense			2 4 6 6
	S-2	SS	24	24	(SC) CLAYEY SAND, dark brown, moist, loose to medium dense			10 9 9 7
5	S-3	SS	24	24		▽		3 4 6 4
	S-4	SS	24	24	(SC) CLAYEY SAND, dark brown, moist, medium dense			2 2 4 4
	S-5	SS	18	18	(SC) CLAYEY SAND, brown, wet, medium dense			8 8 8
10								
					(SP-SC) SAND WITH CLAY, gray, wet, loose			
	S-6	SS	18	18				1 2 2
15								
					(SC) CLAYEY SAND, gray, wet, very loose to loose			
	S-7	SS	18	18				WOH 1 1
20								
	S-8	SS	18	18				1 1 2
25								
	S-9	SS	18	18				WOH WOH 1
30								



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 5.0 WS ☐ WD ☒	BORING STARTED 02/19/20	CAVE IN DEPTH
WL(SHW) WL(ACR)	BORING COMPLETED 02/19/20	HAMMER TYPE Auto
WL	RIG ATV FOREMAN S.B.	DRILLING METHOD

CLIENT	Job #:	BORING #	SHEET
Passero Associates	35:29978	B-1	2 OF 2

PROJECT NAME: FHB Riverfront

ARCHITECT-ENGINEER:

SITE LOCATION: 178 Front Street, Fernandina Beach, Nassau County, FL

NORTHING: | EASTING: | STATION:

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY — RQD% REC.% — 20% 40% 60% 80% 100%

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
					(SC) CLAYEY SAND, gray, wet, very loose to loose				
					(SP-SC) SAND WITH CLAY, gray, wet, loose to medium dense				
35	S-10	SS	18	18				1 1 2	3
40	S-11	SS	18	18				3 3 4	7
45	S-12	SS	18	18				3 4 6	10
					(CH) FAT CLAY WITH SAND, gray, wet, very stiff				
50	S-13	SS	18	18				9 9 10	19
					(SP-SC) SAND WITH CLAY, gray, wet, dense				
55	S-14	SS	18	18				13 12 21	33
					(SP) SAND, gray, wet, medium dense				
60	S-15	SS	18	18				8 11 9	20
					END OF BORING @ 60'				

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 5.0 WS ☐ WD ☒	BORING STARTED 02/19/20	CAVE IN DEPTH
WL(SHW) WL(ACR)	BORING COMPLETED 02/19/20	HAMMER TYPE Auto
WL	RIG ATV FOREMAN S.B.	DRILLING METHOD

CLIENT	Job #:	BORING #	SHEET
Passero Associates	35:29978	B-2	1 OF 2

PROJECT NAME: FHB Riverfront

ARCHITECT-ENGINEER:

SITE LOCATION: 178 Front Street, Fernandina Beach, Nassau County, FL

NORTHING: | EASTING: | STATION:

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — REC.% — 20% 40% 60% 80% 100%

PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	SPT N (BLOWS/FT)	WATER CONTENT %
0					Topsoil Thickness [6.00"]					
	S-1	SS	24	24	(SP) SAND, dark brown, moist, medium dense			2 / 6 / 14 / 20	20	
	S-2	SS	24	24	(SP) SAND, brown, moist, medium dense			11 / 11 / 9 / 8	20	
5	S-3	SS	24	24	(CH) FAT CLAY WITH SAND, dark brown, moist, stiff	▽		4 / 4 / 3 / 4	7	
	S-4	SS	24	24	(SP) SAND, brown, moist, loose			3 / 3 / 3 / 5	6	
	S-5	SS	24	24	(SP) SAND, light brown to gray, wet, loose			3 / 3 / 3 / 3	6	
10										
15	S-6	SS	18	18				3 / 4 / 4	8	
					(SC) CLAYEY SAND, gray, wet, very loose					
20	S-7	SS	18	18				WOH / WOH / 1	1	35
					(CH) FAT CLAY WITH SAND, gray, wet, soft to firm					
25	S-8	SS	18	18				3 / 3 / 3	5	
30	S-9	SS	18	18				2 / 1 / 2	3	

CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 5 WS ☐ WD ☒	BORING STARTED 02/19/20	CAVE IN DEPTH
WL(SHW) WL(ACR)	BORING COMPLETED 02/19/20	HAMMER TYPE Auto
WL	RIG ATV FOREMAN S.B.	DRILLING METHOD

CLIENT	Job #:	BORING #	SHEET
Passero Associates	35:29978	B-2	2 OF 2

PROJECT NAME: FHB Riverfront

ARCHITECT-ENGINEER:

SITE LOCATION: 178 Front Street, Fernandina Beach, Nassau County, FL

NORTHING: | EASTING: | STATION:

CALIBRATED PENETROMETER TONS/FT2: 1, 2, 3, 4, 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — REC.% ——— (20%, 40%, 60%, 80%, 100%)

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

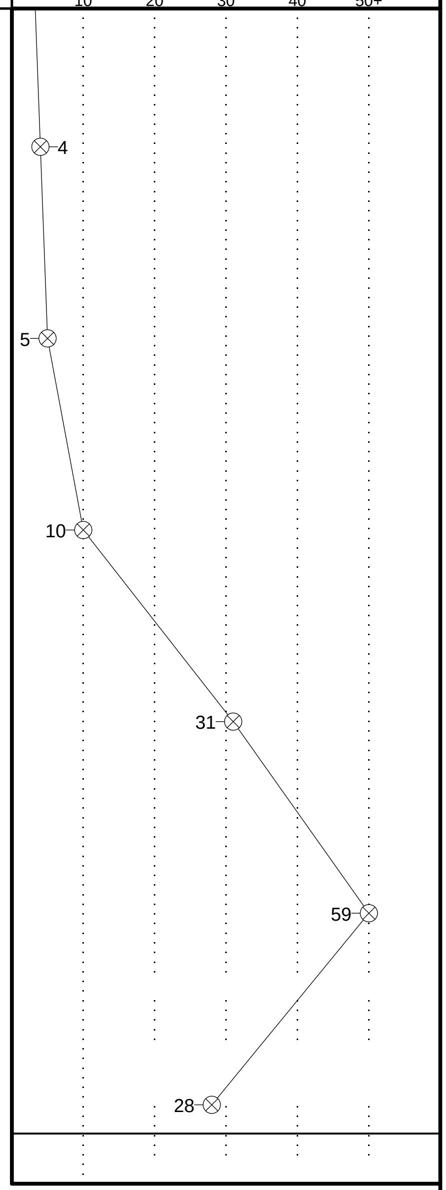
⊗ STANDARD PENETRATION BLOWS/FT (10, 20, 30, 40, 50+)

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	SPT N
					(CH) FAT CLAY WITH SAND, gray, wet, soft to firm				
					(SP) SAND, gray, wet, loose				
35	S-10	SS	18	18				1 2 2	4
					(CH) FAT CLAY WITH SAND, gray, wet, stiff				
40	S-11	SS	18	18				2 2 3	5
45	S-12	SS	18	18				3 3 7	10
					(SP) SAND, gray, wet, dense to very dense				
50	S-13	SS	18	18				11 11 20	31
55	S-14	SS	18	18				13 28 31	59
					(SC) CLAYEY SAND, gray, wet, dense				
60	S-15	SS	18	18				9 10 18	28
					END OF BORING @ 60'				



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 5 WS ☐ WD ☒	BORING STARTED 02/19/20	CAVE IN DEPTH
WL(SHW) WL(ACR)	BORING COMPLETED 02/19/20	HAMMER TYPE Auto
WL	RIG ATV FOREMAN S.B.	DRILLING METHOD

CLIENT	Job #:	BORING #	SHEET
Passero Associates	35:29978	B-3	1 OF 2

PROJECT NAME: FHB Riverfront

ARCHITECT-ENGINEER:

SITE LOCATION: 178 Front Street, Fernandina Beach, Nassau County, FL

NORTHING: | EASTING: | STATION:

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY — RQD% / REC.% — 20% 40% 60% 80% 100%

