APTIM
2481 NW Boca Raton Blvd.
Boca Raton, Florida 33431
Tel: +1 561 391 8102
Fax: +1 561 391 9116
www.aptim.com

March 5, 2019

Mr. Carlos Adorisio
Broward County Environmental Protection and Growth Management Department
Environmental Engineering and Permitting Division
1 North University Drive, Mailbox 201 • Plantation, Florida 33324

Subject: **Accidental Wastewater Discharge Comment Response Letter**
Break of 42" Sewer Force Main at NW 15th Street and I-95
Pompano Beach, FL

Dear Mr. Adorisio:

On behalf of the City of Pompano Beach (COPB) and SICE, Inc. (SICE), Aptim Environmental & Infrastructure, LLC. (APTIM) is pleased to provide Broward County Environmental Protection and Growth Management Department (BCEPD) with this Comment Response Letter in relation to the above referenced incident. This document is provided as requested in your review letter dated February 20, 2019 (**Attachment 1**) for the Accidental Wastewater Discharge Restoration Plan submitted to BCEPD on January 31, 2019.

Executive Summary

In accordance with the Accidental Wastewater Discharge Restoration Plan, APTIM developed an evidence-supported Mass Quantification that included an analysis of water flow rate through the canals, mobilization of sediment, amounts of solid releases from the sewage, amount of sewage removed and how much solids are potentially left in the canals.

A calculation was conducted to estimate the amount of solids released into the canal and potential thicknesses of sewage sludge on top of the sediment. This mathematical estimate is based on inputs and assumptions described in the document; the actual thickness of the sediment will be field verified during the sediment sampling activities. With these calculations, the values for solid particles should be conservatives since they neglect decomposition of the predominant organic fraction that would result in a decay of the TSS and settled solid mass over time. Over 140 aerators were installed to increase the dissolved oxygen content in the water to aerobically degrade the sewage. Dissolved oxygen measurement in the canals support that the aerators were

successful in increasing/maintaining the oxygen content in a range where aerobic degradation of organic compounds is possible. On average, the dissolved oxygen content was about 4 mg/L.

It is estimated that between 21,259 and 27,558 kg of solid particles were spilled, 17,661 kg of this material was removed by the contractor Lanzo in the days following the spill and an additional 2,477 kg was removed by PRINCE. Out of the 1,120 – 7,419 kg of solids remaining in the system, 60% is settleable (672 – 4,452 kg). This amount of solid particles correspond to 5.6 - 37 m3 of a soft/weakly consolidated deposit (198 – 1,310 Cubic Feet or 7.3 - 49 cubic yards).

A hypothetical mathematical model was conducted to estimate the amount of solid released into the canal during the spill and to estimate the depths of sewage related deposits for several canal areas and is presented in **Tables 4 and 5**. These calculations used assumptions about the solids content of the raw sewage, the measured amount of material removed by the contractor Lanzo and PRINCE, the density of the raw sewage solid particles and settled deposit. Model results indicate that potential of settleable material thickness varies from less than a 1 mm to 16 mm depending of the assumptions taken. Concurrently with the Mass Quantification, APTIM collected sediment core samples in the C-1 Canal and Pompano Canal (G-16). The cores show organic leafy material and fine particulates in them. Detailed inspection and logging of the sediment cores collected do not show evidence of foreign sediment present associated with the wastewater spill at any of the locations sampled.

The 52 M gallons of sewage was released over about 6 days (January 4 through 10) and flowed into a reasonably large volume of water in the C-1 Canal. Based on visual observations and flow calculations, there was not a large wave of sludge/water moving through the canals to transport large amounts of solids downstream of the spill. The flow of water/sewage through the C-1 Canal is further limited by berms containing bottom culverts at the FEC Railway Road crossing and at Martin Luther King Blvd crossing. These berms would tend to collect floating solid materials behind them. The water flow rates through the canals were not large enough to mobilize many of the solid particles beyond the C1 Canal or the G-57 gate. The majority of the solids (73-95 percent) were floating near the water surface near the spill location, before the Railway Road and Martin Luther King Blvd crossing berms, and removed soon after the spill.

The cumulative rain flow volume through G-57 within the weeks following the spill (up to February 25) is in the order of 750 M Gallons of water– 15 times the amount wastewater volume spilled from January 4-10. Most of this rainfall was within a two-week period, when G-65 was closed, leading to significant variations in flows through G-57 (See **Figure 4)**. The resulting surrounding surface water flowing into the C-1 and G-16 canals would have had elevated dissolved oxygen content and likely fertilizers (containing nitrogen and phosphorous compounds.) The highly variable flows through the canals may have re-suspended and mobilized a small fraction of the finer particulates. It is assumed that the additional dissolved oxygen, and the total phosphorous and nitrogen nutrients, accelerated the aerobic degradation of the sewage solids in the canals. This assumption is supported by the temporary increase in fecal coliform results and for locations, mostly after G-57, fecal coliform results being reported as “To Numerous To Count” (TNTC) or “confluent”, i.e., there were spikes in bacterial activity after the rain events. This impact of rainfall on accelerating the decomposition of organic material was not taken into account in the

mathematical analysis of the amount of sewage solids left in the canal. As such, the mathematical analysis should be considered a conservative analysis.

APTIM collected sediment core samples in the C-1 Canal and Pompano Canal. Sediment samples were collected at measured step-outs, across the canal, at six (6) separate upstream headwalls of gates and culverts located in C-1 Canal and Pompano Canal and three (3) additional locations were collected outside of the area of impact to represent background conditions.

A total of nine (9) sampling locations were selected for the initial sediment sample collection event. A total of fifty-three (53) sediment samples were collected for screening at the following locations: NW 15th Street Road Crossing, FEC Railway Road Crossing, Martin Luther King (MLK) Blvd. Road Crossing, C- 1 Culvert Crossing north of Atlantic Boulevard, Pompano Canal Culvert Crossing at Dixie Highway, G-57 Crossing Culvert, Atlantic Boulevard/Magner Drive (Background #1), North of W Copans Road at FEC Crossing (Background #2), and Dixie Highway south of McNab Road at FEC Crossing (Background #3). The Sediment Sampling Locations (Gate/Culverts) are illustrated on **Figure 2**.

Sediment cores collected from the canal areas affected by the wastewater spill (NW 15th Street Road Crossing, FEC Railway Road Crossing, Martin Luther King (MLK) Blvd. Road Crossing, C-1 Culvert Crossing north of Atlantic Boulevard, Pompano Canal Culvert Crossing at Dixie Highway, and the G-57 Crossing Culvert) appear similar in composition to the sediment sample collected at Background #2 (W Copans Road).

Detailed inspection and logging of the sediment cores collected from the canal areas affected by the wastewater spill (NW 15th Street Road Crossing, FEC Railway Road Crossing, Martin Luther King (MLK) Blvd. Road Crossing, C-1 Culvert Crossing north of Atlantic Boulevard, Pompano Canal Culvert Crossing at Dixie Highway, and the G-57 Crossing Culvert) do not show evidence of foreign sediment present associated with the wastewater spill at any of the locations sampled.

APTIM is continuing sediment core collection efforts in the following areas to improve evaluation of background conditions and to look for evidence of wastewater-related sediment present in-between the existing sampling locations:

- C-1 Canal in-between Background #2 and NW 15th Street;
- C-1 Canal in-between NW 15th Street and FEC Crossing

APTIM began collecting turbidity reading using a HACH Turbidimeter at eight (8) locations in the C-1 Canal periodically between February 7 and March 4, 2019. The data collected to date shows a decreasing trend in turbidity readings over time in the C-1 & G-16 Canal and were reported below Broward County's turbidity standard of 10 NTU in all locations tested as of March 4, 2019.

Since January 8, 2019, numerous surface water samples were collected and analyzed for fecal coliform by the City of Pompano Beach and Broward County. The canals have been aerated to enhance aerobic degradation of the sewage sludge and fecal coliform. The aerators were removed after the fecal coliform concentrations to below the 800 colony forming units per 100 ml

(cfu/100 ml) performance criteria. At all 16 sample locations the measured cfu/100 ml values are well below 800.

Background

On the afternoon of Friday January 4, 2019, a construction accident caused by a subcontractor working for the Florida Department of Transportation (FDOT) ruptured a 42" pressurized sewage pipe which spilled untreated sewage into the drainage canal system from north of NW 15 Street. The wastewater flowed into the C-1 Canal, traveled south and entered the G-16 canal (Pompano Canal) where it headed east toward the G-57 Gate and finger canal that lead to the Intracoastal Waterway. See Site Location Map provided as **Figure 1** and the location of core samples are in **Figure 2.**

Prince Contracting, LLC (PRINCE), SICE, and the COPB implemented immediate emergency actions to repair the damage and contain the raw sewage. On January 10, 2019, the above-grade bypass was fully installed and stopped the spillage of sewage into the canal system. On January 12, 2019, the original 42" force main pipe was permanently repaired, put back in service, and removal of the bypass began.

The damaged sewage pipe was owned and operated by COPB, PRINCE is the Prime Contractor that was awarded the FDOT roadway project, SICE is a Subcontractor to PRINCE, and Arc Electric is a subcontractor to SICE. It our understanding the sewer pipe was accidentally ruptured by a directional drilling bore that was completed under the direction of Arc Electric.

BCEPD Comments & Responses:

In a letter dated February 20, 2018, BCEPD requested responses to the following comments:

1. Figure 1 of the plan identifies all canals and waterways impacted by the sewage spill. Please advise of any revisions to this figure since January 31, 2019.
2. Please provide an update on the efforts to determine the amount of sewage sludge/waste accumulated on the bottom of the canals and waterways, including a) the results of the proofs of concept, and b) any coordination with the Florida Department of Transportation (FDOT), the Broward County Water Control District (BCWCD) and South Florida Water Management District (SFWMD) to ensure an accurate determination. Please be advised our agency expects strict adherence to the timelines provided in the January 31 plan for this determination and field verification of the results at all locations identified in Figure 1.
3. Please provide an update on the sewage sludge/waste removal efforts, including methods and timelines for each aspect of this task. Please be advised the County expects: a) initiated steps and other ongoing tasks should be also denoted with their start and expected end dates, and b) coordination with FDOT, BCWCD, and SFWMD to ensure the selected removal method(s) do not cause additional impacts to water quality and quantity in the canals and waterways, do not adversely increase the discharges to the sanitary sewer collection, transition and treatment systems, and do not cause objectionable odors.
4. It is our agency's position that the City of Pompano Beach (City) must continue to coordinate efforts to remove sewage sludge/waste that are consistent with the requirements listed in item 3.b) above, and that the City must document said efforts.

Comment #1 - Inventory of impacted waterways

Based on APTIM's evaluation of the available surface water data collected to date, no revisions are recommended to **Figure 1** Estimated Maximum Extent of Fecal Indicator Bacteria in Surface Water, provided to BCEPD on January 31, 2019.

Comment #2 – Update on efforts to determine the amount of sewage sludge/waste accumulated on the bottom of the canals and waterways

In order to determine the amount of amount of sewage sludge/waste accumulated on the bottom of the canals and waterways, the effort was divided into two tasks: Mass Quantification and Field Verification. The Mass Quantification included an analysis of water flow rate through the canals, mobilization of sediment, amounts of solid releases from the sewage, amount of sewage removed and how much solids are potentially left in the canals. A summary and update on the tasks is presented below. The summary shows that about 52 M gallons of sewage was released over multiple days. The water flow rates through the canals were not large enough to mobilize many of the solid particles beyond the C1 canal or the G-57 gate. The majority of the solids were floating near the water surface near the spill location and removed soon after the spill. The remaining settleable solids, on average, should form a soft/weakly consolidated deposit that is only a fraction of an inch thick. This latter value ignores any decomposition of the solids due to microbial action.

Mass Quantification

HYDRAULIC MEASUREMENTS AT POMPANO CANAL STRUCTURES

This section describes hydraulic measurements (including water flow rates and water levels) taken by the South Florida Water Management District (SFWMD) at two gated flow control structures located along the Pompano Canal G-65, and G-57. G-57 is downstream of the spill location after C-1 canal intersects the Pompano canal. G-65 is upstream of G-57 and supplied additional water to the G-16 canal that could mobilize the sewage.

There was little rainfall all January until Jan 21. The only non-zero rain volume record at G-57 station indicates 0.07 inches on January 13. The lack of rain allows for an easy estimation of the extra flow through the canal due to the spill. The G-57 and G-65 discharge data before and after the spill are shown in **Figure 3** and **Table 1**. Daily G-57 flows are in **Table 2**. The "-14.1" flow (cfs) in **Table 1** is the average extra flow mainly due to the sewage release. A flow of 14.1 cfs for six days is approximately 52 M gallon, which is consistent with the estimated total volume of sewage released. As seen from **Table 2** and **Figure 3**, gates G-65 and G-57 were closed on Jan 8 and 11, respectively, thus isolating the wastewater cumulated between the locks and along the C-1 canal allowing for more solids to collect on the water surface or to settle to the bottom of the canal. The "After Spill" values in **Table 1** are zero since both gates were closed. The G-57 water flow was relatively constant except for the few days after the spill (**Figure 3**). The water levels at G-65 and G-57 stayed relatively constant except for small variations after the spill (**Figure 4**). Water levels after G-57 (**Figure 4**) were variable, which may have resulted from tidal influence and intermediate gate opening/closure in response to the spill flow, water level rise upstream the

lock, and water quality concerns to adjacent waterbodies. In addition to gated structures (G-65 and G-57), water flow in C-1 is limited by berms containing bottom culverts at the FEC Railway Road crossing and at Martin Luther King Blvd crossing. These berms will tend to collect floating solid materials behind them. **Figure 5** shows the discharge flows and daily rainfall amounts over a more extended time. The calculated mean discharge flow (sum of flow from G-65, normal C-1 flows and from the spill) though the G-57 gate during the spill was in the order of 30 cfs.

Table 1: Mean flow estimates before, during and within the weeks after the spill.

Period	Flow at G-65 (cfs)	Flow at G-57 (cfs)	Local Sources (cfs)	Balance (cfs)
Before spill	8.2	22.6	14.4	0
During	4.8	33.3	14.4*	-14.1
After Spill	0	0	0	0

*Assumed value.

Table 2: Pompano Canal Discharge data before, during and after the wastewater spill (SFWMD).

Day	Mean flow [cfs]
01 Jan 2019	22.59
02 Jan 2019	22.57
03 Jan 2019	22.56
04 Jan 2019	**26.58**
05 Jan 2019	**33.93**
06 Jan 2019	**47.16**
07 Jan 2019	**38.14**
08 Jan 2019	**32.43**
09 Jan 2019	**19.17**
10 Jan 2019	**14.89**
11 Jan 2019	0
12 Jan 2019	0
13 Jan 2019	0
14 Jan 2019	0
15 Jan 2019	0
16 Jan 2019	0
17 Jan 2019	0

The 52 M gallons of sewage was released over multiple days, thus there was not a large wave of sludge/water moving through the canals to transport large amounts of solids downstream of the spill. Calculations of flow rate through the canals gives a cross-sectional flow speed in the order of 0.3 feet/second for the peak recorded flow rate at G-57 (~115 cfs), and an average current speed in the order of 0.07 feet/second during the wastewater spill (~30 cfs). Although these estimates are general approximations, they indicate relatively low transport velocities of the spilled

wastewater downstream the C-1 canal intersection, eastward towards the Intracoastal Waterway. Also, based on these calculation, it took approximately 2 days for the wastewater to flow from the spill location to Keith Park (~12,000 feet apart).

Relatively high rainfall volumes were observed in the last week of January and the first week of February. (See **Figure 5**.) Surrounding surface water entered the canals resulting in canal water level rise and sporadic G-57 gate openings and discharge through G-57. On February 11, the G-65 gate was opened, releasing approximately 40 cfs into the canal section west of G-57. This has led to more constant flow rates through G-57, which on average exceeded 50 cfs between February 11 and 25. The cumulative flow volume through G-57 within the weeks following the spill (up to February 25) is in the order of 750 M Gallons of water – 15 times the amount wastewater volume spilled from January 4-10.

SUSPENDED SOLIDS CALCULATION

This section describes the calculations of total suspended solid mass in the wastewater, estimates the fraction of material that was removed after surface accumulation, and determined the expected thickness of material accumulated on the channel bed.

The City of Pompano Beach estimated the amount of wastewater discharged during the spill to be 52 M Gallons (196,841m3). The results of a wastewater grab sample collected and analyzed by the Broward County Water and Wastewater Services, on January 24, 2019, indicated TSS (total suspended solids) of 108 mg/l. This level is in the lower limit of representative TSS ranges reported in **Table 3**. As the actual TSS is expected to fluctuate over time, a more conservative estimate of 140 mg/l is also used in the calculations. This higher TSS concentration is in line with values provided in Table 3, and is 30% greater than the result of the analyzed sample. Therefore, the associated calculation results represent the upper limit for the estimated ranges based on the available data.

Table 3: Benchmark values of wastewater sampling (Burk and Minnis, 1994).

Constituent	Unit	Range (Burks and Minnis)[11]	Typical (Burks and Minnis)	Range (UN)[12]	Medium (UN)
Total Nitrogen	mg/l	15-90	40	20-85	40
Total Phosphorous	mg/l	6-20	12	6-20	10
Total Suspended Solids	mg/l	100-400	220	100-350	200
Settable Solids	mg/l	50-200	100	-	-
BOD	mg/l	100-400	250	100-300	200
COD	mg/l	200-1,000	500	-	-
Grease/NVM	mg/l	50-150	100	50-150	100

The mass of solids spilled with the wastewater is determined by multiplying the total wastewater volume by the TSS concentrations: 21,259 kg (measured TSS of 108 mg/l) and 27,558 kg (upper limit TSS of 140 mg/l). According to the information in **Table 3**, approximately 50% of the TSS mass is settleable within 30 to 45 minutes. These are typical values, but uncertainty is acknowledged and as a conservative definition, the settleable fraction is assumed to be 60% (12,755 kg – 16,535 kg). The remaining 40% of non-settleable solids is primarily composed of fines to colloidal material much of which could be captured in the floating material behind the berm with bottom culvert structures at the FEC Railway and at Martin Luther King Blvd road crossings.

On the days following the force main rupture, the contractor Lanzo removed canal liquids with floating solids from the channel section between 15th St and FEC Railway crossing. The effort included four (4) trucks (15 cubic yards) making 15 loads per day, totalizing between 750 and 900 cubic yards of material transferred each day during a 7-days period. The total amount of material removed by Lanzo is estimated to be 5,775 cubic yards.

The density of the particles that compose the TSS in wastewater is in the order of 1,200 kg/m3, and the solids content of the floating material is assumed to be 2% (98% water and air). Our calculations show the material collected in the vacuum trucks had about 4 kg of solids per m3. This corresponds to about 17,661 kg of solid wastewater material (83% and 64% of the total spilled amount of solids, based on the 108 and 140 mg/L TSS respectively).

In parallel to the removal work performed by Lanzo, FDOT directed PRINCE to build sand berms at the spill location to contain the spill flow and support the repair attempts. As part of this effort, on January 5 and 6 a total of 108 cubic yards of sandy material was flushed into the C-1 canal adjacent to the spill, north of NW 15h Street. On January 17 and 18, 2019. PRINCE excavated the berm sand in the C-1 canal along with all the floating wastewater debris located north of the turbidity curtain and gate at NW 15th Street. See **Figures 6** and **7**. Prince hauled away by 21 truck loads of material for a grand total of 378 cubic yards. The balance between placement and removal volumes indicate that an additional 270 cubic yards were removed. It is assumed that 50% of this volume corresponds to spilled solid accumulates – the other half is composed of original canal sediments. The excess of water was drained back to the canal during removal, so the calculations do not include dilution effects. Assuming that the solid content of spilled solid accumulates to be 2% (98% of water and air), our calculations show the material collected in the trucks loads had about 24 kg of solids per m3. This corresponds to additional 2,477 kg of solid wastewater material (11.7 and 9.0% of the total spilled amount of solids, based on the 108 and 140 mg/L TSS respectively).

Summarizing the main outcomes, between 21,259 and 27,558 kg of solid particles were spilled, 17,661 kg of this material was removed by the contractor Lanzo in the days following the spill and an additional 2,477 kg were removed by PRINCE. Out of the 1,120 - 7,419 kg of solids remaining in the system, 60% is settleable (672 - 4,452 kg).

For calculations, it is estimated that the solid content of the settled material is about 10% - which represents a layer of soft/weakly consolidated deposit accumulated near the bottom of the canal. The calculations consider the solid particles to be conservative, neglecting decomposition of the predominant organic fraction that would result in a decay of the TSS mass over time. Considering

the density of the solid particles to be 1,200 kg/m3, one m3 of settled sludge has 120 kg of solids. Therefore, the 672 – 4,452 kg of settleable solid particles correspond to 5.6 - 37 m3 of a soft/weakly consolidated deposit (198 – 1,310 Cubic Feet or 7.3 - 49 cubic yards).

For purpose of comparison and relative scale, the hypothetical sediment distribution was calculated for several canal areas assuming both uniform and non-uniform distribution (see **Tables 4** and **5**). The hypothetical canal areas were chosen solely for calculation purposes. The non-uniform examples assumes a 1/3 deposition rate for each hypothetical canal area. These examples are not representative of real world conditions and do account for the multiple restrictions caused by flow gates and culverts that exist in the C-1 and G-16 Canals.

Hypothetical Canal Areas	Approximate Area (sq. ft.)	Estimated Thickness (inches)
NW 15th Street to FEC Crossing	26,000	0.09 - 0.60
NW 15th Street to MLK Crossing	165,000	0.01 - 0.10
NW 15th Street to G-57	350,000	0.01 - 0.04

Table 4: Estimated Potential Uniform Sediment Thickness at Hypothetical Canal Areas. Ranges associated with TSS of 108 and 140 mg/L, respectively.

Hypothetical Canal Areas	Approximate Area (sq. ft.)	Estimated Thickness (inches)
NW 15th Street to FEC Crossing	26,000	0.04 - 0.25
FEC Crossing to MLK Crossing	139,000	0.01 - 0.05
MLK Crossing to G-57	185,000	0.00 - 0.01

Table 5: Estimated Potential Non-Uniform Sediment Thickness at Hypothetical Canal Areas.

The hypothetical sediment distribution was calculated for several canal areas and presented in **Table 4**. The actual thickness of the sediment must be field verified by way of the sediment sampling activities.

References:

Burks, B.D, Minnis, M.M (1994). Onsite Wastewater Treatment Systems. Madison, WI: Hogarth House, Ltd.

Field Verification

Proof of Concept Evaluation

In accordance with the scope of work proposed in the Accidental Wastewater Discharge Restoration Plan, dated January 31, 2019, APTIM initiated the Proof of Concept #1: C-1 Headwalls Sediment Sampling efforts on February 4, 2019.

Prior to beginning the core sampling efforts, APTIM field tested a barrel core sludge sampling device (AMS, Inc.) and four different diameter clear PVC cores (0.75", 1.5", 2", and 3"). All cores were manually pushed into the sediment and advanced using a weighted drive hammer attachment. As a result of the field testing efforts, APTIM determined that sediment encountered on the canals bottoms in the C-1 canal was competent enough to enter the core barrels and produce recovery with very low frequency of wash out. All collection methods tested were proven to yield adequate recovery, and the 2" diameter clear PVC pipe was selected as the preferred method. A dredge-style sampler was not recommended for sediment sampling.

Sediment Sampling Activities

After the sediment collection method had been tested and confirmed, APTIM collected sediment core samples in the C-1 Canal and Pompano Canal. Sediment samples were collected at measured step-outs, across the canal, at six (6) separate upstream headwalls of gates and culverts located in C-1 Canal and Pompano Canal and three (3) additional locations were collected outside of the area of impact to represent background conditions. The locations of the C-1 Canal, Pompano Canal (G-16), and the flood gates & culverts are illustrated on **Figures 1** and **2**, respectively.

A total of nine (9) sampling locations were selected for the initial sediment sample collection event. Those locations were: NW 15th Street Road Crossing, FEC Railway Road Crossing, Martin Luther King (MLK) Blvd. Road Crossing, C-1 Culvert Crossing north of Atlantic Boulevard, Pompano Canal Culvert Crossing at Dixie Highway, G-57 Crossing Culvert, Atlantic Boulevard/Magner Drive (Background #1), North of W Copans Road at FEC Crossing (Background #2), and Dixie Highway south of McNab Road at FEC Crossing (Background #3). The Sediment Sampling Locations (Gate/Culverts) are illustrated on **Figure 2**.

Once a sediment sample was collected, it was placed against a graduated white backer-board, marked with an independent sample ID, and photographed in the field. After each sediment sample collection, the sediment sample was flushed out from the sampling barrel. The number of step out sediment samples collected varied at each headwall location based on the measured width of the canal (See **Figure 8**). A total of fifty-three (53) sediment samples were collected for screening at the locations and spacing listed below:

- NW 15th Street Road Crossing - 5 sediment samples collected at 6' spacing across canal;
- FEC Railway Road Crossing - 6 sediment samples collected at 6' spacing across canal;
- Martin Luther King (MLK) Blvd. Road Crossing - 8 sediment samples collected at 6' spacing across canal;

- C-1 Culvert Crossing north of Atlantic Boulevard - 3 sediment samples collected at 5' spacing across canal;
- Pompano Canal Culvert Crossing at Dixie Highway - 5 sediment samples collected at 6' spacing across canal;
- G-57 Crossing Culvert - 6 sediment samples collected at 6' spacing across canal;
- Atlantic Boulevard/Magner Drive (Background #1) - 7 sediment samples collected at 5' spacing across canal;
- North of W Copans Road at FEC Crossing (Background #2) - 5 sediment samples collected at 5' spacing across canal; and
- Dixie Highway south of McNab Road at FEC Crossing (Background #3) - 8 sediment samples collected at 20' spacing across canal.

