REPORT

Phase 1 Final Design Report
Hudson River PCBs Superfund Site

Attachment B – Year 2 Supplemental Engineering Data Collection Data Summary Report

General Electric Company
Albany, New York

March 21, 2006

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

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1. Introduction

This *Year 2 Supplemental Engineering Data Collection Data Summary Report* (Year 2 SEDC DSR) has been prepared on behalf of the General Electric Company (GE) to present the geophysical survey information collected as described in the *Supplemental Engineering Data Collection Work Plan Addendum No. 1* (SEDC Addendum No. 1) (Blasland, Bouck & Lee, Inc. [BBL], 2005a), submitted in October 2004 and revised in May 2005, and the results of the geotechnical engineering data collection efforts as described in SEDC Addendum No. 2 (BBL, 2005b), submitted in September 2005. The October 2004 SEDC Addendum No. 1 was approved by the U.S. Environmental Protection Agency (EPA) on October 22, 2004, the May 2005 SEDC Addendum No. 1 was approved by the U.S. Environmental Protection Agency (EPA) on June 10, 2005, and SEDC Addendum No. 2 was approved by the EPA on September 27, 2005. Final approval letters for these two addenda are provided in Exhibit A.

The SEDC Program is outlined in the *Supplemental Engineering Data Collection Work Plan* (SEDC Work Plan) (BBL, 2004a) and has been implemented to assist in the remedial design of the remedy selected by the EPA to address polychlorinated biphenyls (PCBs) in sediments of the Upper Hudson River in New York State. The SEDC activities are part of the remedial design activities described in the *Remedial Design Work Plan* (RD Work Plan) (BBL, 2003), which are being conducted under an Administrative Order on Consent for Hudson River Remedial Design and Cost Recovery (RD AOC), effective August 18, 2003 (Index No. CERCLA-02-2003-2027) (EPA/GE, 2003).

This report constitutes the final submission for Phase 1 of the SEDC Program. The *Year 2 Supplemental Engineering Data Collection Interim Data Summary Report* (Year 2 SEDC IDSR) (BBL, 2005c) presented the results of the engineering data collection efforts described in the SEDC Work Plan (BBL, 2004a) and the results of the additional geotechnical drilling completed as described in the October 2004 SEDC Addendum No. 1 (BBL, 2004b).

1.1 Background

The EPA issued a Superfund Record of Decision (ROD) on February 1, 2002 calling for, among other things, the removal and disposal of PCB-contaminated sediments meeting certain mass per unit area (MPA) and surface concentration or characteristic criteria from the Upper Hudson River (EPA, 2002). The ROD provided for this remedial action to be performed in two phases, with Phase 1 to consist of the first year of dredging at a reduced rate (with at least one month at full-scale production) and Phase 2 to consist of the rest of the project. A summary of the remedial action is presented in subsection 1.2 of the RD Work Plan. For purposes of the remedial action, the EPA divided the Upper Hudson River into three sections as follows:

- **River Section 1:** Former location of Fort Edward Dam to Thompson Island Dam (approximately 6.3 river miles);
- **River Section 2:** Thompson Island Dam to Northumberland Dam (approximately 5.1 river miles); and
- **River Section 3:** Northumberland Dam to the Federal Dam at Troy (approximately 29.5 river miles).

To provide sediment data for the design of the remedy set forth in the ROD, GE conducted a Sediment Sampling and Analysis Program (SSAP), pursuant to a separate Sediment Sampling AOC, which was effective July 26, 2002 (Index No. CERCLA-02-2002-2023) (EPA/GE, 2002). The scope of the SSAP was set forth in the *Sediment Sampling and Analysis Program – Field Sampling Plan* (SSAP-FSP) (Quantitative Environmental Analysis, LLC [QEA], 2002), *Supplemental Field Sampling Plan* (Supplemental FSP) (QEA, 2003), and *Sediment Sampling and Analysis Program – Quality Assurance Project Plan* (SSAP-QAPP) (QEA and Environmental Standards, Inc. [ESI], 2002). The SSAP data was one of the tools used to delineate the areal and vertical extent of dredge areas, set forth in the Phase 1 *Dredge Area Delineation Report* (Phase 1 DAD Report). The SSAP data also provide measurements of certain chemical and physical properties of the sediment to be removed that are important for the design of dredging, transportation, treatment, and disposal activities. The SSAP activities were conducted in 2002 and 2003, and were supplemented in 2004 by the collection of additional sediment data to satisfy data needs for the delineation and selection of the Phase 1 dredge areas.

1.2 SEDC Program Overview

As described in the RD Work Plan, additional engineering data collection and analysis activities are necessary to supplement the information gathered during the SSAP. The SEDC Work Plan was developed based on the results of an evaluation of the data collected in 2002 and 2003 under the SSAP for sampling locations in the three candidate Phase 1 areas described in subsection 2.4 of the RD Work Plan – the Northern Thompson Island Pool (NTIP) in the upper portion of River Section 1, the portion of River Section 1 in the East Griffin Island Area (EGIA), and the areas of River Section 2 in the vicinity of Hot Spots 33 through 35, known as the Northumberland Dam Area (NDA). The evaluation included a detailed review of the sediment core log information, field information, and visual classification results, as well as a review of the geotechnical testing that was conducted under the SSAP, which included collection of 6,497 core samples in the candidate Phase 1 areas. The review of the SSAP data indicated that most of the sediment samples from the candidate Phase 1 areas (more than 75%) were identified as either fine sand or silt. Likewise, the extensive side-scan sonar information and visual classification results in the database support the conclusion that the majority of sediment deposits consist of sand and/or silt.

The original SEDC activities were developed as part of a flexible program designed to accommodate issues that were not known at the time the original SEDC Work Plan was written. For example, it was necessary to collect additional SEDC data, such as those described in Addenda No. 1 and No. 2, in certain areas based on the results of the original SEDC work efforts, and to develop a more focused understanding of the Phase 1 dredge areas after the selection of the actual Phase 1 areas was finalized. An overview of the SEDC program objectives and activities is presented in the following subsections.

1.2.1 Objectives

The primary objective of the SEDC program is to gather the field data needed to develop the remedial design. The data needs identified in the SEDC Work Plan include information regarding the physical characteristics of the riverbed (including sub-strata) in the areas to be dredged. As identified in the SEDC Work Plan (BBL, 2004a), the specific objectives of the SEDC activities are to:

- Identify the presence and characteristics of potential structures/debris (i.e., boulders, man-made obstructions, and debris) in sediments targeted for removal;
- Identify supplemental equipment access issues, if applicable;
- Determine the suitability of available backfill materials in the vicinity of the project area; and
- Collect additional data regarding engineering properties of sediments and underlying strata to support the remedial design, including:
  - Geotechnical properties of in-river sediments and underlying strata;
  - Dredgeability of sediments to be removed;
  - Slope stability adjacent to dredge areas during and following dredging; and
  - Other river characteristics (velocity and discharge, stage, waves).

1.2.2 Additional SEDC Tasks

As work progressed on the Phase 1 remedial design, after submission of the Year 2 SEDC Work Plan to EPA in December 2003 (which EPA approved on February 4, 2004) and collection of initial SEDC data, it became clear that data in addition to that proposed for collection in the Year 2 SEDC Work Plan were needed. The work described in SEDC Addenda No.1 and No. 2 was developed to address these needs, and included supplemental geophysical surveys and additional geotechnical engineering data collection activities.

A more detailed description of each of these activities is provided in Section 2.

2. Additional SEDC Activities and Results

The additional SEDC Program activities consisted primarily of field work to complete supplemental geophysical surveys and collect additional geotechnical engineering data. To accomplish these interrelated tasks, three field crews performed the survey and groundtruth sampling investigations, working from different support vessels. In accordance with the revised version of SEDC Addendum No. 1 (BBL, 2005a), the first crew focused on the acquisition of multibeam hydrographic data, while the second focused on the acquisition of ground-penetrating radar (GPR) and magnetometer (geophysical) data. In accordance with SEDC Addendum No. 2 (BBL, 2005b), the third crew focused on the collection of additional physical samples to corroborate geophysical data.

Each of the tasks conducted to complete the Year 2 SEDC Program and associated results is briefly described below. For more details regarding the supplemental geophysical surveys, refer to the revised version of SEDC Addendum No. 1 (BBL, 2005a). For more details regarding the additional geotechnical engineering data collection efforts, refer to SEDC Addendum No. 2 (BBL, 2005b).

2.1 Supplemental Geophysical Surveys

The supplemental geophysical surveys included multibeam bathymetry, sub-bottom profiling, and magnetometer surveys. In total, more than 140 statute miles of survey tracklines were investigated during the collection of the multibeam hydrographic data to attain maximum sounding coverage within the Phase 1 dredge areas (north of the Snook Kill and on the east side of Griffin Island) in River Section 1, and more than more than 80 statute miles of multi-sensor geophysical data were acquired to complete the sub-bottom profiling and magnetometer surveys.

2.1.1 Multibeam Bathymetry Survey

In August 2005, Ocean Surveys, Inc. (OSI) conducted a multibeam bathymetry survey in accordance with the standard operating procedures (SOPs) provided with the revised version of SEDC Addendum No. 1 (BBL, 2005a). During performance of the survey, tracklines were generally oriented parallel to the course of the river. Since water depth varied considerably throughout the survey areas, trackline spacing was adjusted as needed to achieve full river bed coverage (theoretically, the 120° multibeam profiling system used during this investigation could attain full bottom coverage in a swath 3.46 times the water depth). The HYPACK® MAX "swath-painting" option was used to assist the hydrographic crew in verifying that full bottom coverage was achieved during the survey. This option allowed the team to monitor sounding coverage in real-time. To achieve sounding coverage along the shoreline where water depth limited vessel access, the multibeam transducer head was rotated to a 45° position. This rotation enabled the multibeam system to "look" outward to one side of the vessel and allowed profiling toward the shore beyond areas accessible to the survey vessel. In several areas within the proposed survey limits where submerged aquatic vegetation (SAV) was abundant and/or the survey vessel could not access the shore, the hydrographic crew performed "hand soundings" to augment the multibeam data set (these areas are depicted on Figures 3 and 4 in Exhibit B to this DSR). As such, by use of both instrument and physical soundings, full bottom coverage was attained throughout all of the Phase 1 dredge areas in River Section 1.

Nearly 600 million soundings were recorded during this investigation, covering an area of approximately 6 million square feet. The average data density exceeded 100 points per bin (one square foot) and ranged from one point per bin (45° lines along the shore) to over 2,000 points per bin (in shallow water areas there was multiple survey line overlap). For a statistical comparison of multibeam and singlebeam data, the Phase 1 dredge areas investigated in River Section 1 were subdivided into four areas: Rogers Island West, Rogers Island East, Main River, and Griffin Island. Within each subarea, binned singlebeam data from soundings acquired in 2001 were compared with corresponding multibeam data bins.

A review of several comparative profiles showed that in most relatively flat areas, the two bathymetric surveys produced extremely consistent results. In areas where river bed slopes were pronounced, differences were observed. One explanation for these observed differences may be due to variations in transducer design specifications between the two sounding systems. The singlebeam depth sounder uses a fixed 3° transducer, while the multibeam system forms a sequence of ½° transducer beams. The narrower beam in the multibeam system receives acoustic reflections from a smaller area on the river bed resulting in a more focused measurement.

Where profiles from the two surveys showed different trends or discrepancies in channel shape beyond those that could be explained by system variations, it is believed that differences observed on similar profile sections were the result of natural changes (erosion and/or sedimentation) over the 4-year period between surveys. Detailed information on the evaluation of multibeam and singlebeam profiles is provided in Exhibit B.

The design team uses bathymetric data to develop dredge prisms and calculate potential dredged material quantities. To illustrate potential differences in the volume calculated using the two bathymetric techniques, several models were reviewed. As expected, volumes calculated for dredge design prisms located further from where singlebeam data were actually acquired showed the largest differences when compared to volumes calculated based on the multibeam dataset. Detailed information regarding these differences is provided in Exhibit B.

2.1.2 Sub-Bottom Profiling Survey

To classify the surficial sediments in the river, the sub-bottom profiling survey consisted of acquiring GPR data along survey lines laid out both parallel and oblique to the course of the river within the Phase 1 dredge areas. Initial processing of the GPR data focused on categorizing reflections along the primary or longitudinal survey lines into four classes (Class I - IV) based on reflective characteristics. Reflector characteristics are generally associated with specific sediment types or rock. Class IV radar reflections are the principal focus of this investigation as they typically characterize areas predominantly composed of interbedded silts, silty-sands/sandy-silts, and clay, and often provide information pertaining to sediment thickness. Radar reflections in the remaining class categories provide little sub-bottom information and generally correlate with coarser sediment assemblages, and/or rock on the river bed.

Despite the fact that the majority of sediment deposits targeted for dredging in Phase 1 have been classified as fine sand and/or silt, less than approximately 15% of all the longitudinal survey lines classified within the proposed dredge areas exhibited reflections characterized as Class IV. As a result, the GPR survey was not effective in penetrating the river bed over any large areal extent in the river and providing the information necessary to confidently resolve sediment thickness at a resolution less than approximately 0.5 foot. Based on these findings, the use of GPR is not recommended during future investigations of the river. Detailed information regarding these recommendations is provided in Exhibit B.

2.1.3 Magnetometer Survey

Magnetometer data were acquired concurrently with the GPR data along all survey lines investigated in the Phase 1 dredge areas. The principal focus of the magnetic survey was to identify ferrous objects within the dredge areas that could potentially impact implementation of the project. The magnetometer system used during the survey was equipped with dual cesium sensors that were operated in gradiometer mode. This mode emphasizes short duration anomalies typically associated with man-made ferrous objects.

The magnetometer results were used to identify the locations of numerous isolated magnetic anomalies. With the exception of a few, the majority of anomalies detected were relatively small. In and around Lock 7, the bridges that pass over the river onto Rogers Island, several small private docks, and along the bulkheaded shoreline in downtown Fort Edward the magnetometers detected a significant source of ferrous mass. In some cases, the ferrous mass associated with these known features saturated the sensors and reduced their ability to detect smaller ferrous objects in the area surrounding the larger features. As a result, around these large ferrous features smaller ferrous objects may be present, but were masked by their surroundings and not detected. More detailed information regarding these issues is provided in Exhibit B.

2.2 Additional Geotechnical Engineering Data Collection

Additional geotechnical engineering data collection activities consisted of Standard Penetration Testing (SPT) and Cone Penetrometer Testing (CPT). Atlantic Testing Laboratories Company (ATL) provided the drilling services for both sampling activities, which were carried out in October and November 2005. A series of laboratory analyses designed to characterize the sediments (e.g., shear strength, grain size, Atterberg limits, etc.) was proposed in SEDC Addendum No. 2 (BBL, 2005b), but the visual classification and assessment performed on samples in the field was adequate to gather the desired information. As a result, no samples were retained for laboratory testing.

2.2.1 Field Work

Based on the issues described in SEDC Addendum No. 2 (BBL, 2005b), two SPT borings were drilled in accordance with ASTM D15862, and 16 CPT borings were drilled in accordance with ASTM D5778. Locations of the borings are shown on Figures 1 and 2. The SPT boring logs are included in Exhibit C and the CPT boring logs are included in Exhibit D.

The SPT borings (B-079 and B-080) were advanced by a barge-mounted drilling rig, and samples were collected continuously at 2-foot intervals to varying depths below the existing mudline. Boring B-079 was drilled to rock, while B-080 was drilled to a depth to determine the presence and depth of the underlying clay layer.

The CPTs provided virtually continuous measurements of the cone resistance, friction sleeve resistance, and piezocone pore pressure. These measurements were used to interpret subsurface stratigraphy and estimate engineering properties of the sediments and sub-bottom materials. Where refusal was encountered in an initial CPT boring, the location was off-set from the original location as noted in Table 1 and re-drilled.

Several CPT exploration locations were co-located with SPT borings completed in Phase 1 areas. (This is customary, as no samples are collected during the CPT.) This approach facilitated a better interpretation of CPT results and allowed for a quantifiable calibration of CPT data against available conventional geotechnical soil strength parameters.

All SOPs and applicable ASTM methods previously presented in the SEDC Work Plan (BBL, 2004a) applied to this additional work. Data on cone resistance, friction sleeve resistance, and piezocone pore pressure were obtained by performing CPTs with pore pressure measurements in accordance with ASTM D5778 and the CPT SOP provided with SEDC Addendum No. 2 (BBL, 2005b).

2.2.2 Subsurface Conditions

In general, similar conditions were encountered in broad areas, with some localized distinct features. To facilitate use of the data on the deeper subsurface conditions in the design, the following stratification system was employed:

- Stratum A – very loose to loose dark grey-brown silty sand;
- Stratum B – very soft to medium stiff dark grey lean silty clay; and
- Stratum C – hard dark grey shale bedrock.

These stratifications were based on field observations and previous geotechnical laboratory results. The N values described in the following subsections represent SPT resistances encountered in a particular layer as determined from the number of blows required to drive a 2-inch-outside-diameter, 1-3/8-inch-inside-diameter sampling spoon 1 foot using a 140-pound hammer falling 30 inches. This test is conducted after seating the sampler 6 inches in the bottom of the hole according to ASTM D1586.

Stratum A

Stratum A consists of very loose to loose dark grey-brown silty sand and extended from the mudline to a maximum depth of:

- 12 feet from RM 194.1 to 193.1;
- 26 feet from RM 193.1 to 191.7;
- 10 feet from RM 190.5 to 189.5; and
- 14 feet from RM 185.0 to 183.6.

Stratum A exhibited N values within a range of 0 (weight of the rods) to 8, with a median value of 3. Organic material consisting primarily of wood chips or woody debris was periodically encountered within the stratum, along with occasional brick fragments, and may be the cause of some of the higher recorded N values within the stratum. Tip stresses recorded on the cone were generally very low due to the predominantly non-cohesive, loose nature of Stratum A.

Stratum B

Stratum B consists of very soft to medium stiff dark grey lean silty clay. The surface of Stratum B was encountered at the mudline to a depth of 26 feet, but was generally found underlying Stratum A, and extended to the depth of bedrock. The bedrock surface ranged from 10 to 67 feet below the mudline. Thin layers of silt and silty fine sand at various locations and depths were also encountered within this stratum. Stratum B exhibited N values within a range of 0 (weight of the rods) to 2 with a median value of 0. Although samples in Boring B-079 indicate clay in the split-spoon, the high blow counts are indicative of the presence of extensive rock fragments. Tip stresses recorded on the cone were generally very low due to the predominantly soft cohesive nature of Stratum B. In addition, a marked increase in pore pressure was noted at the interface between the overlying sand (Stratum A) and the clay unit (Stratum B).

Stratum C

Stratum C consists of weathered to sound hard dark grey shale bedrock. Stratum C was encountered in Boring B-079 at a depth of 10 feet. In addition, CPT refusal was encountered in CP-001 through CP-008, CP-011 through CP-014, and CP-016 at depths between 10 and 67 feet. These findings are corroborated by test boring data at close proximity that identify the presence of shale bedrock.

During the advancement of CP-004, refusal was encountered at 67 feet (CP-004 was performed adjacent to Test Boring B-007, which was drilled to 63 feet without encountering rock). CPT refusal was encountered in CP-005 within a sand/gravel layer at 28 feet (as can be understood from the increase pore pressure at that depth), a depth that is commensurate with Test Boring B-067, which indicated increased blow counts in a sand and gravel unit (Stratum A) at a depth of 25 feet. Samples of Stratum C were not obtained for testing purposes.

3. References

BBL. 2005a. *Supplemental Engineering Data Collection Work Plan, Addendum No. 1* (SEDC Addendum No. 1) (Revised Version). Hudson River PCBs Superfund Site. Prepared for General Electric Company, Albany, NY. May 2005.

BBL. 2005b. *Supplemental Engineering Data Collection Work Plan, Addendum No. 2* (SEDC Addendum No. 2). Hudson River PCBs Superfund Site. Prepared for General Electric Company, Albany, NY. September 2005.

BBL. 2005c. *Year 2 Supplemental Engineering Data Collection Interim Data Summary Report* (Year 2 SEDC IDSR). Hudson River PCBs Superfund Site. Prepared for General Electric Company, Albany, NY. March 2005.

BBL. 2004a. *Supplemental Engineering Data Collection Work Plan* (SEDC Work Plan). Hudson River PCBs Superfund Site. Prepared for General Electric Company, Albany, NY.

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EPA/GE. 2002. Administrative Order on Consent for Hudson River Sediment Sampling (Index No. CERCLA-02-2002-2023) (Sediment Sampling AOC). Effective Date July 26, 2002.

EPA/GE. 2003. Administrative Order on Consent for Hudson River Remedial Design and Cost Recovery (Index No. CERCLA-02-2003-2027) (RD AOC). Effective Date August 18, 2003.

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QEA. 2003. *Supplemental Field Sampling Plan* (Supplemental FSP). Hudson River PCBs Superfund Site. Prepared for General Electric Company, Albany, NY.

QEA and ESI. 2002. *Sediment Sampling and Analysis Program – Quality Assurance Project Plan* (SSAP-QAPP). Hudson River PCBs Superfund Site. Prepared for General Electric Company, Albany, NY.

QEA and ESI. 2005. *Supplemental Delineation Sampling Program Data Summary Report* (2004 DSR). Hudson River PCBs Superfund Site. Prepared for General Electric Company, Albany, NY.

QEA, ESI, and OSI. 2004a. *Sediment Sampling and Analysis Program, Data Summary Report for Candidate Phase 1 Areas* (Phase 1 DSR). Hudson River PCBs Superfund Site. Prepared for General Electric Company, Albany, NY.

QEA, ESI, and OSI. 2004b. *Sediment Sampling and Analysis Program, Data Summary Report for Phase 2 Areas* (Phase 2 DSR). Hudson River PCBs Superfund Site. Prepared for General Electric Company, Albany, NY.