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

STANDARD PENETRATION BLOWS/FT — 10 20 30 40 50+

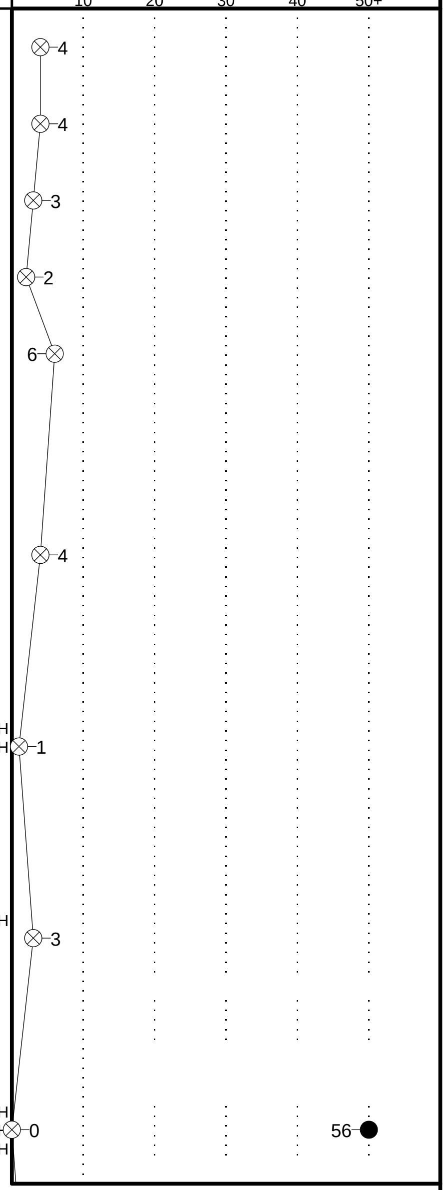
DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	BLOWS/6"
0–2	S-1	SS	24	24	1 2 2 2
2–4	S-2	SS	24	24	2 2 2 3
4–6	S-3	SS	24	24	1 2 1 2
6–8	S-4	SS	24	24	1 1 1 1
8–10	S-5	SS	24	24	1 1 5 24
13.5–15	S-6	SS	18	18	2 1 3
18.5–20	S-7	SS	18	18	WOH WOH 1
23.5–25	S-8	SS	18	18	WOH 1 2
28.5–30	S-9	SS	18	18	WOH WOH WOH

DEPTH (FT)	DESCRIPTION OF MATERIAL
0–0.5	Topsoil Thickness [6.00"]
0.5–8	(SP) SAND, brown to light brown, moist, very loose to loose
8–12	(SP) SAND, contains roots, brown, wet, medium dense
12–17	(SC) CLAYEY SAND, gray, moist, loose
17–27	(CH) FAT CLAY, contains roots, gray, wet, very soft to soft
27–30	(SC) VERY CLAYEY SAND, gray, wet, very loose to loose



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL — WS ☐ WD ☒	BORING STARTED 02/19/20	CAVE IN DEPTH
WL(SHW) — WL(ACR)	BORING COMPLETED 02/19/20	HAMMER TYPE Auto
WL	RIG ATV — FOREMAN S.B.	DRILLING METHOD

CLIENT	Job #:	BORING #	SHEET
Passero Associates	35:29978	B-3	2 OF 2

PROJECT NAME	ARCHITECT-ENGINEER
FHB Riverfront	

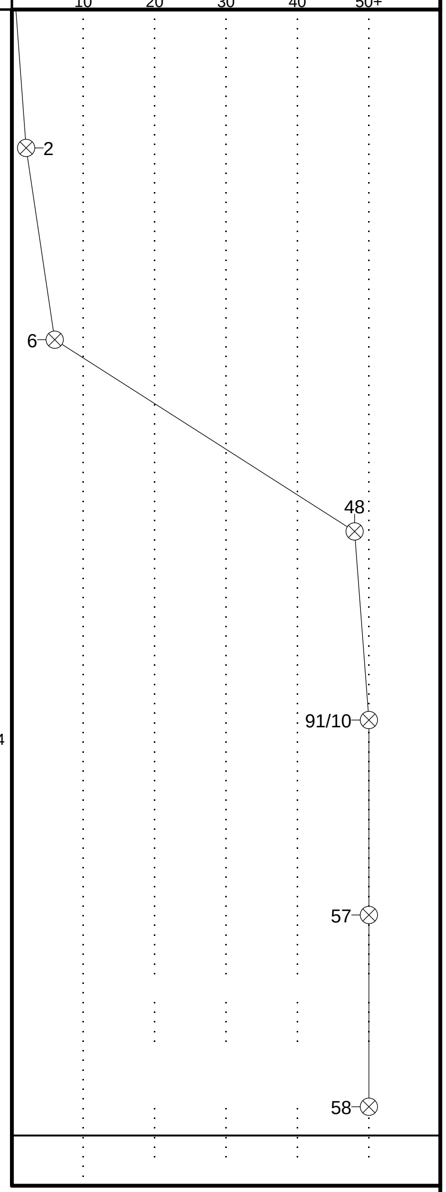
SITE LOCATION
178 Front Street, Fernandina Beach, Nassau County, FL

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT2: 1, 2, 3, 4, 5+
ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — REC.% ——— 20%, 40%, 60%, 80%, 100%
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD PENETRATION BLOWS/FT: 10, 20, 30, 40, 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING — LOSS OF CIRCULATION
SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	SPT N
					(SC) VERY CLAYEY SAND, gray, wet, very loose to loose				
35	S-10	SS	18	18				2 1 1	2
40	S-11	SS	18	18				2 2 4	6
					(SP) SAND, gray, wet, very dense				
45	S-12	SS	18	18				13 27 21	48
					(SP-SC) SAND WITH CLAY, gray, wet, very dense				
50	S-13	SS	16	16				12 41 50/4	91/10
					(SP) SAND, gray, wet, very dense				
55	S-14	SS	18	18				15 24 33	57
60	S-15	SS	18	18				24 25 33	58
					END OF BORING @ 60'				



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL — WS ☐ — WD ☒	BORING STARTED 02/19/20	CAVE IN DEPTH
WL(SHW) — WL(ACR)	BORING COMPLETED 02/19/20	HAMMER TYPE Auto
WL	RIG ATV — FOREMAN S.B.	DRILLING METHOD

CLIENT	Job #:	BORING #	SHEET
Passero Associates	35:29978	B-4	1 OF 2

PROJECT NAME	ARCHITECT-ENGINEER
FHB Riverfront	

SITE LOCATION

178 Front Street, Fernandina Beach, Nassau County, FL

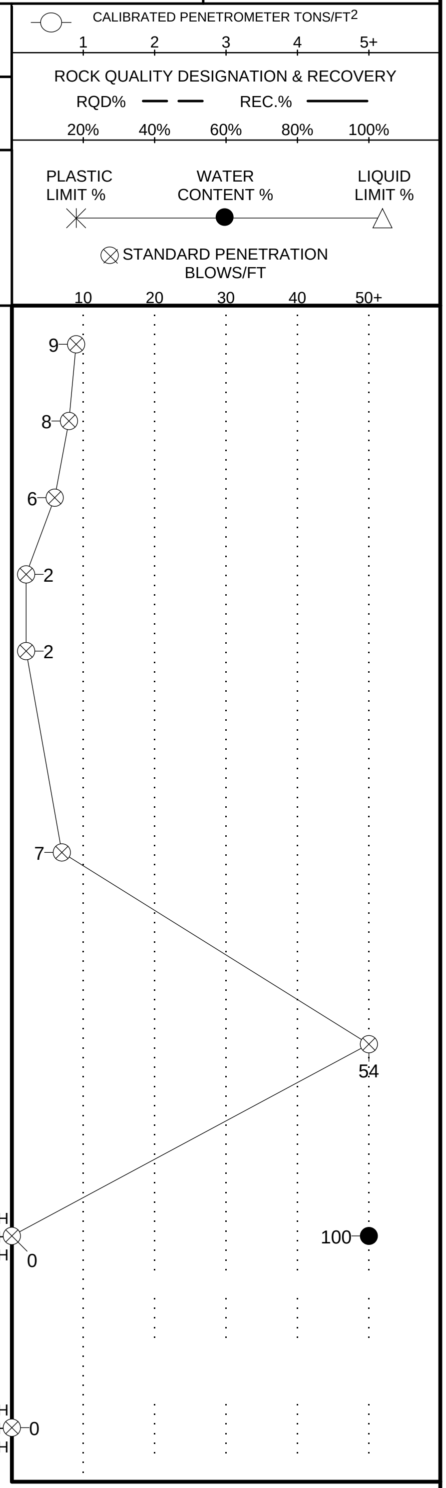
NORTHING	EASTING	STATION

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	24	24	(SP) SAND, brown, moist, medium dense			4 4 5 5
	S-2	SS	24	24				3 4 4 3
5	S-3	SS	24	24	(SP) SAND, contains roots, brown, moist, loose			8 4 2 1
	S-4	SS	24	24	(SP) SAND, contains rock fragments, brown, moist, very loose			1 1 1 1
10	S-5	SS	24	24				1 1 1 1
					(SP) SAND, contains rock fragments, brown, moist, loose			
15	S-6	SS	18	18				5 4 3
					(SP) SAND, contains roots and rock fragments, brown, wet, very dense			
20	S-7	SS	18	18				2 18 36
					(CH) SANDY FAT CLAY, gray, wet, very soft			
25	S-8	SS	18	18				WOH WOH WOH
30	S-9	SS	18	18				WOH WOH WOH