The field photos from the sediment profile screening were reviewed for consistency by a Professional Geologist at each location and a single representative sample interval was selected for re-collection and detailed split core lithological logging. The representative sediment samples were transported to APTIM's office in Boca Raton, photographed, and visually inspected by a Professional Geologist while inside the clear PVC collection core.

The core samples were then secured in an upright position and left undisturbed for 1-week to settle. Post settlement, the water was removed from each PVC collection core using a peristaltic pump carefully not to disturb the top sediment. Once the water had been removed, absorbent paper was placed in the top of the core and pressed down to keep the surface sediment from shifting during realignment and cutting. Each PVC collection core was then cut on both sides, split open, reviewed, and the lithology was logged by a Florida Registered Professional Geologist. Photo Logs (Profile Screening), Lithological Core Logs, and Core Photos (Split Core) are presented in **Attachment 2**.

<u>Preliminary Sediment Sampling Results</u>

The preliminary results of the sediment sampling efforts at the nine (9) canal bottom locations are as follows:

- Sediment cores from Background #1, #2, and #3 appear representative of normal pre-spill canal bottom conditions. Samples from Background #1 and #3 appear consistent with each other in composition. Both samples were collected from the Pompano Canal (G-16) where runoff comes from surface streets and has consistent headland flow (not stagnant).
- The sediment core from Background #2 has larger amount of organic leafy material and fines present as compared to Background #1 and #3. Background #2 was collected in the C-1 Canal north of the spill area. In the C-1 canal, runoff comes from Interstate 95 and adjacent unpaved areas, and does not have consistent headland flow (relatively stagnant).
- The sediment core from Background #2 appears to be the most representative of pre-spill conditions in the C-1 canal.

- Sediment cores collected from the canal areas affected by the wastewater spill (NW 15th Street Road Crossing, FEC Railway Road Crossing, Martin Luther King (MLK) Blvd. Road Crossing, C-1 Culvert Crossing north of Atlantic Boulevard, Pompano Canal Culvert Crossing at Dixie Highway, and the G-57 Crossing Culvert) appear similar in composition to the sediment sample collected at Background #2 (W Copans Road).
- Detailed inspection and logging of the sediment cores collected from the canal areas affected by the wastewater spill (NW 15th Street Road Crossing, FEC Railway Road Crossing, Martin Luther King (MLK) Blvd. Road Crossing, C-1 Culvert Crossing north of Atlantic Boulevard, Pompano Canal Culvert Crossing at Dixie Highway, and the G-57 Crossing Culvert) do not show evidence of foreign sediment present associated with the wastewater spill at any of the locations sampled.

Preliminary Conclusions and Next Actions:

- APTIM is continuing sediment core collection efforts in the following areas to improve evaluation of background conditions and to look for evidence of wastewater-related sediment present in-between the existing sampling locations:

o C-1 Canal in-between Background #2 and NW 15th Street;

o C-1 Canal in-between NW 15th Street and FEC Crossing

Comment #3 – Update on update on the sewage sludge/waste removal efforts on the bottom of the canals and waterways

Based on the preliminary review of the sediment samples collected as part of Proof of Concept #1: C-1 Headwalls Sediment Sampling, APTIM did not identify significant sewage sludge/waste accumulation on the canal bottoms as compared to representative canal background locations. Consequently, APTIM does not recommend Proof of Concept #2: C-1 Headwalls Spot Vacuum Extraction Test be performed at this time.

Comment #4 – Coordination & documentation of sewage sludge/waste removal efforts

Comment Acknowledged. All sewage sludge/waste removal efforts will be proposed to BCEPB prior initiation and will be coordinated with FDOT, BCWCD, and SFWMD to ensure the selected removal method(s) do not cause additional impacts to water quality and quantity in the canals and waterways, do not adversely increase the discharges to the sanitary sewer collection, transition and treatment systems, and do not cause objectionable odors. All sewage sludge/waste removal efforts will be documented appropriately.

Surface Water Quality in the C-1 Canal and Pompano Canal

Since January 8, 2019, numerous surface water samples were collected and analyzed for fecal coliform by the COPB and BCEPD. During and after rain events at the end of January and beginning of February, some fecal coliform results temporarily increased or were "To Numerous To Count (TNTC) or "confluent". For example, there were TNTC events and elevated fecal coliform results after the January 26 and February 1, 2019 rain events. The fecal coliform results decreased towards their pre-rain event values within one to two days. As of February 3, 2019, all fecal coliform values for all sample locations are consistently well below the target level of 800 Colony Forming Units/100mL and on February 8, 2019, the COPB discontinued testing for fecal coliform. Additional testing is on-going by COPB's 3rd Party Consultant, Janicki Environmental, Inc., for Total Kjeldahl Nitrogen (TKN), Nitrogen Oxides (NOx),Total Nitrogen (TN), Total Phosphorus (TP), Orthophosphate (PO4), Chlorophyl a corrected (Chl a (corr)), E. Coli and Enterococci Bacteria. Nonetheless, all surface water levels have remained below the applicable surface water standards for fecal coliform.

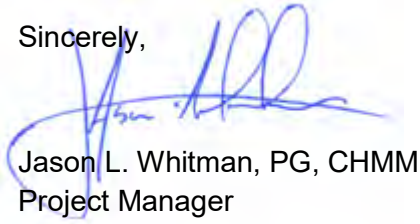
APTIM began collecting turbidity reading using a HACH Turbidimeter at eight (8) locations the C-1 Canal periodically between February 7 and March 4, 2019 (**Table 4**). This test was started in advance of aerator removal to evaluate the effects of aerator removal on the surface water quality. As per the Aerator Implementation & Removal Plan, aerators were removed only after the fecal coliform values were consistently below 800 cfu/100 ml for five (5) consecutive days in a location. The final aerators operating in the C-1 Canal were removed on February 11, 2019. The turbidity measurements from Sample Site 1 measured on February 7, 2019 was collected before the aerators was removed from that location. The table below shows a decreasing trend in turbidity readings over time and are below Broward County's turbidity standard of 10 NTU in all locations tested as of March 4, 2019.

Sample site	Addresses	Turbidity (NTUs)				
		2/7/2019	2/13/2019	2/19/2019	2/21/2019	3/4/2019
1	NW 15th Street & I-95					
		100.00	12.20	8.67	13.50	6.67
2	Avondale					
		7.47	2.11	2.73	1.93	3.71
3	Keith Park					
	(The Gate)		5.32	2.37	2.13	2.76
11	901 NW 10th St					
Added 01/17/19	Mitchell Moore Park		15.70	9.50	9.03	6.26
12	NW 10th Ave/Hammondville					
Added 01/17/19	Road	9.14	11.30	10.80	9.18	4.73
13	NW 6th St & NW 10th Ave					
Added 01/17/19	1001 NW 6th St	9.77	9.55	10.80	8.41	4.23
14	NW 8th St & NW 10th Ave					
Added 01/17/19		10.10	11.70	9.87	9.06	4.55
16	Weaver Park					
Added 01/18/19	800 NW 20th St		9.87	5.63	6.53	7.90

Table 5: Surface Water Turbidity Data collected in the C-1 Canal, Pre and Post Aerator Removal.

If you have any questions or comments concerning this document, please do not hesitate to call me directly.

Sincerely,



Jason L. Whitman, PG, CHMM
Project Manager
Aptim Environmental & Infrastructure, Inc.

Phone: 786-299-7268
Email Address: jason.whitman@aptim.com

FIGURES

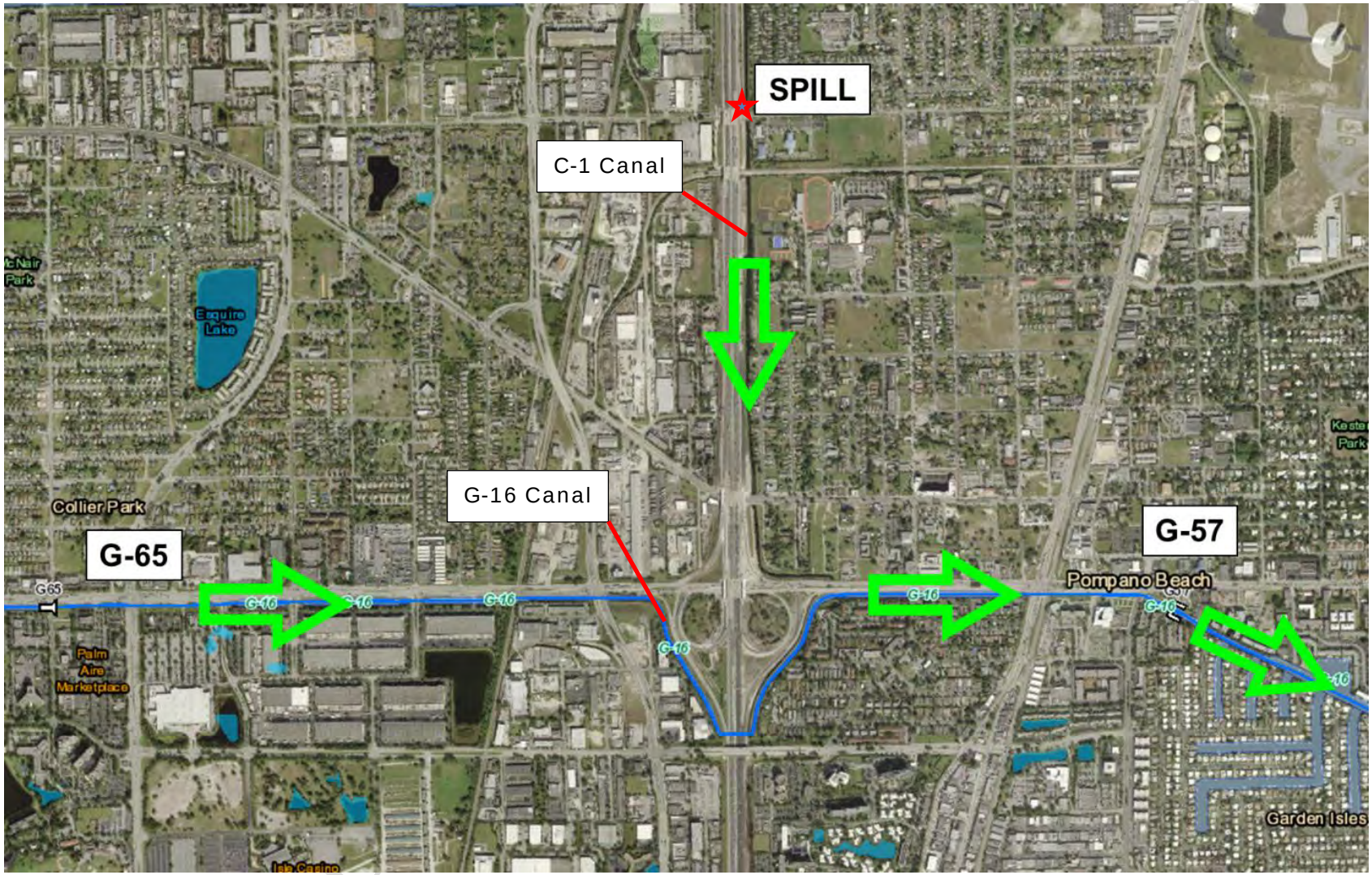
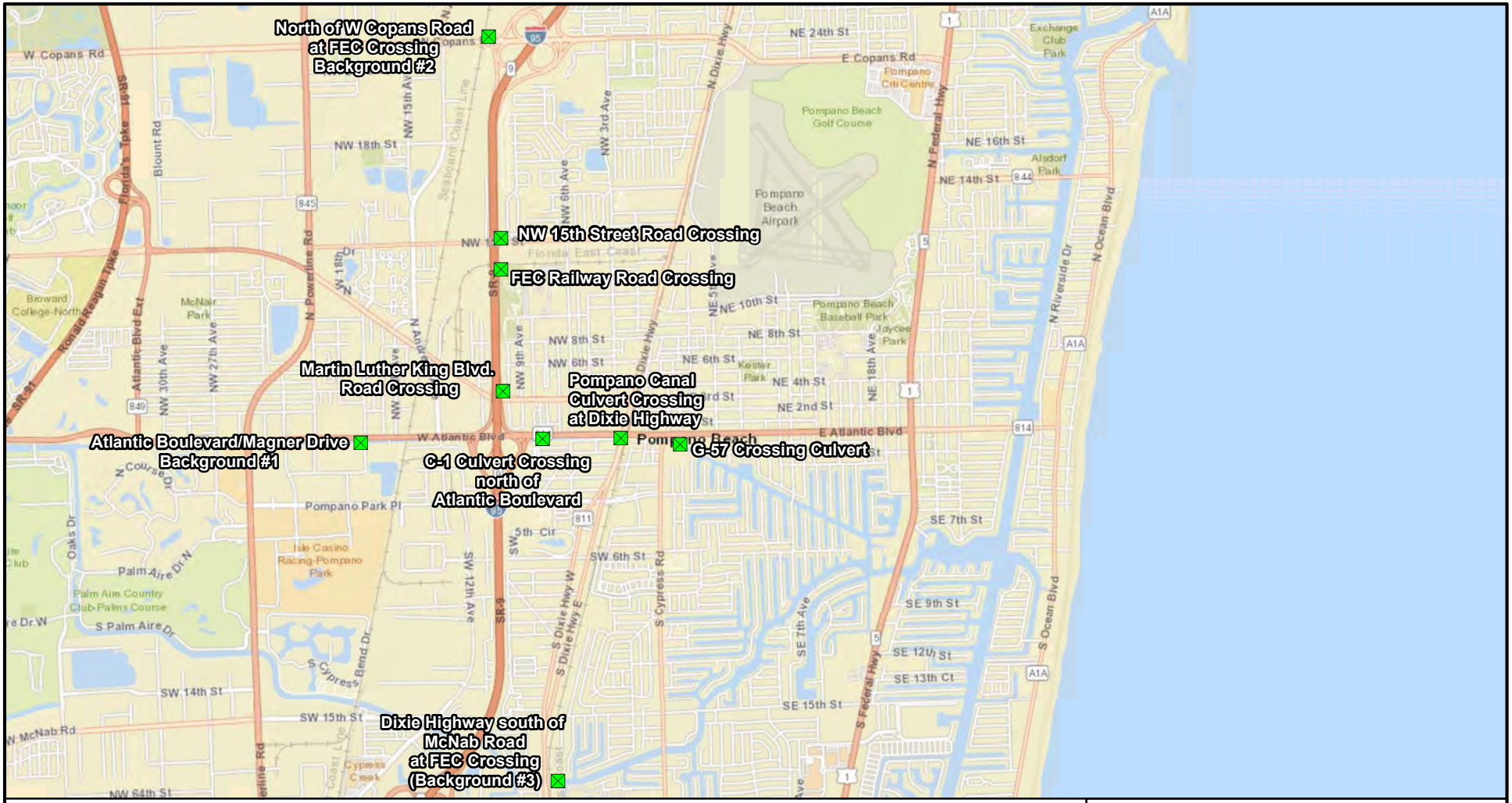


Figure 1: Site Location Map



Legend:

- Flood Gate or Culvert (Sediment Sampling Location)

Notes:

1. Background imagery is ESRI World Street basemap.

N

0 2,000 4,000

Feet

SICE
14350 NW 56th Court, Suite 105
Miami, FL 33054

Accident Wastewater Spill

FIGURE NUMBER 2

C-1 Headwall Sediment Sampling Locations

APTIM
2481 N.W. Boca Raton Blvd.
Boca Raton, FL 33431
www.APTIM.com

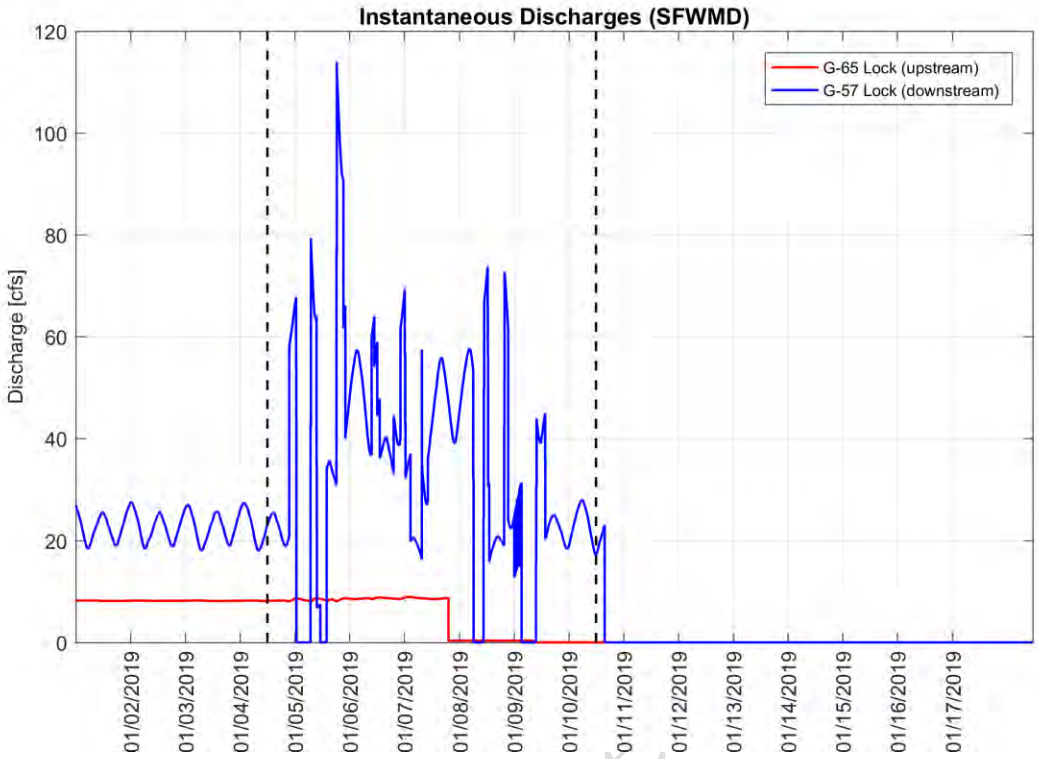


Figure 3: Pompano Canal Discharge data before, during and after the wastewater spill (SFWMD).

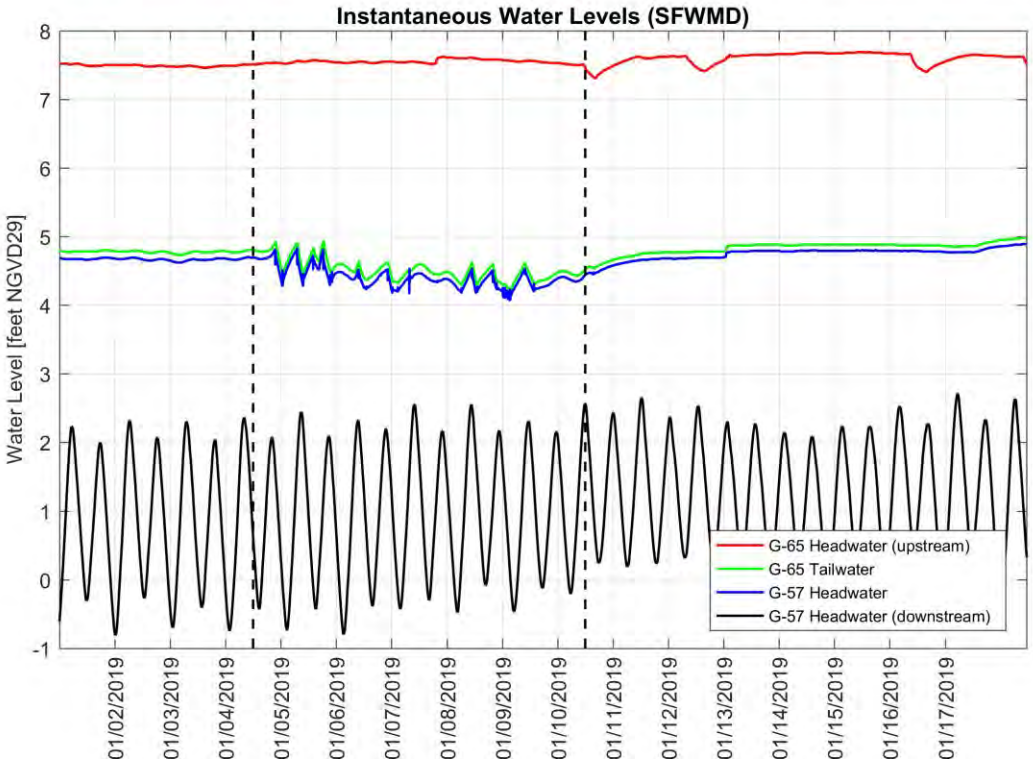


Figure 4: Pompano Canal Water Level data measured before, during and after the wastewater spill (SFWMD).

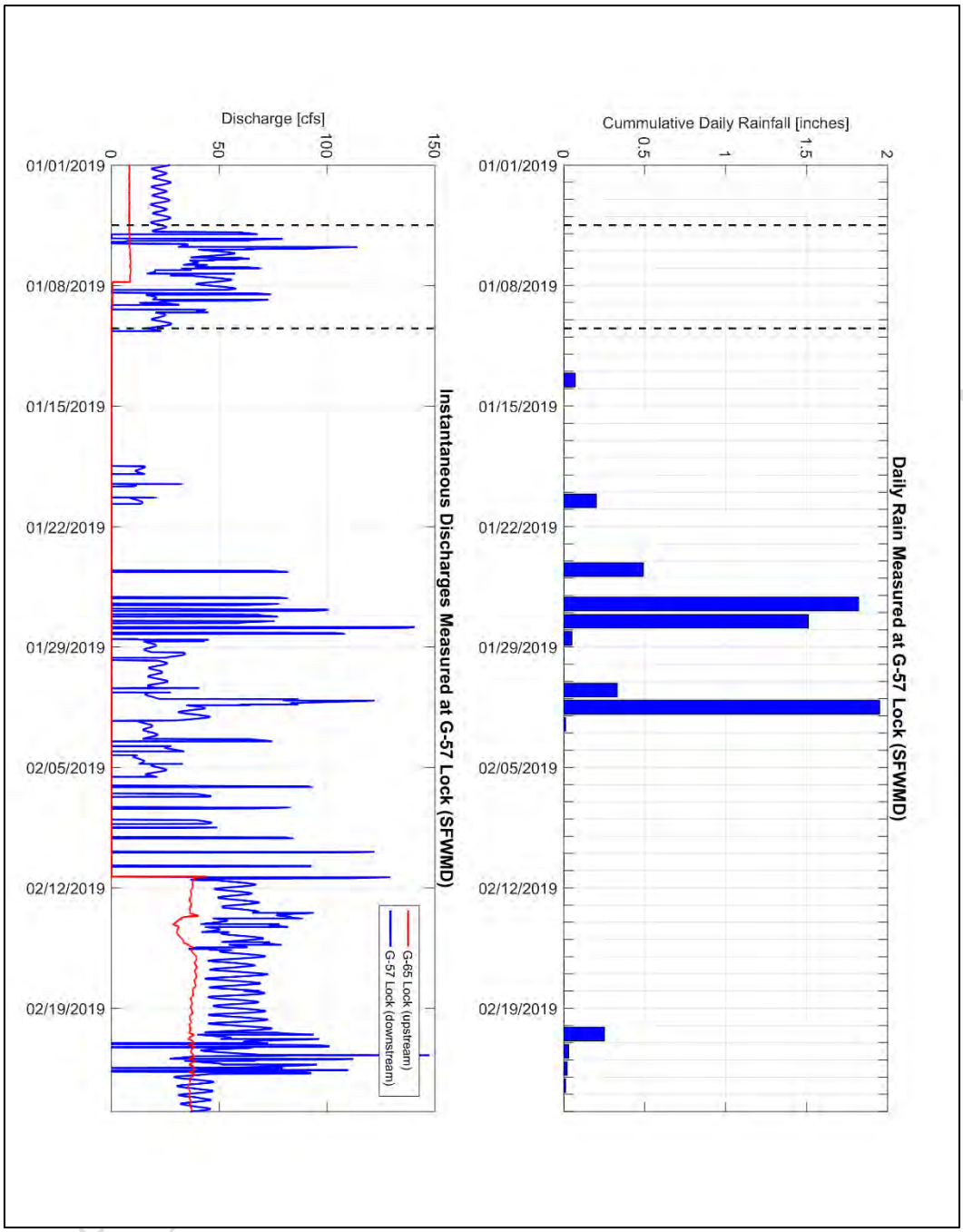


Figure 5: Rain and discharge measurements at Pompano Canal (SFWMD).

Figure 6: Floating material removed accumulated by the floating turbidity curtains and removed from site.

Figure 7: Floating material removed accumulated by the floating curtains and removed from site.

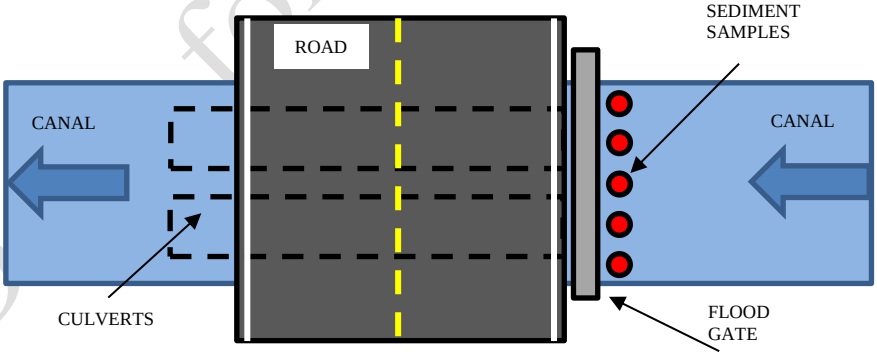


Figure 8: Diagram of typical sediment sampling locations at a road crossing & flood gate structure.