Table

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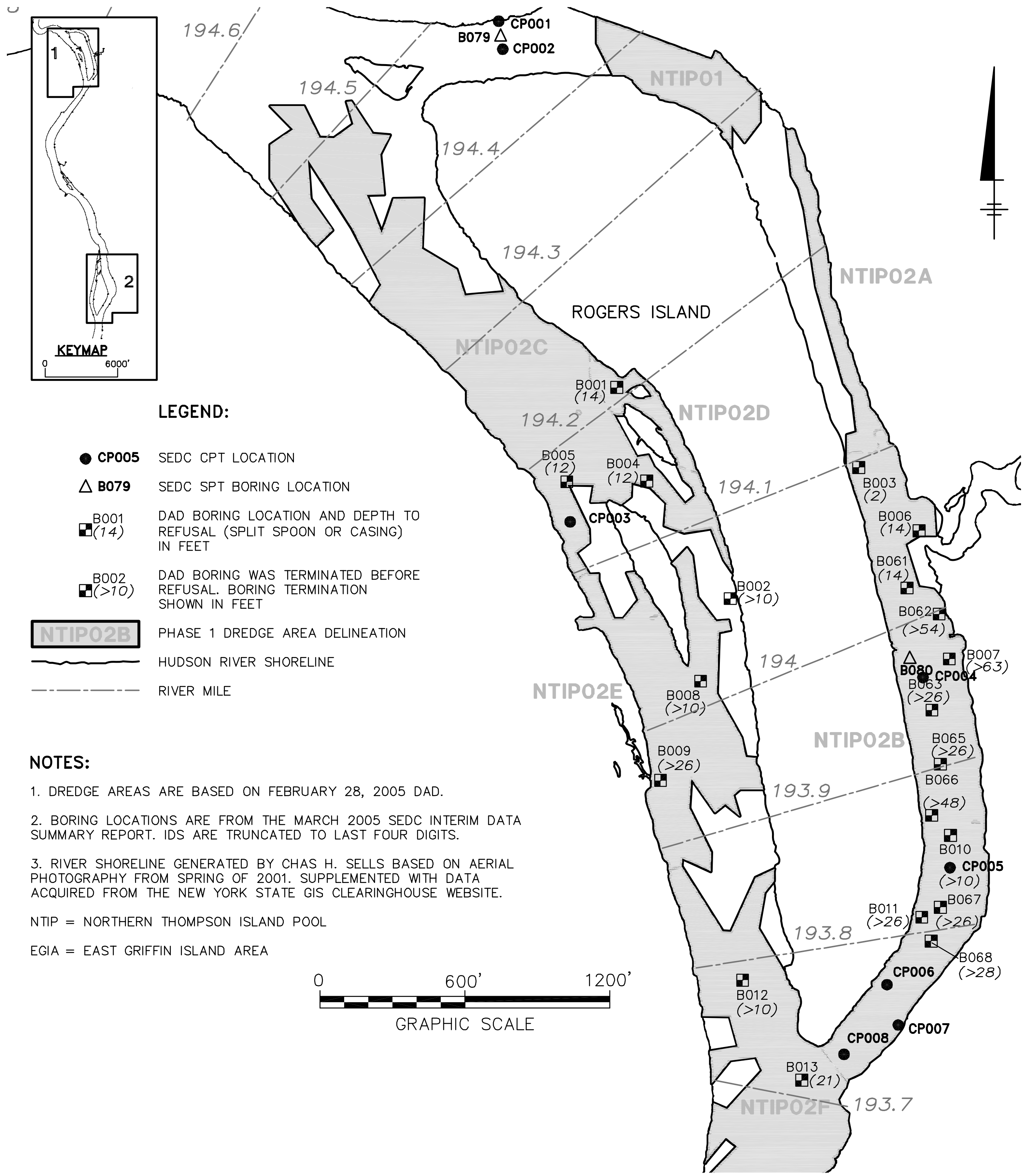
Year 2 Supplemental Engineering Data Collection Data Summary Report

Table 1 - Cone Penetrometer Testing Location Offset Information

CPT ID	Start Date	End Date	Northing	Easting
CP004	10/21/2005	10/21/2005	1614343.388	736166.293
CP005	10/21/2005	10/21/2005	1613557.884	736277.443
CP001	10/24/2005	10/24/2005	1617047.862	734414.077
CP001-A	10/24/2005	10/24/2005	1617040.973	734417.657
CPT001-B	10/24/2005	10/24/2005	1617012.547	734436.66
CP002	10/24/2005	10/24/2005	1616953.111	734430.101
CP002A	10/24/2005	10/24/2005	1616906.251	734483.865
CP002B	10/24/2005	10/24/2005	1616906.251	734483.865
CP003	10/24/2005	10/24/2005	1614988.926	734707.149
CP006	10/24/2005	10/24/2005	1613063.445	736018.011
CP007	10/24/2005	10/24/2005	1612900.228	736062.353
CP007A	10/24/2005	10/24/2005	1612901.72	736040.78
CP007B	10/24/2005	10/24/2005	1612918.368	736009.904
CP008	10/25/2005	10/25/2005	1612780.573	735840.744
CP008A	10/25/2005	10/25/2005	1612769.68	735847.22
CP006A	10/25/2005	10/25/2005	1613070.734	736034.019
CP009	10/31/2005	10/31/2005	1596350.274	737772.273
CP010	10/31/2005	10/31/2005	159304.914	737687.425
CO011	10/31/2005	10/31/2005	1595926.036	737876.075
CP011A	10/31/2005	10/31/2005	1595917.935	737862.109
CP011B	10/31/2005	10/31/2005	1595930.177	737847.010
CP012	11/1/2005	11/1/2005	1595917.383	737825.472
CP012A	11/1/2005	11/1/2005	1595931.644	737821.302
CP012B	11/1/2005	11/1/2005	1595915.722	737806.691
CP013	11/1/2005	11/1/2005	1595709.477	737993.583
CP013A	11/1/2005	11/1/2005	1595711.463	737979.353
CP013B	11/1/2005	11/1/2005	1595719.135	737966.016
CP014	11/1/2005	11/1/2005	1595705.555	737918.723
CP014A	11/1/2005	11/1/2005	1595708.429	737905.966
CP014B	11/1/2005	11/1/2005	1595722.558	7379053.705
CP015	11/1/2005	11/1/2005	1595475.923	737721.493
CP016	11/1/2005	11/1/2005	1595432.087	737996.134
CP016A	11/1/2005	11/1/2005	1595436.58	737976.749
CP016B	11/1/2005	11/1/2005	1595431.751	757959.923

Figures



NOTES:

1. DREDGE AREAS ARE BASED ON FEBRUARY 28, 2005 DAD.
2. BORING LOCATIONS ARE FROM THE MARCH 2005 SEDC INTERIM DATA SUMMARY REPORT. IDS ARE TRUNCATED TO LAST FOUR DIGITS.
3. RIVER SHORELINE GENERATED BY CHAS H. SELLS BASED ON AERIAL PHOTOGRAPHY FROM SPRING OF 2001. SUPPLEMENTED WITH DATA ACQUIRED FROM THE NEW YORK STATE GIS CLEARINGHOUSE WEBSITE.

NTIP = NORTHERN THOMPSON ISLAND POOL

EGIA = EAST GRIFFIN ISLAND AREA

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YEAR 2 SEDC DSR

FINAL DAD AND SEDC EXPLORATION LOCATIONS (RIVER MILE 194.5 TO 193.7)

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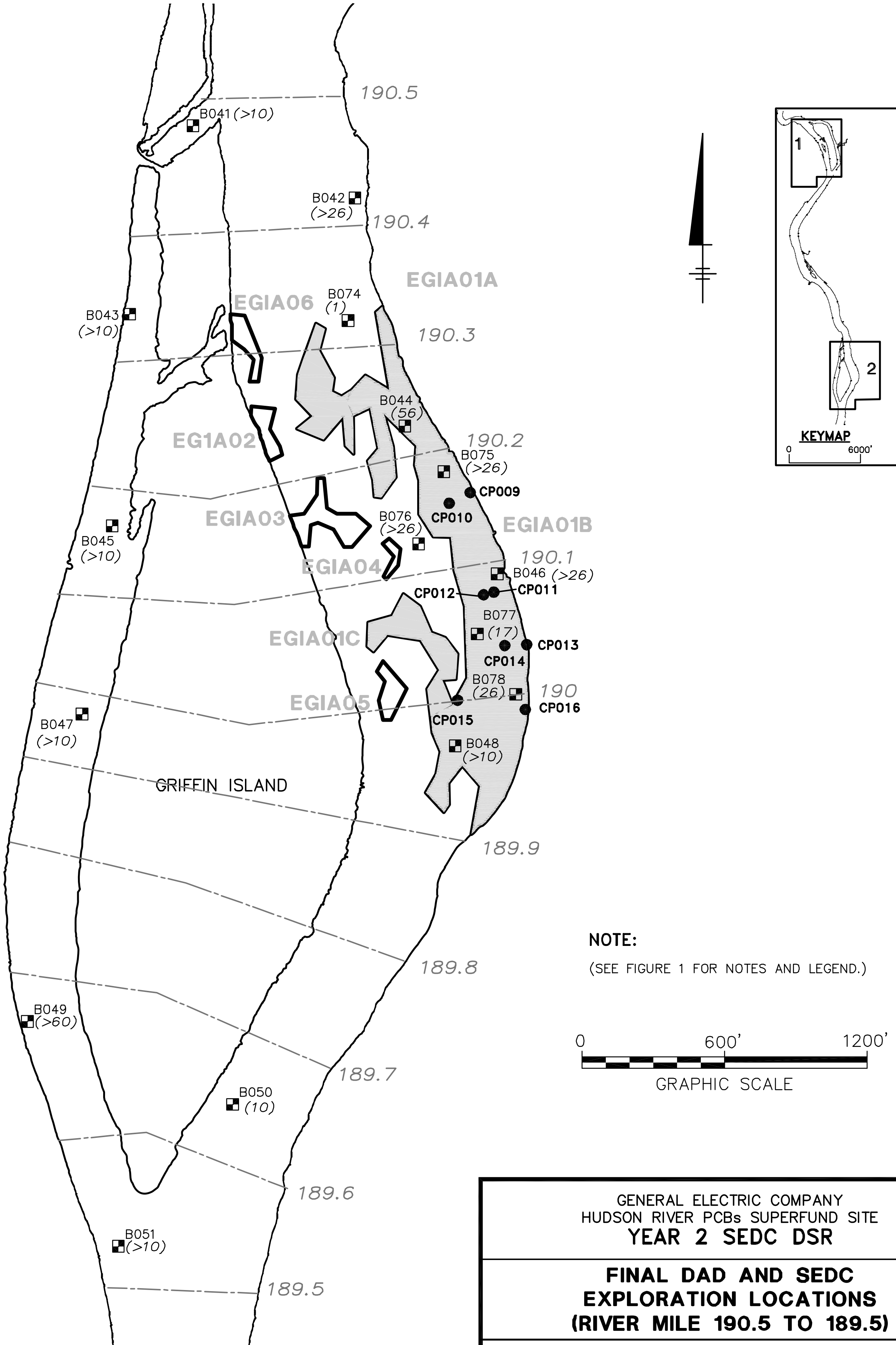
FIGURE
1

X: 20430X03.DWG
L: ON=*, OFF=*REF*
P: PAGESET/PLT-AP1
2/17/06 SYR-85-RLP RLP BGP
N/20430006/DSR/20430B01.DWG



NOTE:

(SEE FIGURE 1 FOR NOTES AND LEGEND.)

0 600' 1200'
GRAPHIC SCALE

X: 20430X03.DWG
L: ON=*, OFF=*REF*
P: PAGESET/PLT-AP1
2/15/06 SYR-85-RLP RLP BGP
N/20430006/DSR/20430B01.DWG

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
YEAR 2 SEDC DSR

FINAL DAD AND SEDC EXPLORATION LOCATIONS (RIVER MILE 190.5 TO 189.5)

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FIGURE
2

Exhibits

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Exhibit A

EPA Approval Letters for SEDC Addenda No. 1 and No. 2

BLASLAND, BOUCK & LEE, INC.
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June 10, 2005

Via First Class Mail

John Haggard
General Electric Company
320 Great Oaks Office Park, Suite 319
Albany, New York 12203

Re: Addendum No. 1 Supplemental Engineering Data Collection Work Plan

Dear Mr. Haggard:

The United States Environmental Protection Agency (EPA) has reviewed General Electric Company's (GE's) Addendum No. 1 Supplemental Engineering Data Collection Work Plan, which was transmitted to the Agency on June 10, 2005.

EPA is approving this document. This written approval supplements EPA's verbal approval that I provided to Bob Gibson on May 31, 2005. The verbal approval was contingent upon eliminating references in the document that linked the Phase 1 Final Design to completion of field work and data processing for activities conducted under this work plan. Verbal approval was given to allow field work to start without delay.

Please call me at (212) 637-3952 if you have any questions.

Sincerely yours,

Doug Garbarini
Team Leader

Hudson River Team

cc: W. Daigle, NYSDEC
R. Gibson, GE

September 27, 2005

Via Electronic Mail and
First Class Mail

John Haggard
General Electric Company
320 Great Oaks Office Park, Suite 323
Albany, New York 12203

Re: Hudson River PCBs Superfund Site

Dear Mr. Haggard:

This is to inform you that the United States Environmental Protection Agency (EPA) has reviewed General Electric Company's (GE's) September 9, 2005, Addendum No. 2 to the Supplemental Engineering Data Collection Work Plan – Year 2 Hudson River PCBs Site. The Addendum is approved.

Please call me at (212) 637-3952 if you have any questions.

Sincerely,

Doug Garbarini
Team Leader
Hudson River Team

cc: William Ports, NYSDEC

Exhibit B

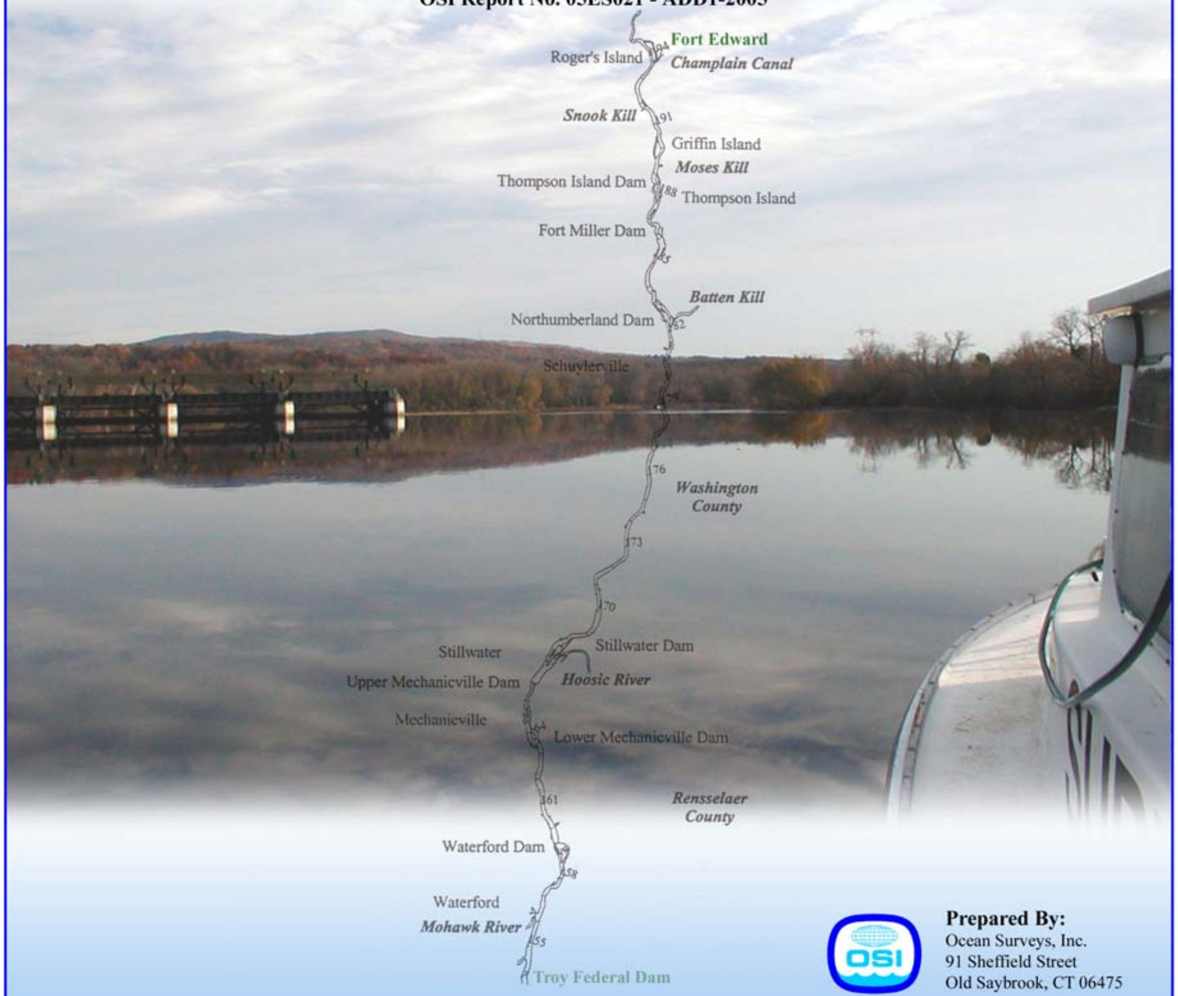
OSI Summary Report
(Only text of report provided here; Appendices can be provided on DVD upon request)

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Addendum No. 1
Survey Investigations
And Supplemental Ground Truth Program Report

Hudson River, River Section 1
Spring/Summer 2005

OSI Report No. 05ES021 - ADD1-2005



Prepared By:
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March 2006

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APPENDICES

Addendum No. 1
Survey Investigations
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1.0 INTRODUCTION

The investigations described herein were performed during the late spring and summer of 2005 by Ocean Surveys, Inc. (OSI) in accordance with Addendum No. 1 (Addendum) (BB&L, 2005) to the *Supplemental Engineering Data Collection Work Plan* (SEDC Work Plan) (BB&L, 2004) submitted to the United States Environmental Protection Agency (USEPA) by General Electric Company (GE) in May 2005. The investigations were developed primarily to provide engineering data to support the Phase 1 remedial design (RD) to implement the February 2002 Record of Decision (ROD) (United States Environmental Protection Agency, 2002) for the Hudson River PCBs Site.

Surveys were performed in River Section 1 in portions of the candidate Phase 1 dredge areas north of the Snook Kill (Northern Thompson Island Pool) and on the east side of Griffin Island (Figure 1). Following the conclusion of these field investigations and an initial review of the acquired data, OSI performed a supplemental ground truth vibratory coring and probing program to aid in the interpretation and review of the acquired data.

2.0 PROJECT SUMMARY

2.1 Project Overview and Objectives

Previous investigations by OSI in support of the project have provided data necessary to meet initial data quality objectives of the RD and to evaluate instrumentation and survey techniques. These surveys included the collection of singlebeam sounding data, side scan sonar imagery and subbottom profile data. These investigations have been described in detail in OSI Data Summary and Interpretation Reports (DSR-F2002,

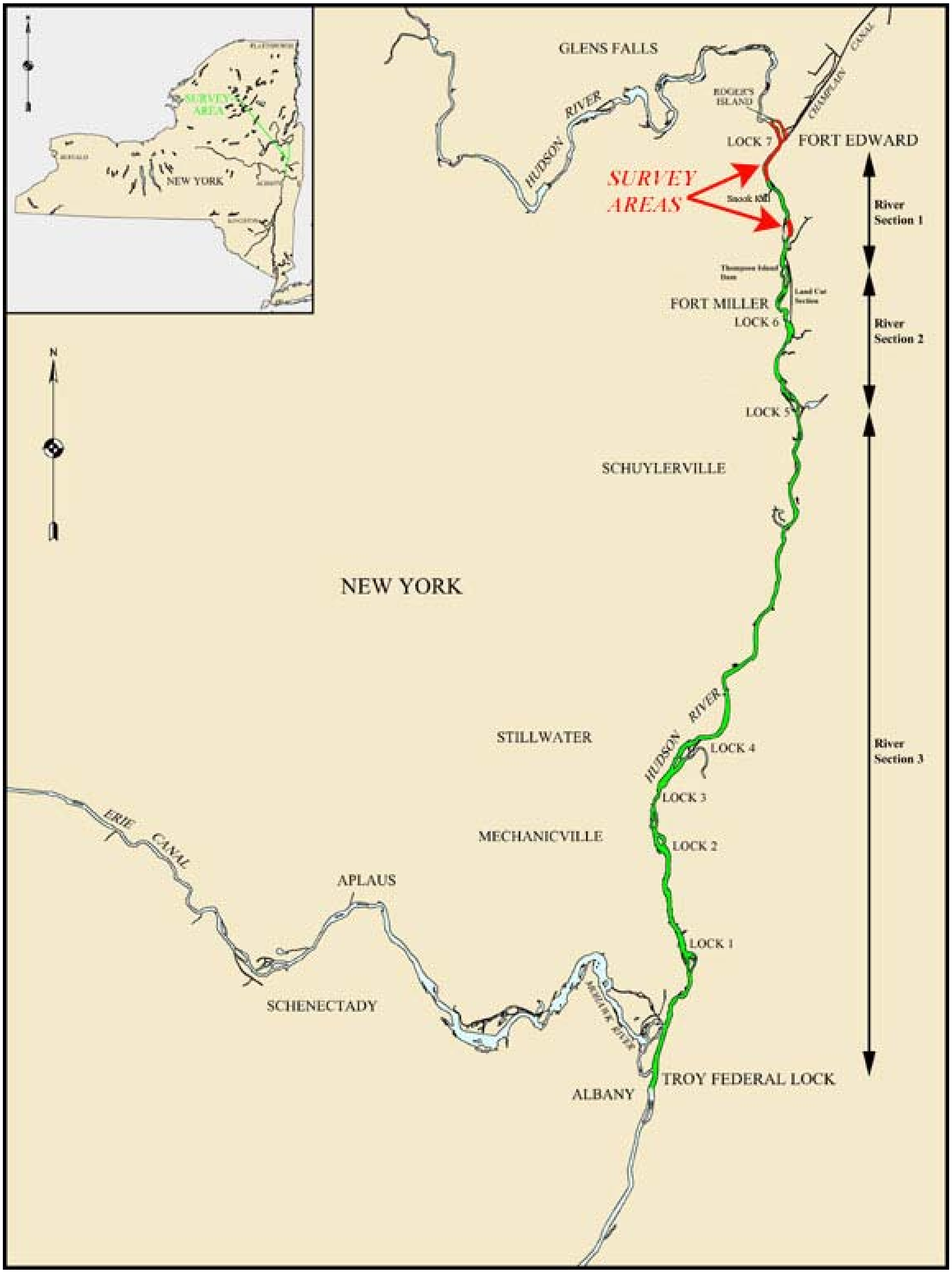

FIGURE 1 – Upper Hudson River survey site location map.

DIR-F2002, DIR-S2003) and in the OSI Subbottom Profiling Test Program Report (SBT-F2003), which were included as appendices in the GE Hudson River Project *Year 1 Data Summary Report* (QEA 2003), the *Data Summary Report for Candidate Phase 2 Areas* (QEA and ESI 2004), and the Draft Phase 2 Data Summary Report (QEA et al., 2004b), respectively.

The SEDC Addendum survey investigations were performed with the primary goal of providing the engineer with data necessary to complete the Phase 1 RD. Specific survey data acquired by OSI in accordance with the Addendum included: multibeam bathymetry, ground-penetrating-radar (GPR), and magnetometer.

Multibeam sounding data were acquired with the intent of:

- Refining the river bed contours previously developed based on singlebeam sounding data, such that the river bed elevation map is accurate to RD specifications necessary for the development of dredge prisms and other design documents
- Evaluating the difference in river bed elevations generated by singlebeam soundings versus multibeam soundings
- Refining the mapping of debris and obstructions identified during the previous side scan sonar survey and quantifying the vertical projection of these obstructions above the river bed surface.

GPR subbottom profiling data were acquired with the intent of:

- Assessing the continuity or heterogeneity of subsurface features, including hard surfaces and distinct sediment strata underlying the river bed
- Identifying subsurface features that may restrict the depth of anchorage for re-suspension control systems and dredging equipment
- Further evaluating the utility of GPR as a remote sensing tool to meet the specifications of the Phase 2 RD.

Magnetometer data were acquired with the primary intent of identifying ferrous objects present on or just beneath the river bed that might impact the project (e.g., utilities, debris, cultural resources).

2.2 Summary of Field Survey and Equipment

Survey and ground truth sampling investigations were planned and accomplished as three interrelated tasks by three separate field crews (40-hour OSHA trained and certified) working from different support vessels. Tasks I and II focused on the acquisition of *multibeam hydrographic data* and *GPR and magnetometer (geophysical) data*, respectively. These surveys were generally performed concurrently during the late spring and early part of the summer, 2005. Multibeam surveys were conducted from OSI's survey vessel, "R/V Echo", a 25-foot long, shallow draft (2.5 feet) vessel outfitted with an over-the-side multibeam transducer mount. Geophysical surveys were performed from OSI's survey vessel "R/V Skimmer", a 21-foot flat-bottom vessel equipped with an in-hull mounted GPR antenna and dual bow-mounted magnetometer sensors. Upon completion of the Task II survey, the R/V Skimmer was used to acquire hand soundings (by the Task I crew) in areas inaccessible to the larger survey vessel including areas choked with abundant submerged aquatic vegetation (SAV).

Task III, initiated after the completion of the Task I & II survey investigations and a preliminary review of the acquired data, consisted of the acquisition of vibratory cores and push probes to supplement and ground truth the GPR data (late summer 2005). Coring and probing were accomplished from OSI's "R/V Willdu", a self-propelled 24 foot by 8 foot pontoon spud vessel equipped with a moon pool in it's deck, a center mounted tripod, lifting winch and vibratory corer. Figure 2 provides photographs of the three OSI vessels used to complete each task and Table 1 presents a detailed chronological summary of the field investigation(s).

Following the conclusion of coring and probing operations, all cores were transported to the GE core processing facility in Ft. Edward for analysis by an OSI geologist. The analysis included: longitudinally splitting, visually describing/logging and photographing each core.

FIGURE 2 – OSI survey vessels used to complete the investigation, R/V Echo (upper), R/V Skimmer (middle) and R/V Willdu (lower).