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL — WS ☐ — WD ☒	BORING STARTED 02/26/20	CAVE IN DEPTH
WL(SHW) — WL(ACR)	BORING COMPLETED 02/26/20	HAMMER TYPE Manual
WL	RIG ATV — FOREMAN S.B.	DRILLING METHOD

CLIENT	Job #:	BORING #	SHEET
Passero Associates	35:29978	B-4	2 OF 2

PROJECT NAME: FHB Riverfront

ARCHITECT-ENGINEER:

SITE LOCATION: 178 Front Street, Fernandina Beach, Nassau County, FL

NORTHING: | EASTING: | STATION:

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — REC.% ——— 20% 40% 60% 80% 100%

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

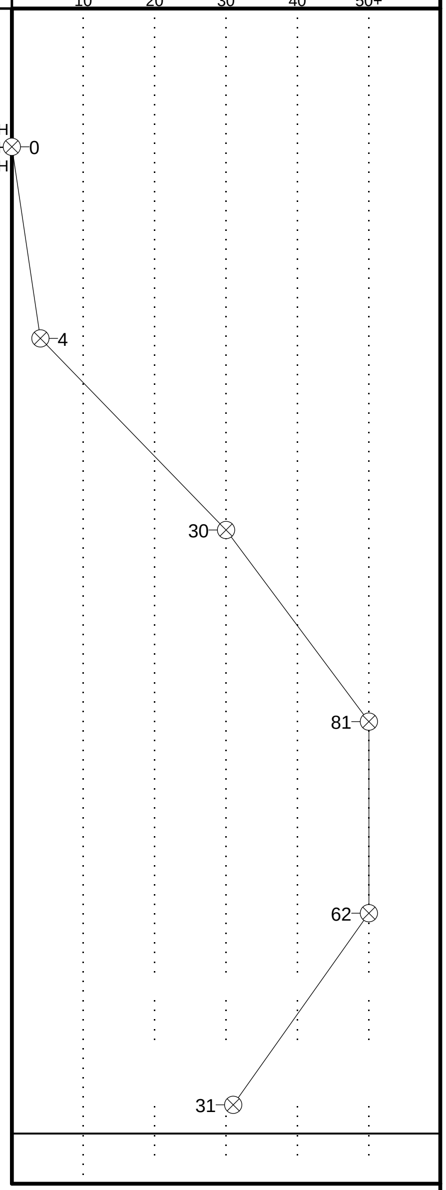
STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	SPT N
					(CH) SANDY FAT CLAY, gray, wet, very soft				
35	S-10	SS	18	18				WOH WOH WOH	0
					(SP-SC) SAND WITH CLAY, gray, wet, loose to dense				
40	S-11	SS	18	18				1 2 2	4
					(SP-SC) SAND WITH CLAY, gray, wet, dense				
45	S-12	SS	18	18				7 7 23	30
					(SP) SAND, gray, wet, dense to very dense				
50	S-13	SS	18	18				19 31 50	81
55	S-14	SS	18	18				16 29 33	62
60	S-15	SS	18	18				10 12 19	31
					END OF BORING @ 60'				



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL — WS ☐ WD ☒	BORING STARTED 02/26/20	CAVE IN DEPTH
WL(SHW) — WL(ACR)	BORING COMPLETED 02/26/20	HAMMER TYPE Manual
WL	RIG ATV — FOREMAN S.B.	DRILLING METHOD

CLIENT	Job #:	BORING #	SHEET
Passero Associates	35:29978	B-5	1 OF 2

PROJECT NAME	ARCHITECT-ENGINEER
FHB Riverfront	

SITE LOCATION: 178 Front Street, Fernandina Beach, Nassau County, FL

NORTHING: | EASTING: | STATION:

CALIBRATED PENETROMETER TONS/FT2: 1, 2, 3, 4, 5+

ROCK QUALITY DESIGNATION & RECOVERY — RQD% / REC.% — 20%, 40%, 60%, 80%, 100%

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

STANDARD PENETRATION BLOWS/FT: 10, 20, 30, 40, 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT	WATER CONTENT %
0–2	S-1	SS	24	24	(SP) SAND, contains rock fragments, dark brown, moist, medium dense			5-8-6-5	14	
2–4	S-2	SS	24	24	(SP) SAND, contains roots, dark brown, moist, loose			10-4-5-5	9	
4–6	S-3	SS	24	24	(SP) SAND, brown, moist, medium dense			3-5-4-2	9	
6–8	S-4	SS	24	24	(SP) SAND, dark brown, moist, loose			2-3-4-5	7	
8–10	S-5	SS	24	24				2-3-3-4	6	
12					(CH) FAT CLAY, gray, wet, very soft					
13.5–15	S-6	SS	18	18				1-1-1	2	138
18.5–20	S-7	SS	18	18				1-1-1	2	
23.5–25	S-8	SS	18	18				WOH-WOH-WOH	0	
28.5–30	S-9	SS	18	18				WOH-WOH-WOH	0	

CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL — WS ☐ WD ☒	BORING STARTED 02/20/20	CAVE IN DEPTH
WL(SHW) — WL(ACR)	BORING COMPLETED 02/20/20	HAMMER TYPE Manual
WL	RIG ATV — FOREMAN S.B.	DRILLING METHOD

CLIENT	Job #:	BORING #	SHEET
Passero Associates	35:29978	B-5	2 OF 2

PROJECT NAME	ARCHITECT-ENGINEER
FHB Riverfront	

SITE LOCATION
178 Front Street, Fernandina Beach, Nassau County, FL

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT2: 1, 2, 3, 4, 5+
ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — REC.% ——— 20%, 40%, 60%, 80%, 100%
PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT %
STANDARD PENETRATION BLOWS/FT: 10, 20, 30, 40, 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING — LOSS OF CIRCULATION
SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
					(CH) FAT CLAY, gray, wet, very soft				
35	S-10	SS	18	18				WOH WOH WOH	0
					(SC) CLAYEY SAND, gray, wet, very loose				
40	S-11	SS	18	18				WOH WOH WOH	0
45	S-12	SS	18	18				WOH WOH WOH	0
					(SP) SAND, gray, wet, dense to very dense				
50	S-13	SS	18	18				9 26 41	67
55	S-14	SS	18	18				14 29 24	53
60	S-15	SS	18	18				10 10 17	27
					END OF BORING @ 60'				

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL — WS ☐ WD ☒	BORING STARTED 02/20/20	CAVE IN DEPTH
WL(SHW) — WL(ACR)	BORING COMPLETED 02/20/20	HAMMER TYPE Manual
WL	RIG ATV — FOREMAN S.B.	DRILLING METHOD

FIELD EXPLORATION PROCEDURES

Standard Penetration Test (SPT) Borings

The Standard Penetration Test (SPT) borings were made in general accordance with the latest revision of ASTM D 1586, "Penetration Test and Split-Barrel Sampling of Soils". The borings were advanced by rotary (or "wash-n-chop") drilling techniques. At 2 ½ to 5 foot intervals, a split-barrel sampler inserted to the borehole bottom and driven 18 inches into the soil using a 140 pound hammer falling on the average 30 inches per hammer blow. The number of hammer blows for the final 12 inches of penetration is termed the "penetration resistance, blow count, or N-value". This value is an index to several in-place geotechnical properties of the material tested, such as relative density and Young's Modulus.

After driving the sampler 18 inches (or less if in hard rock-like material), the sampler was retrieved from the borehole and representative samples of the material within the split-barrel were containerized and sealed. After completing the drilling operations, the samples for each boring were transported to our laboratory where they were examined by our engineer in order to verify the driller's field classification. The retrieved samples will be kept in our facility for a period of six (6) months unless directed otherwise.