ATTACHMENT 1

Environmental Protection and Growth Management Department
ENVIRONMENTAL ENGINEERING AND PERMITTING DIVISION
1 North University Drive, Mailbox 201, Plantation, Florida 33324 • 954-519-1483 • FAX 954-519-1412

Sent via email to: randolph.brown@copbfl.com

February 20, 2019

Randolph Brown, Utilities Director
100 West Atlantic Boulevard
Pompano Beach, FL 33060

Subject: Break of 42" Sewer Force Main at NW 15th Street and I-95 - Restoration Plan

Dear Mr. Brown,

On January 31, 2019, the Broward County Environmental Protection and Growth Management Department (EPGMD), Environmental Engineering and Permitting Division (EEPD) received a restoration plan in response to the subject sewage spill. Following are our agency comments on the submitted plan:

1. Figure 1 of the plan identifies all canals and waterways impacted by the sewage spill. Please advise of any revisions to this figure since January 31, 2019.

2. Please provide an update on the efforts to determine the amount of sewage sludge/waste accumulated on the bottom of the canals and waterways, including a) the results of the proofs of concept, and b) any coordination with the Florida Department of Transportation (FDOT), the Broward County Water Control District (BCWCD) and South Florida Water Management District (SFWMD) to ensure an accurate determination. Please be advised our agency expects strict adherence to the timelines provided in the January 31 plan for this determination and field verification of the results at all locations identified in Figure 1.

3. Please provide an update on the sewage sludge/waste removal efforts, including methods and timelines for each aspect of this task. Please be advised the County expects: a) initiated steps and other ongoing tasks should be also denoted with their start and expected end dates, and b) coordination with FDOT, BCWCD, and SFWMD to ensure the selected removal method(s) do not cause additional impacts to water quality and quantity in the canals and waterways, do not adversely increase the discharges to the sanitary sewer collection, transition and treatment systems, and do not cause objectionable odors.

4. It is our agency's position that the City of Pompano Beach (City) must continue to coordinate efforts to remove sewage sludge/waste that are consistent with the requirements listed in item 3.b) above, and that the City must document said efforts.

Please provide a response to this letter by March 5, 2019. If you have any questions regarding this matter, please feel free to contact Carlos Adorisio at 954-519-1206 (cadorisio@broward.org).

Sincerely,

Sermin Turegun

Sermin Turegun, Director
Environmental Engineering and Permitting Division

cc: Lenny Vialpando, Deputy Department Director, EPGMD

ATTACHMENT 2

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 1

Date: 2/11/19

Description:

Sediment Core @

Background #1

A; 5-ft step

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Location: Pompano Beach, FL

Photograph No. 2

Date: 2/11/19

Description:

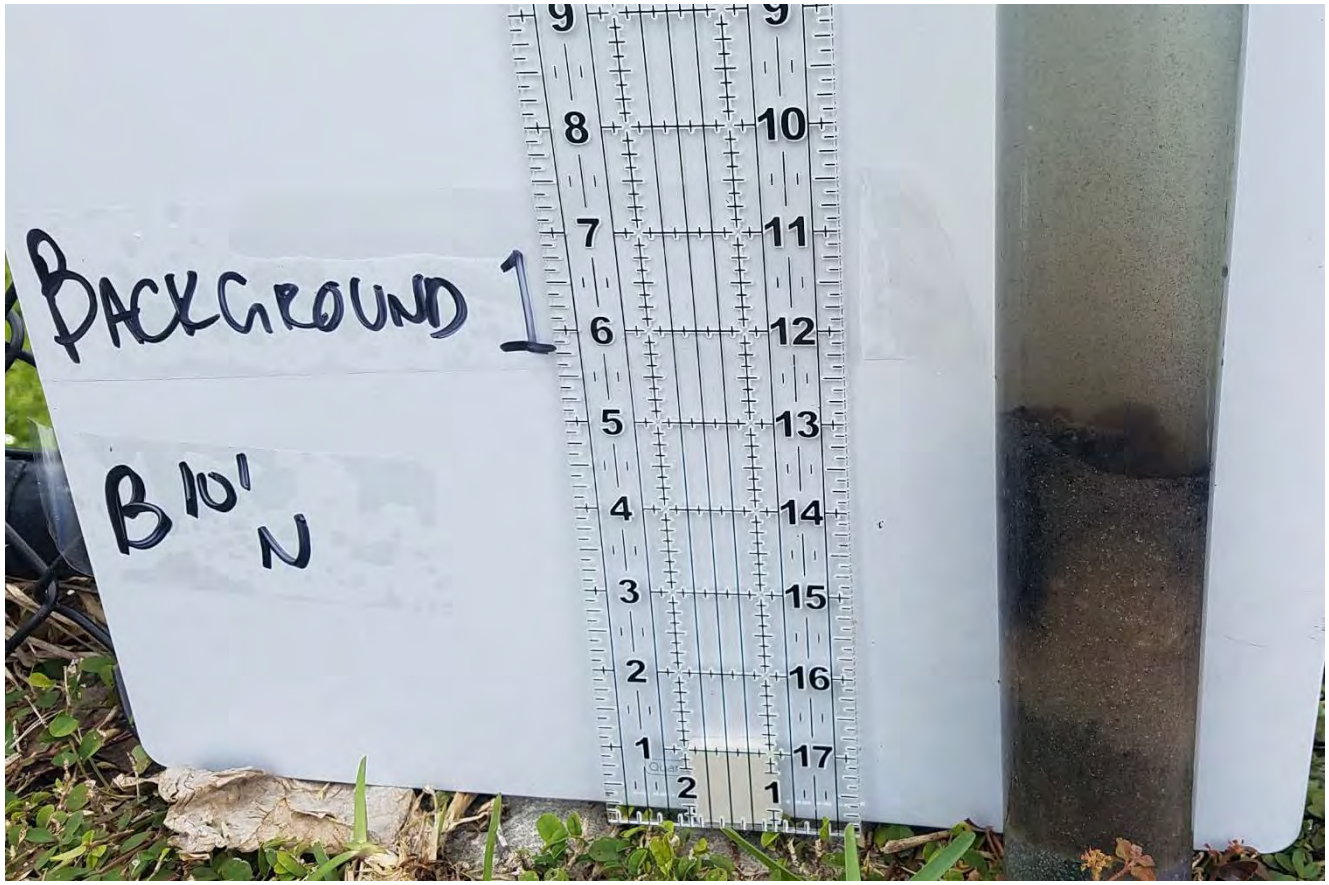
Sediment Core @

Background #1

B, 10-ft step

Prepared by: APTIM

Photographer: Dale Young



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Location: Pompano Beach, FL

Prepared by: APTIM

Photographer: Dale Young

Photograph No. 3

Date: 2/11/19

Description:

Sediment Core @

Background #1

C; 15-ft step

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Location: Pompano Beach, FL

Photograph No. 4

Date: 2/11/19

Description:

Sediment Core @

Background #1

D, 20-ft step

Prepared by: APTIM

Photographer: Dale Young

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Location: Pompano Beach, FL

Photograph No. 5

Date: 2/11/19

Description:

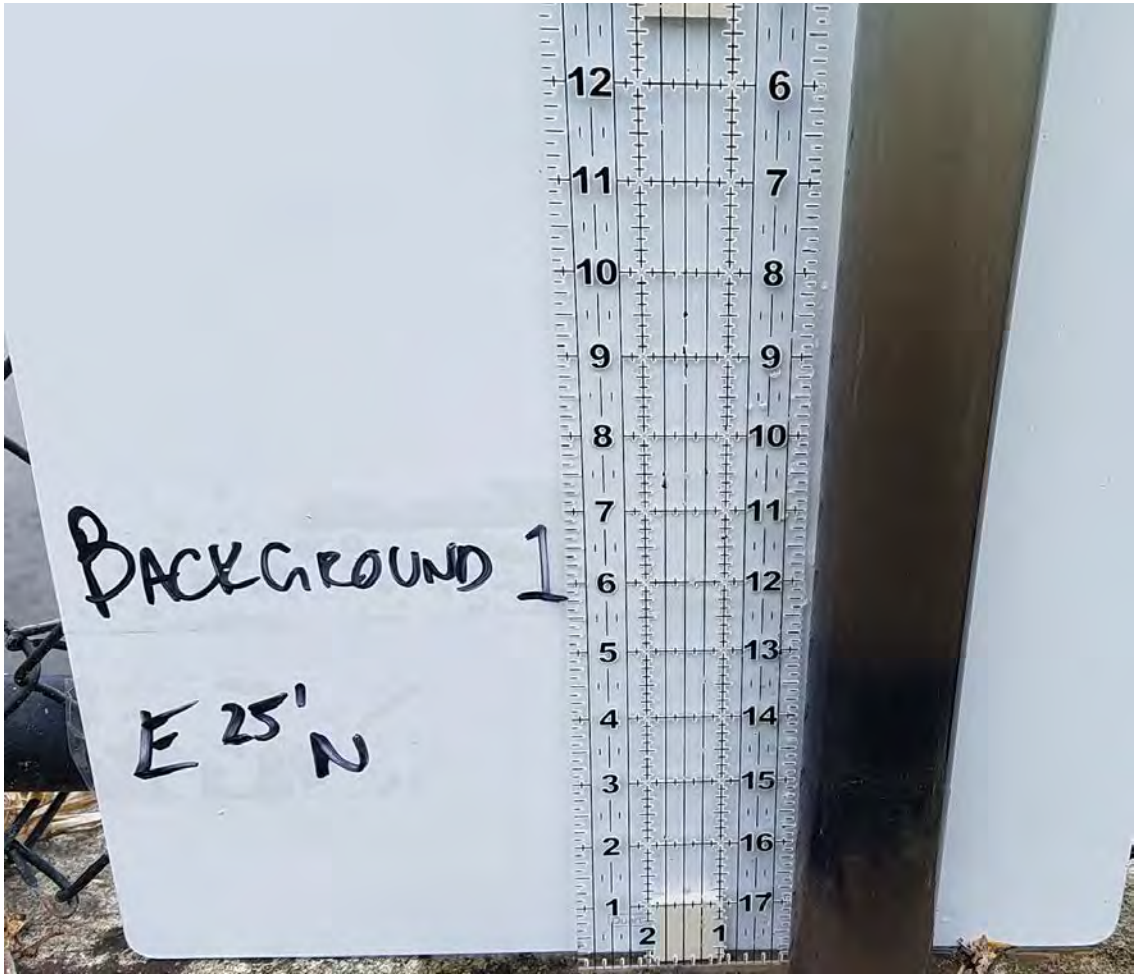
Sediment Core @

Background #1

E; 25-ft step

Prepared by: APTIM

Photographer: Dale Young



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Location: Pompano Beach, FL

Prepared by: APTIM

Photographer: Dale Young

Photograph No. 6

Date: 2/11/19

Description:

Sediment Core @

Background #1

F, 30-ft step

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 1

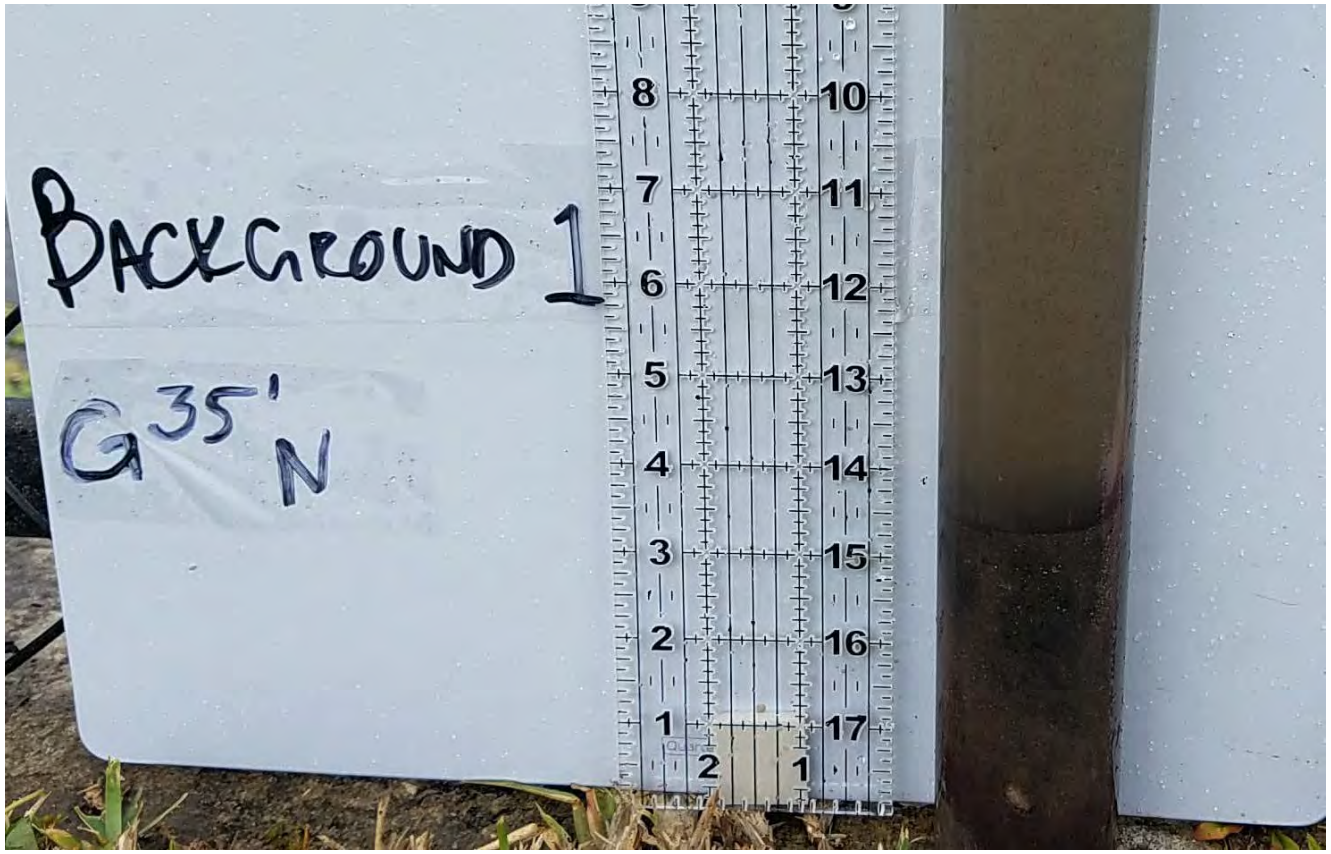
Date: 2/11/19

Description:

Sediment Core @

Background #1

G; 35-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 1

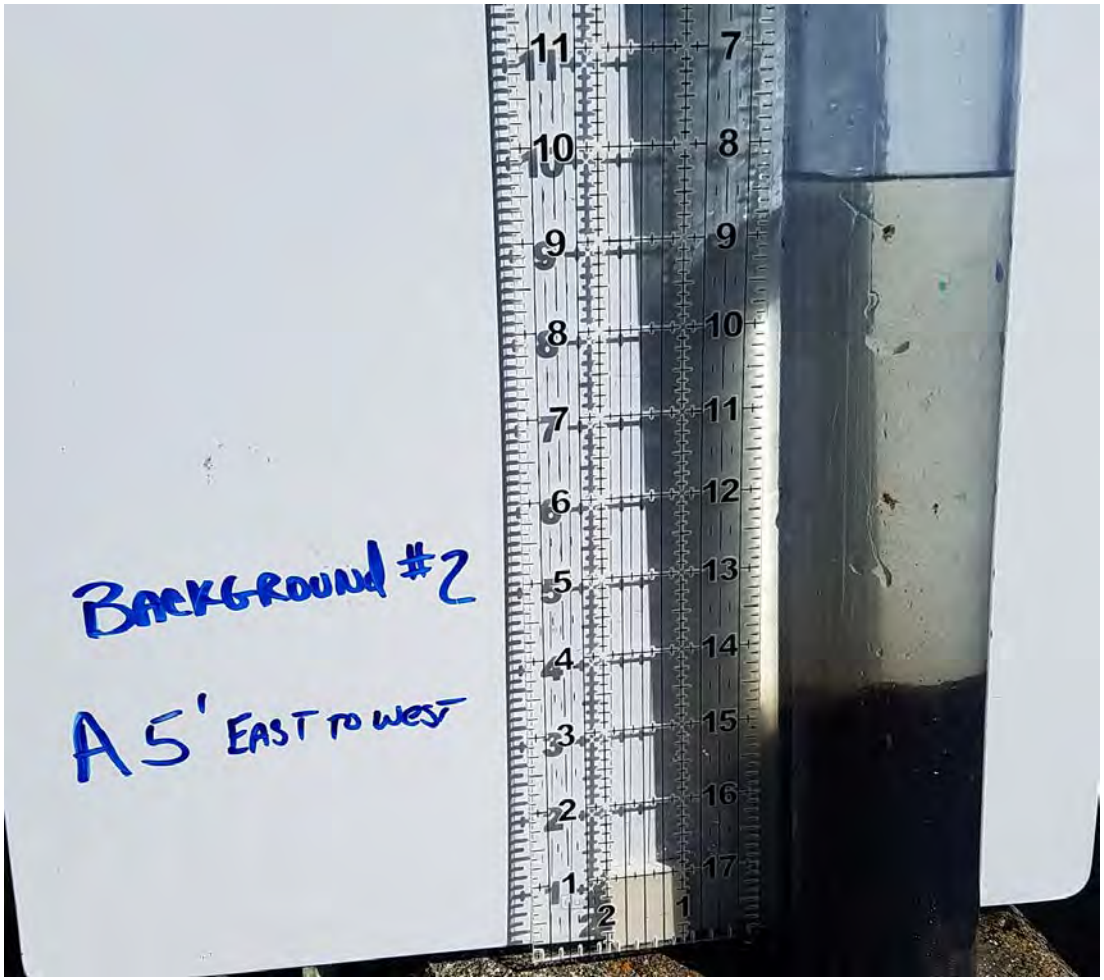
Date: 2/15/19

Description:

Sediment Core @

Background #2

A; 5-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 2

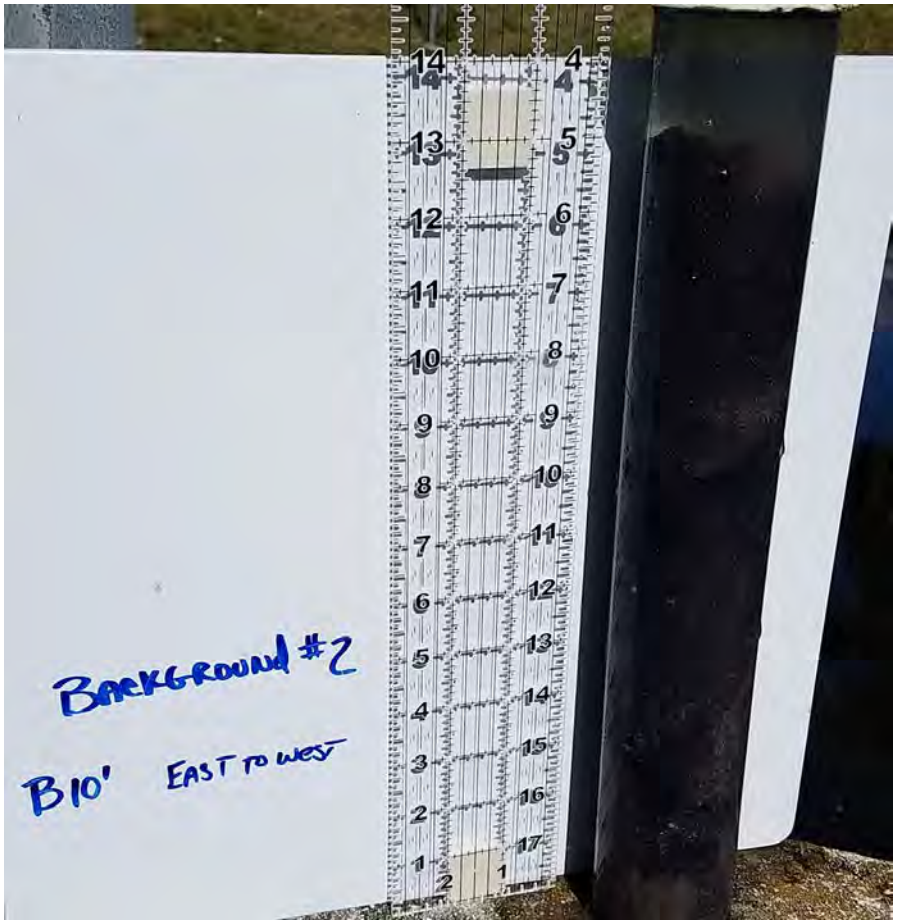
Date: 2/15/19

Description:

Sediment Core @

Background #2

B, 10-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 3

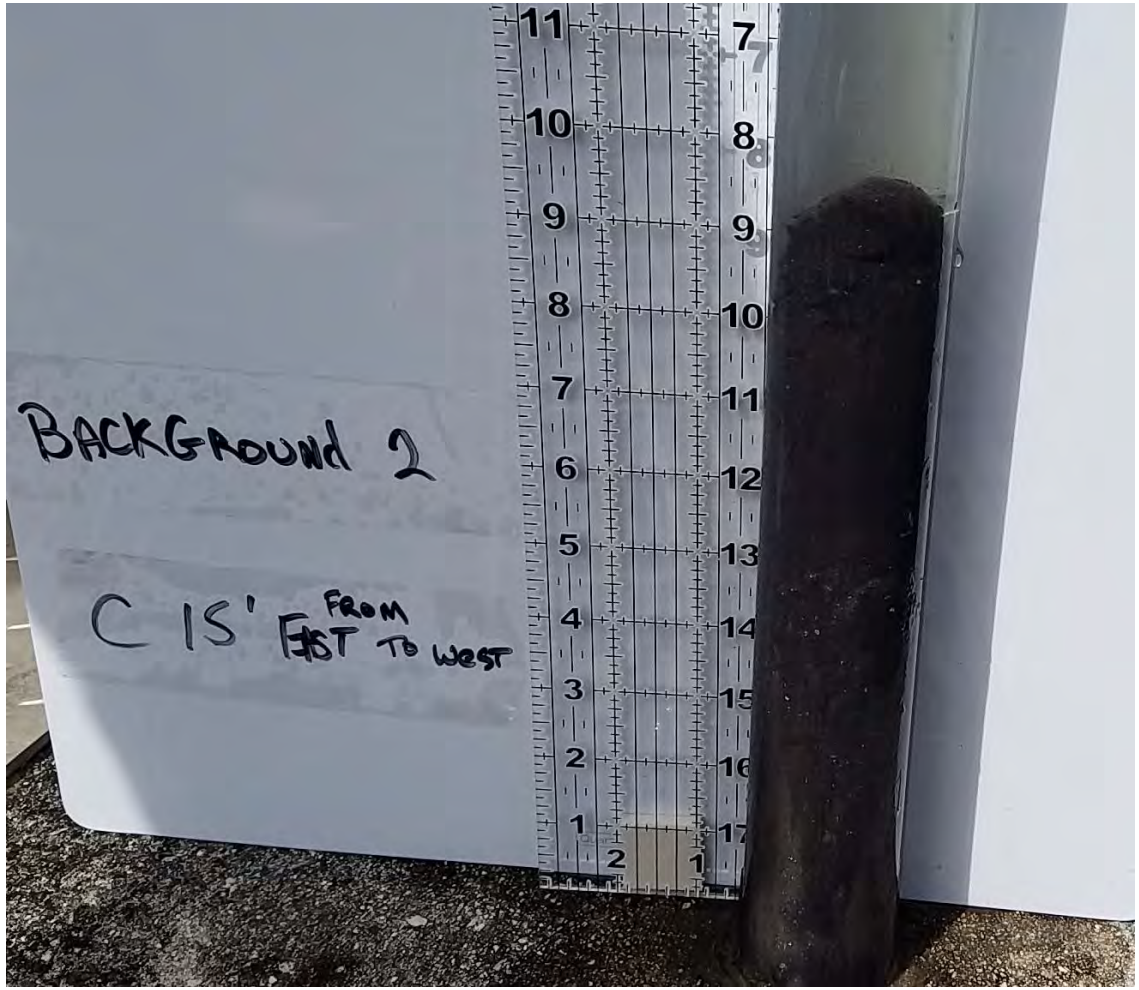
Date: 2/11/19

Description:

Sediment Core @

Background #2

C; 15-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Location: Pompano Beach, FL

Photograph No. 4

Date: 2/11/19

Description:

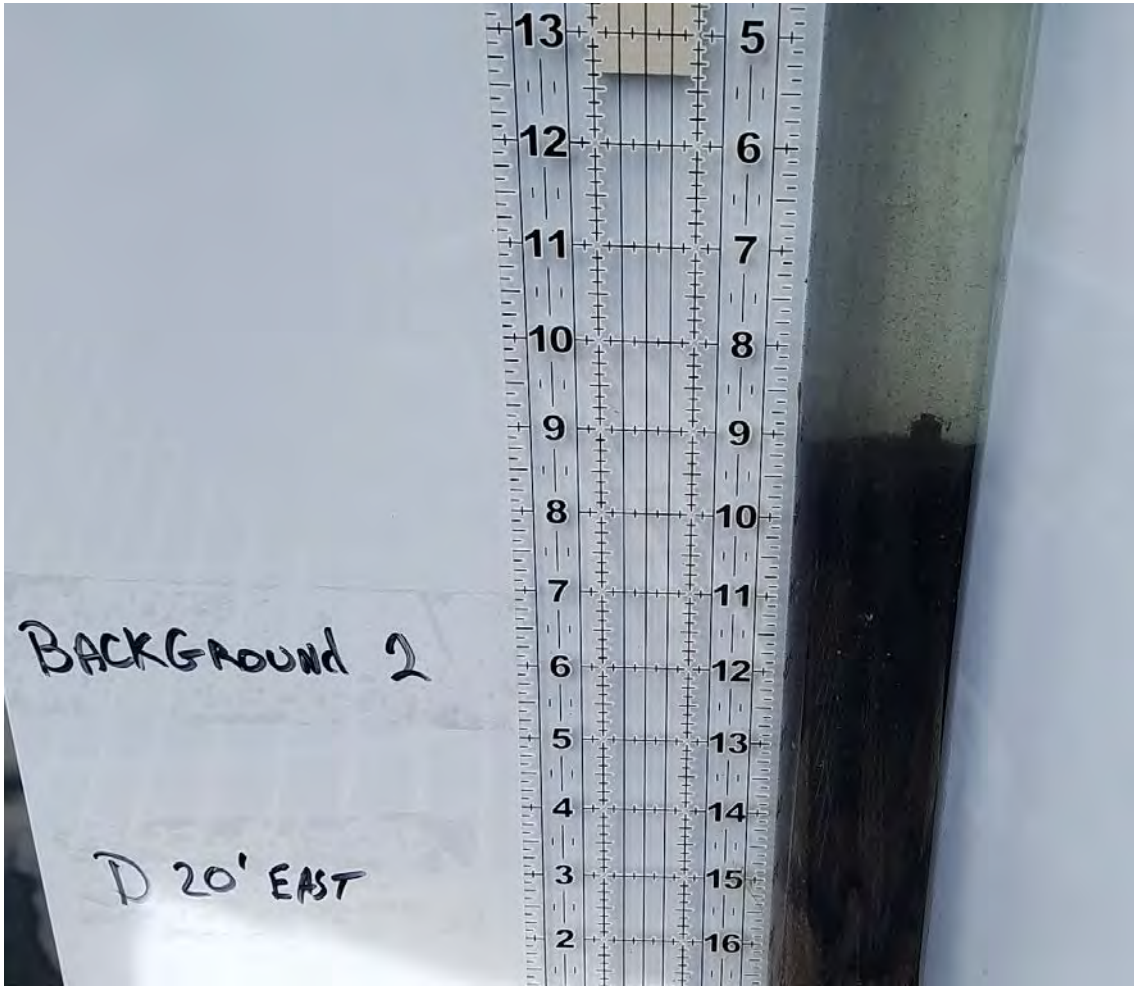
Sediment Core @

Background #2

D, 20-ft step

Prepared by: APTIM

Photographer: Dale Young



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 5

Date: 2/11/19

Description:

Sediment Core @

Background #2

E; 25-ft step

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 1

Date: 2/11/19

Description:

Sediment Core @

Background #3

A; 20-ft step

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 2

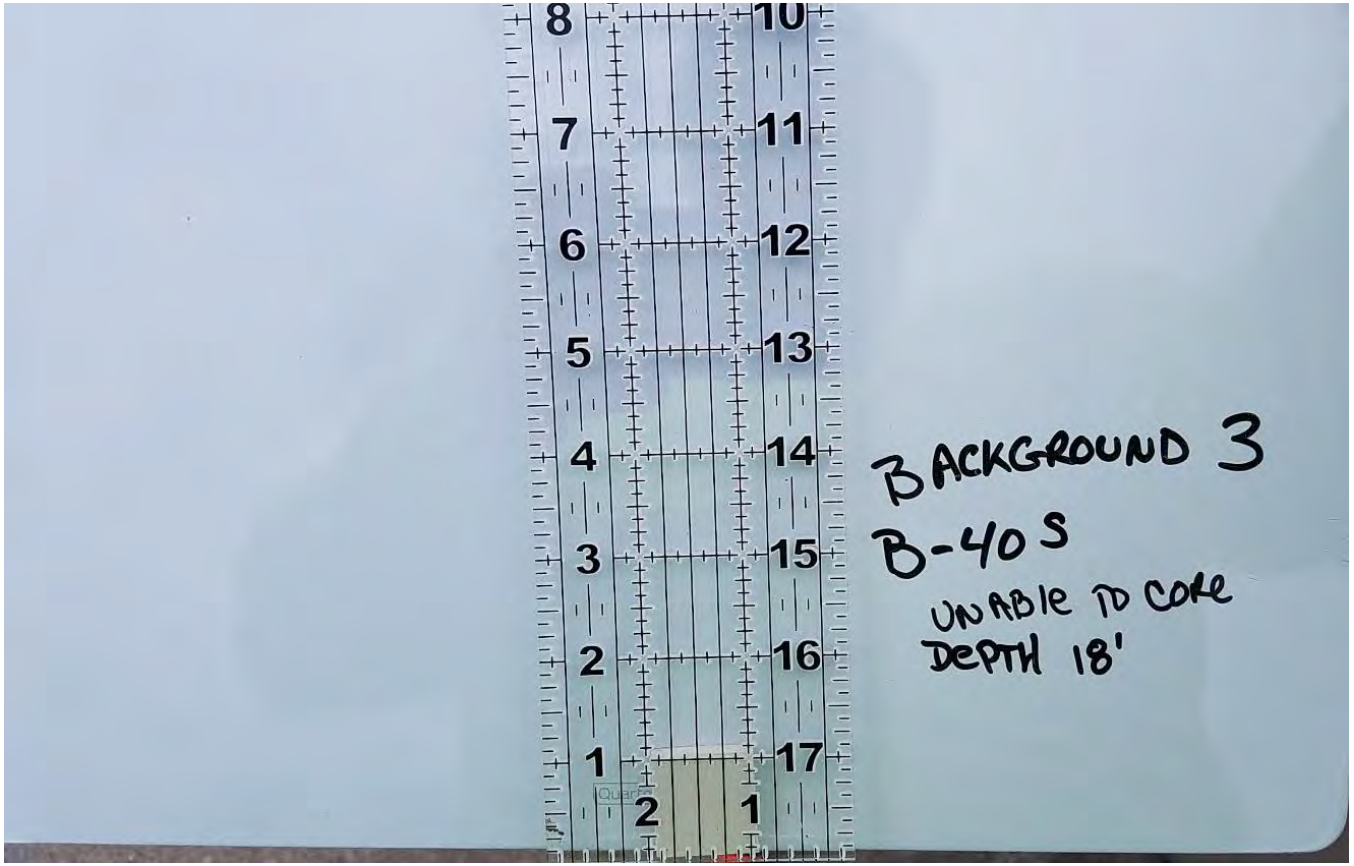
Date: 2/11/19

Description:

Sediment Core @

Background #3

B; 40-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 3

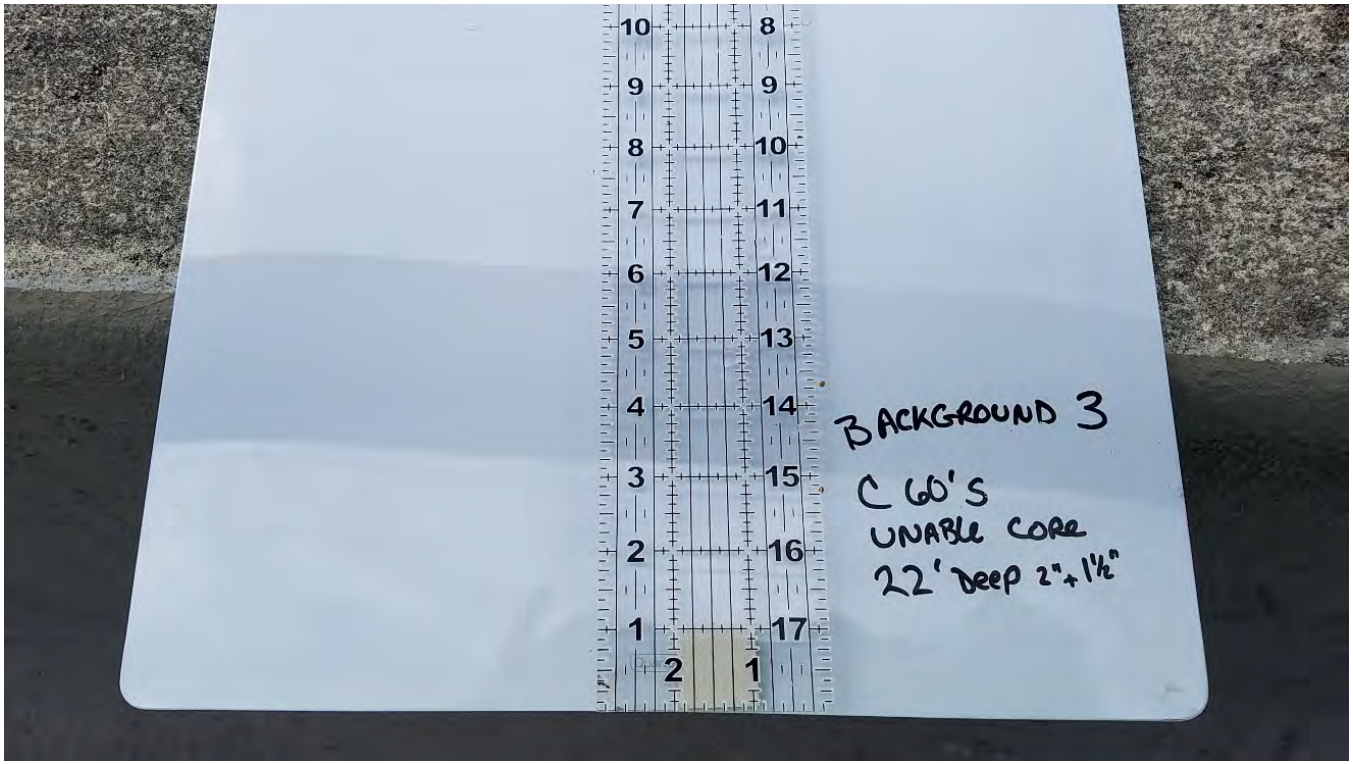
Date: 2/11/19

Description:

Sediment Core @

Background #3

C; 60-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 4

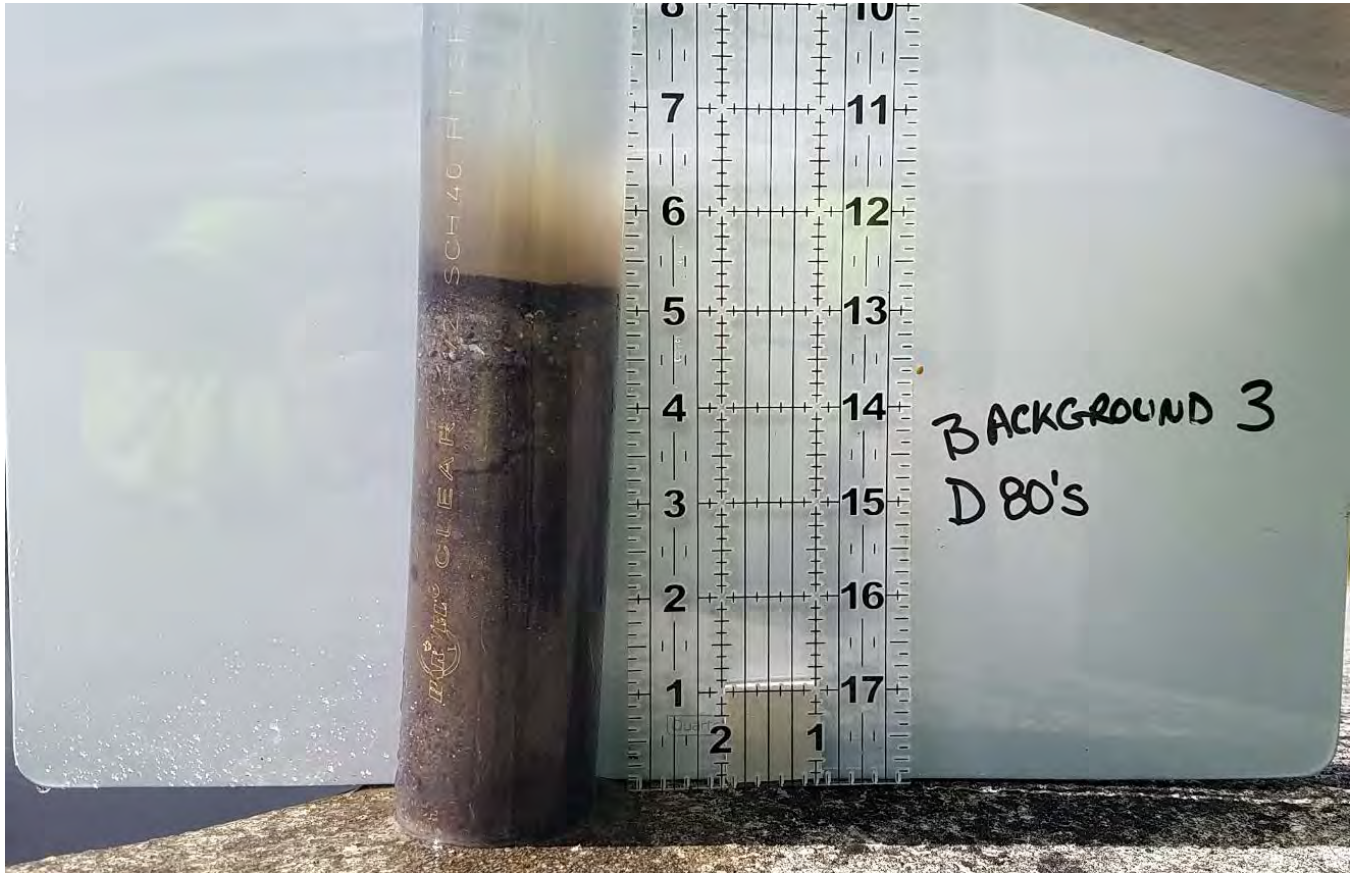
Date: 2/11/19

Description:

Sediment Core @

Background #3

D; 80-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 5

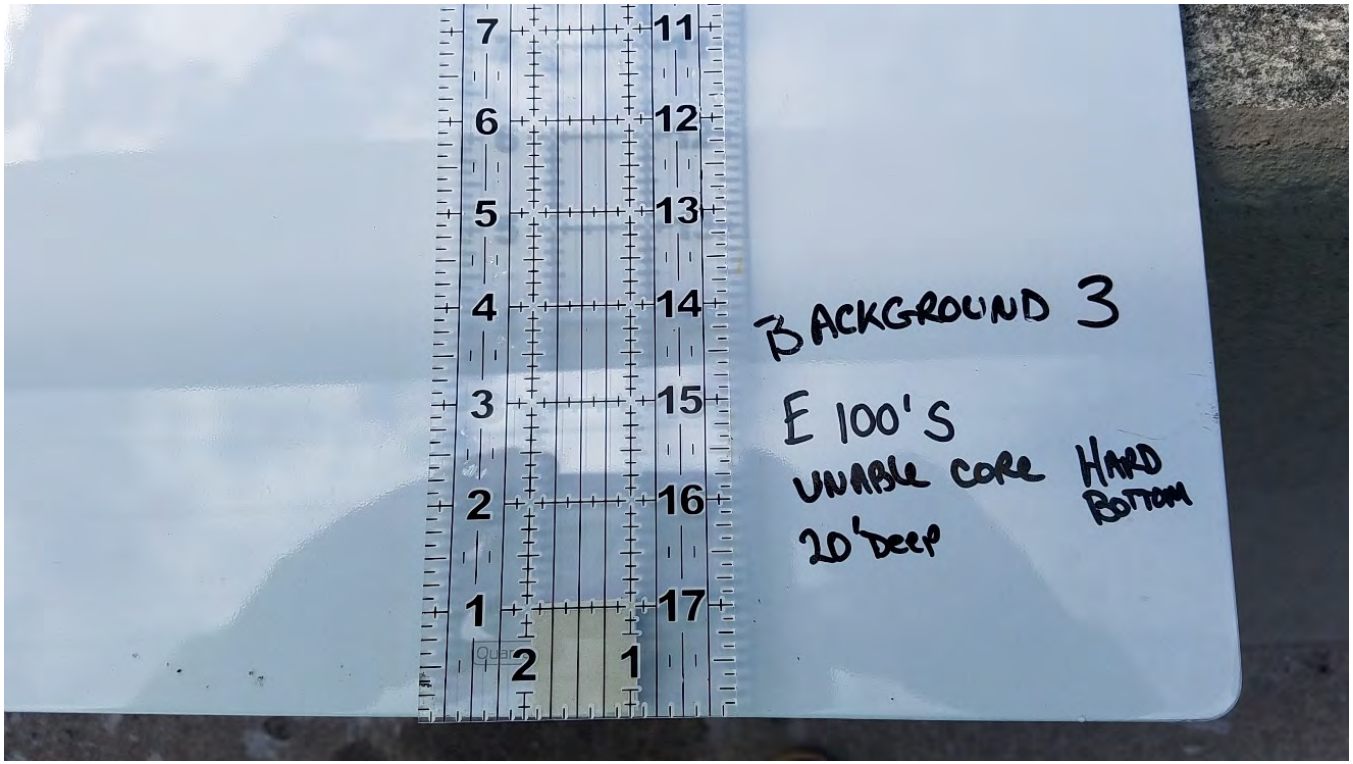
Date: 2/11/19

Description:

Sediment Core @

Background #3

E; 100-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 6

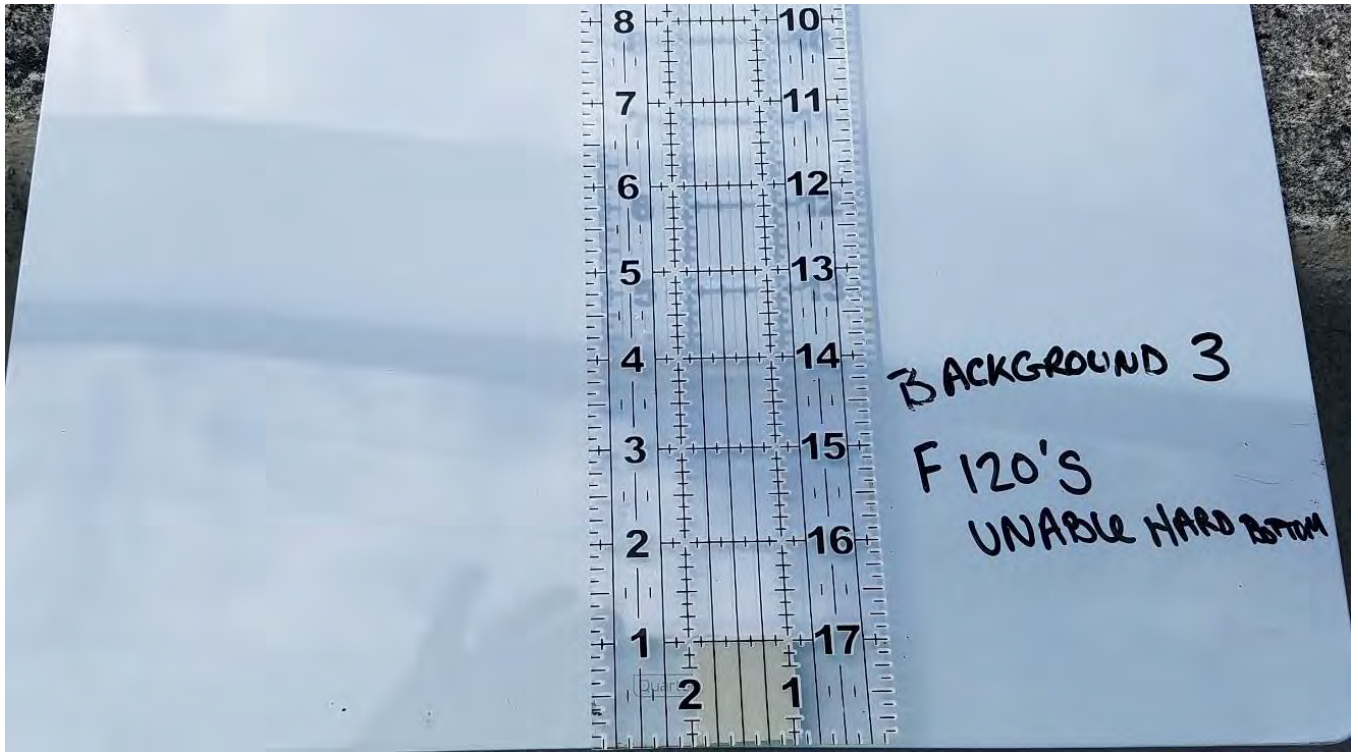
Date: 2/11/19

Description:

Sediment Core @

Background #3

F; 120-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 7

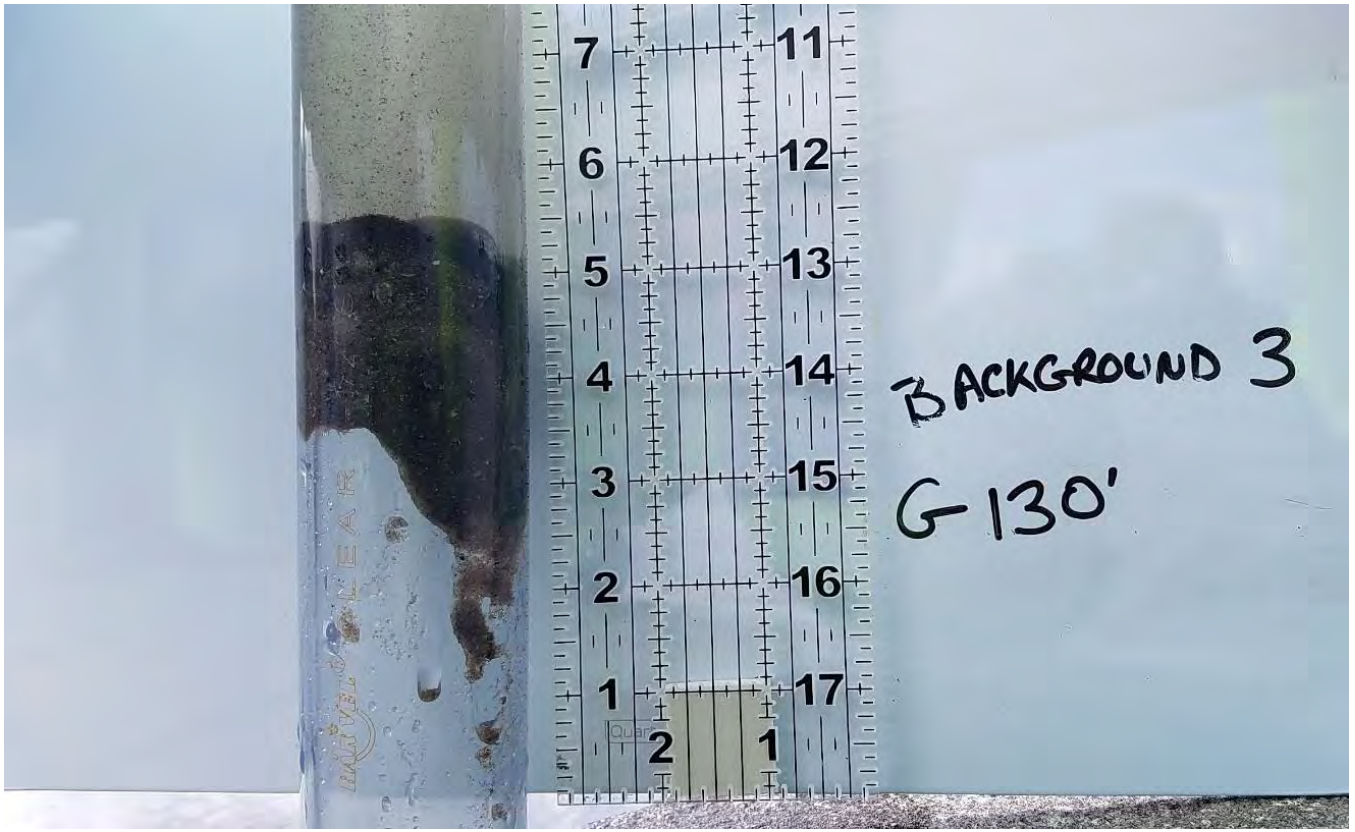
Date: 2/11/19

Description:

Sediment Core @

Background #3

G; 130-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 8

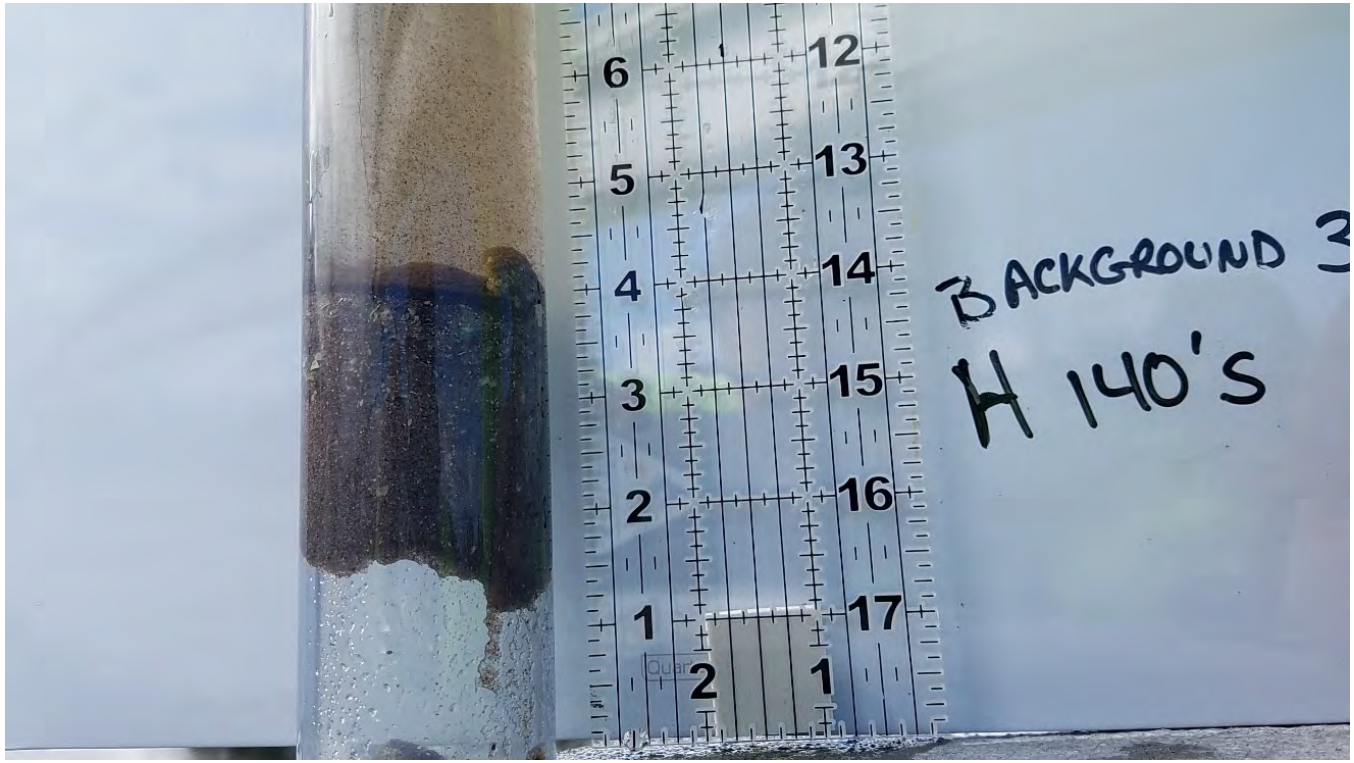
Date: 2/11/19

Description:

Sediment Core @

Background #3

H; 140-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

hotograph No. 1

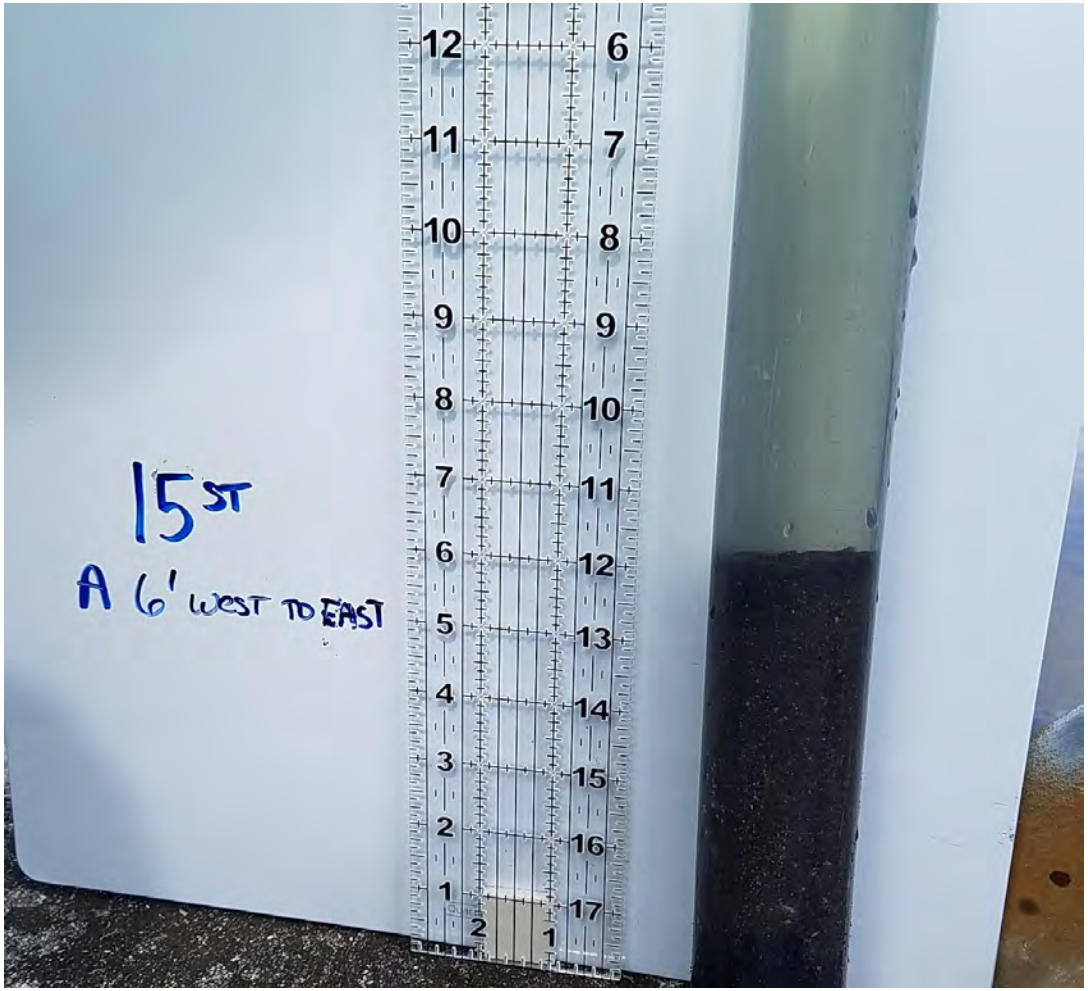
Date: 2/12/19

Description:

Sediment Core @

C-1 NE 15TH ST Crossing

A; 6-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 2

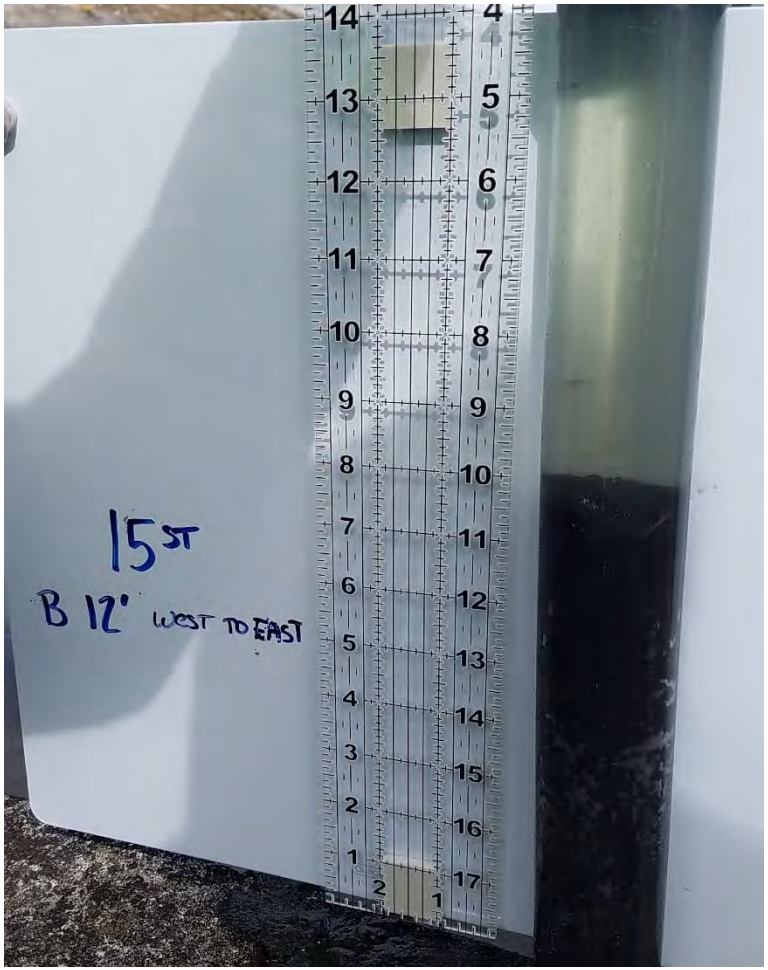
Date: 2/12/19

Description:

Sediment Core @

C-1 NE 15TH ST Crossing

B; 12-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 3

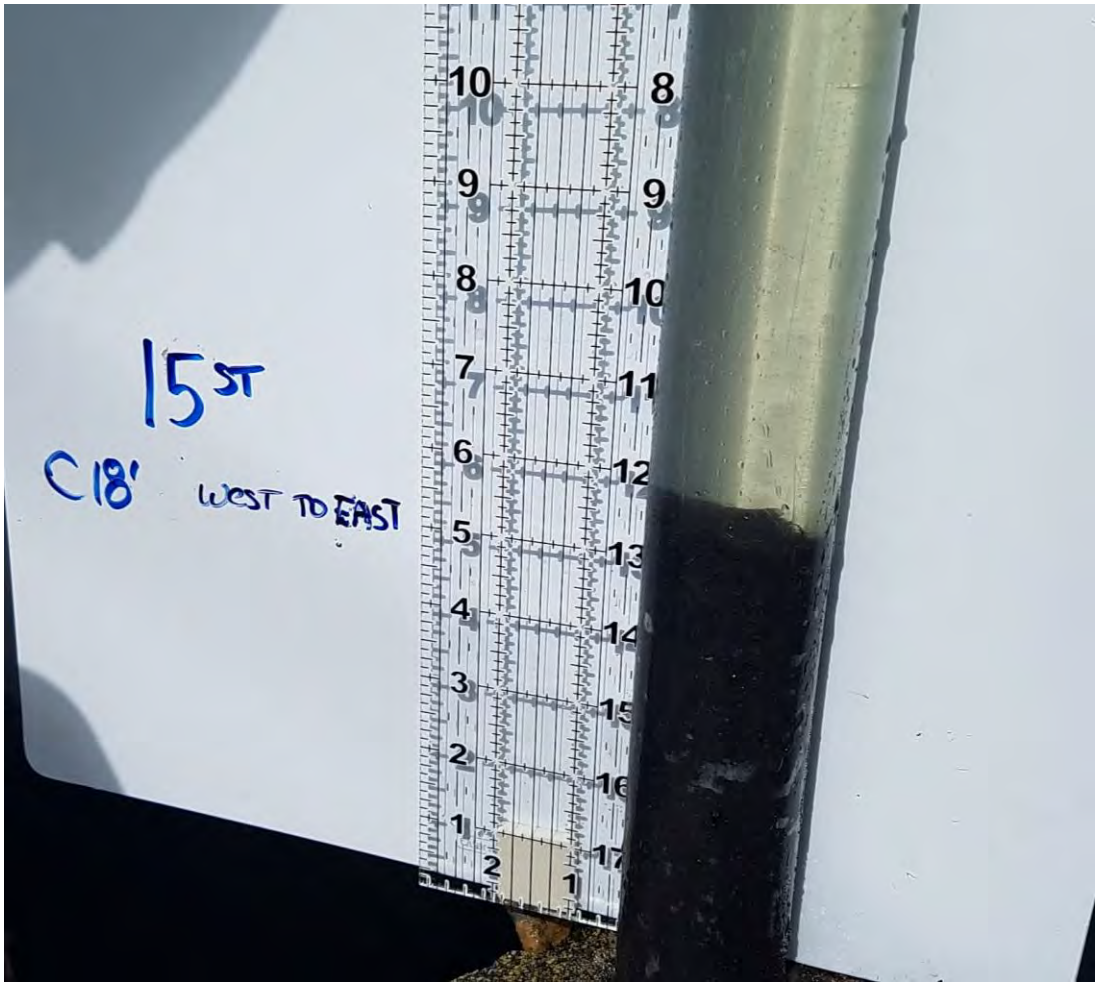
Date: 2/12/19

Description:

Sediment Core @

C-1 NE 15TH ST Crossing

C; 18-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 4

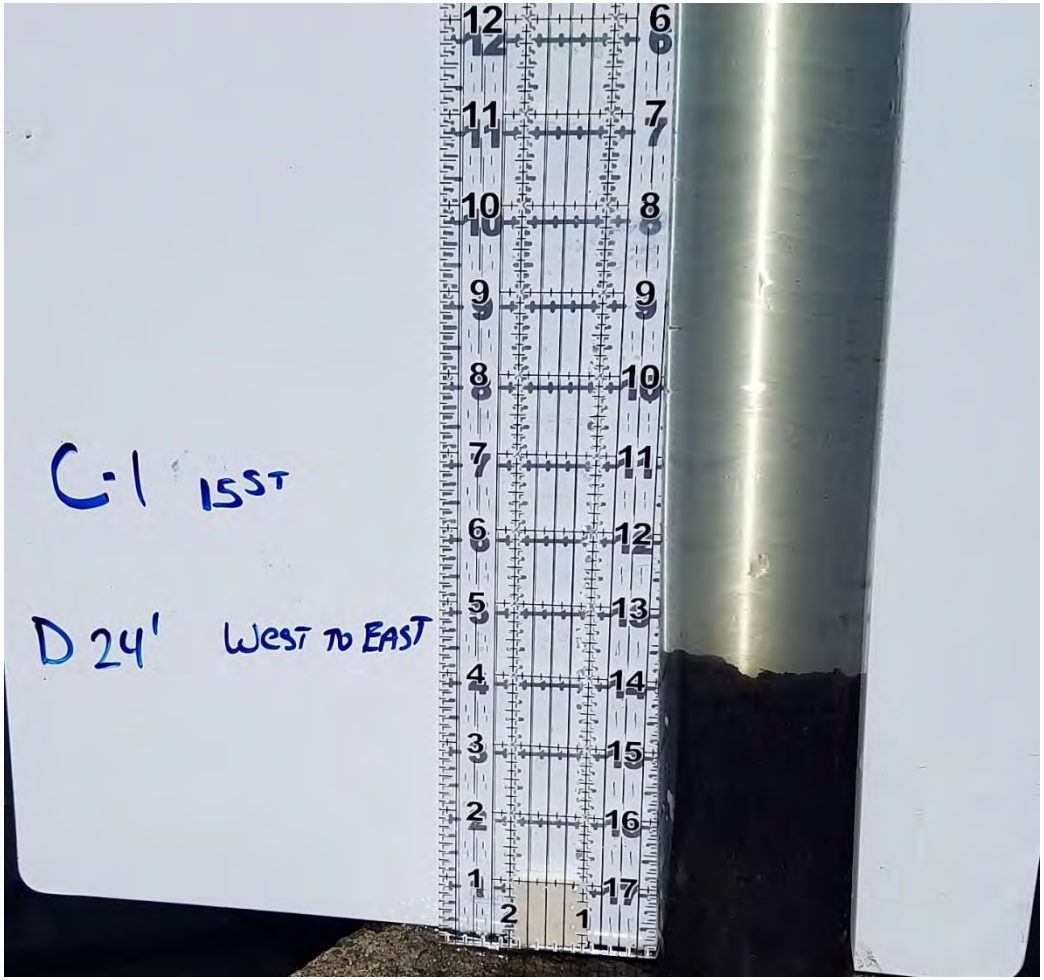
Date: 2/15/19

Description:

Sediment Core @

C-1 NE 15TH ST Crossing

D; 24-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 5

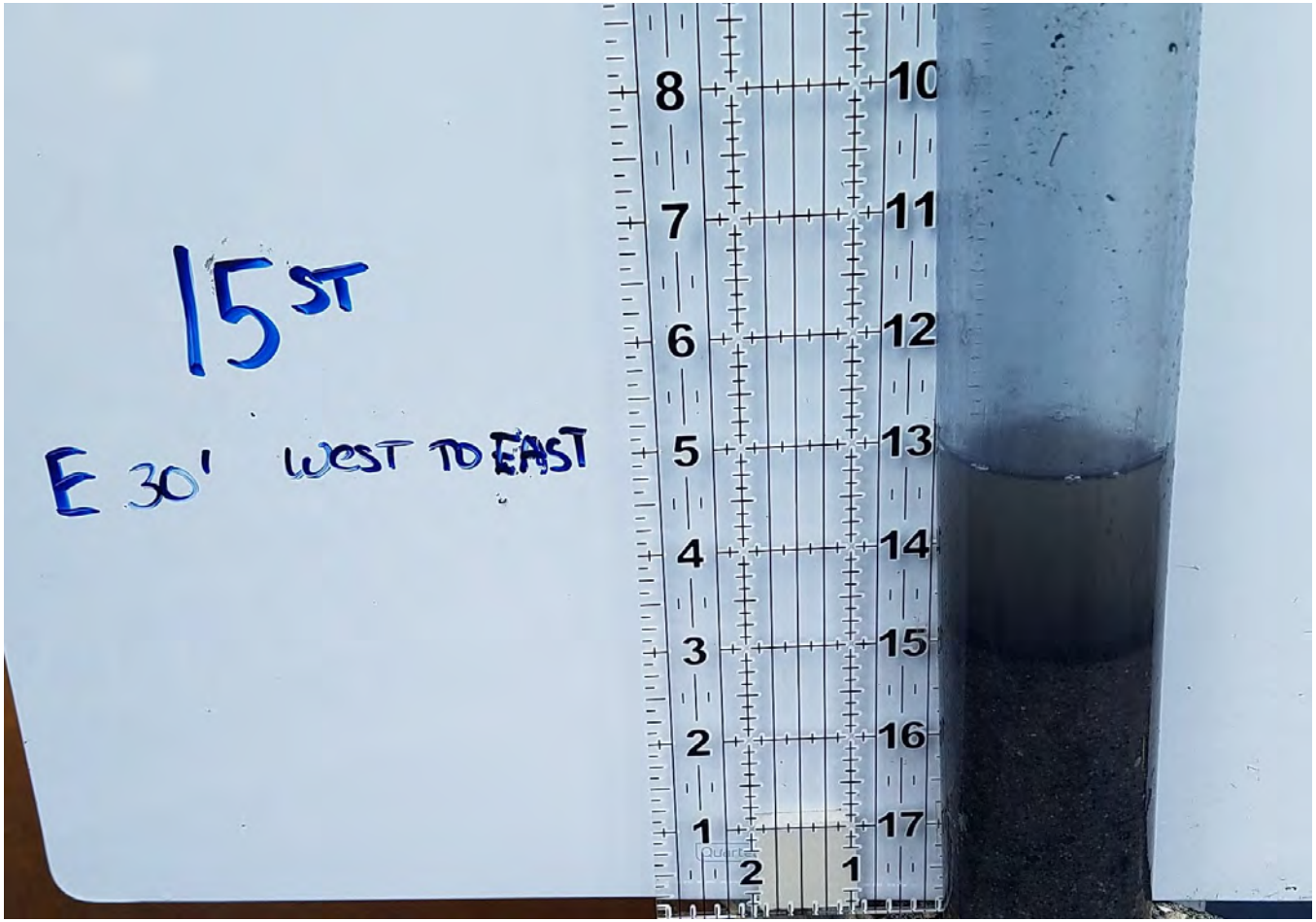
Date: 2/12/19

Description:

Sediment Core @

C-1 NE 15TH ST Crossing

E; 30-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 6

Date: 2/12/19

Description:

Sediment Core @

C-1 NE 15TH ST Crossing

Representative

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 1

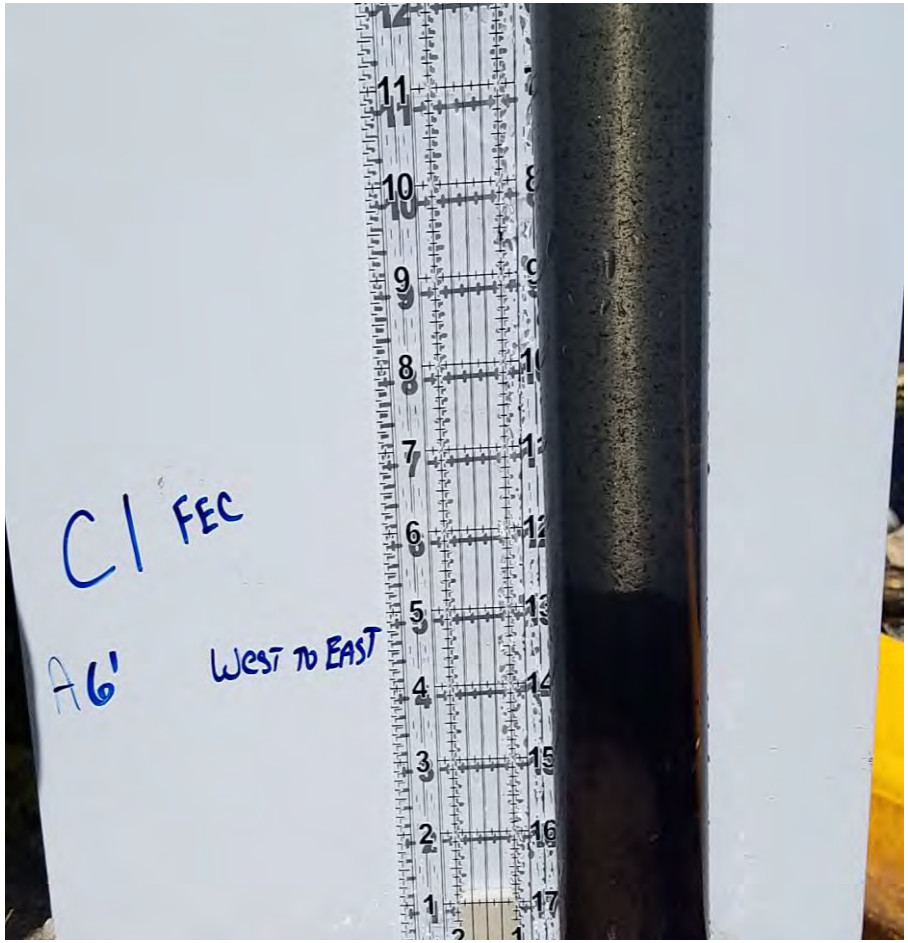
Date: 2/12/19

Description:

Sediment Core @

C-1 FEC Crossing

A; 6-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 2

Date: 2/12/19

Description:

Sediment Core @

C-1 FEC Crossing

B; 12-ft step

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 3

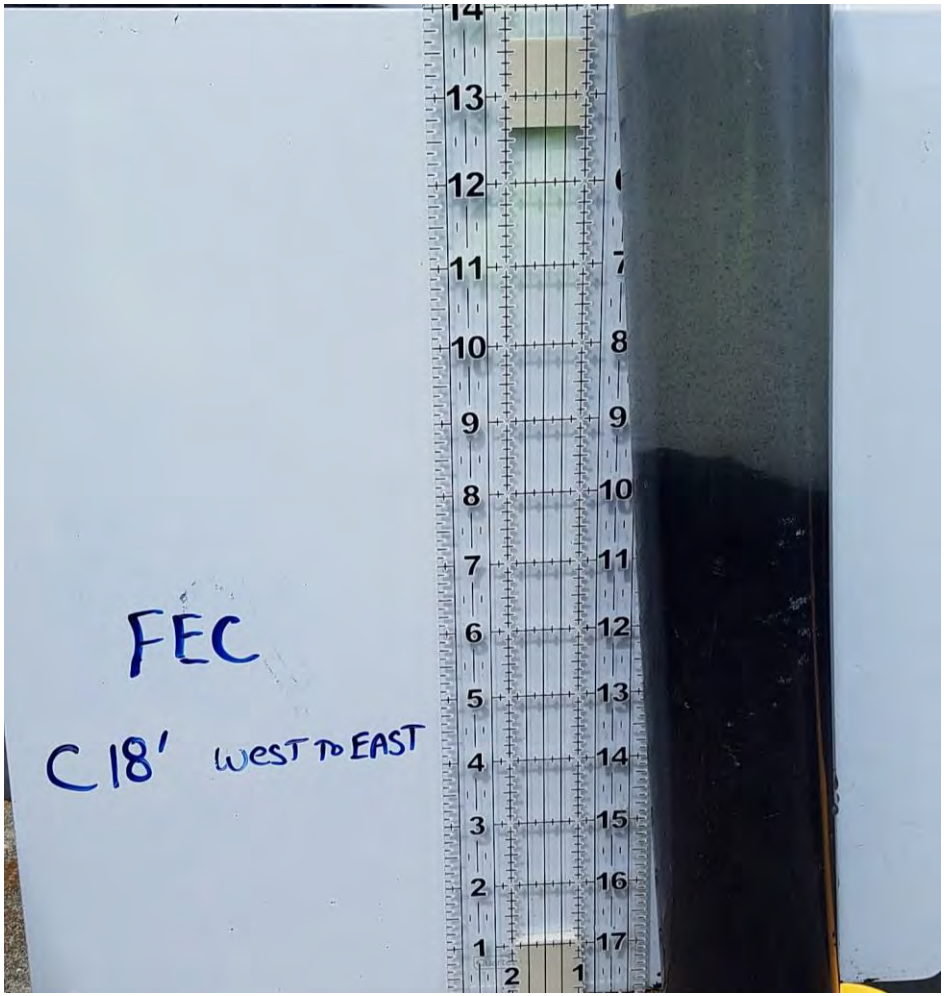
Date: 2/12/19

Description:

Sediment Core @

C-1 FEC Crossing

C; 18-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 4

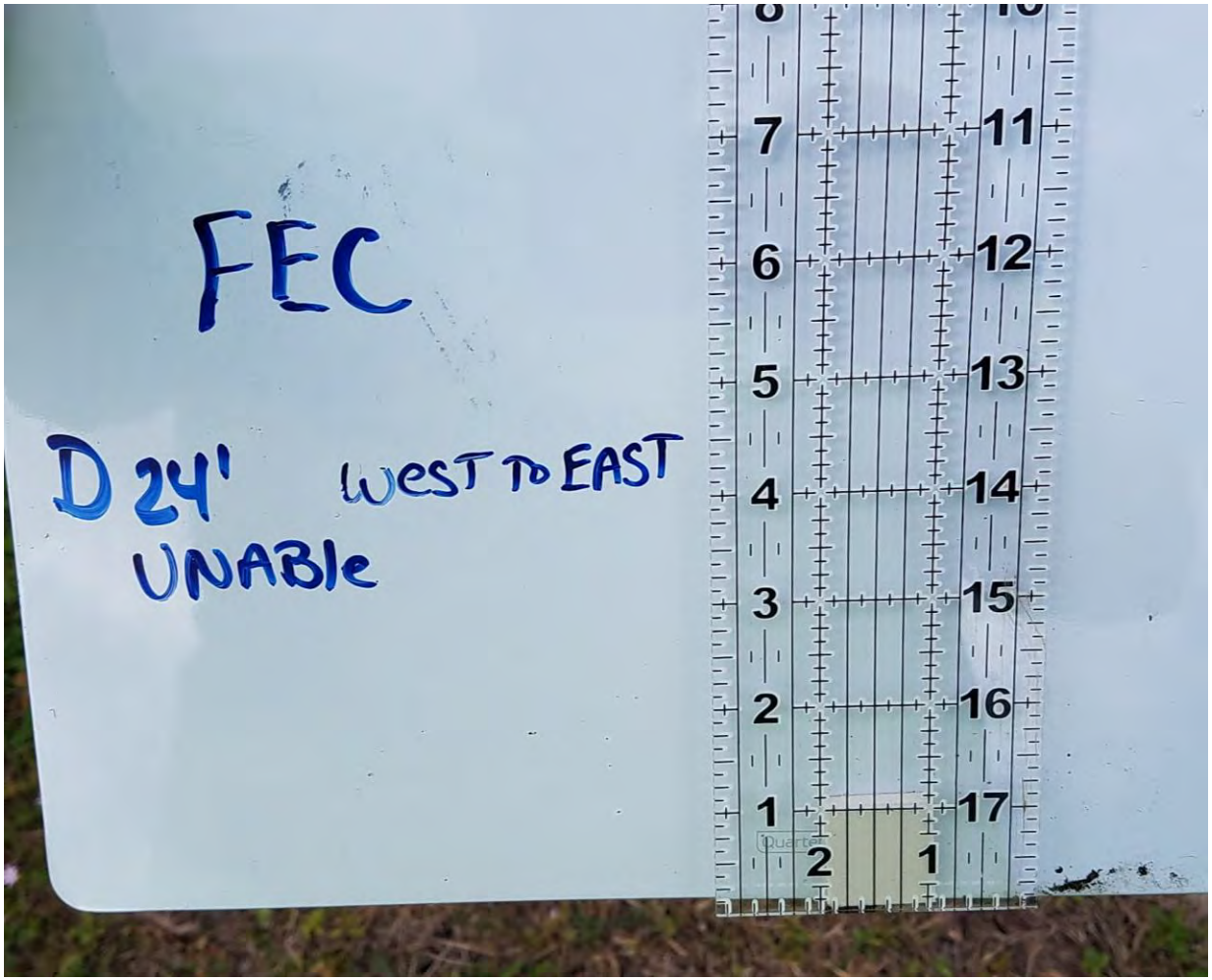
Date: 2/12/19

Description:

Sediment Core @

C-1 FEC Crossing

D; 24-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 5

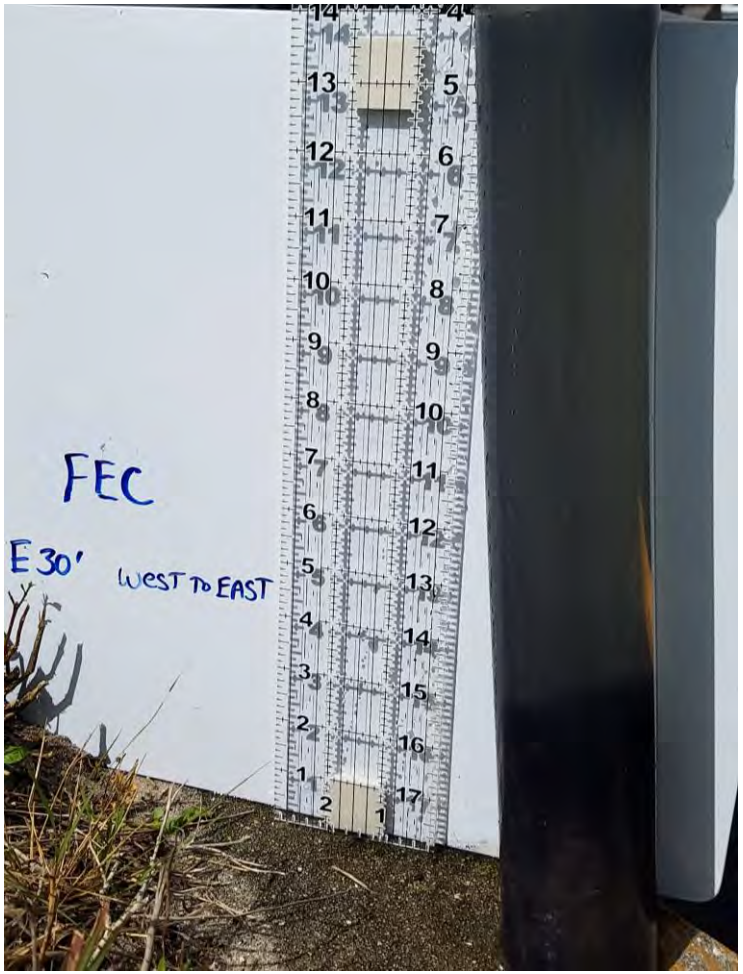
Date: 2/12/19

Description:

Sediment Core @

C-1 FEC Crossing

E; 30-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 6

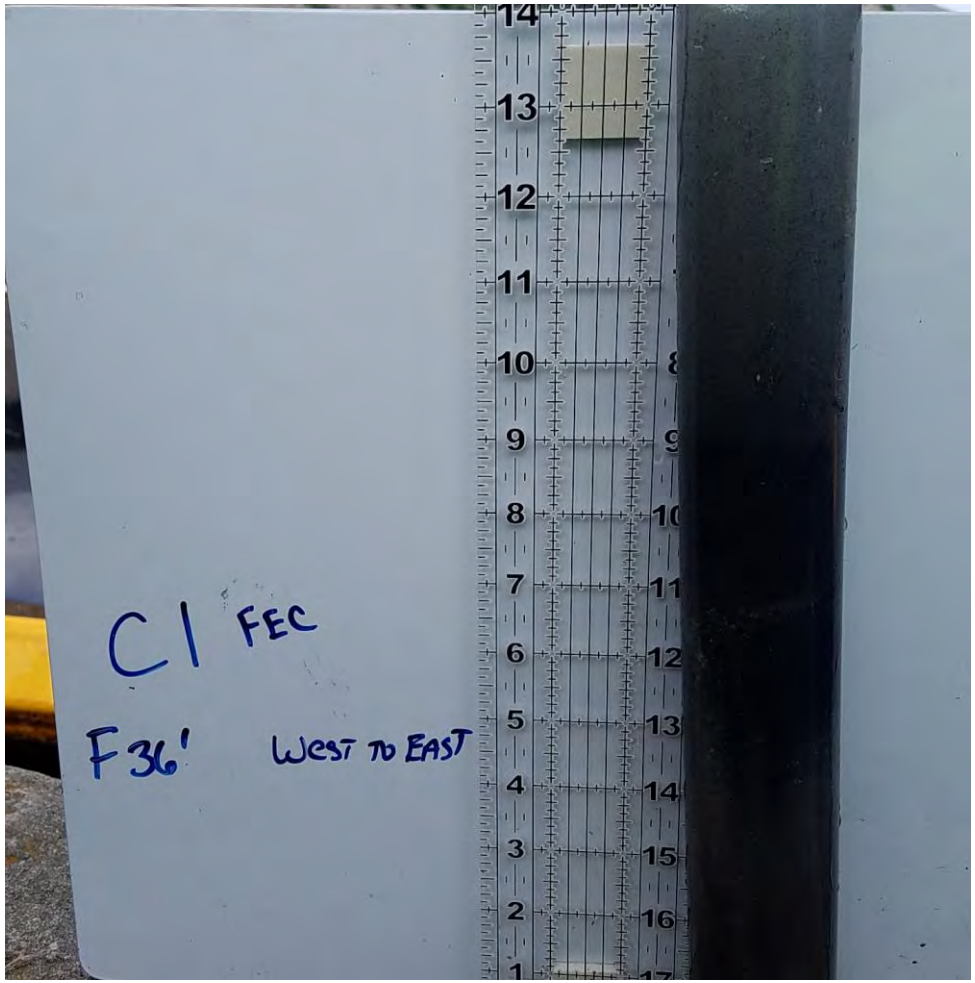
Date: 2/12/19

Description:

Sediment Core @

C-1 FEC Crossing

F; 36-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 7

Date: 2/18/19

Description:

Sediment Core @

C-1 FEC Crossing

Representative

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 1

Date: 2/12/19

Description:

Sediment Core @

C-1 MLK Crossing

A; 6-ft step

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 2

Date: 2/12/19

Description:

Sediment Core @

C-1 MLK Crossing

B; 12-ft step

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 3

Date: 2/12/19

Description:

Sediment Core @

C-1 MLK Crossing

C; 18-ft step

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 4

Date: 2/12/19

Description:

Sediment Core @

C-1 MLK Crossing

D; 24-ft step

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 5

Date: 2/12/19

Description:

Sediment Core @

C-1 MLK Crossing

E; 30-ft step

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 6

Date: 2/12/19

Description:

Sediment Core @

C-1 MLK Crossing

F; 36-ft step

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 7

Date: 2/15/19

Description:

Sediment Core @

C-1 MLK Crossing

G; 42-ft step

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 8

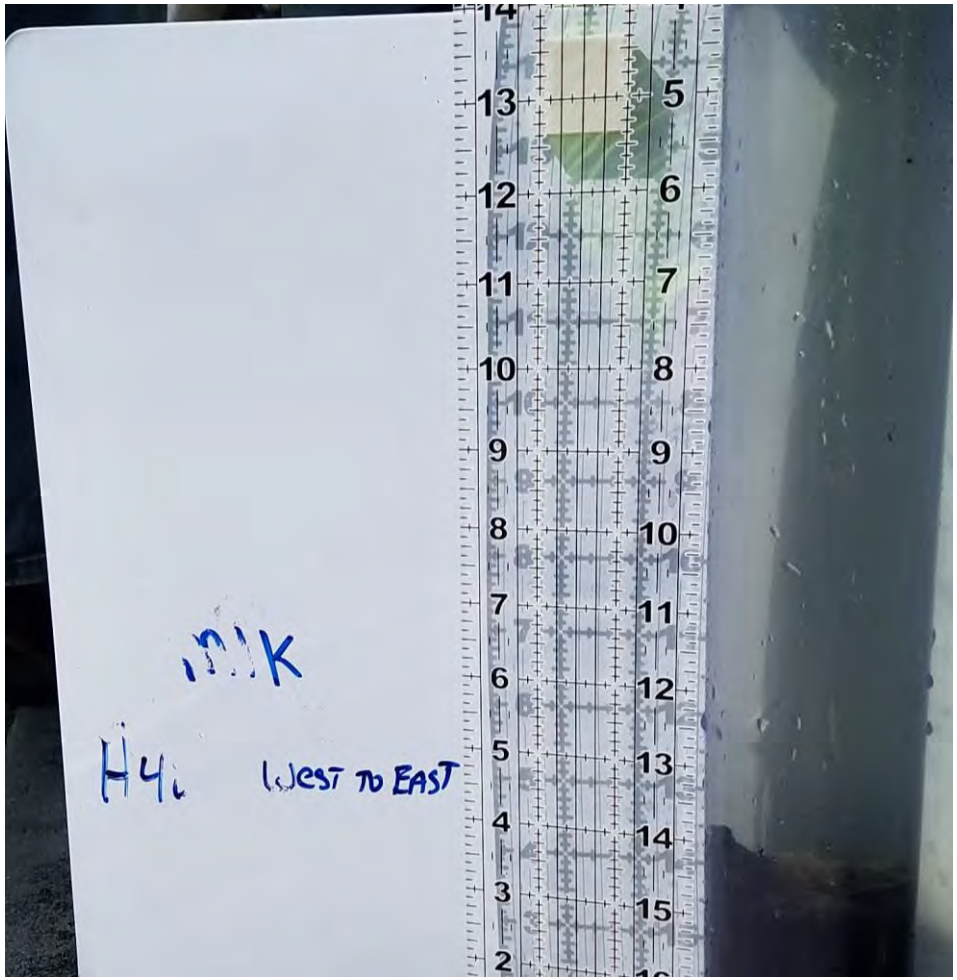
Date: 2/15/19

Description:

Sediment Core @

C-1 MLK Crossing

H; 48-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 8

Date: 2/18/19

Description:

Sediment Core @

C-1 MLK Crossing

Representative

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 1

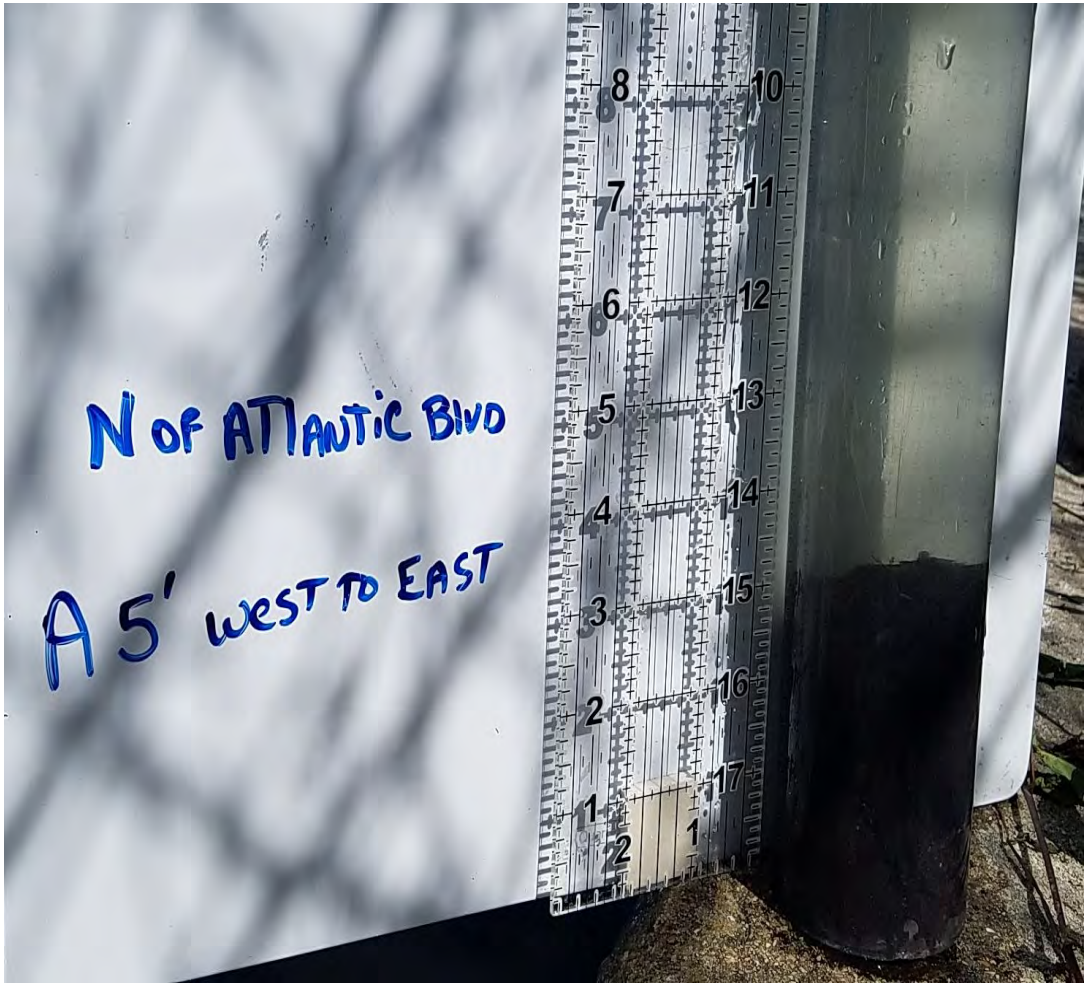
Date: 2/12/19

Description:

Sediment Core @

C-1 Atlantic Culvert Crossing

A; 5-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 2

Date: 2/12/19

Description:

Sediment Core @

C-1 Atlantic Culvert Crossing

B; 10-ft step

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Location: Pompano Beach, FL

Prepared by: APTIM

Photographer: Dale Young

Photograph No. 3

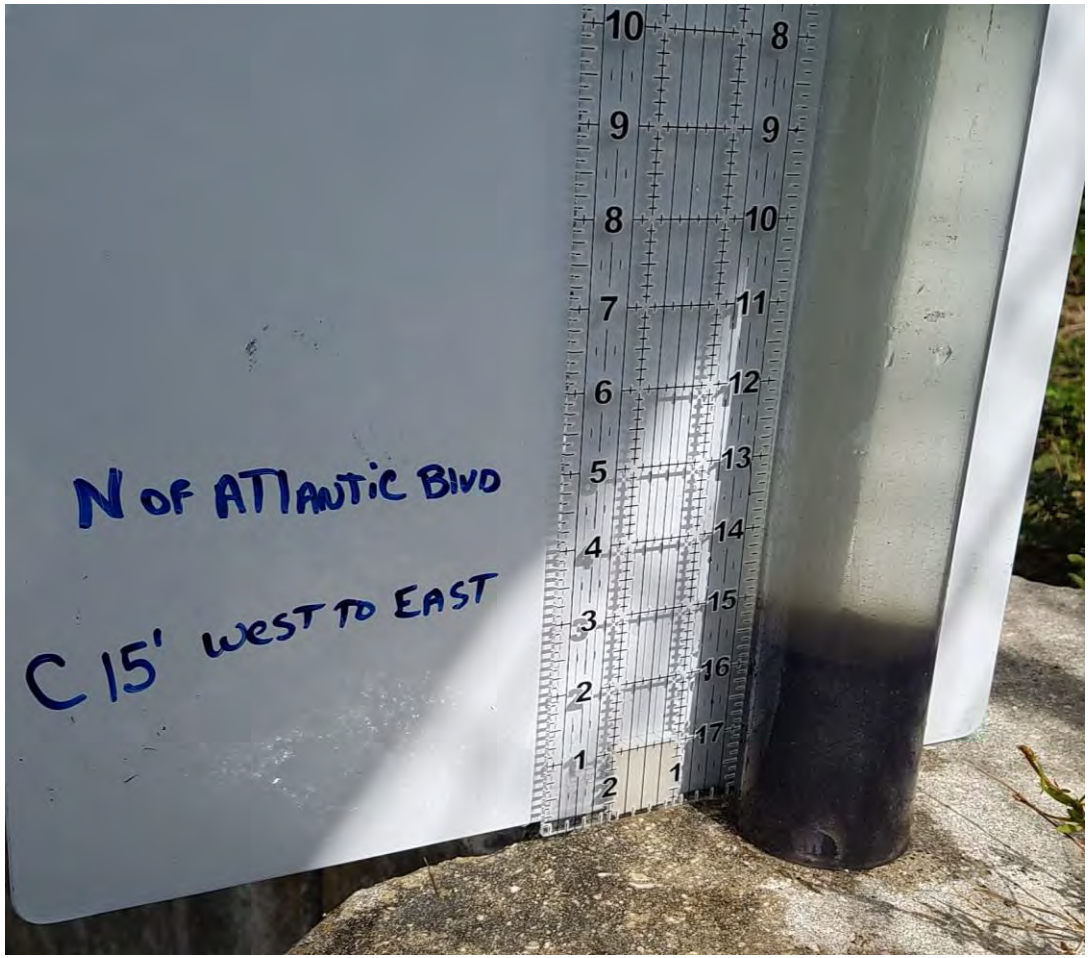
Date: 2/12/19

Description:

Sediment Core @

C-1 Atlantic Culvert Crossing

C; 15-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 3

Date: 2/18/19

Description:

Sediment Core @

C-1 Atlantic Culvert Crossing

Representative

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 1

Date: 2/12/19

Description:

Sediment Core @

Pompano Canal Atlantic

Dixie Culvert

A; 6-ft step

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 2

Date: 2/12/19

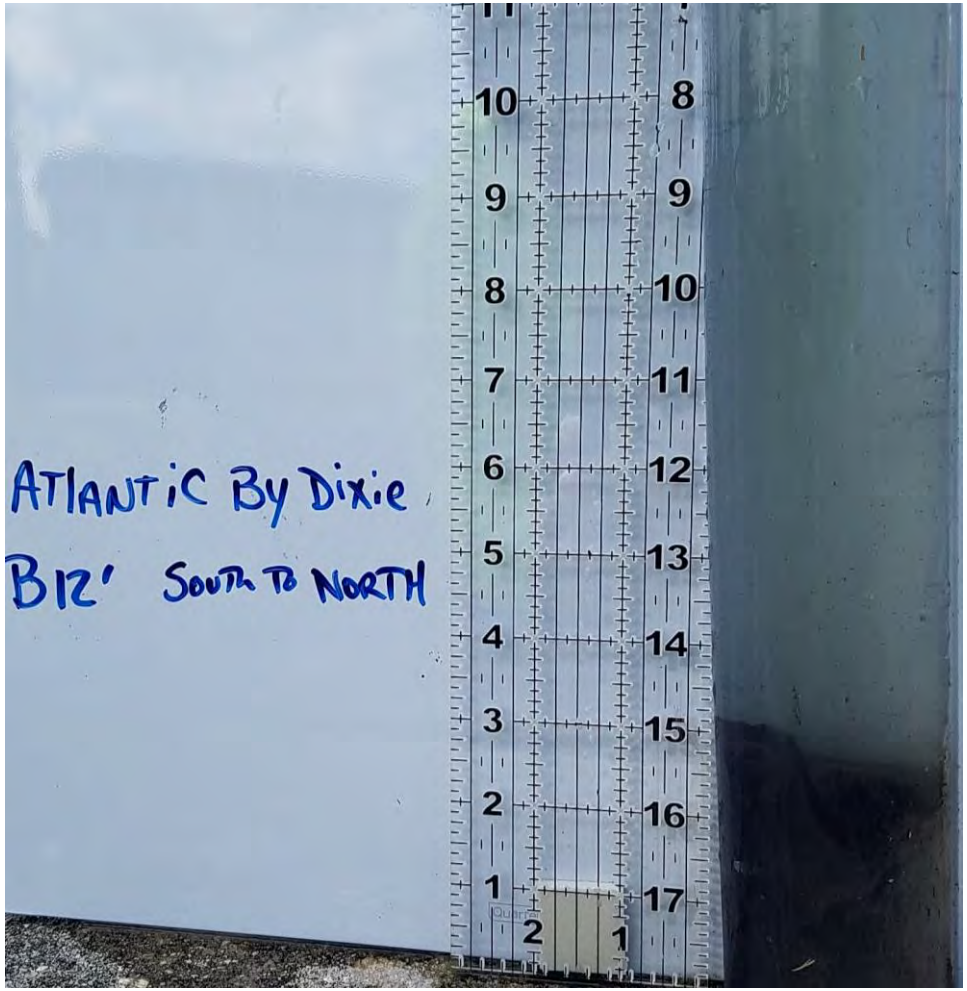
Description:

Sediment Core @

Pompano Canal Atlantic

Dixie Culvert

B; 12-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 3

Date: 2/12/19

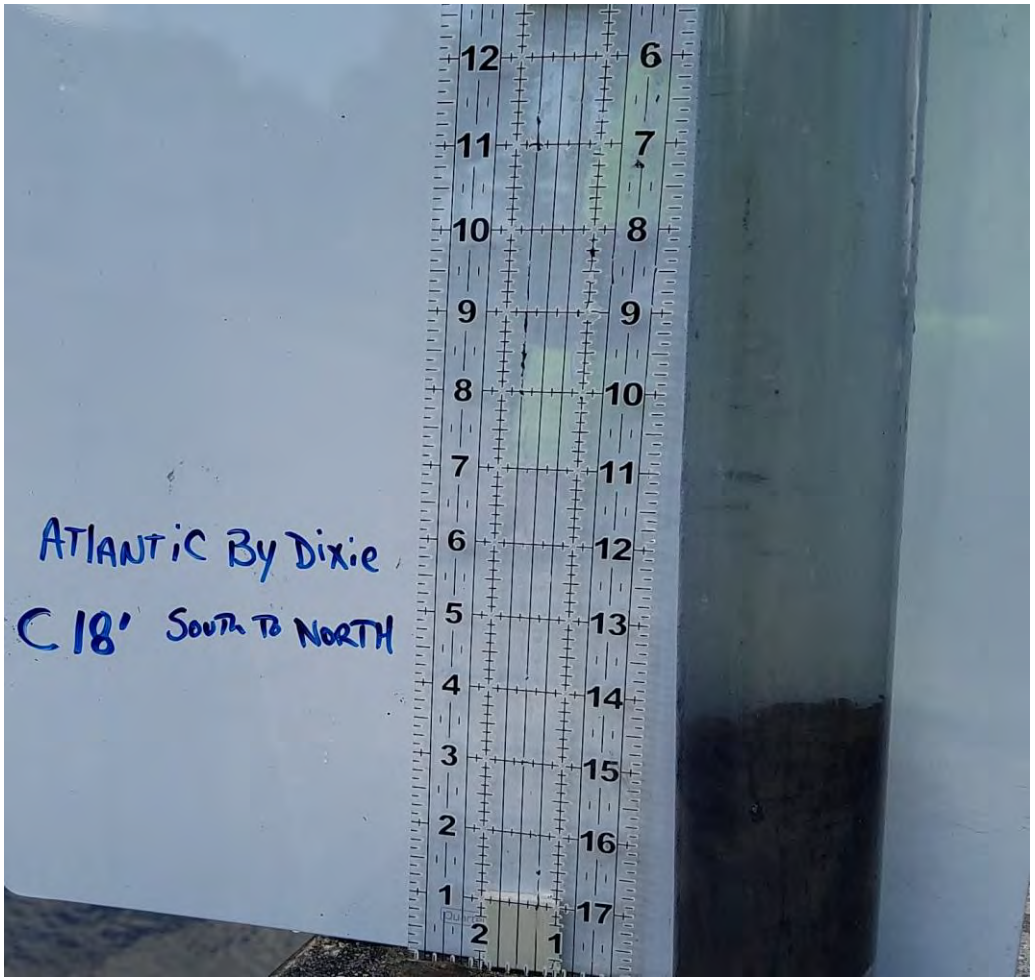
Description:

Sediment Core @

Pompano Canal Atlantic

Dixie Culvert

C; 18-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 4

Date: 2/12/19

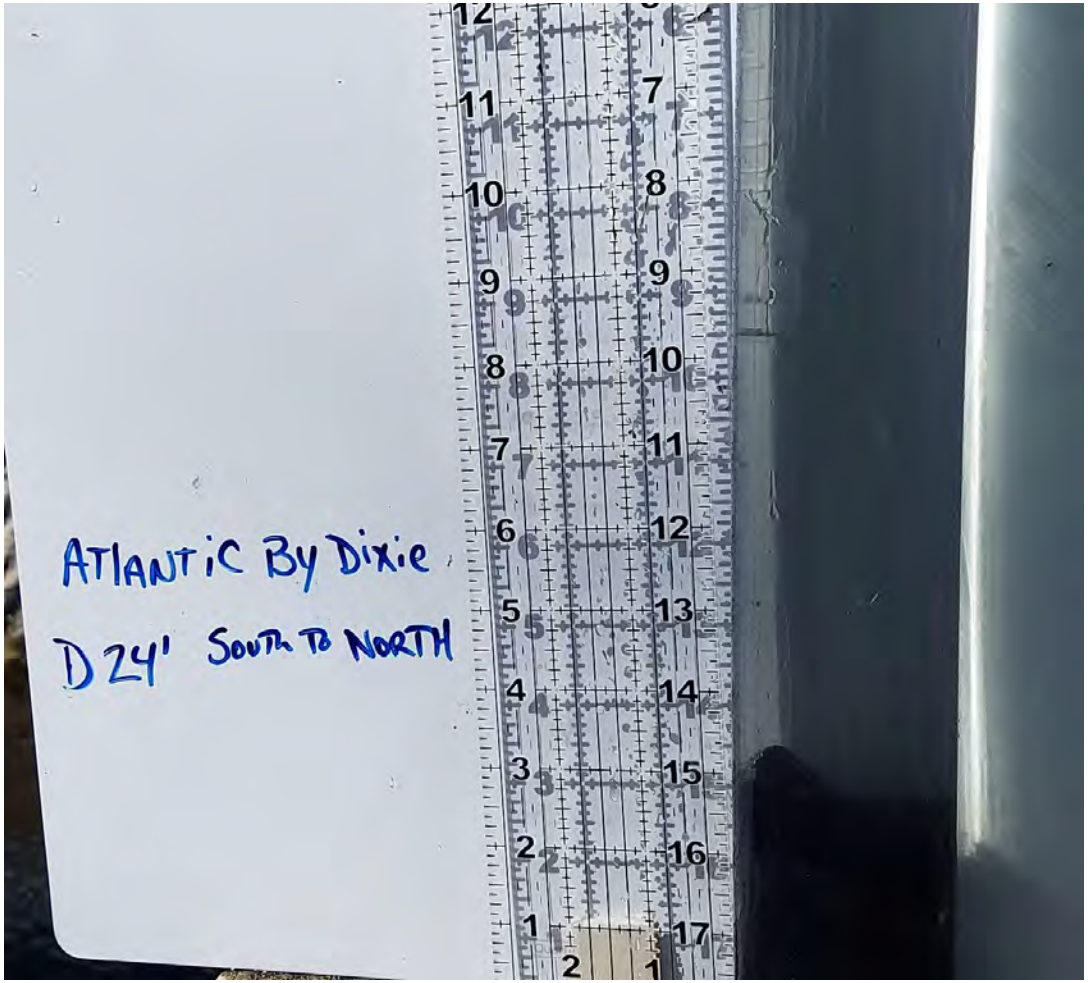
Description:

Sediment Core @

Pompano Canal Atlantic

Dixie Culvert

D; 24-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 5

Date: 2/12/19

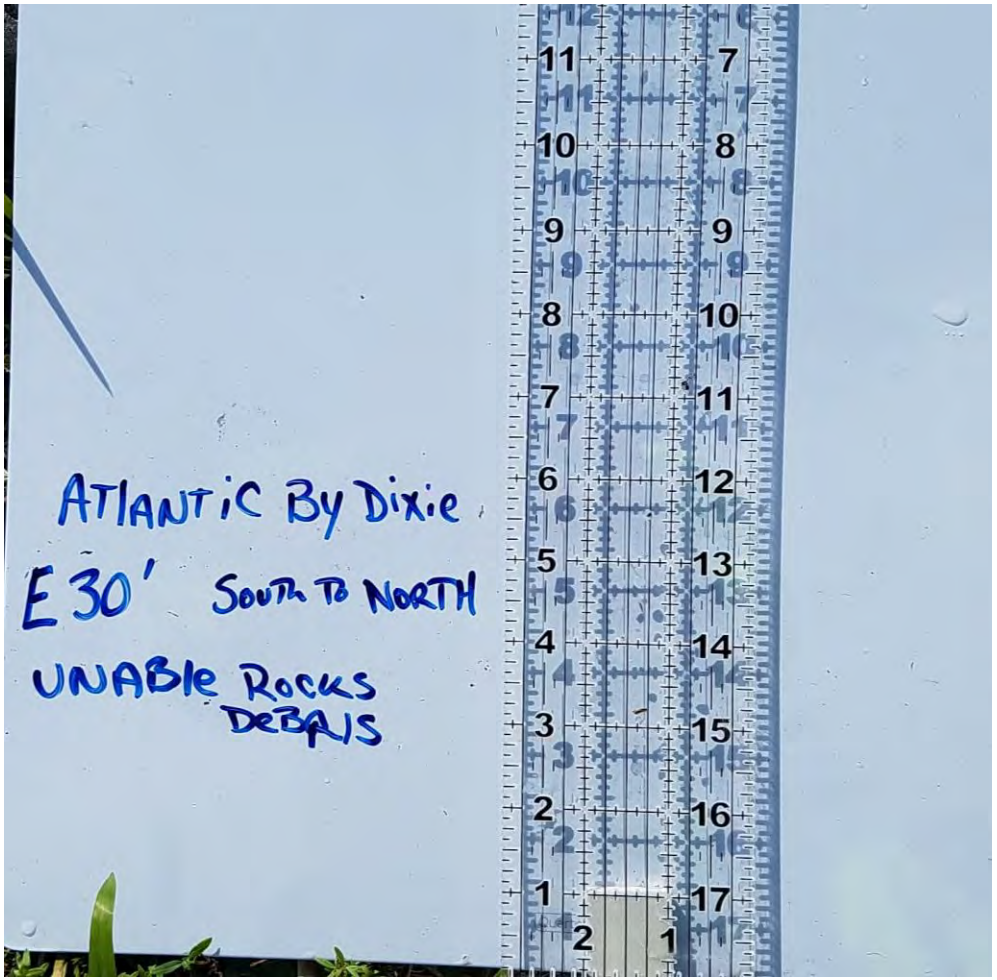
Description:

Sediment Core @

Pompano Canal Atlantic

Dixie Culvert

E; 30-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 6

Date: 2/12/19

Description:

Sediment Core @

Pompano Canal Atlantic

Dixie Culvert

Representative

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 1

Date: 2/13/19

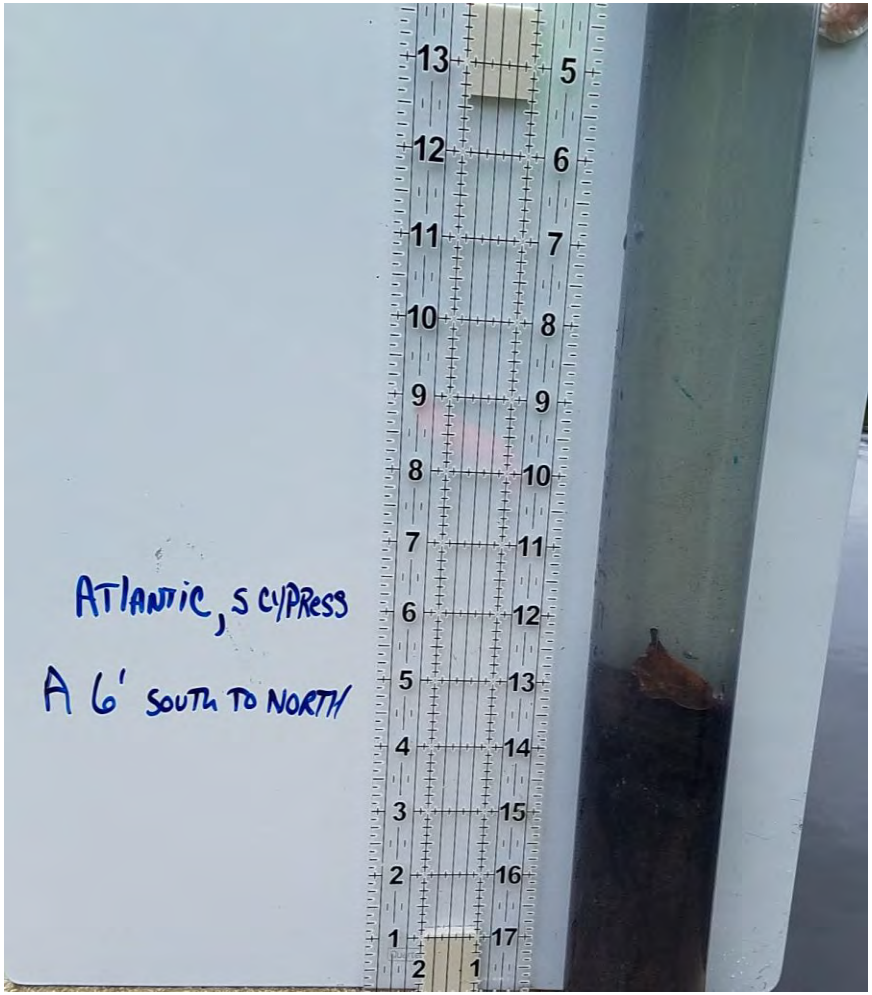
Description:

Sediment Core @

Pompano Canal

G57 Structure

A; 6-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 2

Date: 2/13/19

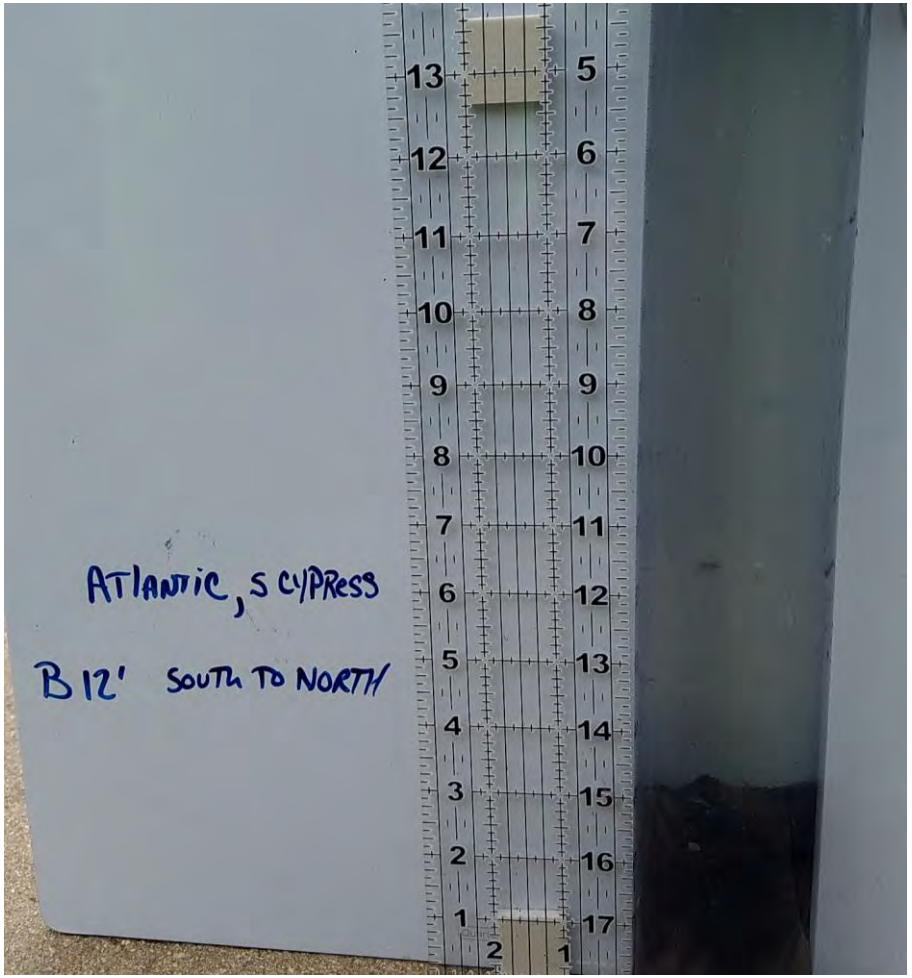
Description:

Sediment Core @

Pompano Canal

G57 Structure

B; 12-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 3

Date: 2/13/19

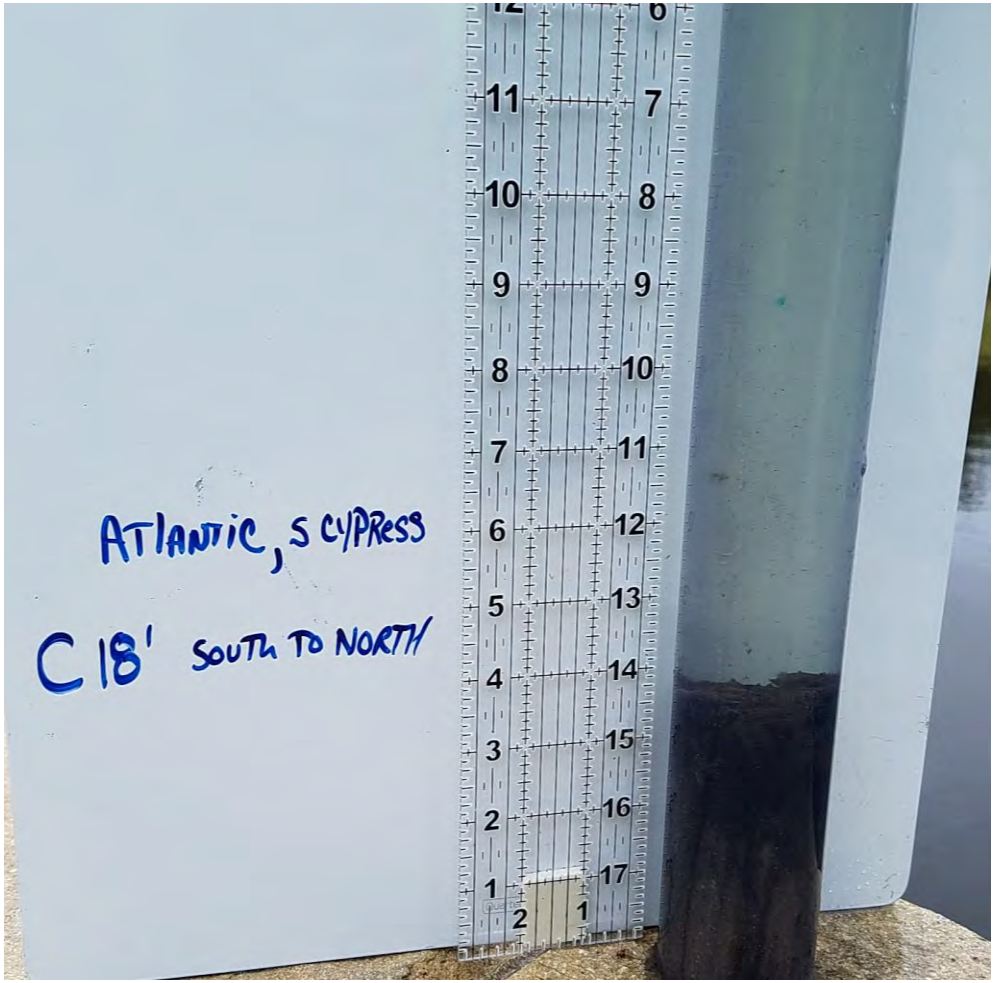
Description:

Sediment Core @

Pompano Canal

G57 Structure

C; 18-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 4

Date: 2/13/19

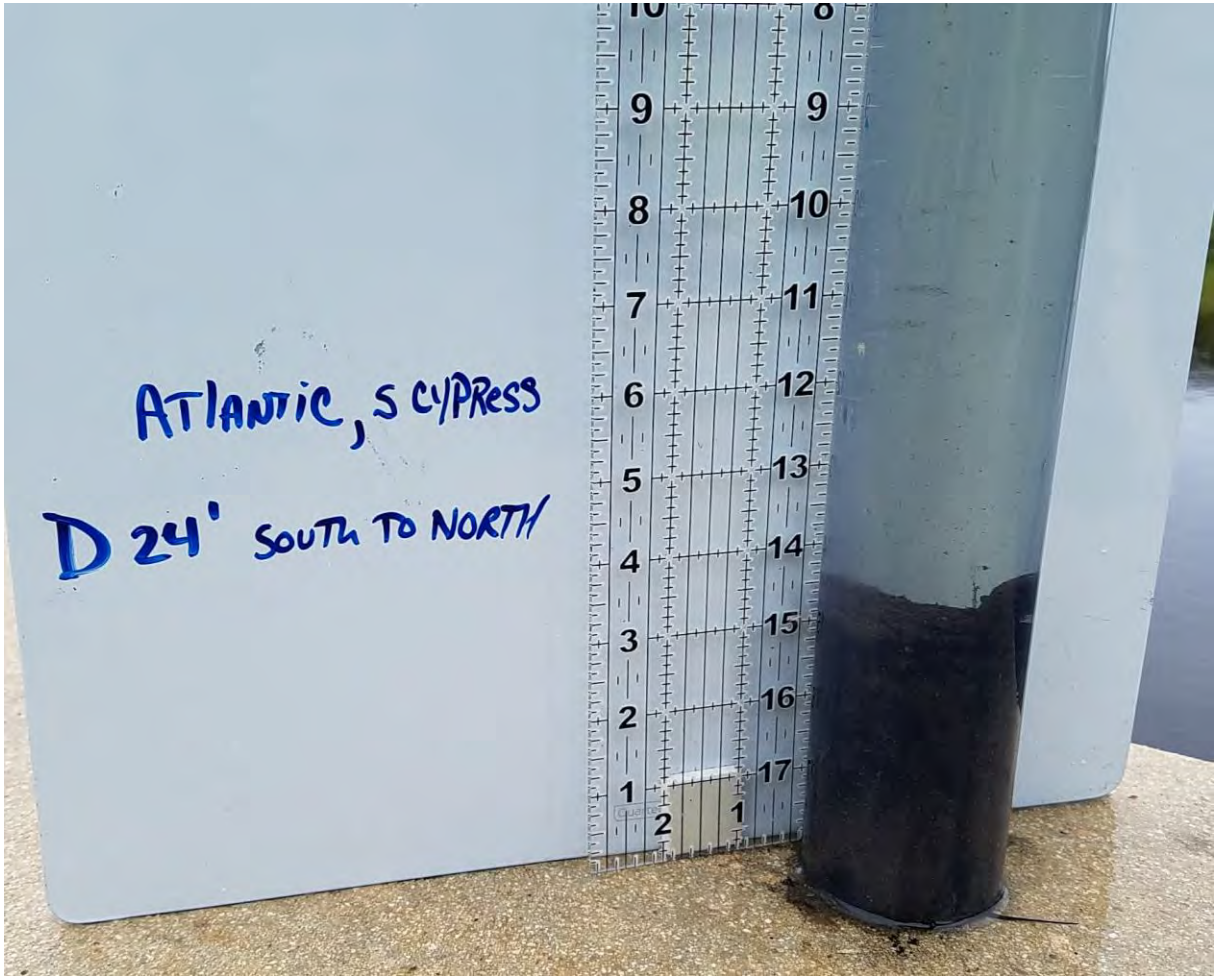
Description:

Sediment Core @

Pompano Canal

G57 Structure

D; 24-ft step



APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 5

Date: 2/13/19

Description:

Sediment Core @

Pompano Canal

G57 Structure

E; 30-ft step

APTIM

Photographic Documentation
Sediment Core Sampling

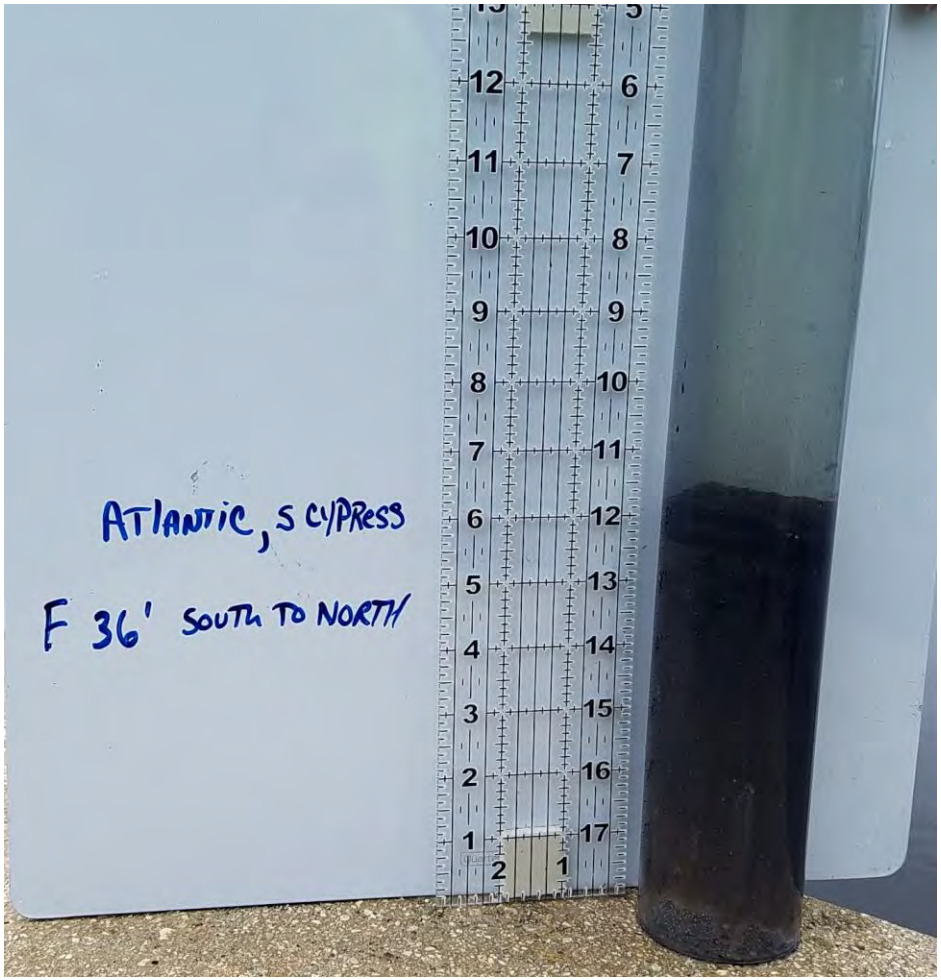
Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 6



Date: 2/13/19

Description:

Sediment Core @

Pompano Canal

G57 Structure

F; 36-ft step

APTIM

Photographic Documentation
Sediment Core Sampling

Client: SICE, Inc.

Prepared by: APTIM

Location: Pompano Beach, FL

Photographer: Dale Young

Photograph No. 7

Date: 2/18/19

Description:

Sediment Core @

Pompano Canal

G57 Structure

Representative

VIBRACORE LOG

PROJECT: C1 Sediment Sampling

VIBRACORE #: Background #2

DATE: 2/26/19

LENGTH RECOVERED: 11.0"

Descriptive terms:
Sandy, Silty, Gravelly, etc. = 35% to 50%
Some = 20% to 35%
Little = 10% to 20%
Trace = 1% to 10%

USCS Classification Silt Guidelines
SP or SW = 0% to 5% silt ML = 50% to 100%
SW-SM = 5% to 12%
SM =12% to 50%

Logging Procedure

1) Layout core and bit sample, checking bottom identification. Ensure that both halves match, and compare the core with the penetrometer record and fieldbook.
2) Delineate and describe each layer USING THIS EXACT FORMAT (see example below):
the type of material (SAND, SILT, GRAVELLY CLAY, etc.);
grain size description (fine, fine to medium, coarse etc.); silt content using **descriptive terms**:
presence of additional components (shell hash/fragments/whole shell/organics/rock etc.) defined by a **descriptive term**.
the location of any individual shell, rock or coral with 2-d measurements;
munsell color; and USCS classification. Any additional notes should be made before the color.
3) Double check all work to ensure that the above procedure has been followed (in order) and that all layer transition depths have been marked.
4) Take a sample that represents each layer from the approximate center of that layer. In the case of repeating sequences, a single sample may represent multiple layers, but must be indicated in the log. A sample number should be assigned to each layer even if a sample has not been taken from that layer.