TABLE 1
Chronological Summary of Field Investigation

DATE	Survey Activity
4 Jun-05	OSI ***hydrographic survey crew travels*** to site from CT / launches survey vessel / establishes navigation base station / begins on-site calibrations.
5 Jun-05	**Multibeam survey investigation (Task I) initiated.**
6-15 Jun-05	Hydrographic crew **acquires multibeam** sounding data.
16 Jun-05	OSI ***Geophysical survey crew travels*** to site from CT/ launches survey vessel/ performs on-site testing and calibration of equipment. Hydrographic crew **acquires multibeam** sounding data.
17 Jun-05	**Magnetometer/GPR survey investigation (Task II) initiated**. Hydrographic crew **acquires multibeam** sounding data.
18-22 Jun-05	Geophysical survey crew **acquires magnetometer/GPR** data. Hydrographic crew **acquires multibeam** sounding data.
23 Jun-05	**Magnetometer/GPR survey interrupted**, while geophysical crew performs other unrelated project tasks. Hydrographic survey crew **acquires multibeam sounding data.**
24-29 Jun-05	Geophysical survey crew **acquires magnetometer/GPR** data. Hydrographic crew **acquires multibeam** sounding data.
30 Jun-05	**Magnetometer/GPR survey investigation (Task II) completed**, geophysical survey crew hauls vessel from water, demobilizes equipment on-site, and returns to CT. Hydrographic crew continues to **acquire multibeam** sounding data.
1 Jul-05	Hydrographic crew continues to **acquire multibeam** sounding data. At the end of the day crew secures survey vessel and equipment on-site and transits to CT for Holiday break.
2-4 Jul-05	Hydrographic survey investigations **halted for holiday break**.
5 Jul-05	Hydrographic **survey crew returns** to site with R/V Skimmer
6-10 Jul-05	Hydrographic crew continues to **acquire multibeam** sounding data.
11 Jul-05	Hydrographic crew hauls R/V Echo from water and launches R/V Skimmer. Crew **begins to acquire hand-soundings** in areas that were inaccessible to the larger survey vessel or abundant with SAV.
12-17 Jul-05	Hydrographic crew **acquires hand-soundings**.
18 Jul-05	**Hydrographic crew completes survey (Task I) investigation**, hauls survey vessel from water, demobilizes equipment on-site, and returns to CT.
17 Aug-05	**Coring/probing crew travels** to site from CT.
18 Aug-05	Coring/probing crew launch coring barge, establish navigation base station, and **initiate coring/probing (Task III) investigation.**
19-20 Aug-05	Perform **coring/probing investigation.**
21 Aug-05	**Coring/probing investigation completed.**
22 Aug-05	Coring/probing crew report to GE core laboratory and setup lab for core processing and **begin core analysis.**
23 Aug-05	Coring/probing crew continues to **perform core analysis.**
24 Aug-05	Coring/probing **crew complete core analysis (Task III).** Crew breaks down laboratory setup, disposes cores, and proceeds to haul coring barge from water and return to CT.

A real-time Kinematic Differential Global Positioning System (RTK DGPS) receiver was installed on each of the survey and coring vessels. Each system was interfaced to an onboard computer and to a shore side GPS base station. This integrated system provided all field crews with the ability to navigate precisely along pre-selected survey tracklines and to specific targeted locations on the river. The accuracy of the positioning system (approximately 1-2 centimeters) was verified at the beginning and ending of each survey day by occupying known survey control monuments provided by Quantitative Environmental Analysis, LLC (QEA). Survey investigations were performed in feet and are referenced horizontally to the New York State Plane Coordinate System, East Zone (3101), NAD 83. To assure an accurate vertical reference for all survey data the RTK DGPS system was also configured to provide continuous GPS antenna height referenced to North American Vertical Datum of 1988 (NAVD88). With the antenna height above the water surface known, all data acquired could be corrected to elevations in this datum. As with the horizontal data, GPS antenna height above the water was confirmed at the beginning and ending of each day by taking a reading at a water level staff that had been leveled to a known benchmark provided by QEA.

A summary of the primary equipment employed on the vessels during each task of this investigation is presented in Table 2. Appendix 1 provides additional information regarding the equipment and equipment layout sketch depicting offsets on each survey vessel from the GPS antennae. Appendix 2 provides equipment specification sheets.

TABLE 2
Summary of Primary Equipment Employed to complete the Investigation

Equipment	Equipment Function
All Vessels (Tasks I,II, & III)	
Trimble 7400 MSi Real-Time Kinematic (RTK) Differential Global Positioning System (DGPS) interfaced with a modified version of HYPACK® MAX PC-based navigation and data logging software package	Satellite positioning system which tracks up to nine satellites (L1 C/A code, L1/L2 full cycle carrier) simultaneously and applies position correction factors relayed to it via radio-link from a shore-based GPS reference station (set at a known control monument) to provide reliable, high precision positioning. The system provides position fixes at a rate of one per second to an onboard navigation and data-logging computer that provides real time trackline control (helmsman steerage for survey lines), digital data recording, and position interfaces for all equipment systems.

Equipment	Equipment Function
Multibeam Survey Vessel (Task I)	
Reson SeaBat 8125 multibeam echosounder	Wide band focused multibeam sonar operating at 455 kilohertz frequency. Features 240 dynamically focused 0.5° receiver beams covering a 120° swath of the river bed. System has a reported depth accuracy of 6 millimeters and allows simultaneous acquisition of backscatter intensity.
TSS Meridian gyro compass	Gyro compass designed for dynamic operation in the marine environment; features a static heading accuracy of 0.05° and dynamic heading accuracy of 0.2°. Provides precise heading updates even through high turn rates up to 200° per second.
TSS DMS-05 motion sensor	Dynamic motion sensor capable of roll and pitch accuracy of 0.05° up to +/-60° variability and heave to +/- 10 meters vertical. Data recorded at a minimum rate of 50 readings per second.
Sea-Bird 19*plus* CTD profiler	The next generation vertical profiler which measures conductivity, temperature, and density 4 times per second. CTD profiler is critical for obtaining sound velocity measurements through the water column for adjusting the echo sounder depth values.
GPR/Magnetometer Survey Vessel (Task II)	
Malå Geoscience RAMAC ground penetrating radar (GPR) system equipped with a 250 MHz monostatic antenna	High-resolution subsurface profiler, which uses high frequency pulsed electromagnetic waves (radar) to detect and measure the depth to discontinuities in the shallow subsurface. If conditions are favorable the reflecting discontinuities relate directly to changes in sediment composition and/or structure in the underlying geology. The electromagnetic waves generated by the system are radiated from a transmitting antenna. During this investigation the radar antenna was placed in a drywell cutout in the hull of the survey vessel.
Geometrics Portable Cesium Magnetometer Model G-858 MagMapper equipped with dual cesium sensors	Magnetometer system which is designed to detect ferrous objects buried beneath or lying on the river bed by measuring variations in cesium electron energy states (changes in ambient magnetic field strength). The system equipped with dual cesium sensors was operated in gradiometer mode which emphasizes shallow magnetic anomalies while eliminating the effects of diurnal variation in the earth's magnetic field and larger scale anomalies related to deep-seated geological features. During this investigation, the dual sensors were mounted vertically four feet apart in a fully-encapsulated bow sprit extending forward of the survey vessel. The G-858 was set to acquire magnetic intensity readings from each sensor at an approximate rate of 3 times per second.
Innerspace 448 singlebeam depth sounder	Microprocessor controlled, high resolution, survey-grade depth sounder that operates at a frequency of 200 kHz, providing precise water depth measurements below the narrow beam (3°) transducer.

Equipment	Equipment Function
KVH AutoComp 1000 digital fluxgate heading sensor	An electronic fluxgate compass with better than 0.5 degrees accuracy and an automatic compensation system. The compass provides means for digital data output to the data-logging program to aid in post processing.
Ground truth Coring/Probing Vessel (Task III)	
OSI Model 500 Portable Vibratory Corer	A portable vibratory coring rig powered by a 7.5 HP gasoline engine coupled to an enclosed, flexible, rotary-drive shaft. An eccentric vibrator is attached to the outer end of the rotary-drive shaft and has a custom mount for direct coupling to a 3" OD (2.87" ID) core barrel. The core barrel is made of thin walled aluminum tubing (15' in length) which also serves as the core liner.

2.2.1 Task I Summary

In total, more than 140 statute miles of survey tracklines were investigated during Task I in an effort to attain maximum sounding coverage within the Phase 1 dredge areas (north of the Snook Kill and on the east side of Griffin Island) in River Section 1. Task I survey investigations were accomplished by a survey crew consisting of a senior multibeam hydrographer and a hydrographic survey technician. Survey tracklines were generally oriented parallel to the course of the river. Since water depth varied considerably throughout the survey areas, trackline spacing was adjusted as needed to achieve full river bed coverage (theoretically, the 120° multibeam profiling system utilized during this investigation could attain full bottom coverage in a swath 3.46 times the water depth). To assist the hydrographic crew in verifying that full bottom coverage was achieved during the survey, the HYPACK® MAX "swath-painting" option was utilized. The "swath-painting" option allows the hydrographer to monitor sounding coverage in real-time. In an effort to achieve sounding coverage along the shoreline where water depth limited vessel access the multibeam transducer head was rotated to a 45-degree position. This rotation enabled the multibeam system to "look" outward to one side of the vessel and allowed profiling toward the shore beyond areas accessible to the survey vessel. In several areas within the proposed survey limits where SAV was abundant and/or the survey vessel could not access the shore the hydrographic crew performed "hand-soundings" to augment the multibeam data set (Figure 3 and 4, presented in the multibeam bathymetry section, present an overview of inaccessible areas and areas where hand-soundings were performed within the proposed survey areas).

2.2.2 Task II Summary

In total, more than more than 80 statute miles of multi-sensor geophysical data were acquired during Task II. Task II investigations were conducted by a survey crew consisting of a geologist and geophysical technician. Singlebeam sounding data were acquired concurrently with magnetometer and GPR subbottom profile data along all tracklines surveyed. Survey lines were laid out both parallel and oblique to the course of the river. Along-river survey lines (parallel to the course of the river) were spaced 35-feet apart and cross-river survey lines extended from bank-to-bank and were spaced approximately 160 feet apart. Cross river survey lines were oriented parallel to the SSAP core grid and adjusted to pass over as many core locations as possible.

During Task II investigations, the onboard geologist performed more than 750 push probes while the survey vessel was on-line acquiring survey data to characterize the near-surface sediments. These probes were accomplished by pushing (by hand) a 1-inch diameter, thick-walled aluminum pipe into the bottom and interpreting the “feel” of the sediments through the probe. By advancing the probe into the river bed the scientist is able to gain information about the near-surface sediments (i.e. degree of compaction, presence of cobbles, gravel, sand, highly-aqueous silt). During each probe attempt, position information, sediment classification, and a comment/description of the sediment encountered were logged. Sediment classifications followed the same eight class scheme used by OSI during earlier remote sensing investigations on the river (1=gravel, 2=coarse sand, 3=fine sand, 4=silt, 5=clay, 6=organics, 7=cobbles, 8=bedrock/rock outcrop).

2.2.3 Task III Summary

Task III consisted of the acquisition of vibratory cores and additional push probes by a crew consisting of a geologist and geotechnical specialist. Core and probe locations were chosen to ground truth the GPR data. In total, forty-six locations were proposed with push probes to be accomplished at all locations and vibratory cores to be recovered at twenty-three of these locations. Push probes accomplished during this task were performed from a stationary vessel and provide much more detailed descriptions of the sediments and subsurface interfaces than the on-line probes performed during Task II. At many of the ground truth locations, multiple push probes were performed to verify findings (additional push probes were accomplished in an approximate five-foot radius circle of each other). During the course of the Task III investigation one proposed probe location was abandoned and several locations were revised to include or not include a core. In summary, forty-five locations were probed, a single vibratory core was collected at twenty-four of these locations and two cores were acquired at a twenty-fifth location, bringing the total number of cores acquired during Task III to twenty-six. Probing and coring procedures followed the same protocol established for earlier sampling programs as described in the GE Hudson River Project Year 1 Data Summary Report (QEA, 2003).

2.3 Summary of Data Processing and Products

Following the completion of the field investigation, the acquired data sets were processed and interpreted. Appendix 1 details the primary steps involved in this process and should be referred to for additional information. Table 3 describes the data presentations associated with each of the acquired data sets (on a task-by-task basis) and the location of the presentation. Since the completion of the survey investigation and prior to the submittal of this report several data products have been submitted to the dredge design/data user teams and/or the USEPA in accordance with SEDC Addendum No. 1 (BBL, 2005). These early submittals are identified in the table and have not been re-submitted with this report. Several data products are presented in a digital appendix included on a DVD presented with the report. All paper field records acquired during the course of the investigation have been annotated and will be archived.

TABLE 3

Data Presentation Summary Table

Data set	Data product description/ location of presentation
TASK I - Multibeam hydrography	
Survey Field Log	A Task I survey field log has been presented to the dredge design/data user teams and the USEPA[1] in a prior submittal and is not included with this report.
Sound Velocity Data	Sound velocity corrector files recorded in the field at the time of data collection, and processed into HYPACK® MAX format have been presented to the dredge design/data user teams and the USEPA in a prior submittal and are not included with this report. Sound velocity profiles, including a listing, statistical summary, and graph for each cast are included in Appendix 3.
Multibeam Performance Tests	Multibeam performance test results are included in Appendix 4.
Multibeam Bathymetry Data	All raw multibeam data in HYPACK® MAX format (which include depth and backscatter information) have been presented to the dredge design/data user teams and the USEPA in a prior submittal and are not included with this report. Multibeam data processed and referenced to project datum and binned to 1'x1', 5'x5', and 10'x10' cell-centered averages are included in the digital appendix. Elevation contours at 0.5 foot intervals constructed from binned 1'x1' data are included in the digital appendix in AutoCAD® Version-14 format DXF file format. Sun-illuminated shaded relief bathymetric images created from the 1'x1' data are included in the digital appendix as georeferenced TIF image files.
Multibeam Quality Assurance and Control Checks	Summaries of overlapping multibeam bathymetric data comparisons in tabular and graphical formats are presented in Appendix 5. A comparative analysis of 2005 multibeam bathymetry and 2001 singlebeam sounding data (which includes summary statistics and frequency plots) is presented in Appendix 6. Multibeam daily calibrations (which include RTK DGPS elevation checks to the QEA benchmark and multibeam nadir beam and spot river bed sounding checks) are summarized in tabular format in Appendix 7.

Data set	Data product description/ location of presentation
TASK II – Geophysical	
Survey Field Log	A Task II survey field log is included Appendix 8.
Survey Tracklines	GPR and magnetometer survey tracklines are included in OSI project drawing 05ES021.1 & .2, Sheets 34, 36-38 (sheet layout and labeling is consistent with prior OSI drawing submittals of the river in which Sheet 1 begins at the Federal Dam in Troy, NY). The drawing sheets are included in the digital appendix as AutoCAD® Version-14 format files. Reduced paper copies of the project drawing sheets are included in Appendix 9. All raw HYPACK® MAX trackline files acquired during the Task II survey have been presented to the USEPA in a prior submittal and are not included with this report.
GPR Data	All unprocessed GPR digital data files (proprietary Malå file format) have been converted to SEG Y format as outlined in Appendix 1. All digital data files (Malå and SEG Y formats) have been presented to the USEPA in a prior submittal and are not included with this report. GPR data were classified based on reflective characteristics. GPR survey tracklines were color-coded to reflect this characterization. This plan view characterization (OSI project drawing 05ES021.1, Sheets 34, 36-38) is included in the digital appendix. Reduced paper copies of the project drawing sheets are included in Appendix 9. A summary table of GPR calibration bar checks is presented in Appendix 10.
Magnetometer Data	All raw magnetometer data are included in the raw HYPACK® MAX trackline files presented to the USEPA in a prior submittal and are not included with this report. Magnetometer data were modeled to display the difference between sensor readings in two multi-colored sun-illuminated images. These presentations (OSI project drawing 05ES021.2, Sheets 34, 36-38) are included in the digital appendix. Reduced paper copies of the project drawing sheets are included in Appendix 9. Magnetic data have been reviewed with respect to sonar targets previously identified by OSI (as reported in a Technical Memorandum prepared by OSI in March 2005 and previously attached to the Year 2 SEDC DSR). The sonar target tables, updated by BBL, Inc (targets re-designated) have been revised to include an additional column to identify sonar targets that have corresponding magnetic anomalies and an estimate of gamma

Data set	Data product description/ location of presentation
Magnetometer Data (cont.)	fluctuation. This revised and updated sonar target table is included in Appendix 11.
Singlebeam Sounding Data	Singlebeam sounding data are included in the raw HYPACK® MAX trackline files presented to the USEPA in a prior submittal and are not included with this report.
On-line Push Probes	Locations of the on-line push probes are included in OSI project drawing 05ES021.1, Sheets 34, 36-38 presented in the digital appendix. A reduced paper copy of the project drawing is included in Appendix 9. Probes have been color-coded based on dominant near-surface sediment type reported. In the digital project drawing file each probe has an associated attribute, which, when selected, provides a summary of information about the probe. Appendix 10 contains a table summarizing on-line probing results.
TASK III - Supplemental core/probe ground truth	
Ground Truth Vibratory Cores and Push Probes	Locations of the ground truth vibratory cores and stationary push probes have been plotted on OSI project drawing 05ES021.1, Sheets 34, 36-38 included in the digital appendix. A reduced paper copy of the project drawing is included in Appendix 9. A table summarizing each core and probe attempt is included in Appendix 10. A complete set of core logs representing each core acquired is included in Appendix 10. Digital photographs of each core at 2-foot intervals for the entire core length in *.JPG format are included in the digital appendix. A table providing a review of ground truth core and stationary probe results with GPR data is provided in Appendix 10.

[1]Submittals to the USEPA were directed to Dr. Roger Flood at the Marine Sciences Research Center, Stony Brook University, Stony Brook, NY

3.0 DATA ANALYSIS AND DISCUSSION OF RESULTS

The following sections discuss the results of a multi-task investigation performed on the Upper Hudson River by OSI in the late spring and summer of 2005 and describe conditions encountered at that time. Seasonal variations, storm events, and/or man's influence since that time may have altered conditions reported herein.

3.1 Task I (Multibeam Bathymetry)

As discussed in Section 2.1, multibeam bathymetric surveying techniques were used in this investigation to refine bathymetric contours and quantify the difference in bathymetric model accuracy between past and present surveys. A third objective of the mapping was to prepare a bathymetric dataset that could be used to supplement the side scan sonar mapping of debris.

Side scan sonar imagery (2002-2003) and singlebeam bathymetry (2001) acquired by OSI during earlier investigations showed that the river bed in River Section 1 displayed a very complex geomorphology and contained numerous objects (fallen trees, rocks, shipwrecks and other debris) that may hinder sediment removal operations. Even with more closely spaced cross-river survey lines (100 foot intervals were used during the 2001 bathymetric survey) singlebeam bathymetry could not provide the detail needed to locate and determine the highest elevation of all debris and geomorphological features present on the river bed. Multibeam bathymetry would define the river bed to the detail needed for the RD by providing full bottom coverage in the candidate Phase 1 dredge areas in all those portions of the river accessible to a survey vessel.

3.1.1 Survey Coverage

Full bottom coverage was attained throughout most of the Phase 1 dredge areas in River Section 1. Real-time coverage monitoring techniques were used to adjust survey line spacing based on beam-width and water depth. Multibeam data were collected in shallow water by rotating the multibeam transducer 45° to “look” to one side of the survey vessel. Where the river bed sloped steeply from shore into two-feet of water, sounding data could be obtained to, or very close to, the shoreline at the time of the survey. Where the river bed sloped gently from shore, the shallow reflection angle between the signal and the river bottom created a complex path for the multibeam signal which decreased signal quality and limited coverage along the shore.

Primarily for quality assurance purposes, the areas investigated were subdivided into longitudinal river sections of varying lengths. At the boundaries of each of these sections, survey lines were extended to provide overlapping multibeam data. An additional survey line, referred to as a "tie line", was run across the river within each overlap area. This scheme of lines allowed quality checks to be performed. Figures 3 and 4 show the locations of the longitudinal river sections, the lines completed within each section, and the tie lines intersecting each overlap area.

In three small locations within Phase 1 dredge areas, one on each side of Rogers Island and one on the east side of Griffin Island, the presence of SAV required the use of hand sounding techniques to map the river bed (Figures 3 and 4). These soundings were acquired along survey lines spaced at 10-foot intervals, with the along-line soundings spaced nominally also at 10-feet. Two additional areas within Phase 2 dredge areas, one on the west side of the river between mile marker 192 and 193 and the west side of Griffin Island, were encountered where the existence of SAV prevented the use of multibeam techniques. During conversations with QEA and GE it was decided to wait until early spring to complete the survey, when water levels are historically higher and the SAV impact is minimized.

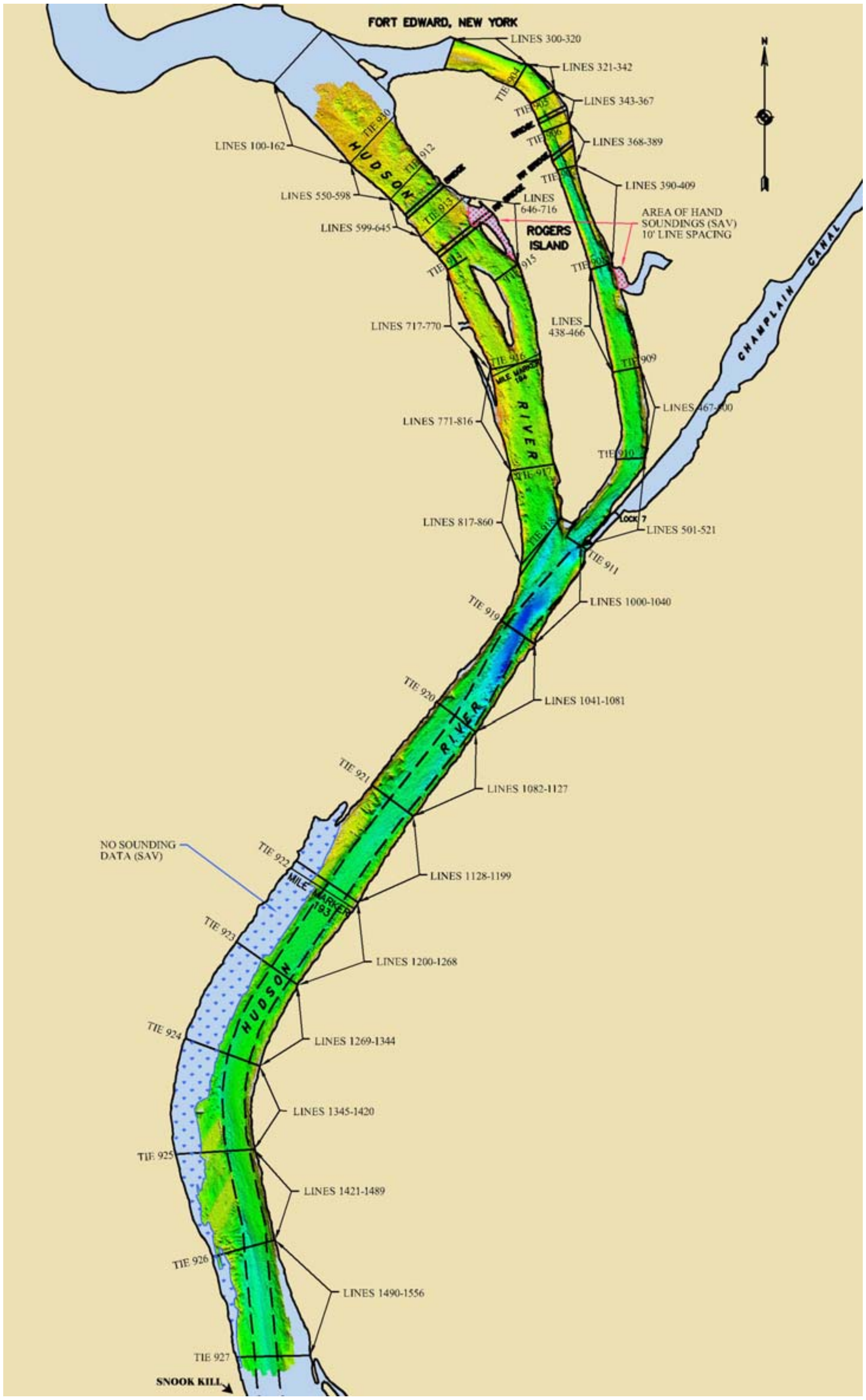

FIGURE 3 – Multibeam survey coverage in areas north of Snook Kill in River Section 1. Areas with full coverage are represented by a sun-illuminated shaded relief map (blue-green-yellow). Red dots identify areas of SAV where hand soundings were performed. Blue dots identify an area where soundings could not be performed due to SAV and shallow water. This figure also identifies survey line designations and the sections into which the survey area was subdivided for data processing and QA/QC analysis.