ECS FLORIDA, LLC "Setting the Standard for Service"
Geotechnical • Construction Materials • Environmental • Facilities

KEY TO SOIL CLASSIFICATION

Description of Compactness or Consistency in Relation To Standard Penetration Resistance

Granular Materials		
Relative Density	**Safety Hammer SPT N-Value (Blow/Foot)**	**Automatic Hammer SPT N-Value (Blow/Foot)**
Very Loose	Less than 4	Less than 3
Loose	4 – 10	3 – 8
Medium Dense	10 – 30	8 – 24
Dense	30 – 50	24 – 40
Very Dense	Greater than 50	Greater than 40

Silts and Clays		
Consistency	**Safety Hammer SPT N-Value (Blow/Foot)**	**Automatic Hammer SPT N-Value (Blow/Foot)**
Very Soft	Less than 2	Less than 1
Soft	2 – 4	1 – 3
Firm	4 – 8	3 – 6
Stiff	8 – 15	6 – 12
Very Stiff	15 – 30	12 – 24
Hard	Greater than 30	Greater than 24

DESCRIPTION OF SOIL COMPOSITION**

(Unified Soil Classification System)

MAJOR DIVISION		Group Symbol	LABORATORY CLASSIFICATION CRITERIA		SOIL DESCRIPTION
			FINER THAN 200 SIEVE %	SUPPLEMENTARY REQUIREMENTS	
Coarse grained (over 50% by weight coarser than No. 200 sieve)	Gravelly soils (over half of coarse fraction larger than No. 4)	GW	<5*	D_{60}/D_{10} greater than 4, $D_{30}^2/(D_{60} \times D_{10})$ between 1 & 3	Well graded gravels, sandy gravels
		GP	<5*	Not meeting above gradation for GW	Gap graded or uniform gravels, sandy gravels
		GM	>12*	PI less than 4 or below A-line	Silty gravels, silty sandy gravels
		GC	>12*	PI over 7 above A-line	Clayey gravels, clayey sandy gravels
	Sandy soils (over half of coarse fraction finer than No. 4)	SW	<5*	D_{60}/D_{10} greater than 6, $D_{30}^2/(D_{60} \times D_{10})$ between 1 & 3	Well graded sands, gravelly sands
		SP	<5*	Not meeting above gradation requirements	
		SM	>12*	PI less than 4 or below A-line	Silty sands, silty gravelly sands
		SC	>12*	PI over 7 and above A-line	Clayey sands, clayey gravelly sands
Fine grained (over 50% by weight finer than No. 200 sieve)	Low compressibility (liquid limit less than 50)	ML	Plasticity chart		Silts, very fine sands, silty or clayey fine sands, micaceous silts
		CL	Plasticity chart		Low plasticity clays, sandy or silty clays
		OL	Plasticity chart, organic odor or color		Organic silts and clays of low plasticity
	High compressibility (liquid limit more than 50)	MH	Plasticity chart		Micaceous silts, diatomaceous silts, volcanic ash
		CH	Plasticity chart		Highly plastic clays and sandy clays
		OH	Plasticity chart, organic odor or color		Organic silts and clays of high plasticity
Soils with fibrous organic matter		PT	Fibrous organic matter; will char, burn or glow		Peat, sandy peats, and clayey peat

***** For soils having 5 to 12 percent passing the No. 200 sieve, use a dual symbol such as SP-SM.
****** Standard Classification of Soils for Engineering Purposes (ASTM D 2487)

SAND/GRAVEL DESCRIPTION MODIFIERS	
Modifier	**Sand/Gravel Content**
Trace	<15%
With	15% to 29%
Sandy/Gravelly	>29%

ORGANIC MATERIAL MODIFIERS	
Modifier	**Organic Content**
Trace	1% to 2%
Few	2% to 4%
Some	4% to 8%
Many	>8%

SILT/CLAY DESCRIPTION MODIFIERS	
Modifier	**Silt/Clay Content**
Trace	<5%
With	5% to12%
Silty/Clayey	13% to 35%
Very	>35%

APPENDIX B – Laboratory Testing

Laboratory Testing Summary
Laboratory Test Procedures

Laboratory Testing Summary

Sample Source	Sample Number	Start Depth (feet)	End Depth (feet)	Sample Distance (feet)	MC[1] (%)	Soil Type[2]	Atterberg Limits[3]			Percent Passing No. 200 Sieve[4]	Moisture - Density (Corr.)[5]		CBR Value[6]	Other
							LL	PL	PI		Maximum Density (pcf)	Optimum Moisture (%)		
B-1	S-9	28.5	30.0	1.5	41	SC				17.4				
B-2	S-7	18.5	20.0	1.5	35	SC				34.5				
B-3	S-9	28.5	30.0	1.5	56	SC				41.0				
B-4	S-8	23.5	25.0	1.5	100	CH				52.5				OC=6.37
B-5	S-6	13.5	15.0	1.5	138	CH				95.5				

Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASTM D 4318, 4. ASTM D 1140, 5. See test reports for test method, 6. See test reports for test method

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content (ASTM D 2974)

Project No. 35:29978
Project Name: FHB Riverfront
PM: Christopher M. Egan
PE: David W. Spangler
Printed On: Tuesday, March 24, 2020

ECS FLORIDA, LLC
7064 Davis Creek Road
Jacksonville, Florida 32256
Phone: (904) 880-0960
Fax: (904) 880-0970

LABORATORY TEST PROCEDURES

Percent Fines Content

The percent fines or material passing the No. 200 mesh sieve of the sample tested was determined in general accordance with the latest revision of ASTM D 1140. The percent fines are the soil particles in the silt and clay size range.

Natural Moisture Content

The water content of the sample tests was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ratio of "pore" or "free" water in a given mass of material to the mass of solid material particles.

Organic Loss on Ignition (Percent Organics)

The organic loss on ignition or percent organic material in the sample tested was determined in general accordance with ASTM D 2974. The percent organics is the material, expressed as a percentage, which is burned off in a muffle furnace at 455±10 degrees Celsius.

APPENDIX C – Test Pits

Test Pit Photographs

Photo 1 – Concrete Cap Near Test Pit #2. Looking From At Existing Grade

Photo 2 – Concrete Cap Near Test Pit #2. Looking Level With Top of Cap.

Photo 3 –Backfill of Test Pit #2 The Day After Backfilling. Washout Observed Near Concrete Cap.

FINAL REPORT
GEOPHYSICAL INVESTIGATION
RIVERFRONT SITE
FERNANDINA BEACH, FLORIDA

Prepared for Passero Associates
St. Augustine, FL

Prepared by GeoView, Inc.
St. Petersburg, FL

March 16, 2021

Mr. Justin Vollenweider AIA, NCAR, CSI-CDT
Passero Associates
4730 Casa Cola Way, Suite 200
St. Augustine, FL 32095

Subject: Transmittal of Final Report for Geophysical Investigation
Riverfront Site – Fernandina Beach, Florida
GeoView Project Number 32823

Dear Mr. Vollenweider,

GeoView, Inc. (GeoView) is pleased to submit the final report that summarizes and presents the results of the geophysical investigation performed at the above referenced site. The purpose of the geophysical investigation was to determine the presence and location of underground utilities and suspected buried debris areas within the project site. GeoView appreciates the opportunity to have assisted you on this project. If you have any questions or comments about the report, please contact us.

Sincerely,
GEOVIEW, INC.

Stephen Scruggs, P.G.
Senior Geophysicist
Florida Professional Geologist
Number 2470

Sean C. Malphurs
Geophysicist

1.0 Introduction

A geophysical investigation was conducted within the proposed riverfront enhancement area in Fernandina Beach, Florida. The investigation was conducted from March 1 and 2, 2021. Of concern are the presence and location of underground utilities and possible tie-backs that may be within the proposed enhancement area. Of additional concern was the location of any areas of significant buried debris or shallow soil disturbances.

2.0 Site Description

The total survey area was approximately 2 acres in plan dimension (Figure 1). Ground cover consisted primarily of grass, the wooden riverfront walkway and asphalt. Objects of potential magnetic interference consisted of a small building, utility poles and vaults, monitoring wells, cars, fencing, and dumpsters.