Example:
SAND, fine to medium grained, trace silt, trace shell hash, coral fragment @ 3.2' (2"x1"), gray (5Y-6/1), (SW-SM).

DEPTH	DESCRIPTION	SAMPLE NO.& DEPTH FOR EVERY LAYER
0.0"		
	Clayey Organics - leaf debris and wood fragments up to (1.25" x 0.25"), little sand (fine grained), trace shell hash, (2.5Y-3/1) very dark gray, (PT)	Sample dried from 0-5"
5.0"		
6.0"	Sand, fine grained, quartz, trace silt, trace shell hash, trace organics, (2.5Y-5/1) gray, (SP)	
10.0"		
11.0"	End of core	
15.0"		
20.0"		

VIBRACORE LOG

PROJECT: C1 Sediment Sampling

VIBRACORE #: Background #2B

DATE: 2/28/19

LENGTH RECOVERED: 8.0"

Descriptive terms:
Sandy, Silty, Gravelly, etc. = 35% to 50%
Some = 20% to 35%
Little = 10% to 20%
Trace = 1% to 10%

USCS Classification Silt Guidelines
SP or SW = 0% to 5% silt ML = 50% to 100%
SW-SM = 5% to 12%
SM =12% to 50%

Logging Procedure

1) Layout core and bit sample, checking bottom identification. Ensure that both halves match, and compare the core with the penetrometer record and fieldbook.
2) Delineate and describe each layer USING THIS EXACT FORMAT (see example below):
the type of material (SAND, SILT, GRAVELLY CLAY, etc.);
grain size description (fine, fine to medium, coarse etc.); silt content using **descriptive terms**:
presence of additional components (shell hash/fragments/whole shell/organics/rock etc.) defined by a **descriptive term**.
the location of any individual shell, rock or coral with 2-d measurements;
munsell color; and USCS classification. Any additional notes should be made before the color.
3) Double check all work to ensure that the above procedure has been followed (in order) and that all layer transition depths have been marked.
4) Take a sample that represents each layer from the approximate center of that layer. In the case of repeating sequences, a single sample may represent multiple layers, but must be indicated in the log. A sample number should be assigned to each layer even if a sample has not been taken from that layer.

Example:
SAND, fine to medium grained, trace silt, trace shell hash, coral fragment @ 3.2' (2"x1"), gray (5Y-6/1), (SW-SM).

DEPTH	DESCRIPTION	SAMPLE NO.& DEPTH FOR EVERY LAYER
0.0"		
	Sand, fine grained, quartz, trace silt, trace shell hash, trace organics, (1.25"x0.25") whole shell @ 1.0", (0.5"x0.75") rock @ 2.5", 0.75" silty pocket @ 4.0", (2.5Y-4/2) dark grayish brown, (SW)	
4.5"		
5.0"	Sand, fine grained, quartz, little silt, trace shell hash, trace organics, (2.0"x1.0") and (1.0"x0.75") rocks @ 5.5", (0.25"x0.5") shell fragment @ 6.0", (2.5Y-4/2) dark grayish brown, (SP-SM)	
8.0"		
	End of Core	
10.0"		
15.0"		
20.0"		

VIBRACORE LOG

PROJECT: C1 Sediment Sampling

VIBRACORE #: Background #2C

DATE: 2/28/19

LENGTH RECOVERED: 5.5"

Descriptive terms:
Sandy, Silty, Gravelly, etc. = 35% to 50%
Some = 20% to 35%
Little = 10% to 20%
Trace = 1% to 10%

USCS Classification Silt Guidelines
SP or SW = 0% to 5% silt ML = 50% to 100%
SW-SM = 5% to 12%
SM =12% to 50%

Logging Procedure

1) Layout core and bit sample, checking bottom identification. Ensure that both halves match, and compare the core with the penetrometer record and fieldbook.
2) Delineate and describe each layer USING THIS EXACT FORMAT (see example below):
the type of material (SAND, SILT, GRAVELLY CLAY, etc.);
grain size description (fine, fine to medium, coarse etc.); silt content using **descriptive terms**:
presence of additional components (shell hash/fragments/whole shell/organics/rock etc.)
defined by a **descriptive term**.
the location of any individual shell, rock or coral with 2-d measurements;
munsell color; and USCS classification. Any additional notes should be made before the color.
3) Double check all work to ensure that the above procedure has been followed (in order) and that all layer transition depths have been marked.
4) Take a sample that represents each layer from the approximate center of that layer. In the case of repeating sequences, a single sample may represent multiple layers, but must be indicated in the log. A sample number should be assigned to each layer even if a sample has not been taken from that layer.

Example:
SAND, fine to medium grained, trace silt, trace shell hash, coral fragment @ 3.2' (2"x1"), gray (5Y-6/1), (SW-SM).

DEPTH	DESCRIPTION	SAMPLE NO.& DEPTH FOR EVERY LAYER
0.0"		
0.5"	Silty Sand, fine grained, quartz, little (SM) organics, trace shell hash, (2.5Y-2.5/1) black,	Sample dried from 0-0.5"
4.5"	Sand, fine grained, quartz, trace silt, trace shell hash, trace rocks up to 0.5" trace organics with leaf debris, 1.0" rock @ 3.5", (2.5Y-4/1) dark gray, (SW)	
5.0"		
5.5"	Organic (leaf debris and wood fragments up to (0.5"x0.25")) Sand, fine grained, quartz, little silt, trace shell hash, (2.5Y-3/1) very dark gray, (SP-SM)	
	End of core	
10.0"		
15.0"		
20.0"		

VIBRACORE LOG

PROJECT: C1 Sediment Sampling

VIBRACORE #: 15th St.

DATE: 2/26/19

LENGTH RECOVERED: 4.5"

Descriptive terms:
Sandy, Silty, Gravelly, etc. = 35% to 50%
Some = 20% to 35%
Little = 10% to 20%
Trace = 1% to 10%

USCS Classification Silt Guidelines
SP or SW = 0% to 5% silt ML = 50% to 100%
SW-SM = 5% to 12%
SM =12% to 50%

Logging Procedure

1) Layout core and bit sample, checking bottom identification. Ensure that both halves match, and compare the core with the penetrometer record and fieldbook.
2) Delineate and describe each layer USING THIS EXACT FORMAT (see example below):
the type of material (SAND, SILT, GRAVELLY CLAY, etc.);
grain size description (fine, fine to medium, coarse etc.); silt content using descriptive terms:
presence of additional components (shell hash/fragments/whole shell/organics/rock etc.)
defined by a descriptive term.
the location of any individual shell, rock or coral with 2-d measurements;
munsell color; and USCS classification. Any additional notes should be made before the color.
3) Double check all work to ensure that the above procedure has been followed (in order) and that all layer transition depths have been marked.
4) Take a sample that represents each layer from the approximate center of that layer. In the case of repeating sequences, a single sample may represent multiple layers, but must be indicated in the log. A sample number should be assigned to each layer even if a sample has not been taken from that layer.

Example:
SAND, fine to medium grained, trace silt, trace shell hash, coral fragment @ 3.2' (2"x1"), gray (5Y-6/1), (SW-SM).

DEPTH	DESCRIPTION	SAMPLE NO.& DEPTH FOR EVERY LAYER
0.0"	Sand, fine grained, quartz, little silt, some organics with wood fragments up to 0.25", trace shell hash, (2.5Y-2.5/1) black, (SM)	Sample dried from 0-3"
4.5"		
5.0"	End of Core	
10.0"		
15.0"		
20.0"		

VIBRACORE LOG

PROJECT: C1 Sediment Sampling

VIBRACORE #: 15th St. South

DATE: 2/28/19

LENGTH RECOVERED: 12.5"

Descriptive terms:
Sandy, Silty, Gravelly, etc. = 35% to 50%
Some = 20% to 35%
Little = 10% to 20%
Trace = 1% to 10%

USCS Classification Silt Guidelines
SP or SW = 0% to 5% silt ML = 50% to 100%
SW-SM = 5% to 12%
SM =12% to 50%

Logging Procedure

1) Layout core and bit sample, checking bottom identification. Ensure that both halves match, and compare the core with the penetrometer record and fieldbook.
2) Delineate and describe each layer USING THIS EXACT FORMAT (see example below):
the type of material (SAND, SILT, GRAVELLY CLAY, etc.);
grain size description (fine, fine to medium, coarse etc.); silt content using **descriptive terms:**
presence of additional components (shell hash/fragments/whole shell/organics/rock etc.) defined by a **descriptive term.**
the location of any individual shell, rock or coral with 2-d measurements;
munsell color; and USCS classification. Any additional notes should be made before the color.
3) Double check all work to ensure that the above procedure has been followed (in order) and that all layer transition depths have been marked.
4) Take a sample that represents each layer from the approximate center of that layer. In the case of repeating sequences, a single sample may represent multiple layers, but must be indicated in the log. A sample number should be assigned to each layer even if a sample has not been taken from that layer.

Example:
SAND, fine to medium grained, trace silt, trace shell hash, coral fragment @ 3.2' (2"x1"), gray (5Y-6/1), (SW-SM).

DEPTH	DESCRIPTION	SAMPLE NO.& DEPTH FOR EVERY LAYER
0.0"		
0.75"	Clayey Organics, (2.5Y-2.5/1) black, (PT)	Sample dried from 0-0.75"
	Sand, fine to medium grained, quartz, trace silt, trace organics, trace shell hash, trace rocks up to 0.25", 0.75" and 2(0.5"x0.25") rocks @ 12.0", (2.5Y-4/1) dark gray, (SW)	
5.0"		
10.0"		
12.5"	End of core	
15.0"		
20.0"		

VIBRACORE LOG

PROJECT: C1 Sediment Sampling

VIBRACORE #: FEC

DATE: 2/26/19

LENGTH RECOVERED: 7.0"

Descriptive terms:
Sandy, Silty, Gravelly, etc. = 35% to 50%
Some = 20% to 35%
Little = 10% to 20%
Trace = 1% to 10%

USCS Classification Silt Guidelines
SP or SW = 0% to 5% silt ML = 50% to 100%
SW-SM = 5% to 12%
SM =12% to 50%

Logging Procedure

1) Layout core and bit sample, checking bottom identification. Ensure that both halves match, and compare the core with the penetrometer record and fieldbook.
2) Delineate and describe each layer USING THIS EXACT FORMAT (see example below):
the type of material (SAND, SILT, GRAVELLY CLAY, etc.);
grain size description (fine, fine to medium, coarse etc.); silt content using **descriptive terms**:
presence of additional components (shell hash/fragments/whole shell/organics/rock etc.)
defined by a **descriptive term**.
the location of any individual shell, rock or coral with 2-d measurements;
munsell color; and USCS classification. Any additional notes should be made before the color.
3) Double check all work to ensure that the above procedure has been followed (in order) and that all layer transition depths have been marked.
4) Take a sample that represents each layer from the approximate center of that layer. In the case of repeating sequences, a single sample may represent multiple layers, but must be indicated in the log. A sample number should be assigned to each layer even if a sample has not been taken from that layer.

Example:
SAND, fine to medium grained, trace silt, trace shell hash, coral fragment @ 3.2' (2"x1"), gray (5Y-6/1), (SW-SM).

DEPTH	DESCRIPTION	SAMPLE NO.& DEPTH FOR EVERY LAYER
0.0"		
1.0"	Clayey Organics, (2.5Y-2.5/1) black, (PT)	Sample dried from 0-0.5"
3.0"	Sand, fine grained, quartz, trace silt, trace organics, trace shell hash, 1.5" rock @ 2.0", (2.5Y-5/2) grayish brown, (SW)	
5.0"	Sand, fine grained, quartz, little silt, trace organics, trace shell hash, (2.5Y-4/1) (SP)	
7.0"	Sand, fine grained, quartz, trace silt, trace shell hash, (2.5Y-4/2) (SP)	
10.0"	End of core	
15.0"		
20.0"		

VIBRACORE LOG

PROJECT: C1 Sediment Sampling

VIBRACORE #: FEC South

DATE: 2/28/19

LENGTH RECOVERED: 4.5"

Descriptive terms:
Sandy, Silty, Gravelly, etc. = 35% to 50%
Some = 20% to 35%
Little = 10% to 20%
Trace = 1% to 10%

USCS Classification Silt Guidelines
SP or SW = 0% to 5% silt ML = 50% to 100%
SW-SM = 5% to 12%
SM =12% to 50%

Logging Procedure

1) Layout core and bit sample, checking bottom identification. Ensure that both halves match, and compare the core with the penetrometer record and fieldbook.
2) Delineate and describe each layer USING THIS EXACT FORMAT (see example below):
the type of material (SAND, SILT, GRAVELLY CLAY, etc.);
grain size description (fine, fine to medium, coarse etc.); silt content using **descriptive terms**:
presence of additional components (shell hash/fragments/whole shell/organics/rock etc.) defined by a **descriptive term**.
the location of any individual shell, rock or coral with 2-d measurements;
munsell color; and USCS classification. Any additional notes should be made before the color.
3) Double check all work to ensure that the above procedure has been followed (in order) and that all layer transition depths have been marked.
4) Take a sample that represents each layer from the approximate center of that layer. In the case of repeating sequences, a single sample may represent multiple layers, but must be indicated in the log. A sample number should be assigned to each layer even if a sample has not been taken from that layer.

Example:
SAND, fine to medium grained, trace silt, trace shell hash, coral fragment @ 3.2' (2"x1"), gray (5Y-6/1), (SW-SM).

DEPTH	DESCRIPTION	SAMPLE NO.& DEPTH FOR EVERY LAYER
0.0"		
	Clayey Organics with leaf debris, little sand, trace shell hash, color is mottled: (2.5Y-2.5/1) black and (2.5Y-3/1) very dark gray (PT)	Sample dried from 0-2.5"
2.5"		
4.5"	Sand, fine to medium grained, quartz, trace silt, some organics-leaf debris and wood fragments up to (0.25"x0.5"), trace shell hash, trace whole shell up to 0.75", (1.5"x0.5") wood fragment @ 3.0", (2.5Y-3/1) very dark gray, (SW)	
5.0"		
	End of core	
10.0"		
15.0"		
20.0"		

VIBRACORE LOG

PROJECT: C1 Sediment Sampling

VIBRACORE #: MLK

DATE: 2/26/19

LENGTH RECOVERED: 6.5"

Descriptive terms:
Sandy, Silty, Gravelly, etc. = 35% to 50%
Some = 20% to 35%
Little = 10% to 20%
Trace = 1% to 10%

USCS Classification Silt Guidelines
SP or SW = 0% to 5% silt ML = 50% to 100%
SW-SM = 5% to 12%
SM =12% to 50%

Logging Procedure

1) Layout core and bit sample, checking bottom identification. Ensure that both halves match, and compare the core with the penetrometer record and fieldbook.
2) Delineate and describe each layer USING THIS EXACT FORMAT (see example below):
the type of material (SAND, SILT, GRAVELLY CLAY, etc.);
grain size description (fine, fine to medium, coarse etc.); silt content using **descriptive terms:**
presence of additional components (shell hash/fragments/whole shell/organics/rock etc.)
defined by a **descriptive term.**
the location of any individual shell, rock or coral with 2-d measurements;
munsell color; and USCS classification. Any additional notes should be made before the color.
3) Double check all work to ensure that the above procedure has been followed (in order) and that all layer transition depths have been marked.
4) Take a sample that represents each layer from the approximate center of that layer. In the case of repeating sequences, a single sample may represent multiple layers, but must be indicated in the log. A sample number should be assigned to each layer even if a sample has not been taken from that layer.

Example:
SAND, fine to medium grained, trace silt, trace shell hash, coral fragment @ 3.2' (2"x1"), gray (5Y-6/1), (SW-SM).

DEPTH	DESCRIPTION	SAMPLE NO.& DEPTH FOR EVERY LAYER
0.0"	Clayey Organics - leaf debris and wood fragments up to (1.0"x0.25"), little sand (fine grained), (2.5Y-2.5/1) black, (PT)	Sample dried from 0-5"
4.5"		
5.0"	Sandy Organics - leaf debris and wood fragments up to 0.25", some clay, trace shell hash, (2.5Y-3/1) very dark gray, (PT)	
6.0"	End of core	
10.0"		
15.0"		
20.0"		

VIBRACORE LOG

PROJECT: C1 Sediment Sampling

VIBRACORE #: Culvert

DATE: 2/26/19

LENGTH RECOVERED: 4.0"

Descriptive terms:
Sandy, Silty, Gravelly, etc. = 35% to 50%
Some = 20% to 35%
Little = 10% to 20%
Trace = 1% to 10%

USCS Classification Silt Guidelines
SP or SW = 0% to 5% silt ML = 50% to 100%
SW-SM = 5% to 12%
SM =12% to 50%

Logging Procedure

1) Layout core and bit sample, checking bottom identification. Ensure that both halves match, and compare the core with the penetrometer record and fieldbook.
2) Delineate and describe each layer USING THIS EXACT FORMAT (see example below):
the type of material (SAND, SILT, GRAVELLY CLAY, etc.);
grain size description (fine, fine to medium, coarse etc.); silt content using **descriptive terms**:
presence of additional components (shell hash/fragments/whole shell/organics/rock etc.) defined by a **descriptive term**.
the location of any individual shell, rock or coral with 2-d measurements;
munsell color; and USCS classification. Any additional notes should be made before the color.
3) Double check all work to ensure that the above procedure has been followed (in order) and that all layer transition depths have been marked.
4) Take a sample that represents each layer from the approximate center of that layer. In the case of repeating sequences, a single sample may represent multiple layers, but must be indicated in the log. A sample number should be assigned to each layer even if a sample has not been taken from that layer.

Example:
SAND, fine to medium grained, trace silt, trace shell hash, coral fragment @ 3.2' (2"x1"), gray (5Y-6/1), (SW-SM).

DEPTH	DESCRIPTION	SAMPLE NO.& DEPTH FOR EVERY LAYER
0.0"	Sandy Organics - leaf debris, seed pods, wood fragments up to (0.75"x 0.25"), some clay, trace shell hash, (2.5Y-2.5/1) black, (PT)	Sample dried from 0-3"
3.0"		
4.0"	Sandy Organics - leaf debris, seed pods, wood fragments up to (0.75"x0.25"), little clay, trace shell hash, trace whole shells up to (0.75"x0.25") (2.5Y-3/1) very dark gray, (PT)	
5.0"	End of Core	
10.0"		
15.0"		
20.0"		

VIBRACORE LOG

PROJECT: C1 Sediment Sampling

VIBRACORE #: Dixie

DATE: 3/26/19

LENGTH RECOVERED: 6.0"

Descriptive terms:
Sandy, Silty, Gravelly, etc. = 35% to 50%
Some = 20% to 35%
Little = 10% to 20%
Trace = 1% to 10%

USCS Classification Silt Guidelines
SP or SW = 0% to 5% silt ML = 50% to 100%
SW-SM = 5% to 12%
SM =12% to 50%

Logging Procedure

1) Layout core and bit sample, checking bottom identification. Ensure that both halves match, and compare the core with the penetrometer record and fieldbook.
2) Delineate and describe each layer USING THIS EXACT FORMAT (see example below):
the type of material (SAND, SILT, GRAVELLY CLAY, etc.);
grain size description (fine, fine to medium, coarse etc.); silt content using **descriptive terms**:
presence of additional components (shell hash/fragments/whole shell/organics/rock etc.) defined by a **descriptive term**.
the location of any individual shell, rock or coral with 2-d measurements;
munsell color; and USCS classification. Any additional notes should be made before the color.
3) Double check all work to ensure that the above procedure has been followed (in order) and that all layer transition depths have been marked.
4) Take a sample that represents each layer from the approximate center of that layer. In the case of repeating sequences, a single sample may represent multiple layers, but must be indicated in the log. A sample number should be assigned to each layer even if a sample has not been taken from that layer.

Example:
SAND, fine to medium grained, trace silt, trace shell hash, coral fragment @ 3.2' (2"x1"), gray (5Y-6/1), (SW-SM).

DEPTH	DESCRIPTION	SAMPLE NO.& DEPTH FOR EVERY LAYER
0.0"		
2.0"	Organic (leaf debris and wood fragments up to 0.25") Sand, fine to medium grained, quartz, little clay, trace shell hash, trace whole shells up to 1.0", (2.5Y-2.5/1) black, (SC)	Sample dried from 0-1.5"
4.0"	Sand, fine to medium grained, quartz, little clay, little organics, trace shell hash, trace whole shells up to 1.0", (2.5Y-3/1) very dark gray (SC)	
5.0"		
6.0"	Sand, fine grained, quartz, little silt, trace shell hash, trace rocks up to 0.75", silty laminae @ 4.0", (2.5Y-4/1) dark gray, (SM)	
	End of core	
10.0"		
15.0"		
20.0"		

VIBRACORE LOG

PROJECT: C1 Sediment Sampling

VIBRACORE #: G-57

DATE: 2/26/19

LENGTH RECOVERED: 8.5"

Descriptive terms:
Sandy, Silty, Gravelly, etc. = 35% to 50%
Some = 20% to 35%
Little = 10% to 20%
Trace = 1% to 10%

USCS Classification Silt Guidelines
SP or SW = 0% to 5% silt ML = 50% to 100%
SW-SM = 5% to 12%
SM =12% to 50%

Logging Procedure

1) Layout core and bit sample, checking bottom identification. Ensure that both halves match, and compare the core with the penetrometer record and fieldbook.
2) Delineate and describe each layer USING THIS EXACT FORMAT (see example below):
the type of material (SAND, SILT, GRAVELLY CLAY, etc.);
grain size description (fine, fine to medium, coarse etc.); silt content using **descriptive terms**:
presence of additional components (shell hash/fragments/whole shell/organics/rock etc.)
defined by a **descriptive term**.
the location of any individual shell, rock or coral with 2-d measurements;
munsell color; and USCS classification. Any additional notes should be made before the color.
3) Double check all work to ensure that the above procedure has been followed (in order) and that all layer transition depths have been marked.
4) Take a sample that represents each layer from the approximate center of that layer. In the case of repeating sequences, a single sample may represent multiple layers, but must be indicated in the log. A sample number should be assigned to each layer even if a sample has not been taken from that layer.

Example:
SAND, fine to medium grained, trace silt, trace shell hash, coral fragment @ 3.2' (2"x1"), gray (5Y-6/1), (SW-SM).

DEPTH	DESCRIPTION	SAMPLE NO.& DEPTH FOR EVERY LAYER
0.0"		
0.25"	Clayey Organics, little Sand, trace shell hash, (PT) trace whole shells up to (0.5"x0.25"), (2.5Y-2.5/1) black	Sample dried from 0-0.2"
4.0"	Sand, fine grained, quartz, little silt, trace organics, trace shell hash, color is mottled: (2.5Y-5/2) grayish brown and (2.5Y-3/1) very dark gray, (SP-SM)	
5.0"	Sand, fine to medium grained, quartz, trace silt, trace shell hash, trace rocks up to 0.25", 0.75" whole shell @ 5.0" (2.5Y-4/1) dark gray, (SW-SM)	
8.5"	End of core	
10.0"		
15.0"		
20.0"		


TARGET
BK
BK 2
15ST
Fec
MIK
CULVERT
N ATLANTIC
ATLANTIC
DIXIE
G57


Comments: Good Practices, At Risk Behaviors, Actions Taken and/or Coaching Given
Fec
PAGE 01
Site Name:
Comments:
U.S.STD.
No.241P
ENGINEER


BK 2
15ST


Comments: Good Practices, At Risk Behaviors, Actions Taken and/or Coaching Given
Fec
A006 Nov-2
PAGE 01
Site Name:
Comments: Good Practice
Actions Taker
No.24P ENGINEER
U.S.ST'D.


Observer Name:
Site Name:
Comments: Good Practices, At Risk Behaviors, Actions Taken and/or Coaching Given
MK
PAGE 01
A006 Nov 2017
PAGE 01
Observer Name:
Site Name:
Comments: Good Practices, At Risk Behaviors, Actions Taken and/or Coaching Given


APTIM
TARGET
OBSERVATIONS
Boat Operations / SCUBA Safety
Date
Month
Day
Year
Work Shift
DAY
NIGHT
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
Observer Name:
Site Name:
Comments: Good Practices, At Risk Behaviors, Actions Taken and/or Coaching Given
A006 Nov-2017
PAGE 01
CULVERT
N ATLANTIC
JULY
AUG
SEP
OCT
NOV
DEC
Observer Name:
Site Name:
Comments: Good Pra
Actions T
A006 Nov-2017


APTIM
TARGET
OBSERVATIONS
Boat Operations / SCUBA Safety
Date
Month
Day
Year
Work Shift
DAY
NIGHT
JAN
FEB
MAR
APR
MAY
JUNE
NOV
DEC
Observer Name:
Site Name:
Comments: Good Practices, At Risk Behaviors, Actions Taken and/or Coaching Given
ATLANTIC
DIXIE
PAGE 01


Expectation Questions
Yes
No
N/A
06
Is the deck clear of tripping hazards?
07
Is the dive flag elevated and visible to other boats in the area?
08
Is there an adequate supply of sunscreen available?
PAGE 01
Samsonite