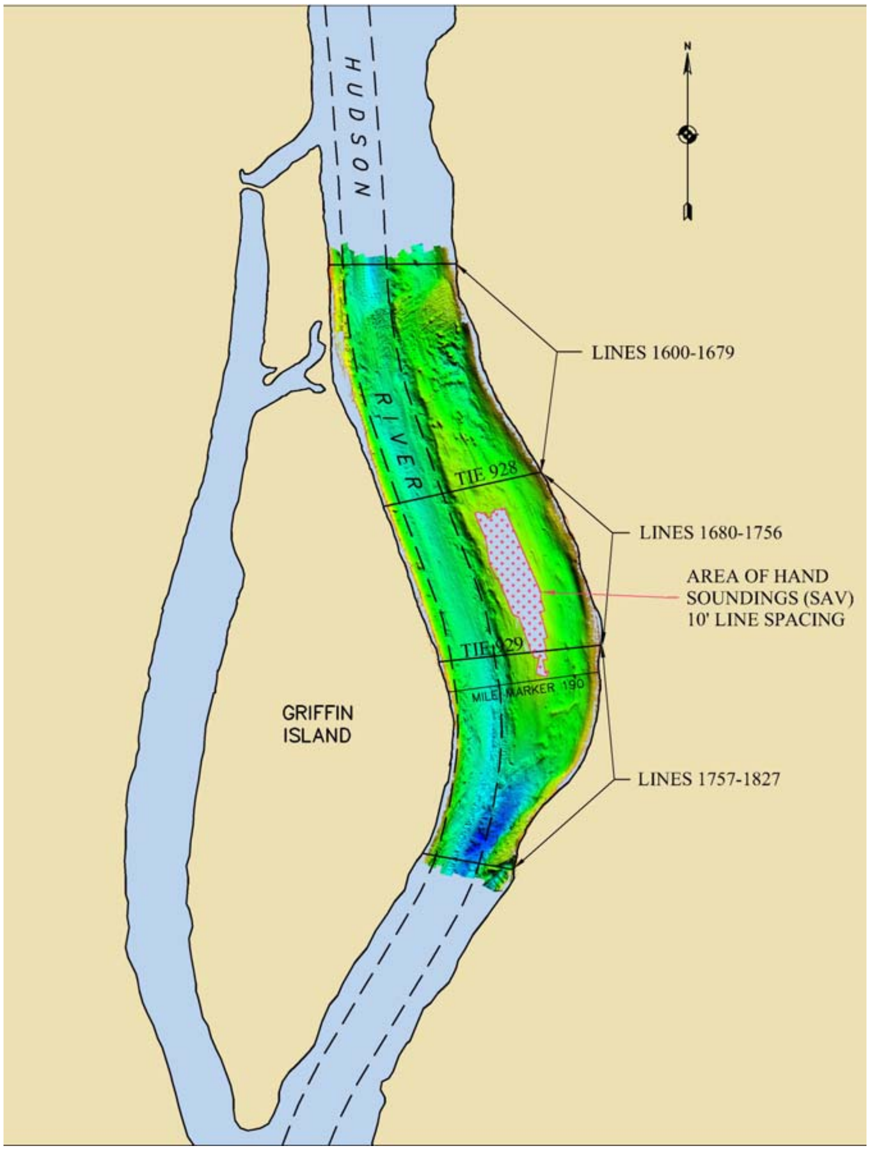

FIGURE 4 – Multibeam survey coverage in areas adjacent to Griffin Island in River Section 1. Areas with full coverage are represented by a sun-illuminated shaded relief map (blue-green-yellow). Red dots identify areas of SAV where hand soundings were performed. This figure also identifies survey line designations and the sections into which the survey area was subdivided for data processing and QA/QC analysis.

3.1.2 Multibeam Quality Control

During field data acquisition multibeam data accuracy and confidence checks were performed as documented in Appendix 7. The specific confidence checks performed included verifications for:

Vessel Position Accuracy – At the beginning and ending of each survey day the accuracy of the GPS positioning system was verified by maneuvering the vessel along side an established project control monument. The GPS position solution reported by the onboard navigation system was then compared with the known coordinates for the monument.

RTK Vertical Measurement – At the beginning and ending of each survey day a measurement from a project vertical control benchmark to the water surface was made to establish the water surface elevation. This value was then compared to the RTK tide value reported by the navigation system.

Water Mass Sound Speed. At least once per day a "bar check" was performed for the nadir beam of the multibeam depth sounder. This procedure involves lowering (under the multibeam transducer) an acoustic reflector, on a calibrated line, to known depths. These depths are stored for later comparison with final data that has been corrected using the speed of sound profiles for the entire water column made at regular intervals throughout each day. In addition, the bar is also lowered to the river bed to perform a spot sounding that is also compared to the multibeam reported depth.

Following the field investigation, as part of the data processing, further QA/QC analyses were performed to insure data quality. During the quality assurance process the average depth calculated for each 1 x 1 foot bin from one subset of data was compared to the average depth for that same bin calculated from another subset of data. Statistical summaries of these comparisons were prepared. Appendix 1 contains a detailed summary of the processing procedures and Appendix 5 contains the statistical summaries for these comparisons. In total, fifty-four data quality comparisons were performed on the acquired data set. The greatest deviation of the mean value for differences in these comparisons was 0.11 feet and the greatest standard deviation was 0.32 feet.

3.1.3 Multibeam To Singlebeam Data Comparisons

Nearly 600 million soundings were recorded during this investigation, covering an area of about six million square feet. The average data density exceeded 100 points per bin (one square foot) and ranged from one point per bin (45° lines along the shore) to over 2,000 points per bin (in shallow water areas where multiple survey line overlap exists).

By comparison, the singlebeam soundings acquired in 2001 were collected along survey lines oriented perpendicular to the course of the river and spaced nominally at 100 feet intervals. An analysis of the singlebeam data density yields approximately two soundings in each one-foot bin (where the bins represent the location of the cross river tracklines). When comparing the areas investigated between the two surveys, the singlebeam dataset has only $1/50^{th}$ the average data density as the multibeam coverage, and more importantly the singlebeam sounding coverage is skewed in concentration to those locations where survey lines were actually run. It is important to recognize that to develop a 1 x 1 foot surface model of the Phase 1 river bed using just the singlebeam data; depth in 99 out of approximately every 100 square feet of river must be interpolated. This process results in substantial smoothing for areas with very complex morphology.

To quantitatively study the differences between the 2005 multibeam and 2001 singlebeam data sets, two comparisons were made. Each of these is discussed below.

Multibeam Data Along Singlebeam Survey Lines

For a statistical comparison of multibeam and singlebeam data, the Phase 1 dredge areas investigated in River Section 1 were subdivided into four areas; Rogers Island West, Rogers Island East, Main River, and Griffin Island (Figure 5). Within each subarea, binned singlebeam data from soundings acquired in 2001 were compared with corresponding multibeam data bins. This procedure creates two sets of colocated data for each segment of the river, one with averaged singlebeam data in each bin and another with averaged multibeam data in each bin. The difference between corresponding datasets on a bin-by-bin basis was calculated. The statistics resulting from this comparison are shown in Table 4.

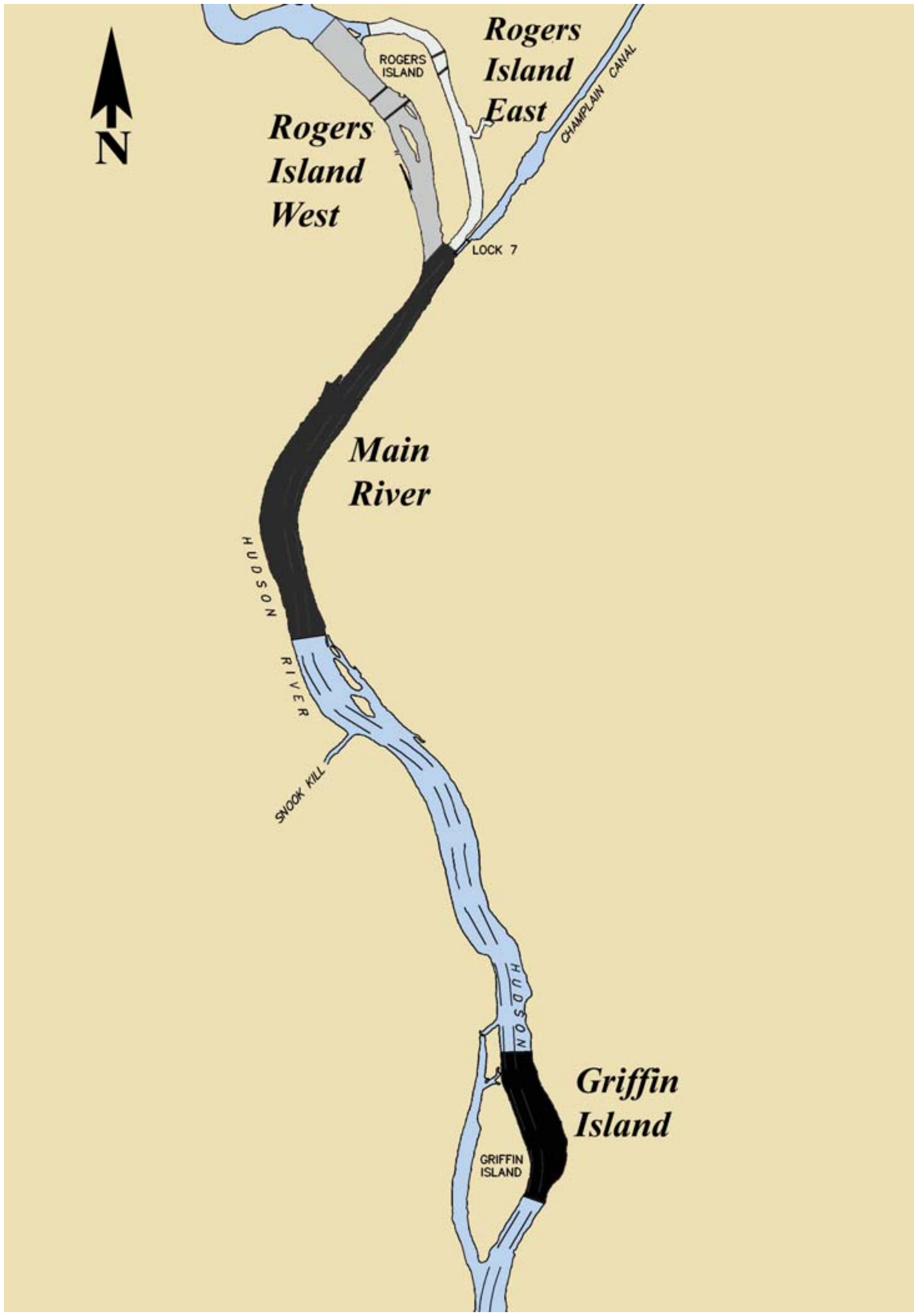

FIGURE 5 – Subareas established in River Section 1 for statistical comparison of multibeam and singlebeam data.

TABLE 4
Statistical Comparison of 2005 Multibeam to 2001 Singlebeam

Rogers Island West
Intersection Ranges of 2005 Multibeam & 2001 Singlebeam

Mean	0.15’
Median	0.12’
Mode	0.08’
Standard Deviation	0.33’
Number of Bins	3456

Main River
Intersection Ranges of 2005 Multibeam & 2001 Singlebeam

Mean	0.09’
Median	0.07’
Mode	0.09’
Standard Deviation	0.36’
Number of Bins	9068

Rogers Island East
Intersection Ranges of 2005 Multibeam & 2001 Singlebeam

Mean	0.23’
Median	0.22’
Mode	-0.09’
Standard Deviation	1.01’
Number of Bins	2479

Griffin Island
Intersection Ranges of 2005 Multibeam & 2001 Singlebeam

Mean	0.04’
Median	0.02’
Mode	0.00’
Standard Deviation	0.24’
Number of Bins	9114

A review of several comparative profiles showed that in most relatively flat areas the two data sets agree extremely well (Figure 6). In areas where river bed slopes were pronounced, differences were observed (Figure 7). One explanation for these observed differences may be due to differences in transducer design specifications between the two sounding systems. The singlebeam depth sounder uses a fixed 3° transducer while the multibeam system forms a sequence of ½° transducer beams. The narrower beam receives acoustic reflections from a smaller area on the river bed resulting in a more focused measurement.

Where profiles showed different trends, or shape beyond those that could be explained by system variations, it is believed that differences observed on similar profile sections were the result of natural changes (erosion and/or sedimentation) over the four-year period between surveys (Figure 8).

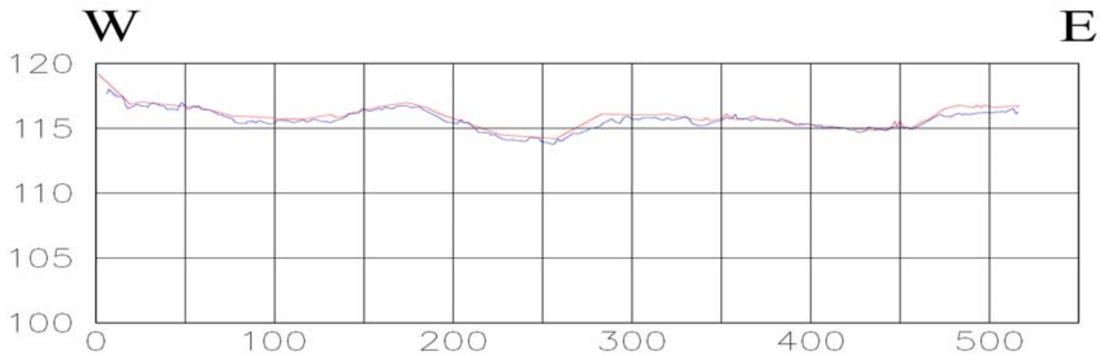

FIGURE 6 – Representative profile constructed from data acquired in area Rogers Island West illustrating where singlebeam and multibeam data matched well in relatively flat river bed conditions. (Blue line based on multibeam data, red line based on singlebeam data).

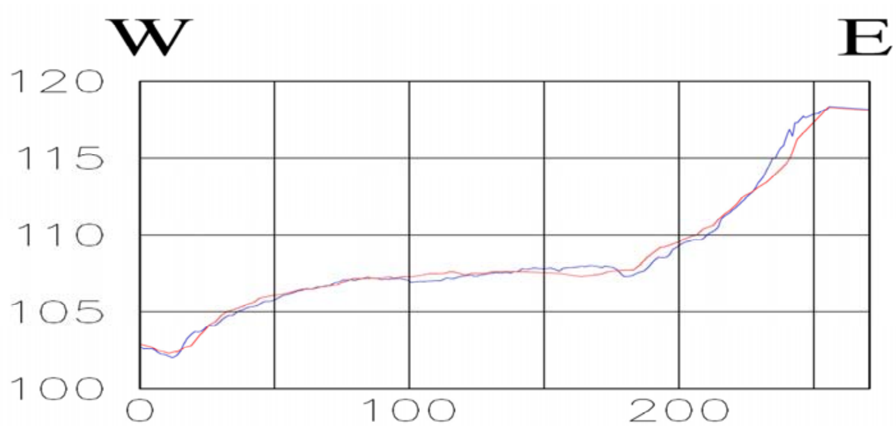

FIGURE 7 – Representative profile constructed from data acquired in area Main River illustrating where singlebeam and multibeam data match well in the flat areas but differ on the slopes. (Blue line based on multibeam data, red line based on singlebeam data).

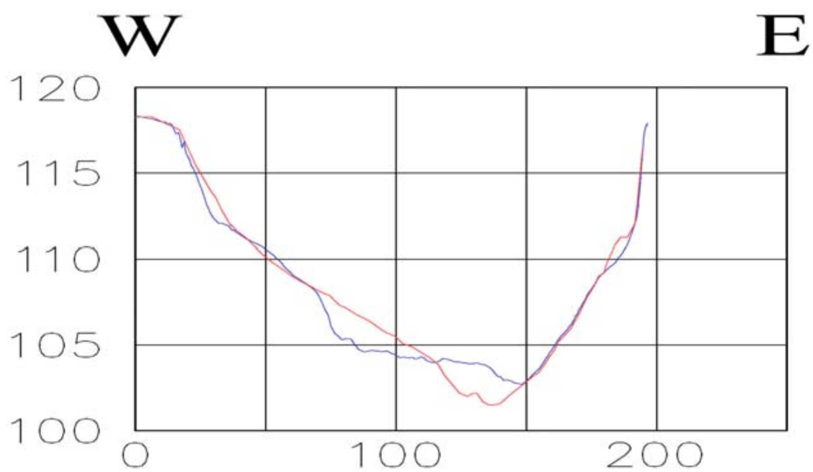

FIGURE 8 - Representative profile constructed from data acquired in area Rogers Island East illustrating where singlebeam and multibeam data differ in river bed morphology. These differences are interpreted to be associated with erosion and/or sedimentation occurring between the two surveys. (Blue line based on multibeam data, red line based on singlebeam data).

Volumes Using Multibeam Data and Singlebeam Data

Another important requirement of the bathymetric data set is to be able to allow the design team to calculate potential dredge material quantities. To illustrate potential differences in the volume calculated using the two bathymetric techniques, several models were reviewed. As expected, volumes calculated for dredge design prisms located further from where singlebeam data were actually acquired showed the largest differences when compared to volumes calculated based on the multibeam dataset. To illustrate this point, two sample profiles are shown in Figure 9. These profiles were generated using the singlebeam and multibeam surface models at locations between actual singlebeam survey lines, where elevation bins were interpolated from adjacent 100-foot spaced singlebeam lines. These two profiles emphasize the potential for disagreement between surface models created using the interpolated singlebeam data versus the multibeam data.

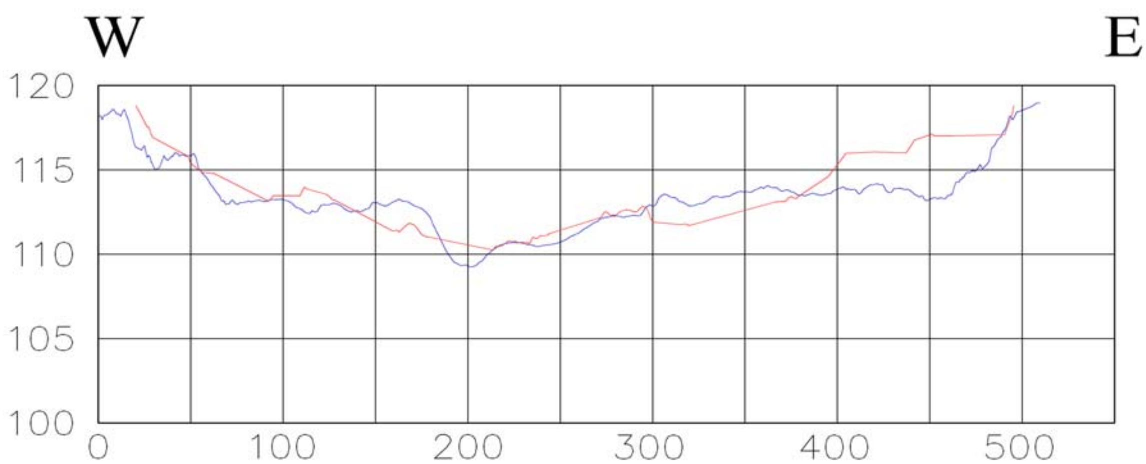

FIGURE 9 – Representative profile constructed from data acquired in Rogers Island West comparing singlebeam data generated using an interpolated surface and high-density multibeam data. (Blue line based on multibeam data, red line based on singlebeam data).

3.2 Tasks II and III

3.2.1 Gound-Penetrating Radar and Ground Truth Data

Initial review of the GPR records focused on better understanding the character and distribution of the various type radar reflections observed within the areas investigated in order to best plan the ground truth investigation. As part of this review, radar reflections were classified based on their dominant characteristics. These characteristics included: the ability of the radar signal to penetrate the river bed, the return strength of the river bed reflector, the appearance of the river bed reflector, and the appearance of subsurface reflectors. Reflector characteristics are generally associated with specific sediment types or rock on the river bed as verified by on-line push probes. During this initial review, radar data acquired along the longitudinal tracklines (parallel to the course of the river) were classified. As part of this classification process, survey tracklines were color-coded to represent each classification. Following this process, an overview of radar classifications was made (as depicted in OSI drawing 05ES021.1, Sheets 34, 36-38) and used to plan the ground truth investigation. Table 5 outlines the classification scheme and color-coding that was used to characterize radar reflections.

TABLE 5
GPR Reflective Classifications

GPR Signal Classification & Trackline Color Coding	Characterization
I RED	GPR records exhibit numerous diffractions on river bed surface with no penetration of the radar signal below the bottom. The river bed reflector appears irregular in profile. Probe unable to penetrate bottom. The river bed is principally composed of bedrock, rocks and cobbles.
II Orange	Limited or restricted signal penetration into the river bed with minor diffractions. Limited probe penetration into bottom. The river bed may be overlain by a thin veneer of silt but is principally composed of coarse sands and gravel with small rocks common to abundant.
III Yellow	Limited penetration of the signal into the river bed. River bed reflector is well-defined. If detected, underlying radar reflectors are weak and discontinuous. The river bed is principally composed of sandy sediments with minor components of silts and clays. River bottom can be penetrated with effort by probing.
IV Blue	Variable penetration of the signal into the river bed. River bed reflector is underlain by numerous strong and weak reflectors. The river bed is principally composed of interbedded silts, silty-sands/sandy-silts and clay. The river bottom is easily probed with occasional resistance when the probe encounters subsurface beds of varying compaction and thickness.

The Class I and IV radar reflections are the most easily differentiated in the classification as they represent the extreme ends of the scheme. Class IV radar reflections provide the most subbottom information, and are the principal focus of this investigation since they often provided information pertaining to sediment thickness. Unfortunately, less than approximately 15% of all the longitudinal survey lines classified exhibited reflections characterized as Class IV. A representative section of GPR data acquired during the investigation (west side of the river near Mile Marker 192.7) that exemplifies Class IV radar reflections is shown in Figure 10. On-line push probes accomplished along this profile line encountered highly aqueous silts and fine sands at least two-feet thick. These findings were later confirmed by ground truth cores acquired in the area.

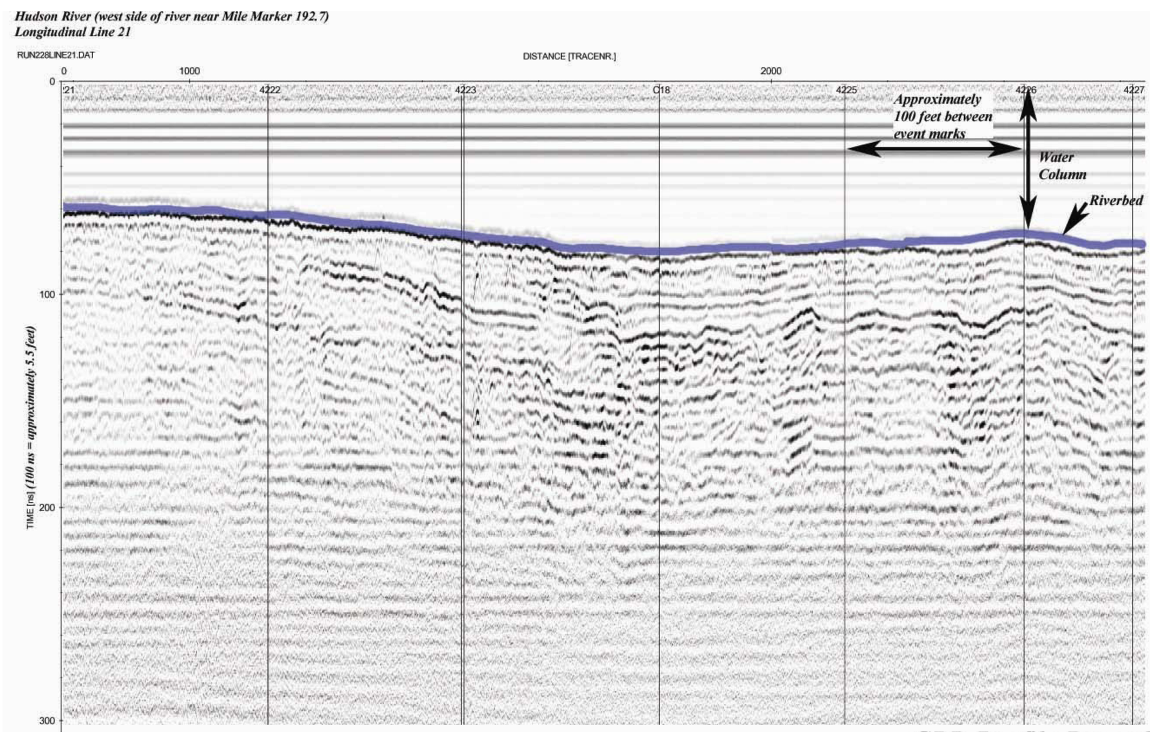

FIGURE 10 – Reproduced section of GPR data acquired in River Section 1 which exemplifies Class IV radar returns.