3.0 Description of Geophysical Methodology

The geophysical investigation was conducted using time domain electromagnetics (TDEM), ground penetrating radar (GPR), and electronic utility locate (EUL) equipment. The EUL was used to identify any underground utilities that were either carrying electrical power or could be energized by an induced electrical current. The TDEM was used to identify buried structures metallic in nature. The GPR was used to help identify both electrical and non-electrical underground utilities, locate any soil disturbances, or further evaluate any TDEM features identified within the survey area.

A combination of three geophysical methods was used for the site investigation. The three selected methods are complementary, in that, the EUL can accurately and rapidly detect many types of underground utilities and the TDEM can identify metallic features that may be associated with buried debris. GPR, which is slower, can then be used to confirm the results of the EUL and TDEM survey and to identify other underground utilities or structures that are non-detectible by the EUL or TDEM. It is typically possible to evaluate the burial depth of the underground utilities using both the GPR and EUL methods.

The positions of the geophysical results were recorded using a Trimble Geo7X Global Positioning System (GPS). A Wide Area Augmentation System (WAAS) was used to augment GPS with additional signals for increasing the reliability, integrity, accuracy and availability of the GPS signal. By using WAAS, an accuracy of less than 3 ft in the horizontal dimension was achieved.

4.0 Description of Geophysical Investigation

4.1 Time Domain Electromagnetics

The survey grids for the TDEM geophysical investigation were established along transect lines spaced five to ten ft apart or where accessible within the survey area. A discussion of the limitations of the survey grid is provided in Appendix A2.1.

The TDEM survey was conducted with a Geonics, Ltd. Model EM-61 Buried Metal Detector (EM-61). The survey was conducted along parallel lines spaced five feet (ft) apart. The TDEM readings were collected every 0.62 ft along the transect lines. The TDEM data was then contoured using Surfer^{tm}, a computer-contouring program. A discussion of the TDEM method is provided in Appendix A2.2.

The lateral sensitivity of the TDEM equipment to surficial metallic debris is usually 3 ft of less. In such areas, it is not possible to discriminate which portion of the instrument response is being caused by the surficial debris and which portion (if any) is being cause by buried metallic debris. Accordingly, it is usually not possible to determine if buried metallic debris is present within 3 ft of areas where any surficial metallic debris is present. It is not possible to determine the depth of debris burial in areas where the TDEM response is affected by the presence of surficial metallic debris.

4.2 Electrical Utility Locating

A RD 7000 System was used to perform the EUL survey. The EUL method can be conducted in both the passive and active mode. In the passive mode, the EUL detects underground utilities that are energized by a 60 Hertz current. These utilities can be either actively carrying an electrical current or may be non-electrical metallic utilities that have been energized by a nearby electrical utility. It is because of this energizing that a particular utility may be incorrectly identified as an electrical utility. For the EUL equipment to identify an electrical utility in the passive mode, the utility must be carrying a sufficient amperage (load). If the load on a particular utility is low or zero then it will not be possible to identify the utility in this mode.

In the active mode, the EUL is directly connected to the particular utility and an energizing current is induced. This method only works when the utility is metallic, if a particular utility changes from a metallic to non-metallic then the

EUL will not be able to identify the utility beyond the point of that transition. Some non-metallic pipelines, such as gas pipelines, have metallic trace wires emplaced along the pipeline. If this wire is broken or corroded then it will not be possible to locate the utility beyond that point.

4.3 Ground Penetrating Radar

The GPR survey was performed to help characterize any identified utilities, locate soil distances or anomalous features identified by the TDEM. The GPR data was collected using a GSSI radar system with a 350-megahertz antenna. A time range setting of 93 nano-seconds was used. This time range setting provided information to an estimated depth of 4 to 6 ft below land surface (bls). A description of the GPR technique and the methods employed for buried debris studies is provided in Appendix A2.3.

It is noted that underground utilities at the project site were identified using these geophysical methods only. Physical probing or other visual confirmation for the presence and/or identification of the suspected underground utilities was not performed. The identification of the utilities was based solely on above-ground observations; e.g., proximity to water valves and by observations made into manholes and vaults.

5.0 Survey Results

The results of the geophysical investigation are presented on Figures 1 through 3. In addition, the color contour map of the TDEM results is provided on Figure 4. It is noted that only utilities with a metallic component are shown on Figure 4. The estimated depths of the underground utilities are provided. In general the estimated depths of the underground utilities are accurate to within a tolerance of +/- 25 percent. Plan view positions recorded with the GPS are usually accurate to within +/- 3-ft. If determinable, the type of underground utility is also indicated. The location of the underground utilities was also indicated on the ground surface using spray paint and/or wire pin flags. GeoView uses the American Public Works Association (APWA) uniform color codes for temporary marking of underground utilities which is as follows:

The following color designation was used:

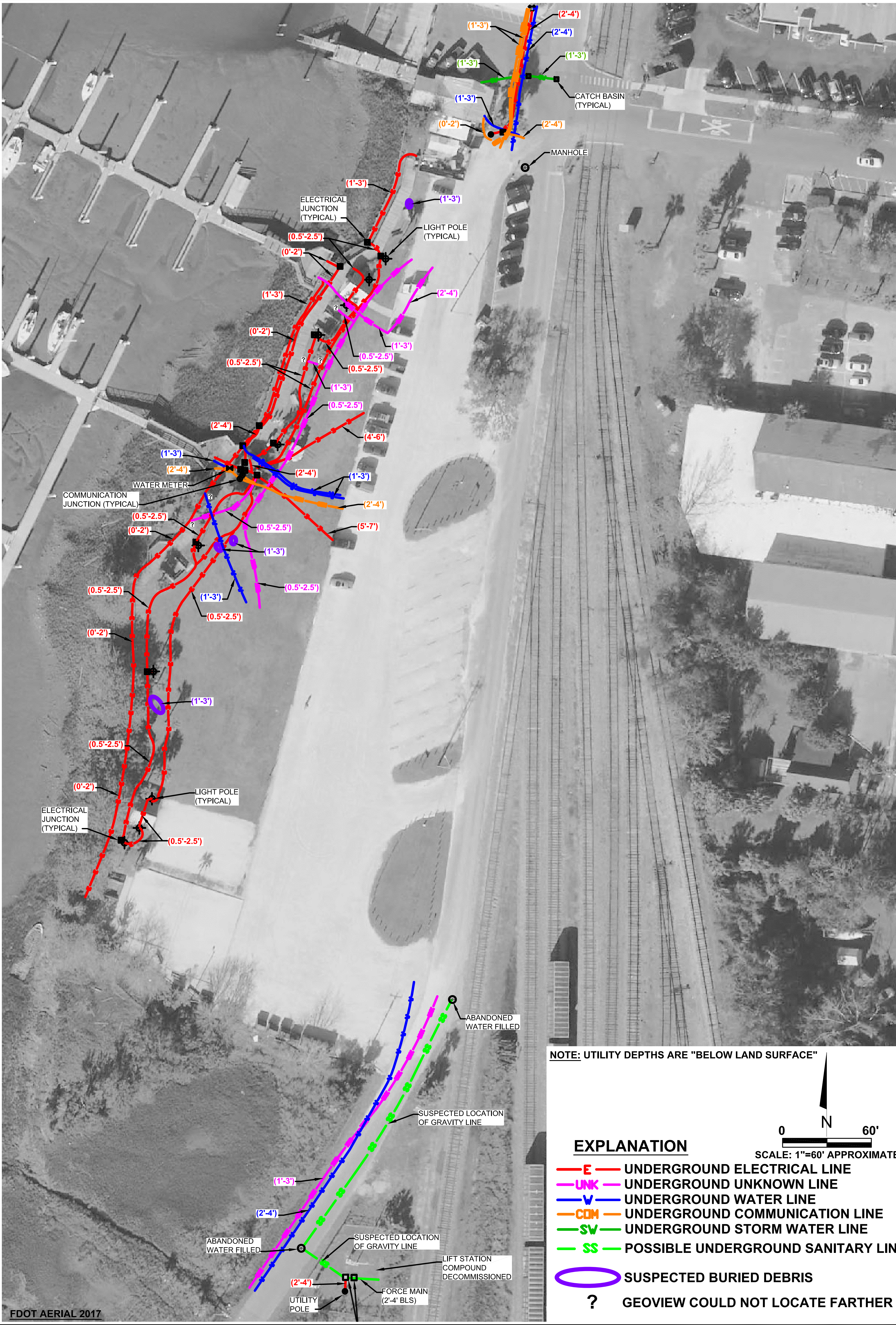
- Water: blue
- Electric: red
- Storm Water: dark green
- Sanitary: light green
- Communication: orange
- Unknown: Pink (magenta in figures)

In addition to the identified utilities, the GPR data identified 4 minor areas of suspected buried debris within the survey area ranging in depth from just below the surface to approximately 3 ft bls. These areas of suspected buried debris are most likely organic or non-metallic in nature as there was little to no TDEM response (not associated with surficial interference) throughout the survey area as shown on Figure 4. These areas identified by the GPR data are also shown on Figures 1 through 3 by purple polygons.