The remaining class categories I, II, and III provide limited subbottom information. Classes II and III contain similar sediment assemblages, and clear distinction between these classes is more interpretive and often relied on supplemental ground truth information. Figures 11 and 12 provide representative sections of GPR data acquired during the survey investigation that illustrate the reflective classifications defined for the

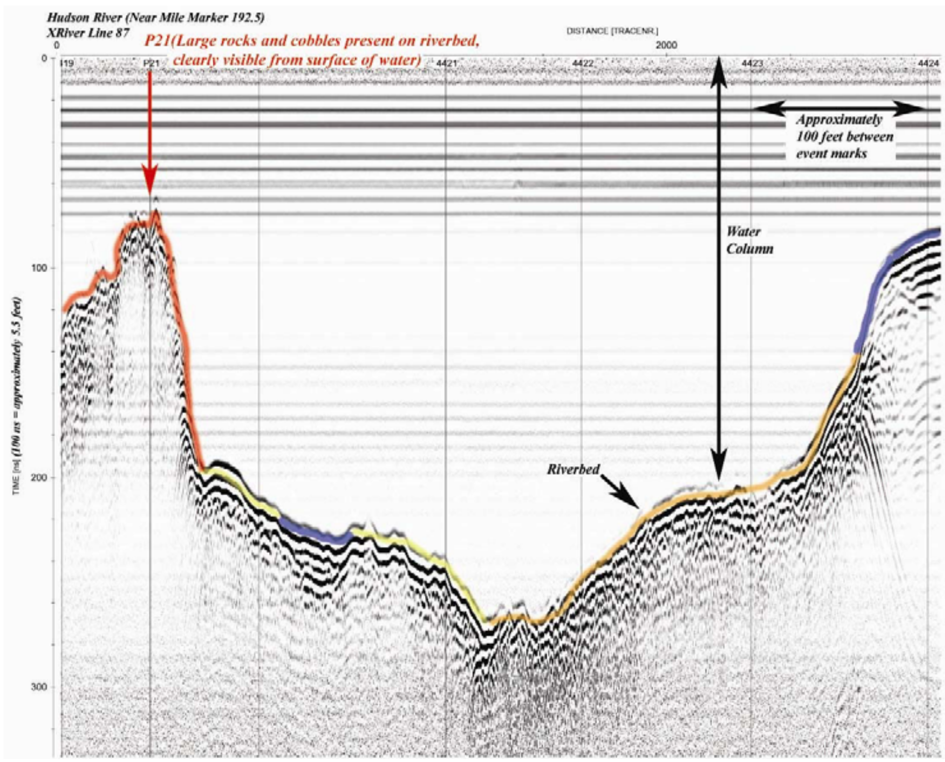

FIGURE 11 – Reproduced section of GPR data acquired in River Section 1 which illustrates all radar reflective classifications. Radar classes, differentiated by color in the figure correspond to description classifications in Table 5.

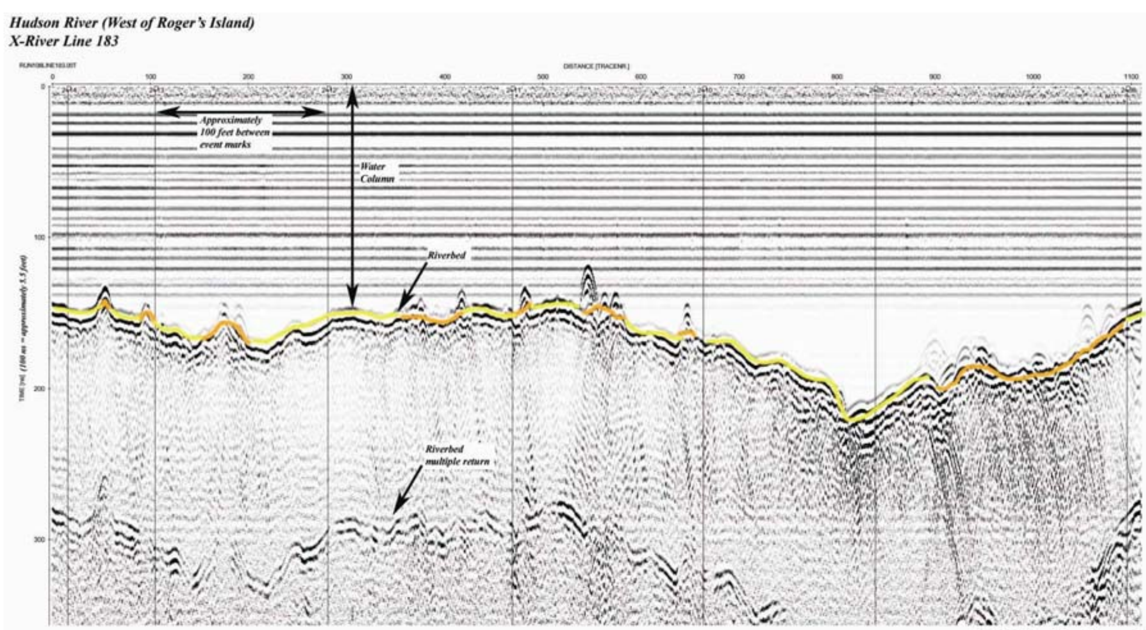

FIGURE 12 – Reproduced section of GPR data acquired in River Section 1 (west of Rogers Island) which illustrates Class II (orange) and III (yellow) radar reflections. Note the diffraction patterns in the record which indicate the presence of coarse sand, gravel and small rocks in the area.

project. In Figure 11, note the location of the push probe accomplished along the line that verified the Class I GPR characterization. In Figure 12, the surface diffractions present in the record in close proximity to the river bed are generally indicative of coarse sand, gravel and small rocks which typify the Class II category.

Ground truth cores and probes were located in areas that would help to verify surficial sediment types and to encounter specific subbottom reflectors. During the ground truth investigation, GPR records were frequently referenced in the field to better understand the preliminary findings and allow the geologist to modify the ground truth program to attain the most useful supportive information. During the field investigation a log summarizing each ground truth core/probe attempt was kept. Based on this field log, a ground truth coring and probing results table was constructed (Appendix 10). This table (is extremely useful as it) provides a synopsis of each attempt that includes a field comment and in the case of a core an additional laboratory/logging comment. Following the conclusion of the ground truth investigation, GPR records were re-examined and reviewed closely with ground truth results (core logs, core photographs, summary table of ground truth coring and probing results).

A review of the GPR records with the ground truth data allowed for a better understanding of the GPR data, the average radar velocity in the surficial sediments, and the observed vertical resolution of the GPR system. To accomplish this review, the actual locations of the cores and probe were projected onto the GPR records. The GPR records were then closely examined in an attempt to identify subbottom reflectors interpreted to be correlative with sediment interfaces observed. If a subbottom reflector could be identified, a velocity analysis was performed for those sediments overlying the reflector. The velocity analysis entailed determining the difference in time (on the time-based GPR records) between the river bed reflector and the identified subbottom reflector and relating this time to the thickness of sediment identified in the core and/or probe. With the time difference and thickness known, the radar velocity in the sediments overlying the reflector could be calculated. Figure 13 has been constructed to illustrate the steps involved in correlating a sediment interface identified in core to a specific subbottom reflector observed on the GPR records and using this information to calculate radar velocity in the sediments. In this presentation the subbottom reflector shaded orange on the GPR records is correlative with the coarse sand and gravel interface logged in Core C5.

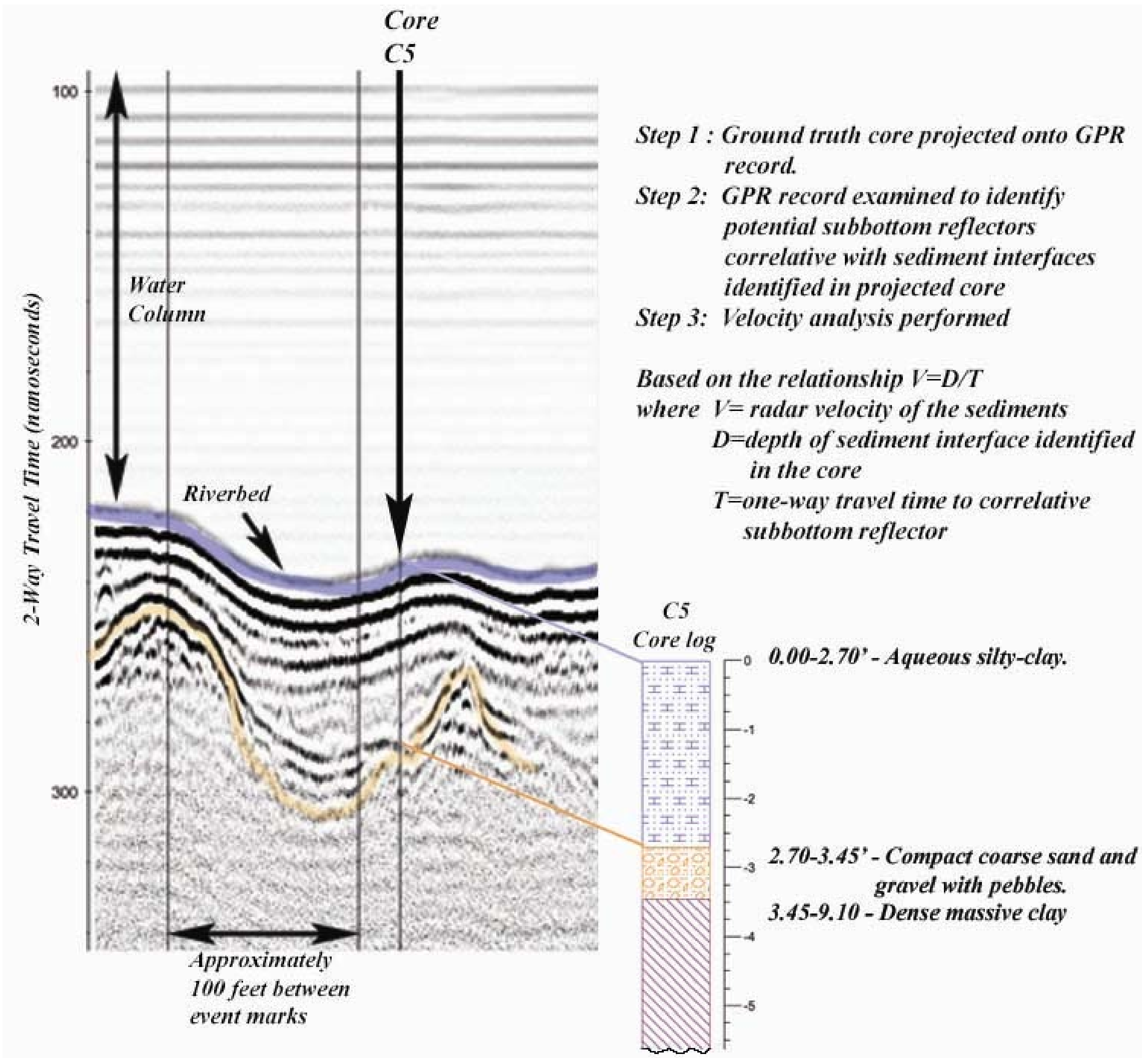

FIGURE 13 – Reproduced section of GPR data acquired on the east side of Griffin Island which illustrates the process of correlating a specific subbottom reflector to a sediment interface identified in a core.

A review table of ground truth correlations is presented in Appendix 10. This table is based on relating interfaces identified in the ground truth cores and probes to specific subbottom reflectors observed on the GPR records. The table provides a review comment for each correlation made and where applicable an estimate of radar velocity and the dielectric constant (a dimensionless ratio used for comparing propagation velocities of electromagnetic waves (radar) through various earth materials). In reviewing this table, it should be noted that the correlations made between the ground truth cores and GPR reflectors were principally based on sediment interfaces visually identified in the cores and did not consider the various other parameters which may be (in some cases) responsible for altering the dielectric properties of the subsurface sediments and reflecting the radar signal. It is beyond the project scope to perform an analysis that could take into account all the variables that might be responsible for altering the dielectric properties of the river sediments.

Although calculated radar velocities for the surficial sediment sequences varied considerably throughout the areas investigated (0.11-0.22 ft/ns), the high-confidence correlations made in the silty sediment areas suggest the average radar velocity closely resembles the radar velocity in the water column (as documented by daily GPR calibration bar checks and the velocity adaptation module included in the processing software package (described in further detail in Appendix 1)). The resultant estimate of vertical accuracy of the GPR system attained during this investigation was at approximately 0.5 foot. This 0.5 foot accuracy estimate is the result of system capabilities and variable subsurface conditions observed over short horizontal distances.

Figure 14, a reproduced section of GPR data acquired in the survey area on the east side of Griffin Island, provides an example of several ground truth cores (C3, P5, C4, and C5) located along a survey line with the primary intent of sampling a specific subbottom reflector (highlighted in orange in this figure). This figure illustrates the intricacy in tracing a subbottom reflector and correlating it to a specific sediment interface (or change in sediment characteristic) identified in the ground truth cores (in this example the coarse sand and gravel unit identified in the cores). Note the radar velocity calculated for the sediments overlying the “orange” reflector in the vicinity of ground truth cores C4 and C5 (0.11 ft/ns, located on the right side of the figure) is considerably different than the velocity calculated for the sediments overlying the reflector in the vicinity of core C3 (0.19 ft/ns, located on the left side of the figure) even though the sediments all appear to be part of the same subsurface unit. As all of these cores were accomplished fairly close to one another (within approximately 300 feet) and provide an ideal control data set, this example illustrates the complexity in precisely and confidently mapping sediment thickness based on GPR data in the river. Close examination of the ground truth correlation table further substantiates these findings. Often cores and probes accomplished at many of the ground truth locations produced dissimilar results due to varying subsurface conditions making the task of cross correlation between the ground truth and GPR data not absolute.

A review of GPR data allowed for the identification of coarse sediment and/or rocky areas within or adjacent to several of the proposed dredge areas as illustrated in Figures 14 and 15. Ground truth cores and/or probes acquired/accomplished within many of these type areas verified the interpretation. In several areas, specifically east of Griffin Island, ground truth cores recovered dense clay underlying the shallow coarse sediment deposits (C3, C5, C6, C8, C9, and C10).

3.2.2 Magnetometer Data

Magnetometer data were processed with the primary intent of identifying ferrous objects within the Phase 1 dredge areas that could potentially impact the project. Two multi-colored sun-illuminated images that illustrate isolated magnetic anomalies have been constructed and are presented on OSI drawing 05ES021.2, Sheets 34, 36-38 (one for the dredge areas north of the Snook Kill and another for the dredge area east of Griffin Island). Since these presentations are based on gradiometer data (difference between the magnetic field detected by the two magnetometer sensors separated vertically and mounted on the bow of the survey vessel), diurnal magnetic variations and background magnetic field fluctuations related to the local geology have been essentially removed from the modeled data.

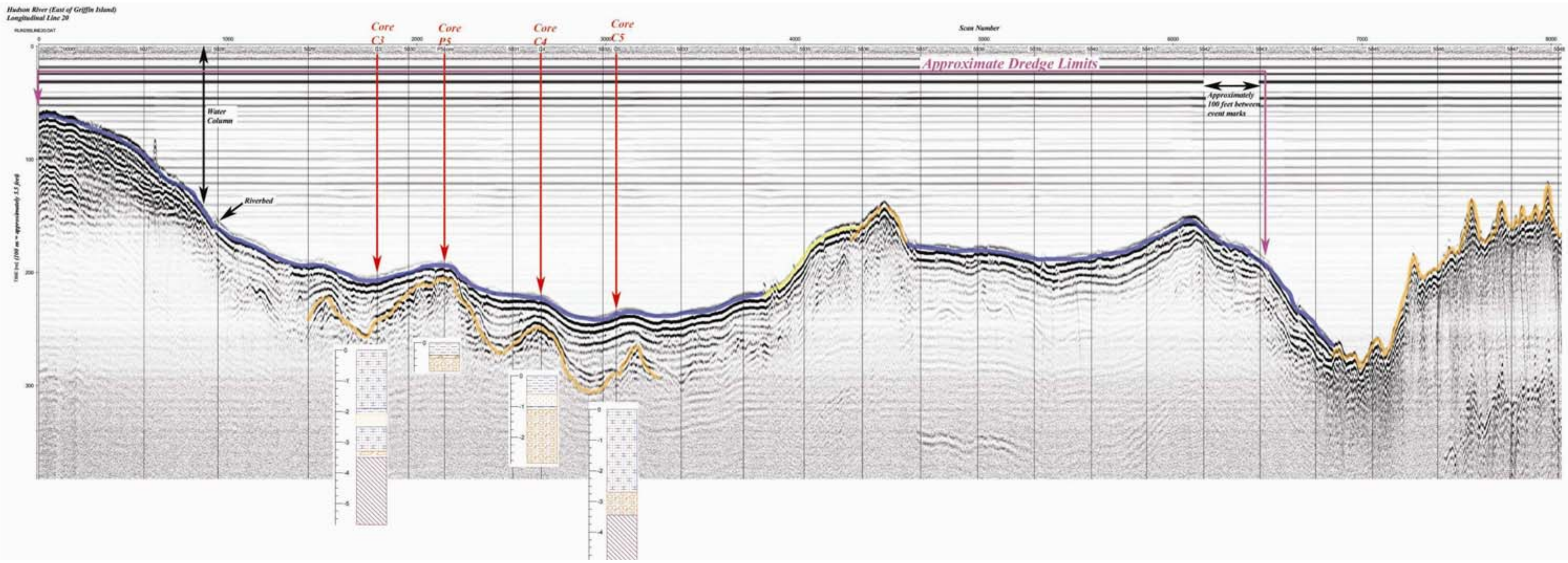

FIGURE 14 – Reproduced section of GPR data acquired on the east side of Griffin Island. Record provides an example of how ground truth cores were located along a survey line with the primary intent of sampling a specific subbottom reflector (highlighted in orange in this figure). Figure also provides additional illustration of the various GPR classes defined for the project. Note the coarse sediment/rock area identified just outside the proposed dredge limits shown in the figure.

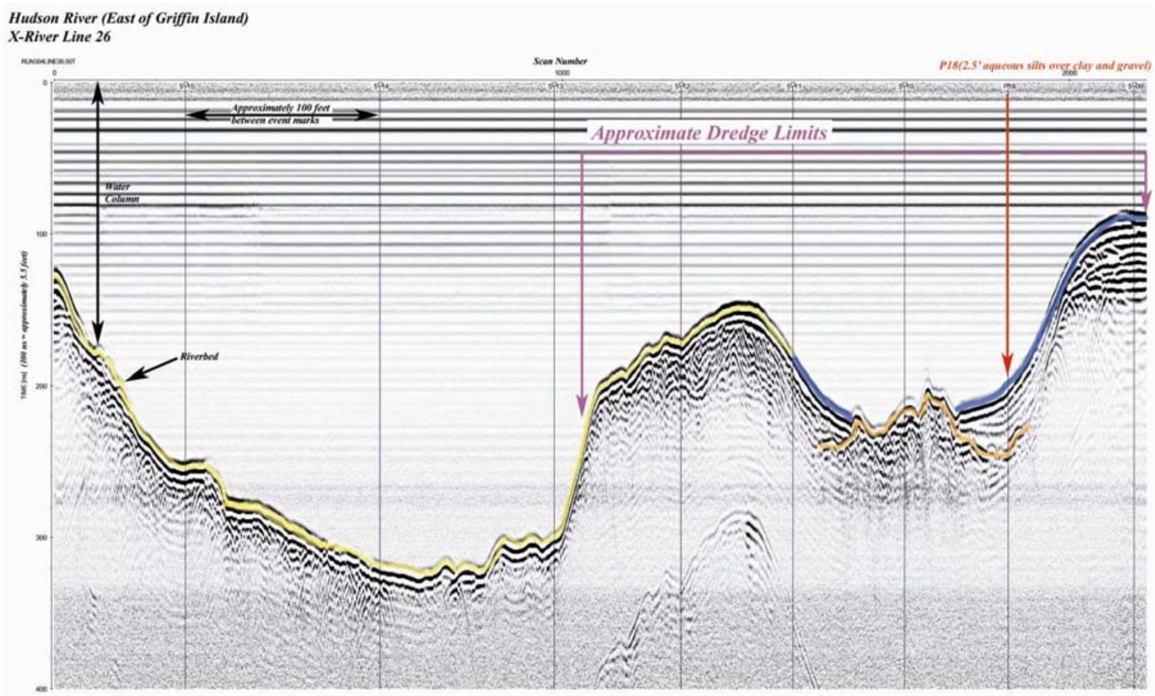

FIGURE 15 – Reproduced section of GPR data acquired on the east side of Griffin Island. Record identifies a coarse sediment reflector (Class II, highlighted in orange in this figure) cropping out on the river bed within the approximate dredge limits.

With the exception of a few significant magnetic anomalies identified in the river, these images illustrate that most of the areas investigated are free of potentially significant ferrous obstructions. The most striking exceptions to these findings were observed in and around Lock 7, the bridges that pass over the river onto Rogers Island, several small docks (including the QEA dock) and along the bulkheaded shoreline in downtown Ft. Edward. In these areas, the magnetometers detected a significant source of ferrous mass (as would be expected), which in some cases overwhelmed (saturated) the sensors. As a result, it is possible that isolated ferrous targets, located in close proximity to these larger ferrous features, may have gone undetected, masked by the larger anomalies.

As documented on the survey trackline plot, additional survey lines were investigated in the vicinity of NOAA charted shipwrecks on the southwestern end of Rogers Island in an attempt to identify/verify the wreck locations. The magnetometers detected several anomalies in this area suggesting remnants of the wrecks may still be present. During the survey, water clarity was excellent and the remnants of a sunken barge could be observed along the southwestern shore of Rogers Island in an area where the magnetometers had detected a large anomaly. The approximate limits of the sunken barge, based on visual observations made during the survey, are plotted on OSI drawing 05ES021.2, Sheet 38.

In accordance with the dredge design/data user teams' request, magnetic data have been reviewed with respect to sonar targets previously identified by OSI in the survey areas (OSI March 2005 Technical Memorandum included as Appendix F of the Year 2 SEDC DSR). The sonar target tables (including re-designation of sonar targets by BBL from OSI's original submittal) have been revised to include a column to identify sonar targets that have corresponding magnetic anomalies and an estimate of magnetic intensity (gamma fluctuation). This revised sonar target table is included in Appendix 11.

Although several of the magnetic anomalies detected during this survey had coincidental side scan sonar targets and/or are clearly related to the detection of the navigation buoys/anchors present in the river during the survey, the vast majority of the anomalies detected could not be related to any distinguishable feature. It should be noted that when comparing anomalies it can not be assumed that anomalies of similar intensities represent ferrous objects of similar size. The measured magnetic intensity (gamma fluctuation) is exponentially proportional to the distance the detected ferrous object is from the magnetometer sensor (i.e. a 100 lb ferrous object will produce a significantly larger gamma fluctuation when detected from a distance of 10 feet vs. 20 feet away). Similarly, the amount of ferrous metal present within an object will play a significant role in the size anomaly detected (an increase in ferrous mass will produce a larger anomaly when detected from a similar distance). The assumption that similar gamma fluctuations represent similar size ferrous objects should not be made without considering the distance the sensor was from the sensed object. Consequently, when comparing anomalies throughout the river during dredge planning, water depth plus the sensor height above the water's surface (minimum distance sensor could have been to a sensed target on the river bed) should be considered when estimating potential target size and impact.

During the survey investigation posted water line crossing signs were observed along the banks of the river marking the location of pipeline between Ft. Edward and Rogers Island. The magnetometers did not detect this pipeline suggesting it is comprised of a non-ferrous material, extremely small, or has possibly been removed. Further investigation regarding this pipeline should be considered during dredge planning. The approximate location of the pipeline crossings signs observed along the bank of the river on the east side of Rogers Island are plotted on OSI drawing 05ES021.2, Sheet 38.

4.0 SUMMARY AND RECOMMENDATIONS

A multi-task survey investigation and ground truth program was accomplished in Upper Hudson River in River Section 1 (in portions of the candidate Phase 1 dredge areas north of the Snook Kill and on the east side of Griffin Island) in accordance with Addendum No. 1 to the *Supplemental Engineering Data Collection Work Plan* submitted to the United States Environmental Protection Agency by General Electric Company in May 2005. The investigations were performed with the primary goal of providing the dredge design/data user teams with data to complete the Phase 1 remedial design.

Survey and ground truth sampling investigations were planned and accomplished as three interrelated tasks. Tasks I and II focused on the acquisition of *multibeam hydrographic data* and *GPR and magnetometer data*, respectively. Task III consisted of the acquisition of vibratory cores and push probes to ground truth the GPR data. Following completion of the field investigations and near the conclusion of the final analysis and processing of the acquired data sets, OSI met with representatives from the dredge design/data user teams and GE. These meetings were held to review the findings of the investigations and focus on end products that would best aid the teams in their design and implementation of the remedial action selected for Phase 2. Based on these meetings the following summary and recommendations have been prepared.

Multibeam bathymetry data acquired during Task I were used to construct a high-resolution surface model of the river bed. Comparative analyses made between the river bed surface model constructed based on the multibeam sounding data and a surface model of the river bed based on singlebeam soundings (acquired by OSI in 2001) found that the multibeam model is far superior to the singlebeam model. The multibeam surface model more accurately depicts the current river bed surface in terms of mapping locations and heights of possible river bed debris/obstructions to dredging operations and determining river bed elevations for dredge planning and monitoring. The volume computations that were performed using the singlebeam data and compared with computation for the same areas using the multibeam data also point to the value of the multibeam methods for dredge volume computations. Although these comparisons were close in some areas of the river, they showed significant differences in other areas, pointing to both the value of full bottom coverage and a more recent survey.

Based on the comparative analyses and high-resolution river bed models generated during this investigation, the dredge design/data user teams recommend that multibeam data be acquired during upcoming investigations supporting the remedial design. Furthermore, it is recommended that prior to dredging the final multibeam modeled surface should be reviewed to identify obstructions on the river bed that may have been recently deposited or previously not identified during the side scan sonar survey of the river bed.

Ground penetrating radar (GPR) data acquired along survey lines laid out both parallel and oblique to the course of the river within the Phase 1 dredge areas provided information pertaining to the surficial sediments present in the river. Initial processing of the GPR data focused on classifying reflections along the primary or longitudinal survey lines into four classes (Class I- IV) based on reflective characteristics. Reflector characteristics are generally associated with specific sediment types or rock. Class IV radar reflections are the principal focus of this investigation as they typically characterize areas predominately composed of interbedded silts, silty-sands/sandy-silts and clay and often provide information pertaining to sediment thickness. Radar reflections in the remaining class categories provide little subbottom information and are generally correlative with coarser sediment assemblages, and/or rock on the river bed. Unfortunately, less than approximately 15% of all the longitudinal survey lines classified within the proposed dredge areas exhibited reflections characterized as Class IV.

A review of the GPR records with the ground truth data allowed for a better understanding of the GPR data, the average radar velocity in the river sediments and vertical resolution of the radar system within the areas investigated. Calculated radar velocities for the surficial sediment sequences varied considerably throughout the areas (0.11-0.22 ft/ns). The higher-confidence level correlations made in the silty sediment areas suggest the average radar velocity of those sediments closely resembles the velocity of the water column (approximately 0.11 ft/ns, as documented by daily calibration bar checks). The approximate vertical accuracy of the GPR system attained during this investigation was at best 0.5 foot. This 0.5 foot accuracy is the result of system capabilities and variable subsurface conditions over short horizontal distances.

It has been proven that GPR data can provide information pertaining to surficial sediment characteristics and distribution of sediment types within the areas investigated. However, a time-intensive processing and analysis of the GPR data (including correlation with ground truth data) is required to attain this information. This investigation has documented the limited effectiveness of the GPR in penetrating the river bed (over any large areal extent in the river) and confidently resolving sediment thickness at a resolution less than approximately 0.5 feet. Based on these findings and the existing time-constraints and dredge plans already in-place, the dredge design/data user teams recommend curtailing the use of GPR during future investigations of the river. It is their consensus that the time and effort spent in acquisition and processing additional GPR data will not lend itself significantly to the dredge design.

Magnetometer data were acquired concurrently with GPR along all survey lines investigated in the Phase 1 dredge areas. The principal focus of the magnetic survey was to identify ferrous objects within the dredge areas that could potentially impact the project. The magnetometer system utilized during the investigation was equipped with dual cesium sensors that were operated in gradiometer mode that emphasizes short duration anomalies typically associated with manmade ferrous objects.

The magnetometer proved successful in meeting its primary objective and identified the location of numerous isolated magnetic anomalies. With the exception of a few, the majority of anomalies detected were relatively small and in general most of the Phase 1 dredge areas appear to be free of potentially significant ferrous obstructions. In and around Lock 7, the bridges that pass over the river onto Rogers Island, several small docks and along the bulkheaded shoreline in downtown Ft. Edward the magnetometers detected a significant source of ferrous mass. In some cases the ferrous mass associated with these known features overwhelmed (saturated) the sensors and generally reduced their ability to detect smaller ferrous objects in the area surrounding the larger features. When planning dredging in and around these large ferrous features it should be understood that smaller ferrous objects may not have been detected and are masked by their surroundings.

Based on the successful results of the magnetometer survey which includes the ease of acquisition and minimal processing effort required to put the data into a useable format, the dredge design/data user teams recommend that dual sensor magnetometer data be acquired during upcoming investigations supporting the remedial design. Furthermore, it is recommended that singlebeam soundings be acquired along with any magnetometer data acquired in the future. The soundings are used in estimating the distance the magnetometer sensors were from any ferrous target sensed on the river bed (documenting water depth at the time of survey), which is essential in the task of estimating potential target size and impact of the anomalies.

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Exhibit C

SEDC Addendum No. 2 Test Boring Logs (B-079 and B-080)

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Energy Park / Longe Site Geotechnical Drilling Program
Boring Log

Date/Time Start:	10/12/2005	10:39	**Northing (ft):**	1616993.8	
Date/Time End:	10/12/2005	11:48	**Easting (ft):**	734416.9	
Drilling Company:			**Water Elevation (ft):**	120.9	
Driller's Name:			**Water Depth (ft):**	7.5	
Rig Type:			**Borehole Depth (ft):**	10.1	
Drilling Method:		AUGER	**Mud Line (ft):**	113.4	
Auger/Casing Diam. (in):		4.25	**Geologist:**	ADAM CHWALIBOG	

Boring ID: **B-079**

Client: General Electric Company

Vane Shear Strength			
	Depth (ft)	**Peak (lbs)**	**Remolded (lbs)**
1			
2			
3			

Comments:

DEPTH OF SAMPLE (ft)		ELEVATION OF SAMPLE (ft)		SAMPLE TYPE*	BLOWS ON SAMPLER FOR 6 inches	CLASSIFICATION OF MATERIAL**	RECOVERY (ft)	SEDIMENT DESCRIPTION
from	to	from	to					
0.0	2.0	113.4	111.4	SS	1 - 1 - 3 - 3	MS/GR/--/OR	0.5	GRAY AND BROWN MEDIUM TO COARSE SAND, SOME GRAVEL, TRACE ORGANICS, TRACE ROCK AND BRICK FRAGMENTS
2.0	4.0	111.4	109.4	SS	5 - 6 - 3 - 2	MS/GR/--/OR	0.6	GRAY-BROWN MEDIUM TO COARSE SAND, SOME GRAVEL, TRACE ORGANICS, TRACE BRICK FRAGMENTS
4.0	6.0	109.4	107.4	SS	4 - 4 - 4 - 8	CS/--/--/--	1.0	GRAY TO BLACK COARSE SAND AND GRAVEL, TRACE BRICK FRAGMENTS
6.0	8.0	107.4	105.4	SS	33 - 34 - 50 -	CL/SI/--/GR	1.3	GRAY CLAY, SOME SILT, TRACE GRAVEL, TRACE QUARTZ
8.0	10.0	105.4	103.4	SS	35 - 45 - 50/0.5 -	CL/--/--/SI	1.3	GRAY CLAY, TRACE SILT, TRACE GRAVEL
10.0	10.1	103.4	103.3	SS	50/1 - - -		0.1	BLACK SHALE FRAGMENTS

Notes:
** Sample Type*
'SS' : Split Spoon, 'ST' : Shelby Tube, 'RC' : Rock Core

*** Classification of material*
Primary/Some/Little/Trace

GR: Gravel
CS: Coarse sand
MS: Medium sand

FS: Fine sand
SI: Silt
CL: Clay

OR: Organic

Energy Park / Longe Site Geotechnical Drilling Program
Boring Log

Date/Time Start:	10/11/2005	8:25	**Northing (ft):**	1614418.4	**Boring ID:**	**B-080**
Date/Time End:	10/11/2005	9:45	**Easting (ft):**	736113.5	**Client:**	General Electric Company
Drilling Company:		ATL	**Water Elevation (ft):**	120.7		
Driller's Name:			**Water Depth (ft):**	12.0		
Rig Type:		CME 55	**Borehole Depth (ft):**	16.0		
Drilling Method:		AUGER	**Mud Line (ft):**	108.7		
Auger/Casing Diam. (in):		4.25	**Geologist:**			

Vane Shear Strength

	Depth (ft)	Peak (lbs)	Remolded (lbs)
1			
2			
3			

Comments:

DEPTH OF SAMPLE (ft) from	DEPTH OF SAMPLE (ft) to	ELEVATION OF SAMPLE (ft) from	ELEVATION OF SAMPLE (ft) to	SAMPLE TYPE*	BLOWS ON SAMPLER FOR 6 inches	CLASSIFICATION OF MATERIAL**	RECOVERY (ft)	SEDIMENT DESCRIPTION
0.0	2.0	108.7	106.7	SS	2 - 2 - 4 - 6	MS/GR/--/OR	0.5	GRAY MEDIUM TO COARSE SAND, SOME GRAVEL, TRACE ORGANICS, SILVER SHEEN
2.0	4.0	106.7	104.7	SS	2 - 2 - 3 - 4			NO RECOVERY
4.0	6.0	104.7	102.7	SS	1 - 1 - 1 - 2	MS/--/--/OR	0.6	GRAY MEDIUM TO COARSE SAND, TRACE ORGANICS, TRACE GRAVEL
6.0	8.0	102.7	100.7	SS	WOR - WOH - 3 - 1	MS/--/--/GR	1.0	GRAY-BROWN MEDIUM TO COARSE SAND, TRACE GRAVEL
8.0	10.0	100.7	98.7	SS	WOR - 1/1.0 - - 1	CL/SI/--/--	2.0	GRAY CLAY, SOME SILT, FEW BROWN SILT LAMINATIONS
10.0	12.0	98.7	96.7	SS	1 - 1 - 1 - 1	CL/SI/--/--	2.0	GRAY CLAY, SOME SILT, FEW BROWN SILT LAMINATIONS
12.0	14.0	96.7	94.7	SS	WOR - WOR - WOH - 2	CL/SI/--/--	2.0	GRAY CLAY, SOME SILT, FEW BROWN SILT LAMINATIONS
14.0	16.0	94.7	92.7	SS	WOR - WOH - WOH - 1	CL/SI/--/--	2.0	GRAY CLAY, SOME SILT, FEW BROWN SILT LAMINATIONS

Notes:
** Sample Type*
'SS' : Split Spoon, 'ST' : Shelby Tube,
'RC' : Rock Core

*** Classification of material*
Primary/Some/Little/Trace

GR: Gravel
CS: Coarse sand
MS: Medium sand

FS: Fine sand
SI: Silt
CL: Clay

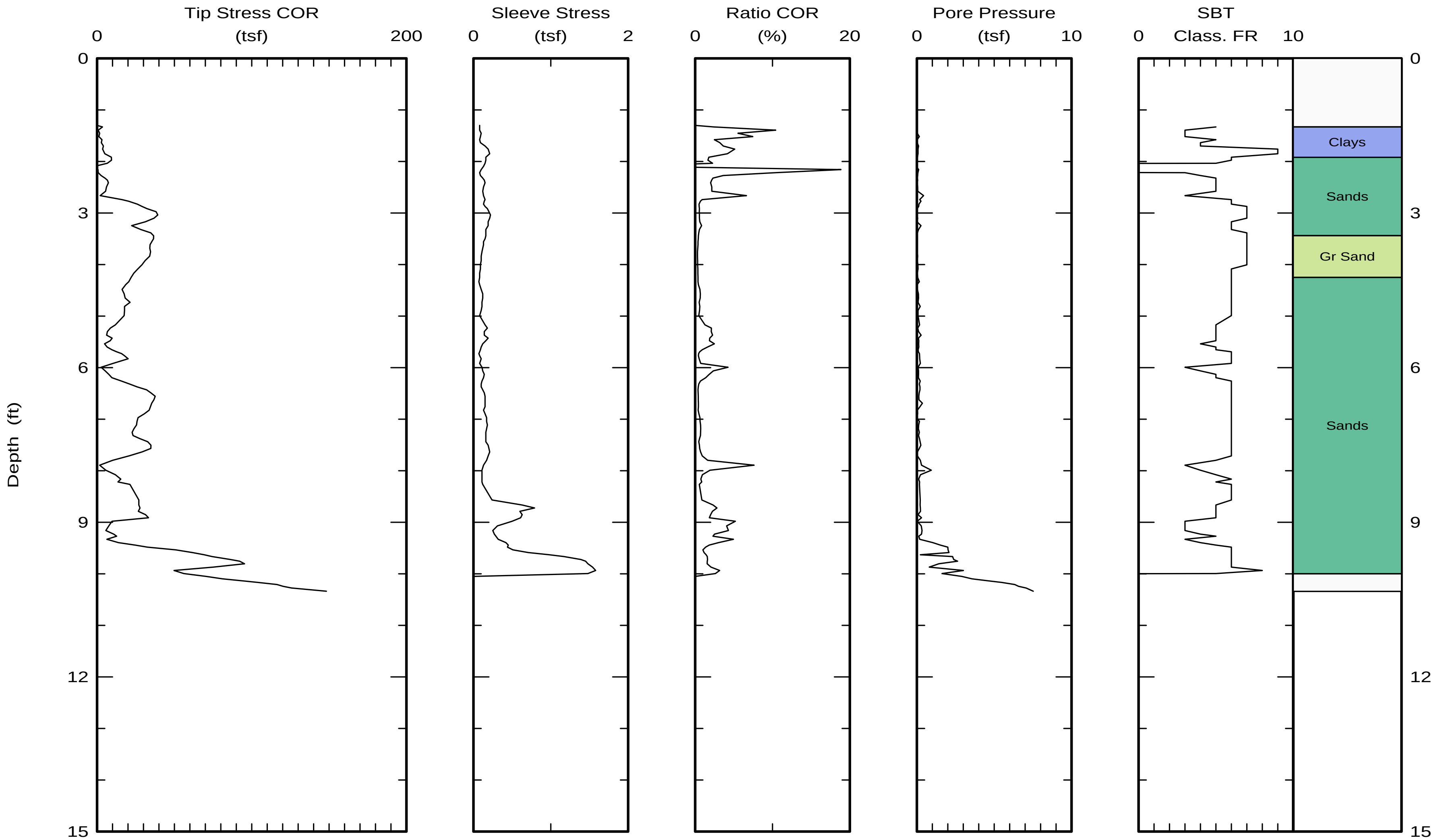
OR: Organic

Exhibit D

SEDC Addendum No. 2 CPT Logs

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

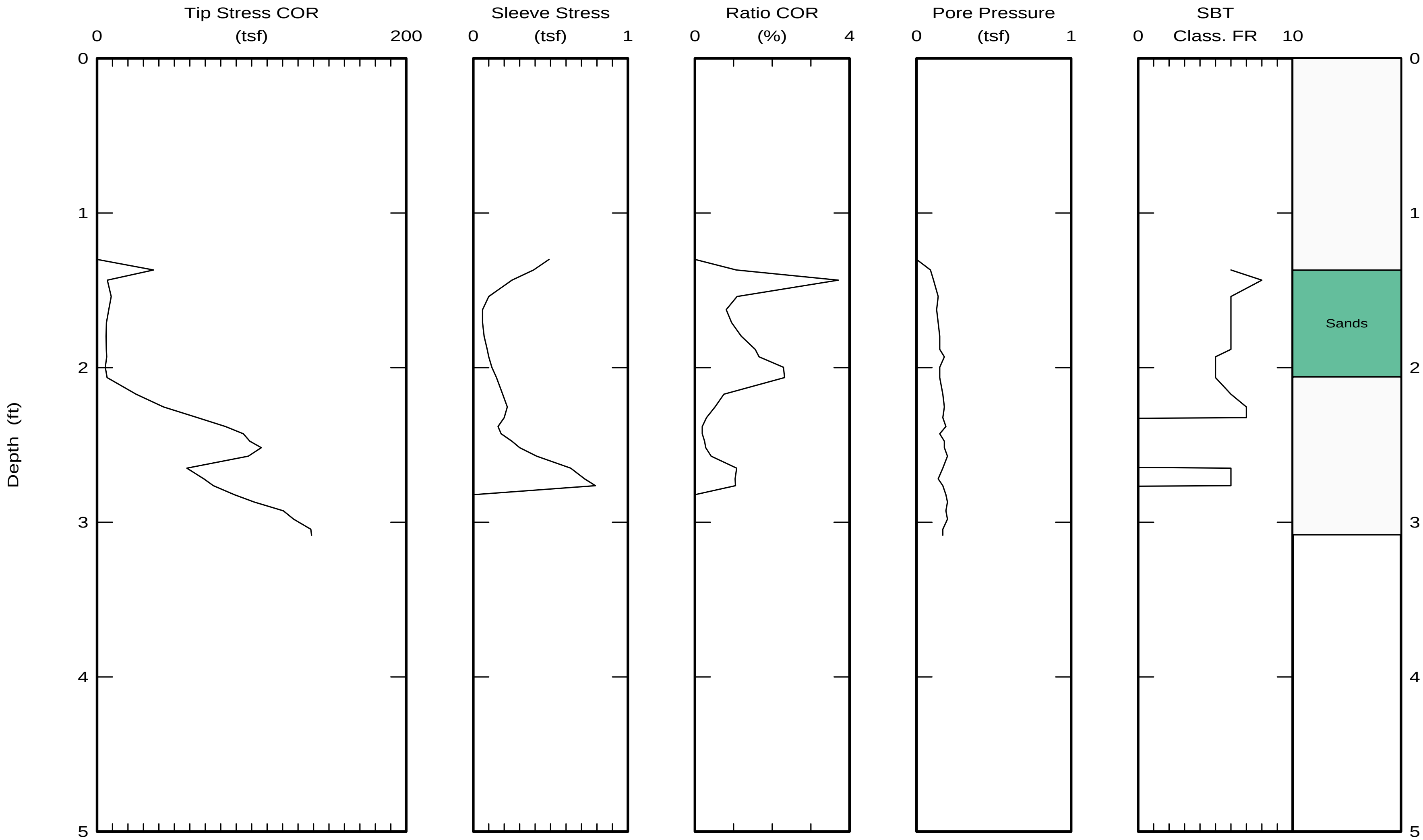
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1617047.862 Easting: 734414.077 Elevation: 116.9	Date: 24/Oct/2005 Test ID: CP001 Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 10.34 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

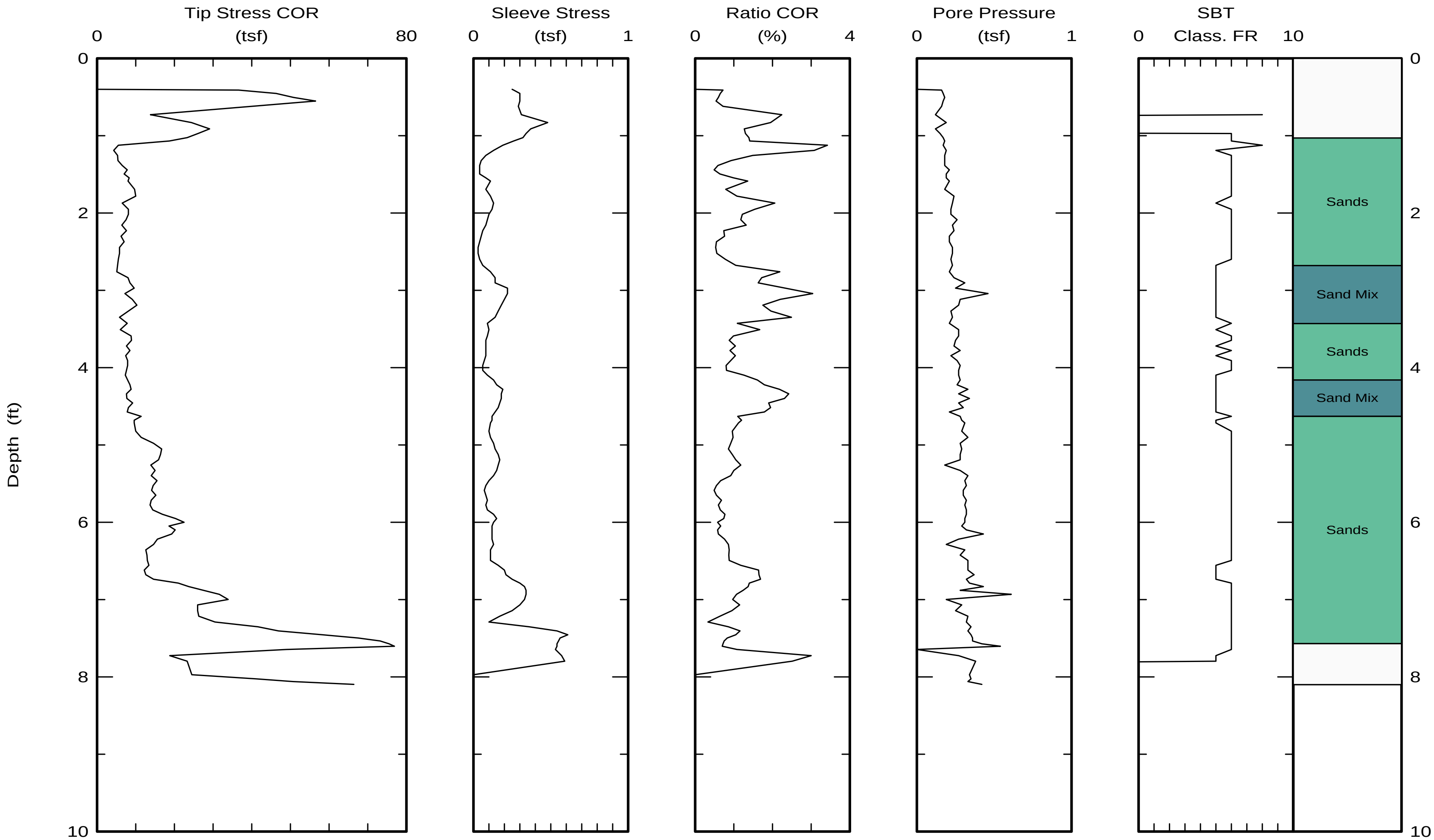
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1617040.973 Easting: 734417.657 Elevation: 116.9	Date: 24/Oct/2005 Test ID: CP001A Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 3.08 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

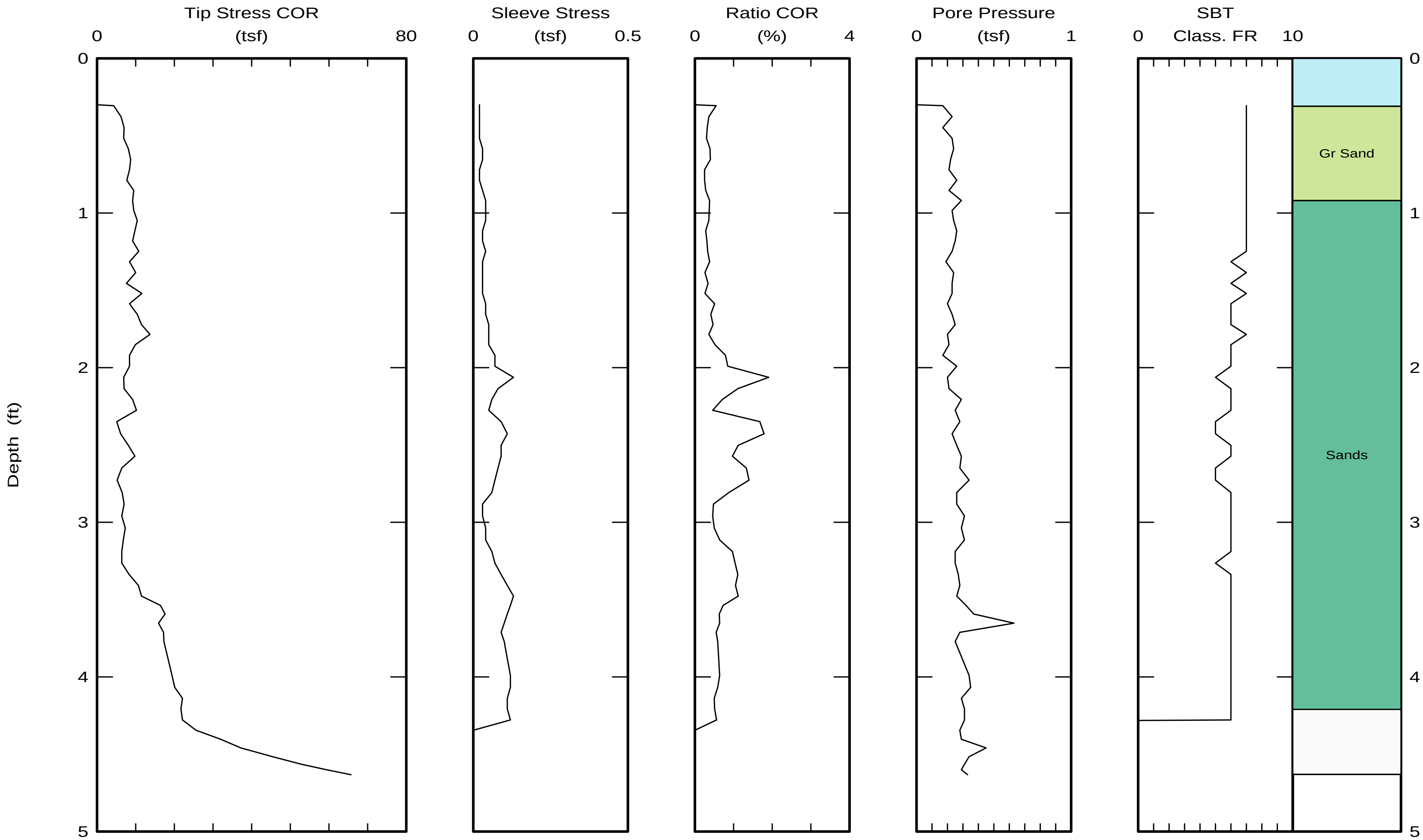
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: Easting: Elevation: 115.0	Date: 24/Oct/2005 Test ID: CP001B Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 8.10 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