The survey did not identify any tie-backs within the depth range of the GPR or TDEM (4 to 6 ft bls). In addition, the EUL was unable to induce a traceable signal on any tie-backs (if present). This suggests that either the suspected tie-backs are not within the survey area or are too small in diameter and too short in lateral distance to be resolved by this geophysical survey.

An example of the GPR data across an area of the suspected buried debris is provided in Appendix 1. A discussion of the limitations of the geophysical techniques in utility studies is provided in Appendix 2.

APPENDIX 1
FIGURES AND EXAMPLE OF GPR DATA



GeoView

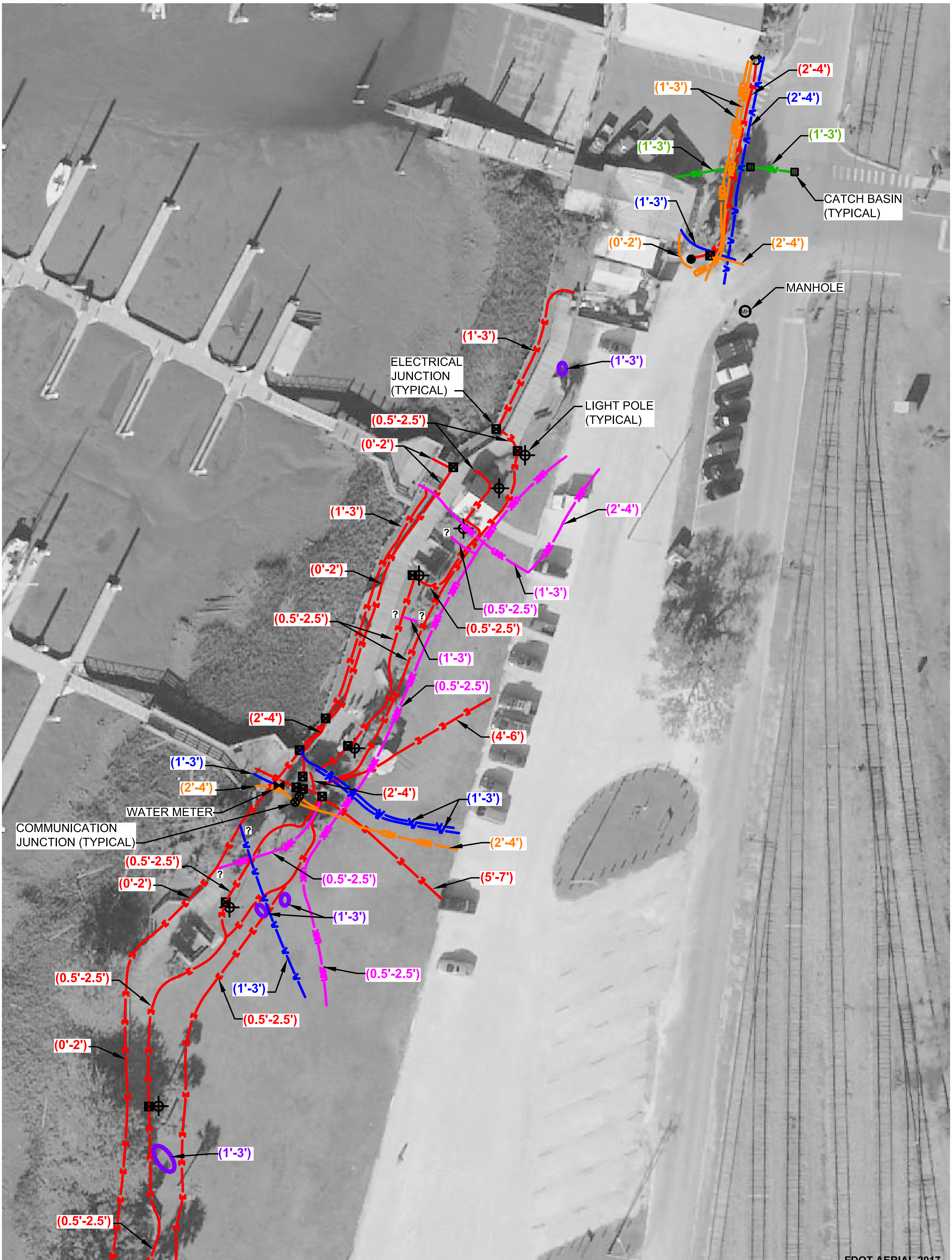
FIGURE 1

OVERALL SITE MAP SHOWING RESULTS OF GEOPHYSICAL INVESTIGATION

RIVERFRONT SITE
S FRONT STREET
FERNANDINA BEACH, FLORIDA

PASSERO ASSOCIATES
ST. AUGUSTINE, FLORIDA

PROJECT: 32823
DATE: 03/16/21



EXPLANATION

- E — UNDERGROUND ELECTRICAL LINE
- UNK — UNDERGROUND UNKNOWN LINE
- W — UNDERGROUND WATER LINE
- SUSPECTED BURIED DEBRIS
- COM — UNDERGROUND COMMUNICATION LINE
- SS — POSSIBLE UNDERGROUND SANITARY LINE
- SW — UNDERGROUND STORM WATER LINE
- ? GEOVIEW COULD NOT LOCATE FARTHER

NOTE: UTILITY DEPTHS ARE "BELOW LAND SURFACE"

N

0 40'