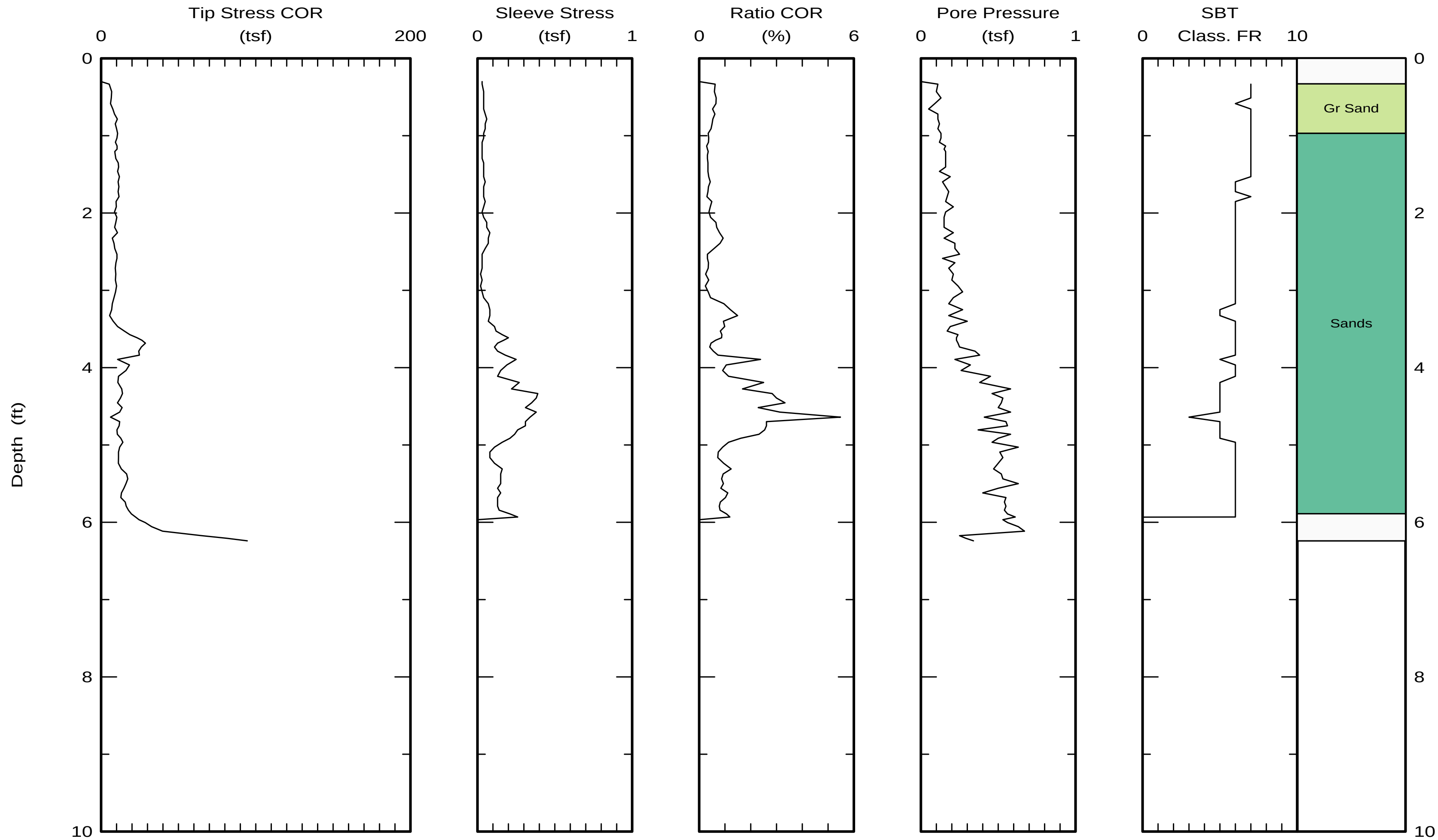
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1616953.111 Easting: 734430.101 Elevation: 112.7	Date: 24/Oct/2005 Test ID: CP002 Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 4.63 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

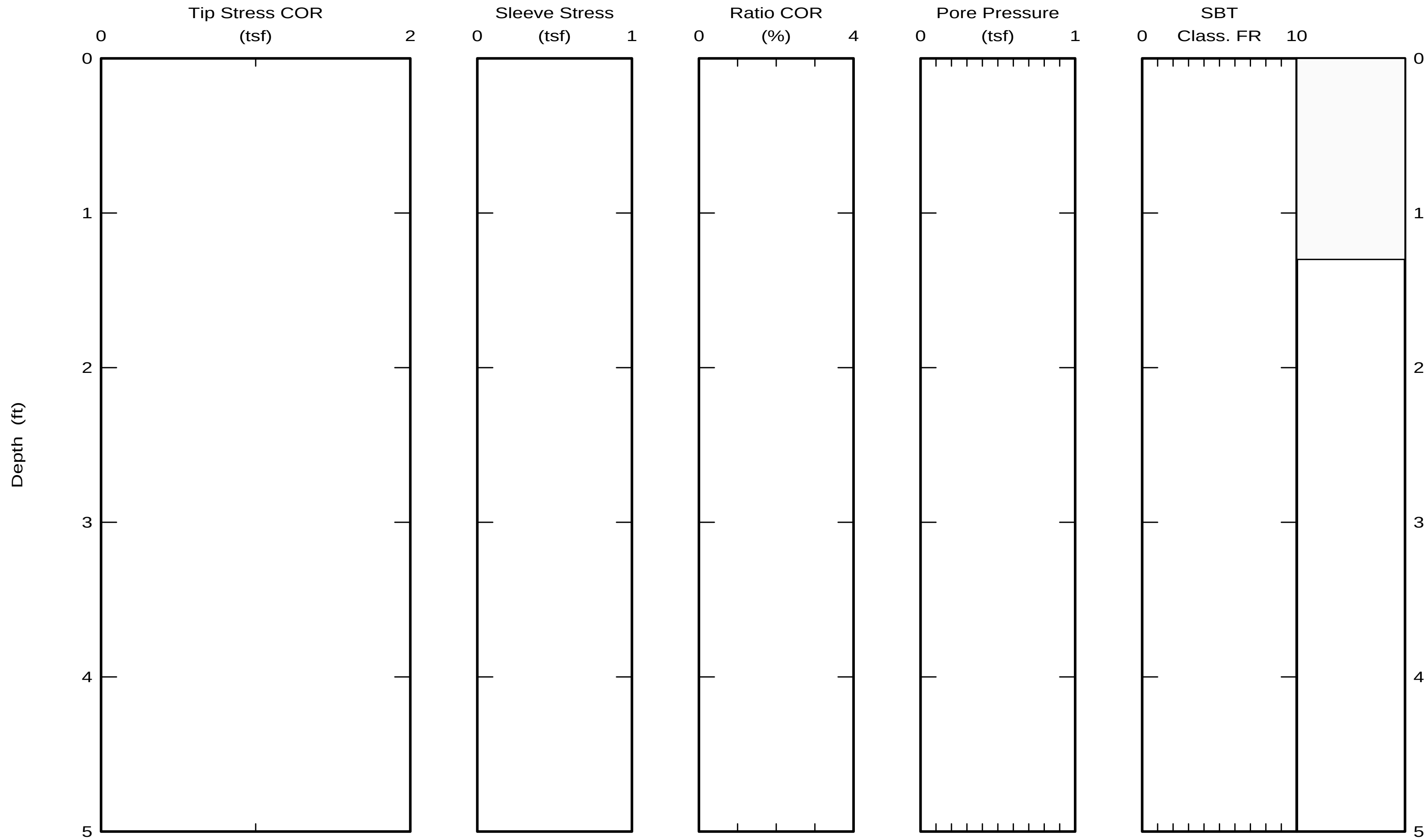
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1616396.496 Easting: 734453.896 Elevation: 112.7	Date: 24/Oct/2005 Test ID: CP002A Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 6.24 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

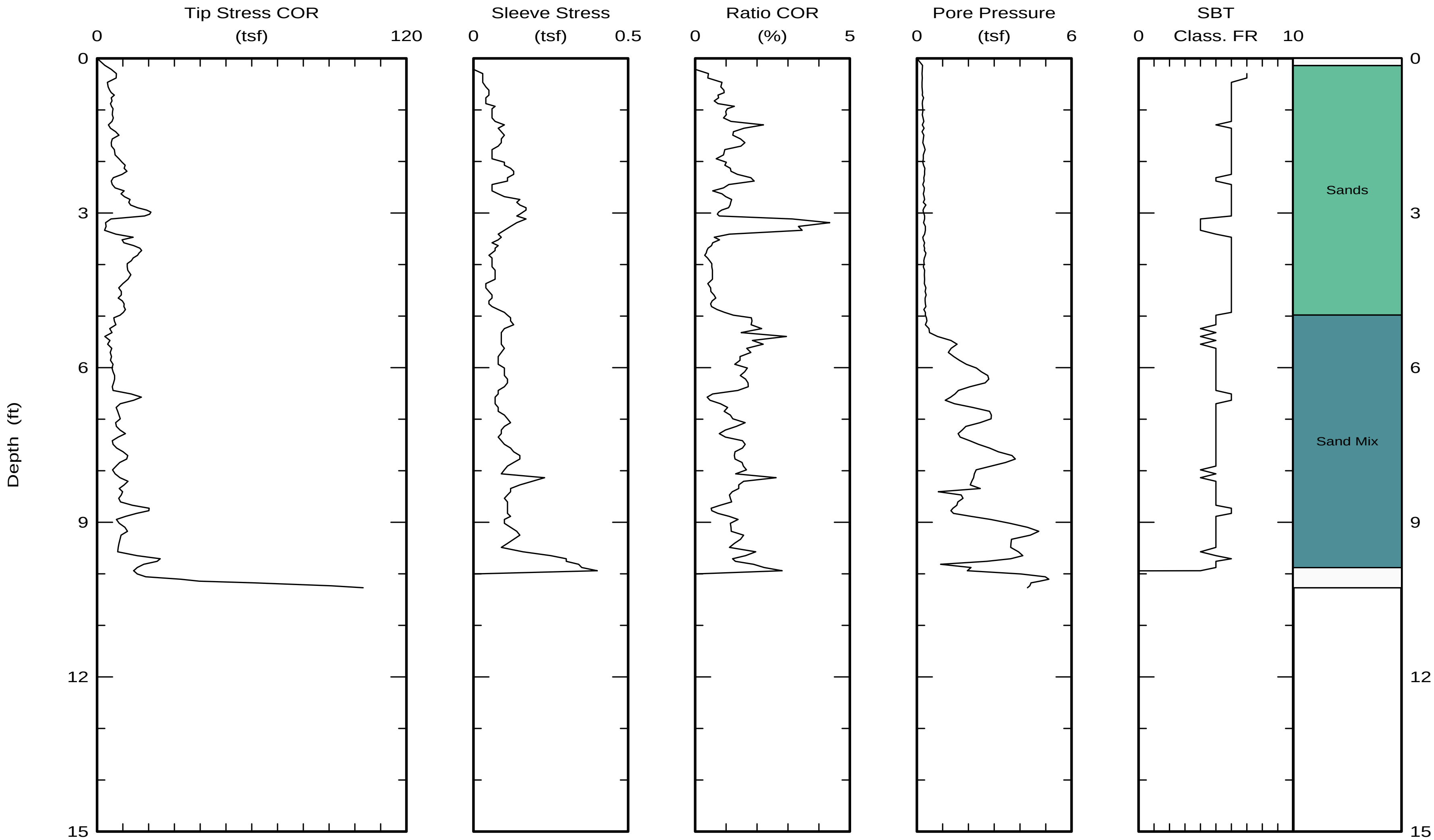
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1616906.251 Easting: 734483.865 Elevation: 114.9	Date: 24/Oct/2005 Test ID: CP002B Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 1.30 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

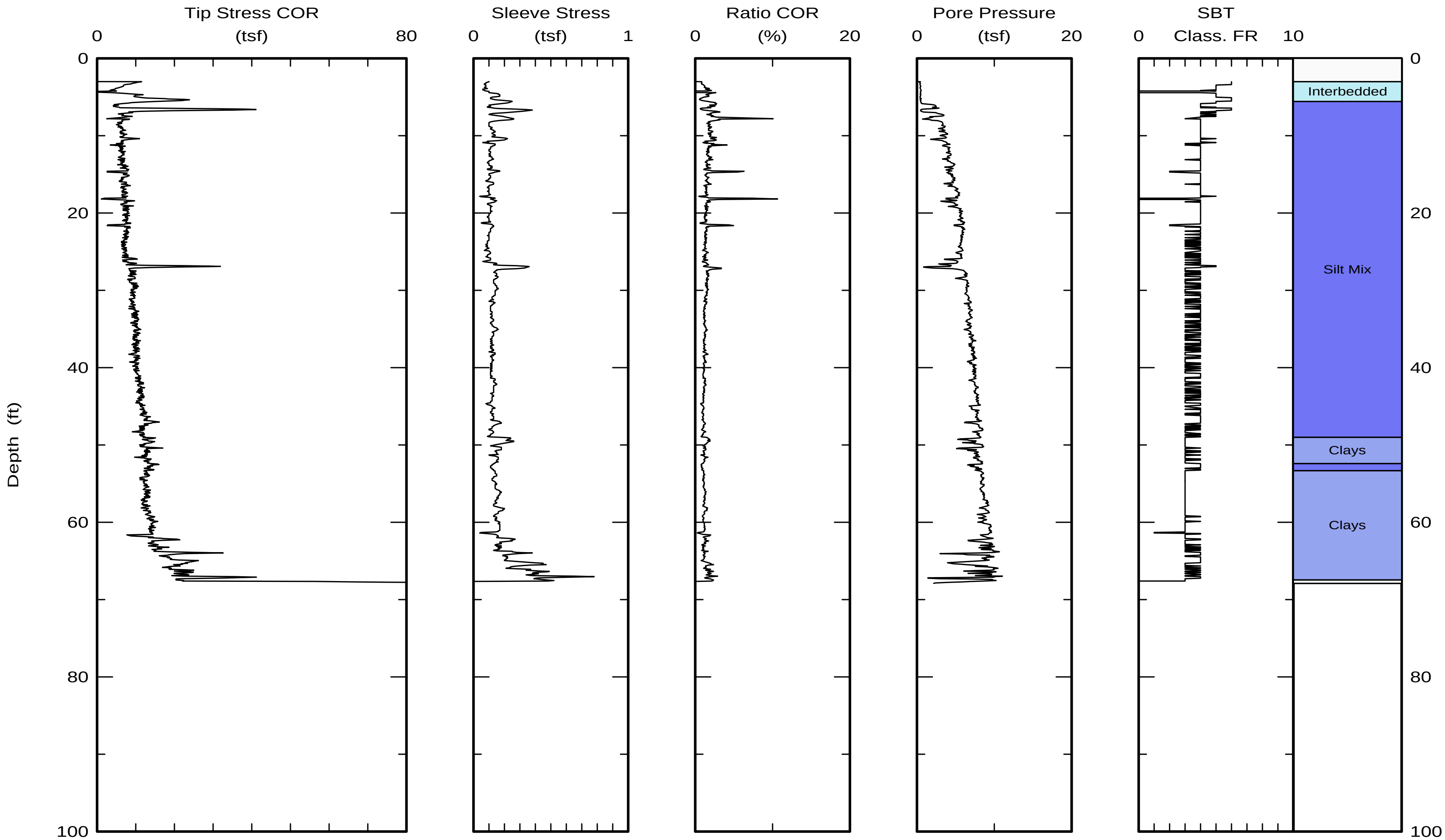
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1614988.926 Easting: 734707.149 Elevation: 113.7	Date: 24/Oct/2005 Test ID: CP003 Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 10.27 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

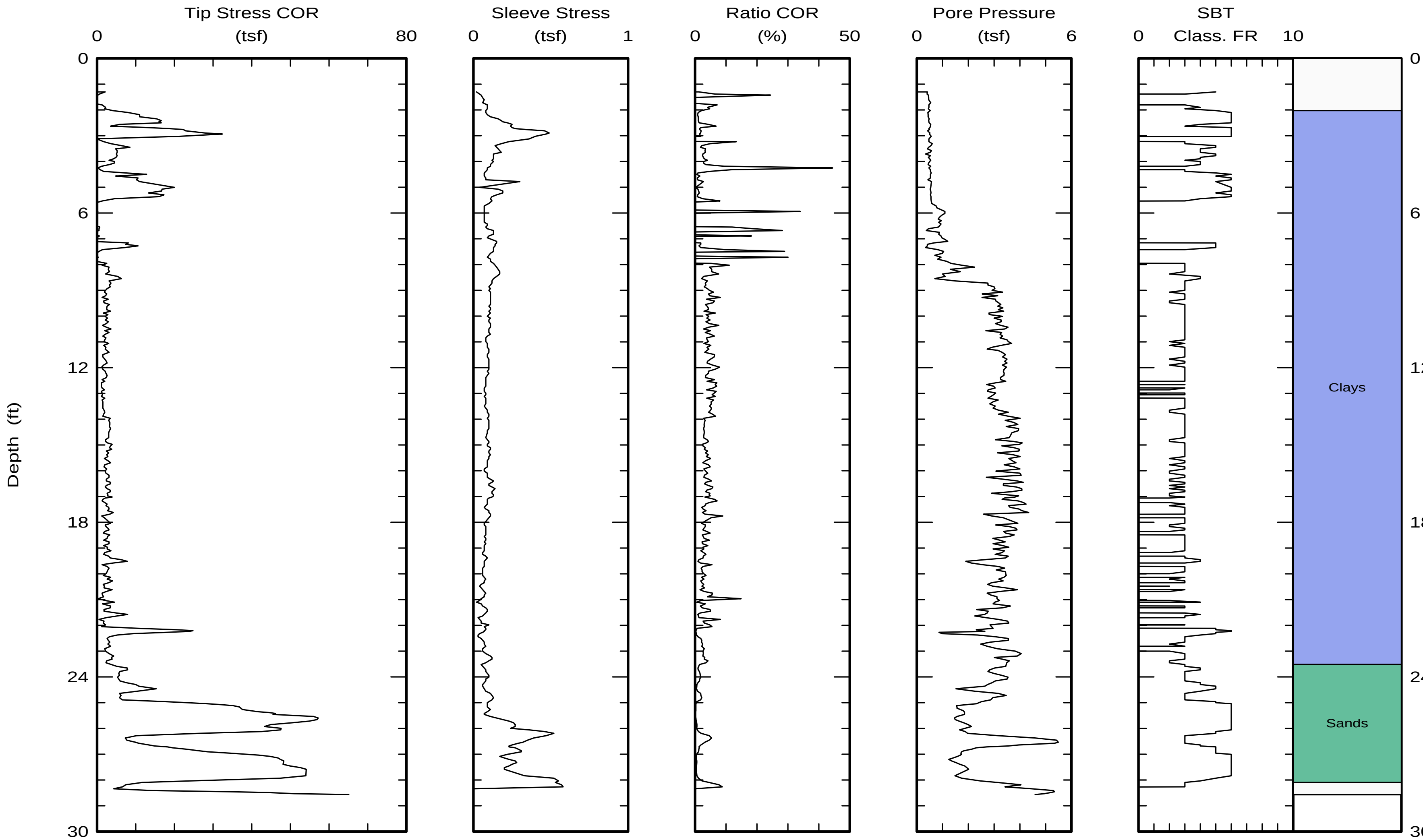
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1614343.388 Easting: 736166.293 Elevation: 108.9	Date: 21/Oct/2005 Test ID: CP004 Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 67.91 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

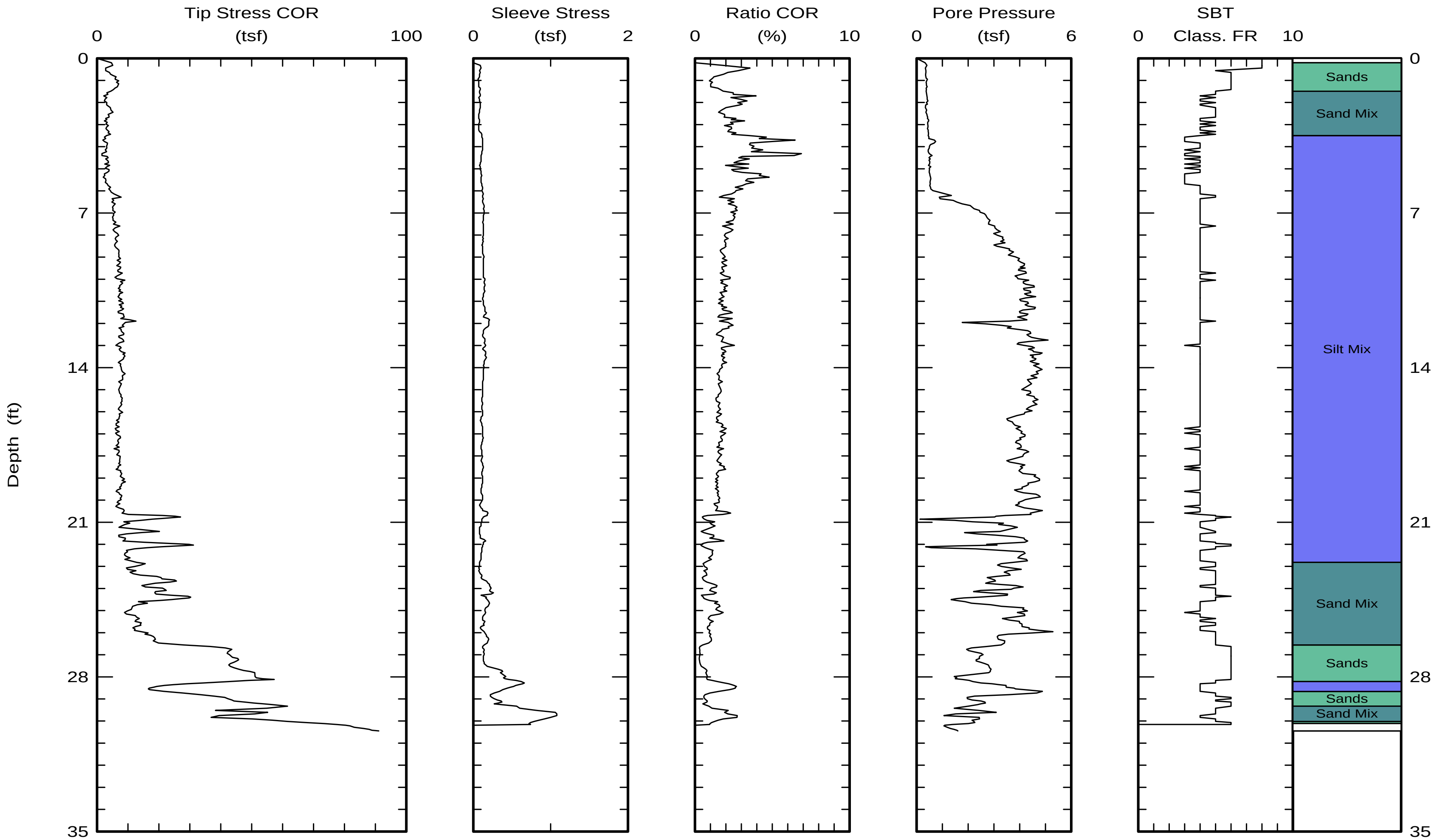
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1613557.884 Easting: 73277.443 Elevation: 106.7	Date: 21/Oct/2005 Test ID: CP005 Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 28.57 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1613063.455 Easting: 736013.011 Elevation: 109.9	Date: 24/Oct/2005 Test ID: CP006 Project: CD2518
	Client: BBL Job Site: River Section 1	