SCALE: 1"=40' APPROXIMATE

GeoView

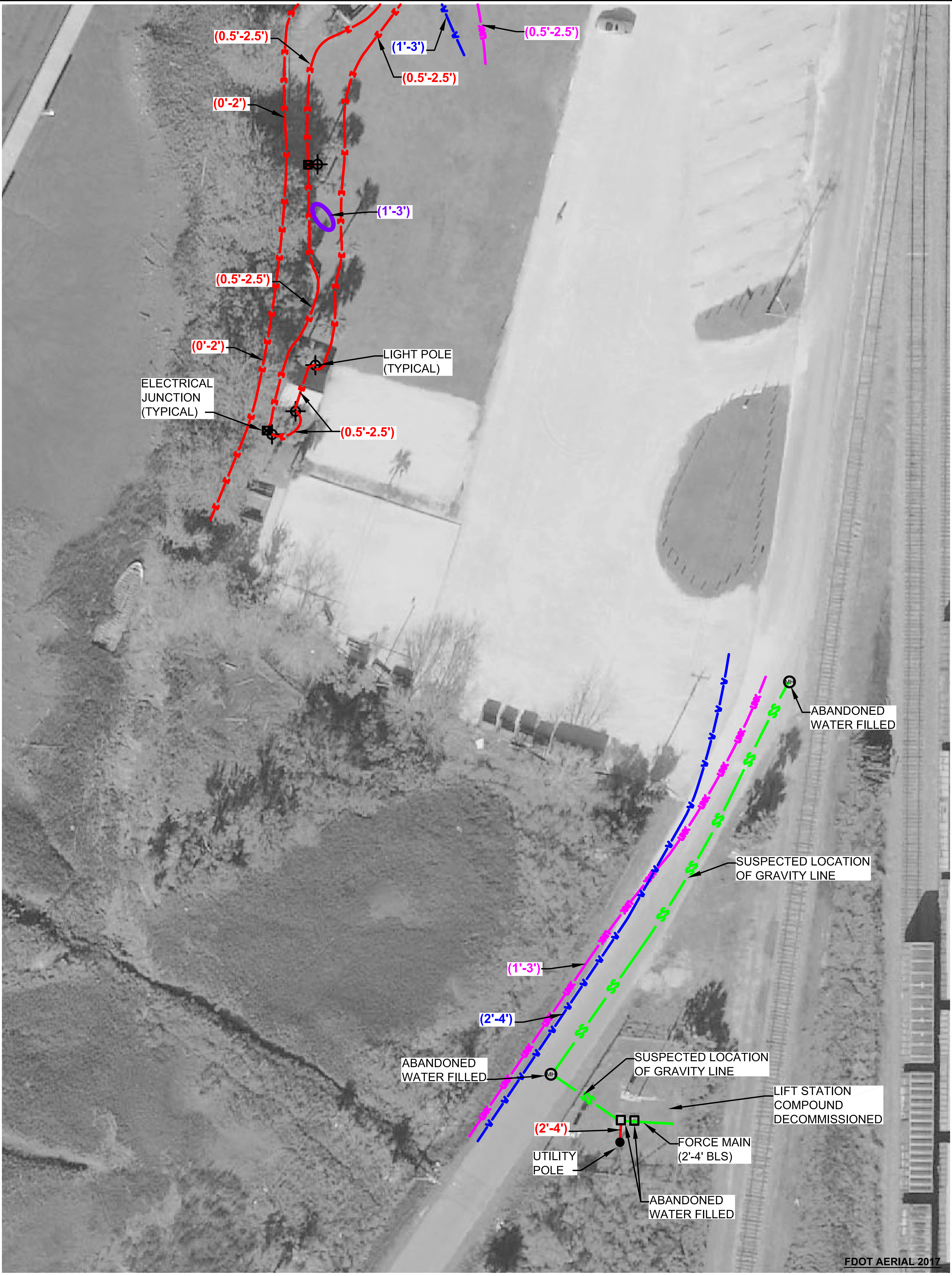
FIGURE 2

NORTHERN SITE MAP SHOWING RESULTS OF GEOPHYSICAL INVESTIGATION

RIVERFRONT SITE
S FRONT STREET
FERNANDINA BEACH, FLORIDA

PASSERO ASSOCIATES
ST. AUGUSTINE, FLORIDA

PROJECT: 32823
DATE: 03/16/21



EXPLANATION

- E — UNDERGROUND ELECTRICAL LINE
- UNK — UNDERGROUND UNKNOWN LINE
- W — UNDERGROUND WATER LINE
- SUSPECTED BURIED DEBRIS
- COM — UNDERGROUND COMMUNICATION LINE
- SS — POSSIBLE UNDERGROUND SANITARY LINE
- SW — UNDERGROUND STORM WATER LINE
- ? GEOVIEW COULD NOT LOCATE FARTHER

NOTE: UTILITY DEPTHS ARE "BELOW LAND SURFACE"

N
0 40'
SCALE: 1"=40' APPROXIMATE

GeoView

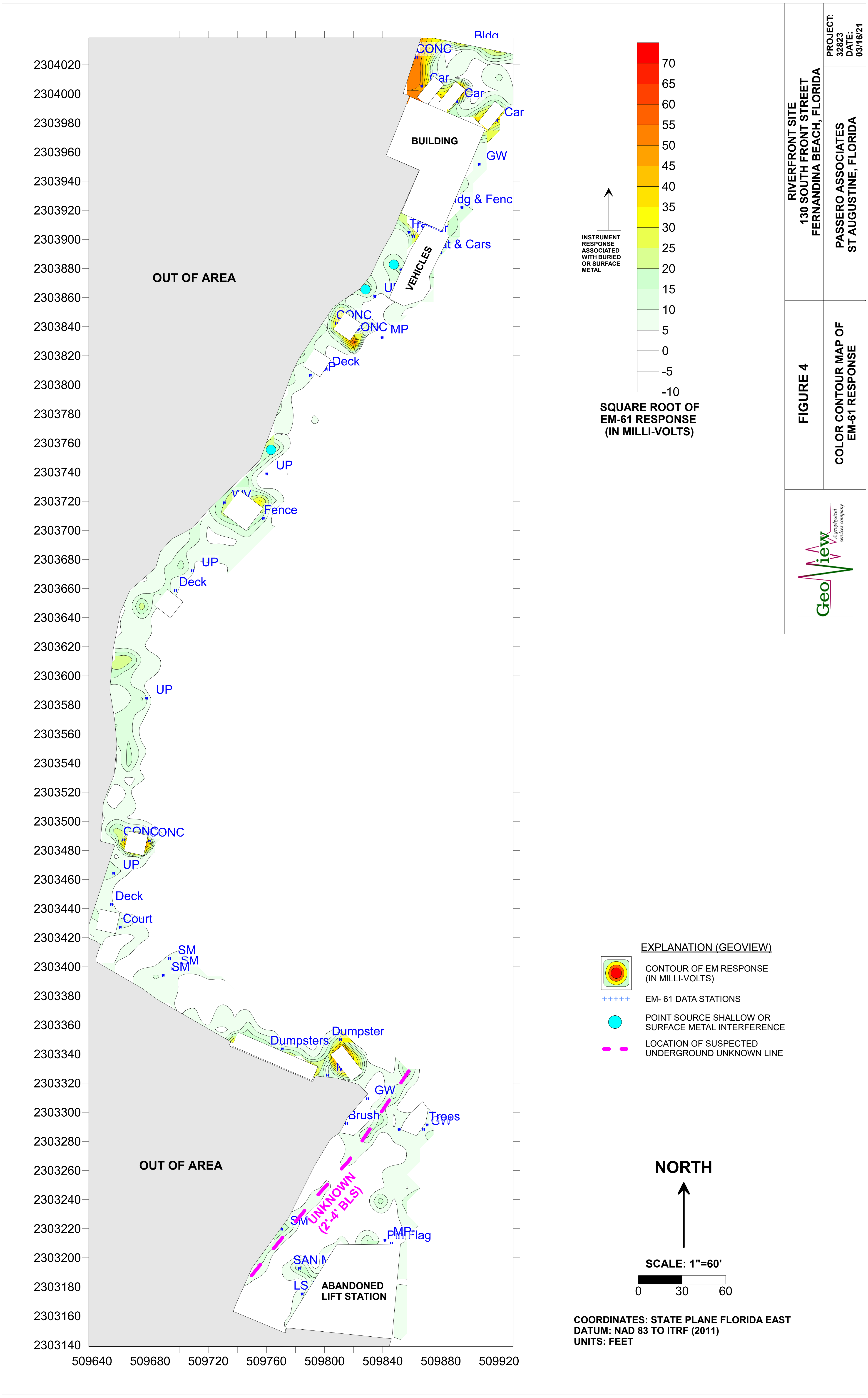
FIGURE 3

SOUTHERN SITE MAP SHOWING RESULTS OF GEOPHYSICAL INVESTIGATION

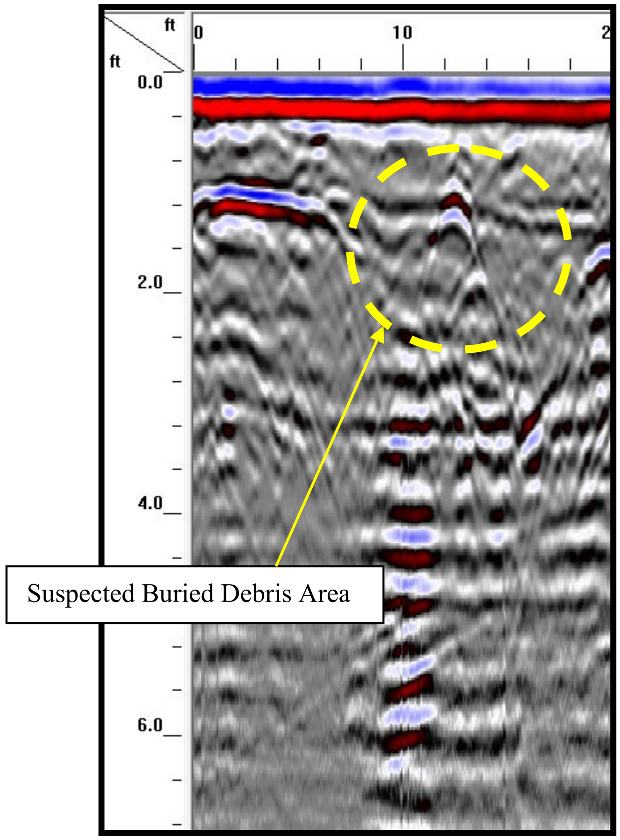
RIVERFRONT SITE
S FRONT STREET
FERNANDINA BEACH, FLORIDA

PASSERO ASSOCIATES
ST. AUGUSTINE, FLORIDA

PROJECT: 32823
DATE: 03/16/21



RIVERFRONT SITE
130 SOUTH FRONT STREET
FERNANDINA BEACH, FLORIDA
PASSERO ASSOCIATES
ST AUGUSTINE, FLORIDA
PROJECT: 32823
DATE: 03/16/21
FIGURE 4
COLOR CONTOUR MAP OF EM-61 RESPONSE
GeoView A geophysical services company
OUT OF AREA
BUILDING
VEHICLES
CONC
Car
GW
Deck
MP
UP
Fence
Court
SM
Dumpsters
Dumpster
Brush
Trees
UNKNOWN (2'-4' BLS)
SAN
LS
ABANDONED LIFT STATION
70 65 60 55 50 45 40 35 30 25 20 15 10 5 0 -5 -10
INSTRUMENT RESPONSE ASSOCIATED WITH BURIED OR SURFACE METAL
SQUARE ROOT OF EM-61 RESPONSE (IN MILLI-VOLTS)
EXPLANATION (GEOVIEW)
CONTOUR OF EM RESPONSE (IN MILLI-VOLTS)
+++++ EM- 61 DATA STATIONS
POINT SOURCE SHALLOW OR SURFACE METAL INTERFERENCE
LOCATION OF SUSPECTED UNDERGROUND UNKNOWN LINE
NORTH
SCALE: 1"=60'
0 30 60
COORDINATES: STATE PLANE FLORIDA EAST
DATUM: NAD 83 TO ITRF (2011)
UNITS: FEET
509640 509680 509720 509760 509800 509840 509880 509920
2303140 2303160 2303180 2303200 2303220 2303240 2303260 2303280 2303300 2303320 2303340 2303360 2303380 2303400 2303420 2303440 2303460 2303480 2303500 2303520 2303540 2303560 2303580 2303600 2303620 2303640 2303660 2303680 2303700 2303720 2303740 2303760 2303780 2303800 2303820 2303840 2303860 2303880 2303900 2303920 2303940 2303960 2303980 2304000 2304020



GPR Profile Showing Suspected Southernmost Buried Debris Area

APPENDIX 2
DESCRIPTION OF GEOPHYSICAL METHODS, SURVEY METHODOLOGIES AND LIMITATIONS

A2.1 On Site Measurements

The positions of the geophysical transect lines were recorded using a Trimble Geo7X Global Positioning System (GPS). These GPS systems typically have an accuracy of 1 to 3 ft.

A2.2 Time Domain Electromagnetics

The TDEM (EM-61) method evaluates the magnitude of an induced (secondary) electromagnetic (EM) field caused by a primary EM field after that primary field is suddenly shut off.

During a TDEM (EM-61) sounding, an electrical current is caused to flow in a horizontal transmitter coil located near the ground. The current is maintained until a static magnetic field is established. The current in that coil is then rapidly terminated. This produces a strong electromotive force that induces eddy (secondary) currents in the ground. The eddy currents are caused by the presence of subsurface conductors. With increasing time, the strength of the eddy currents diminishes. The eddy currents, when they are still present induce a voltage in the receiver coil that is proportional to eddy current strength. The eddy current strength also depends on the amount of metal in the subsurface. The more metal present, the longer the eddy currents persist. Field measurement consists of reading the output voltage from the receiver coil registered at a particular time after field shut-off. If no metal is present near the coil, then there are no eddy currents at a late time and the reading is near zero. If metal is present near the coil, then the eddy currents persist for a longer time, and the reading is some positive number. By sensing only the response from the buried metal, the method is capable of detecting targets in highly conductive environments. For TDEM surveys the Geonics Ltd. Model EM-61 metal detection (EM-61) system is used. The EM-61 instrument response is recorded on field-portable computerized data logger (Polycorder Digital Data Recorder) for subsequent data processing and contouring.

The EM-61 survey is performed along predetermined transect lines. The transect lines are typically uni-directional and oriented parallel to the long axis of the site. The spacing between transects ranges from 2 to 5 ft, depending upon the desired size of the target to be identified.

A2.3 Ground Penetrating Radar

Ground Penetrating Radar (GPR) consists of a set of integrated electronic components which transmits high frequency (200 to 1500 megahertz [MHz]) electromagnetic waves into the ground and records the energy reflected back to the ground surface. The GPR system consists of an antenna, which serves as both a transmitter and receiver, and a profiling recorder that both processes the incoming signal and provides a graphic display of the data. The GPR data can be reviewed as both printed hard copy output or recorded on the profiling recorder's hard drive for later review. GeoView uses a GSSI GPR system.

A GPR survey provides a graphic cross-sectional view of subsurface conditions. This cross-sectional view is created from the reflections of repetitive short-duration electromagnetic (EM) waves that are generated as the antenna is pulled across the ground surface. The reflections occur at the subsurface contacts between materials with differing electrical properties. The electrical property contrast that causes the reflections is the dielectric permittivity that is directly related to conductivity of a material. The GPR method is commonly used to identify such targets as underground utilities, underground storage tanks or drums, buried debris, voids, rebar or geological features.

The greater the electrical contrast between the surrounding materials (earth or concrete) and target of interest, the greater the amplitude of the reflected return signal. Unless the buried object is metal, only part of the signal energy will be reflected back to the antenna with the remaining portion of the signal continuing to propagate downward to be reflected by deeper features. If there is little or no electrical contrast between the target interest and surrounding earth materials it will be very difficult if not impossible to identify the object using GPR.

A GPR survey is conducted along survey lines (transects) which are measured paths along which the GPR antenna is moved. Electronic marks are placed in the data by the operator at designated points along the GPR transects. These marks allow for a correlation between the GPR data and the position of the GPR antenna on the ground.

For underground utility surveys, the GPR investigation is conducted along a set of perpendicularly orientated transects. The survey is conducted in two directions because the definitive GPR signal response associated with an underground utility is only obtained when the GPR antenna is passed perpendicular to the long axis of the utility. Spacing between the transects typically ranges from 2.5 to 20 feet depending upon the complexity of the configuration of the underground utilities. The location of the underground utilities is typically painted on the ground surface and/or provided on a scaled map.

To determine the depth of an underground utility using GPR, the time of travel of the GPR signal between the utility and the ground surface is divided by the velocity of the GPR signal. The velocity of the GPR signal can be obtained either from published tables of velocities for the type of soil underlying the site or by directly calibrating the GPR system on site by using utilities with known depths. The accuracy of GPR-derived utility depths typically ranges from 10-25 percent of the total depth.

The analysis and collection of GPR data is both a technical and interpretative skill. The technical aspects of the work are learned from both training and experience. Interpretative skills for utility studies are developed by having the opportunity to compare GPR data collected in numerous settings to the results from confirmatory studies performed at the same locations.

The ability of GPR to collect interpretable information at a project site is limited by the attenuation (absorption) of the GPR signal within subsurface soil materials. Once the GPR signal has been attenuated at a particular depth, information regarding deeper features will not be obtained. GeoView can make no warranties or representations of geological conditions that may be present beyond the depth of investigation or resolving capability of the GPR equipment or in areas that were not accessible to the geophysical investigation.

Conventional Utility Locating

A RD 7000 System is used by GeoView to locate underground utilities using conventional means. The system consists of a dual-function receiver and transmitter. The receiver can be operated in two modes: active and passive. In the passive mode the receiver detects the presence of underground utilities that are energized by a 60 Hertz cycle current. These utilities can either be those actually carrying electrical power or those utilities that are both metallic and sufficiently close to the electrical lines to have an electrical field induced within them.

In the active mode, an electrical current is deliberately induced into the utility by the transmitter. The frequency of this field can be varied from 1 to 80 Hertz. The electrical field is induced using a transmitter which is either directly attached to the utility, placed on or above the utility or attached to an induction coil which is placed around the utility. Depths of underground utilities can be determined when the EUL equipment is being used in the active mode. Depths are typically accurate to within 10 percent of the total utility depth.

The results of the GeoView investigation are limited by the capabilities of the GPR, TDEM and EUL methods at the project site. GeoView can make no warranties or representations of subsurface conditions beyond the capabilities of the geophysical methods. Results of this investigation should be used only to help anticipate where, what type and approximate depth of the underground utilities that will be encountered during demolition activities at the project site. All standard operating procedures typically employed for utility-removal projects should be followed.