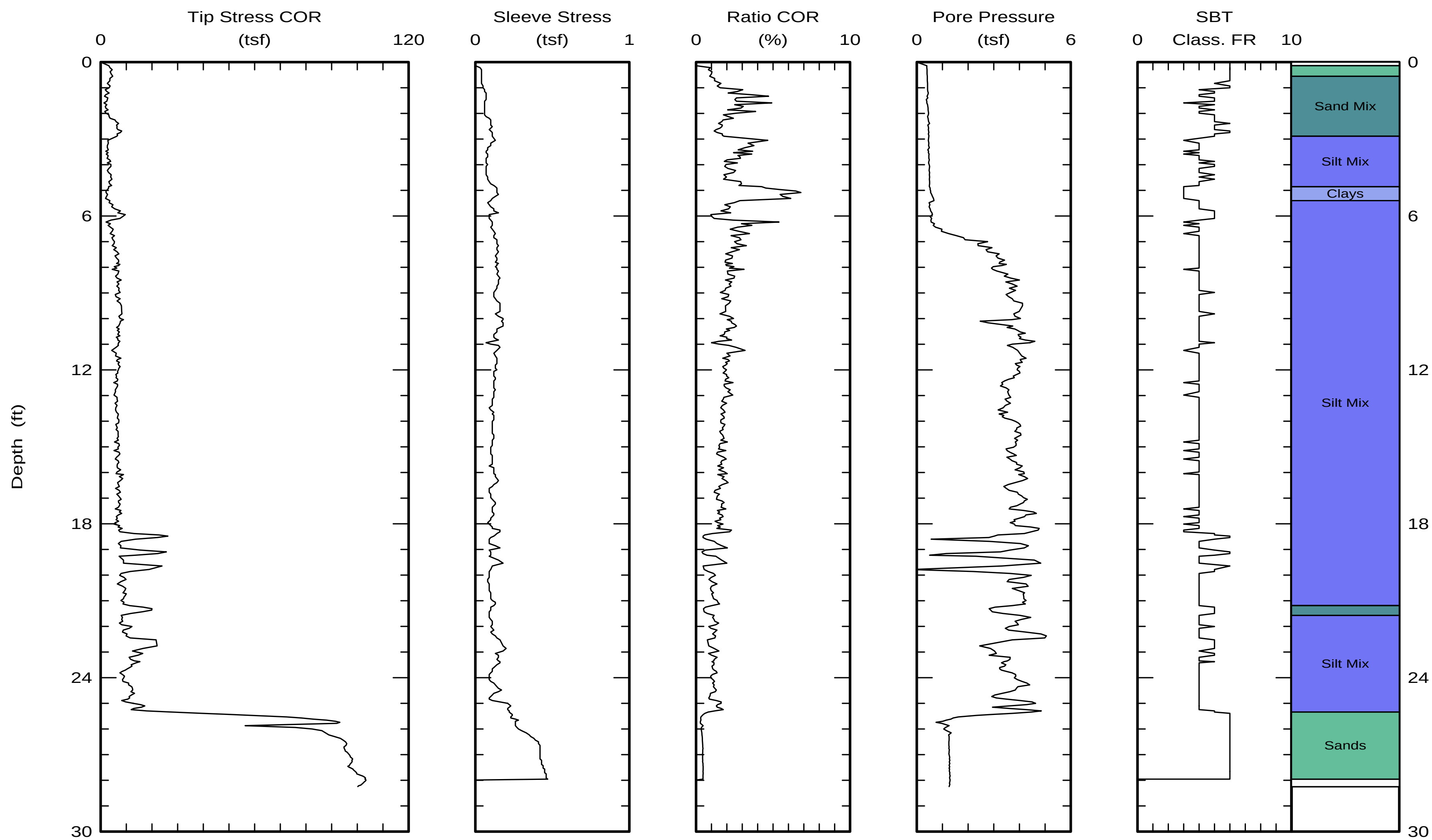


Maximum depth: 30.45 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Test ID: CP006
File: Z24O0508C.ecp

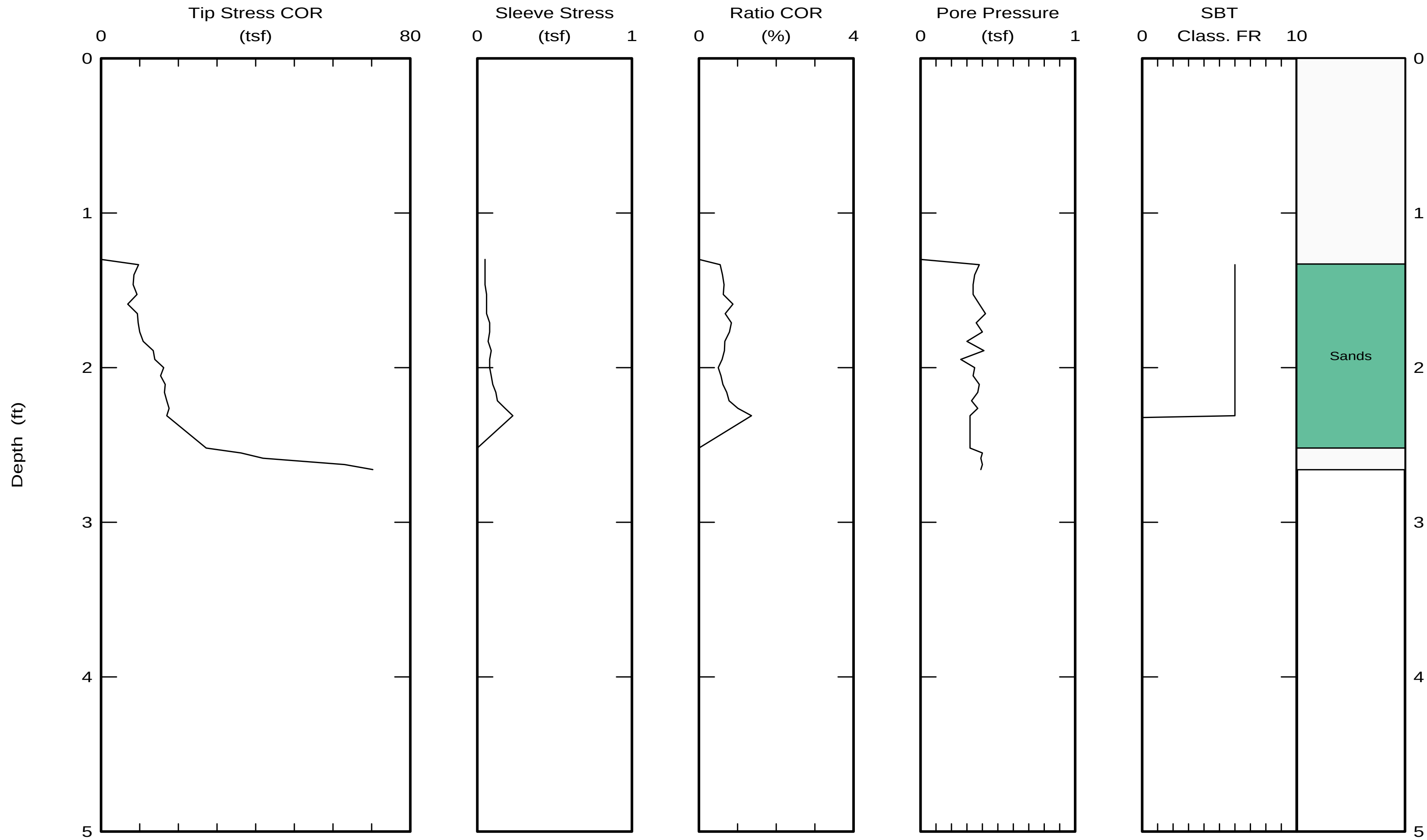
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1613070.734 Easting: 736034.019 Elevation: 107.6	Date: 25/Oct/2005 Test ID: CP006A Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 28.25 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

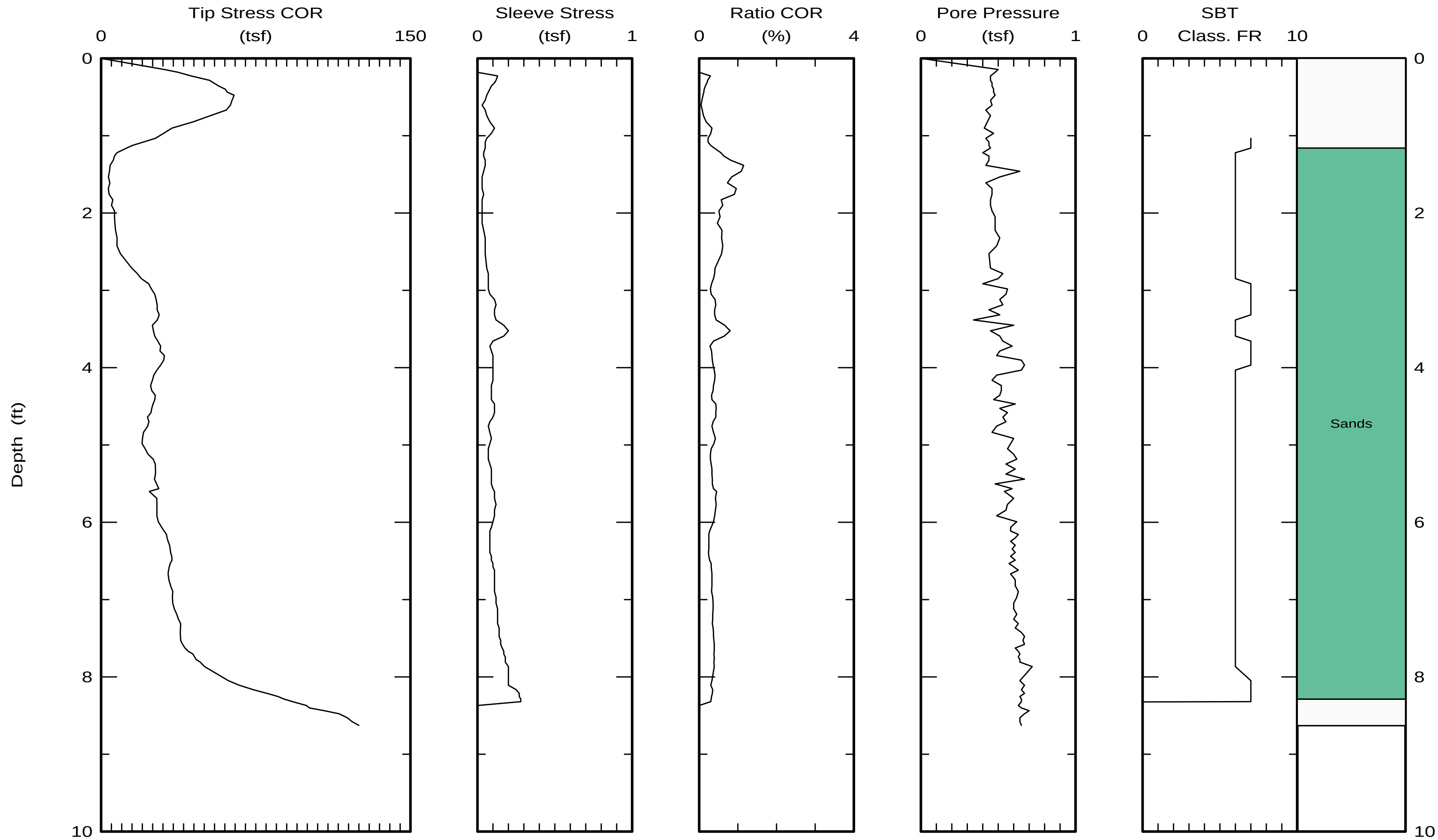
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1612900.228 Easting: 736062.353 Elevation: 111.4	Date: 24/Oct/2005 Test ID: CP007 Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 2.66 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

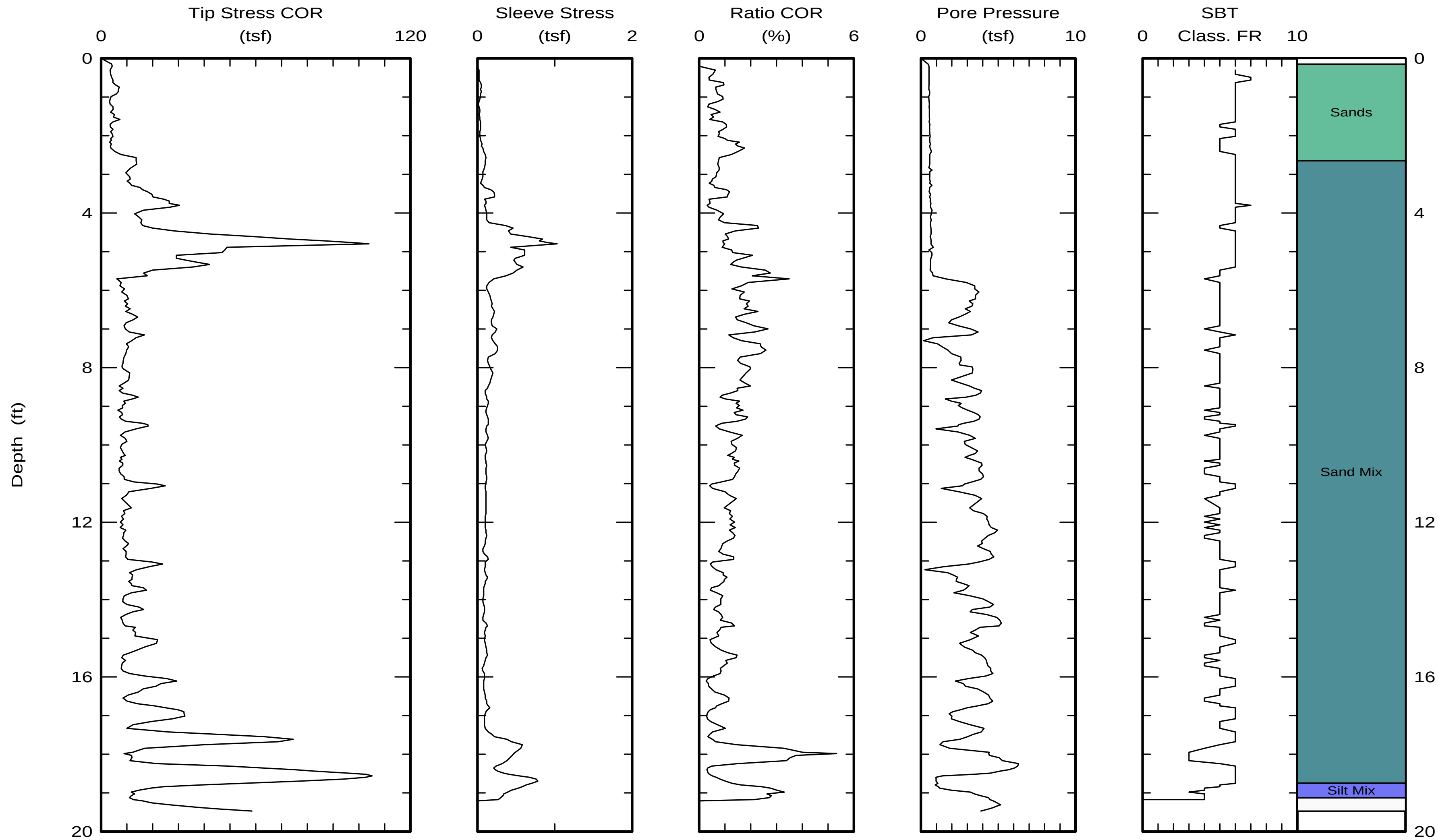
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: Easting: Elevation: 106.6	Date: 24/Oct/2005 Test ID: CP007A Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 8.63 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

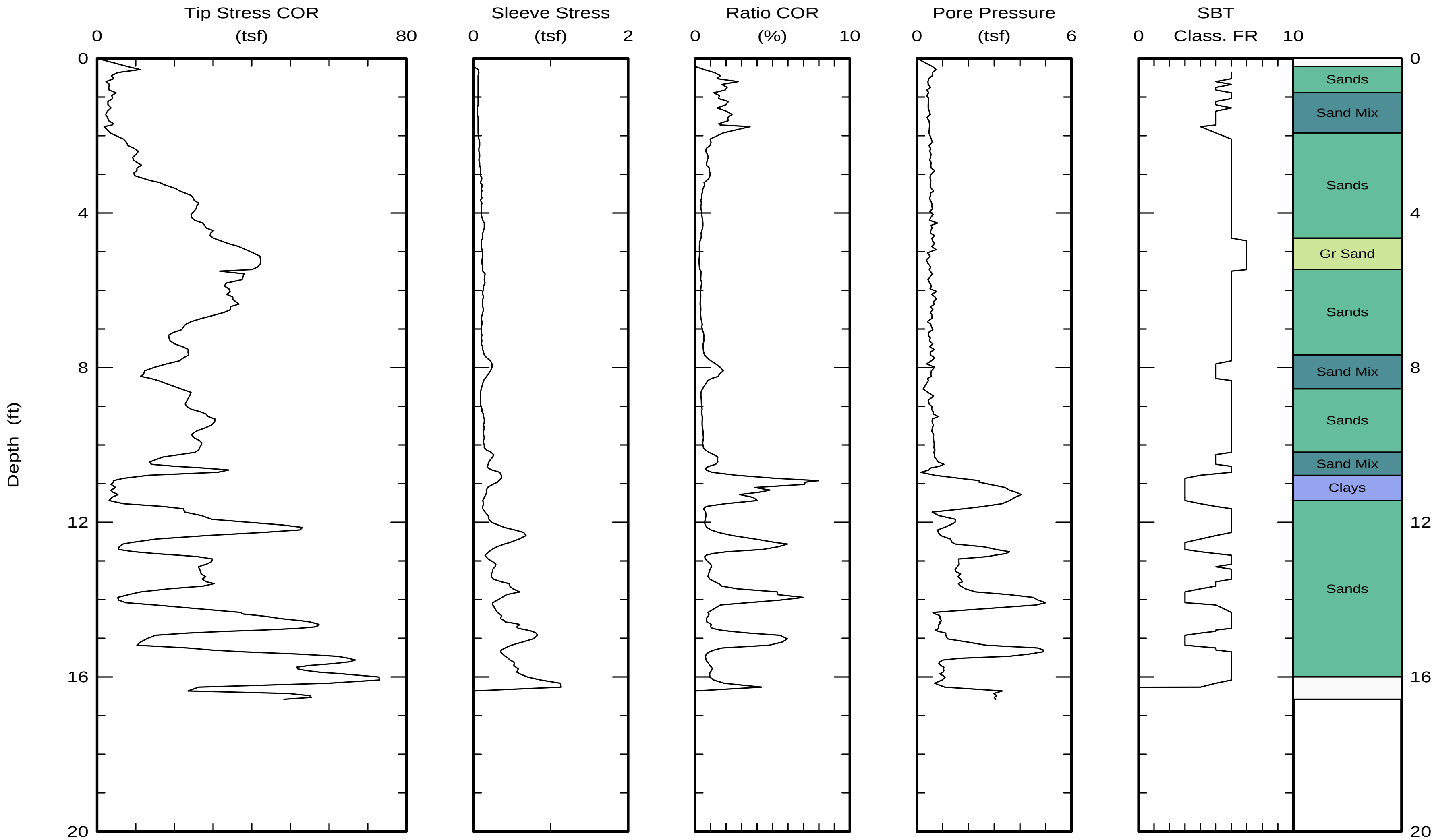
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: Easting: Elevation: 103.9	Date: 24/Oct/2005 Test ID: CP007B Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 19.47 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1612780.573 Easting: 735840.774 Elevation: 101.9	Date: 25/Oct/2005 Test ID: CP008 Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 16.58 (ft)

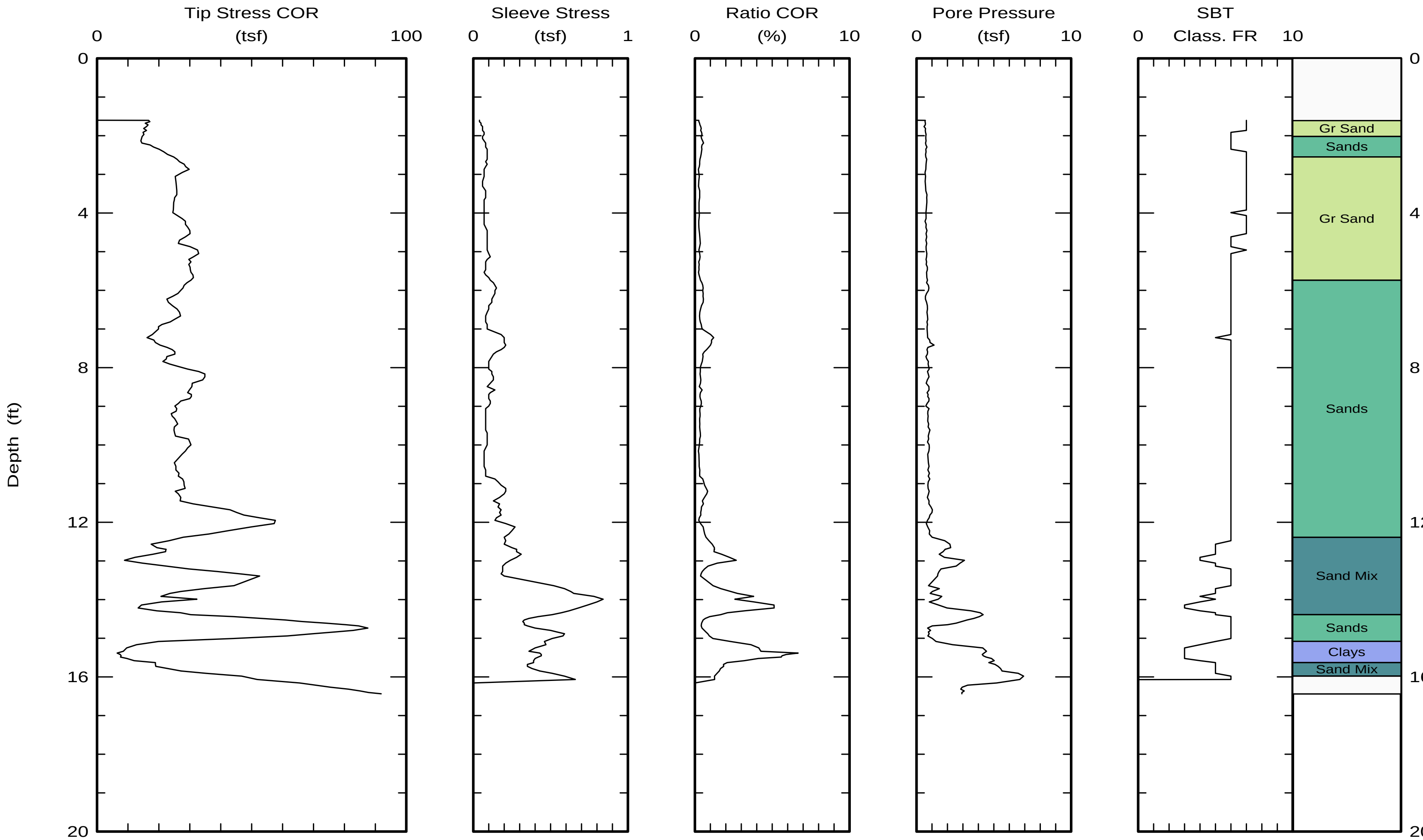
Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Atlantic Testing Laboratories, Limited
Canton, New York 13617
315-386-4578
info@AtlanticTesting.com
www.AtlanticTesting.com

Northing:
Easting:
Elevation: 101.9

Date: 25/Oct/2005
Test ID: CP008A
Project: CD2518

Client: BBL
Job Site: River Section 1

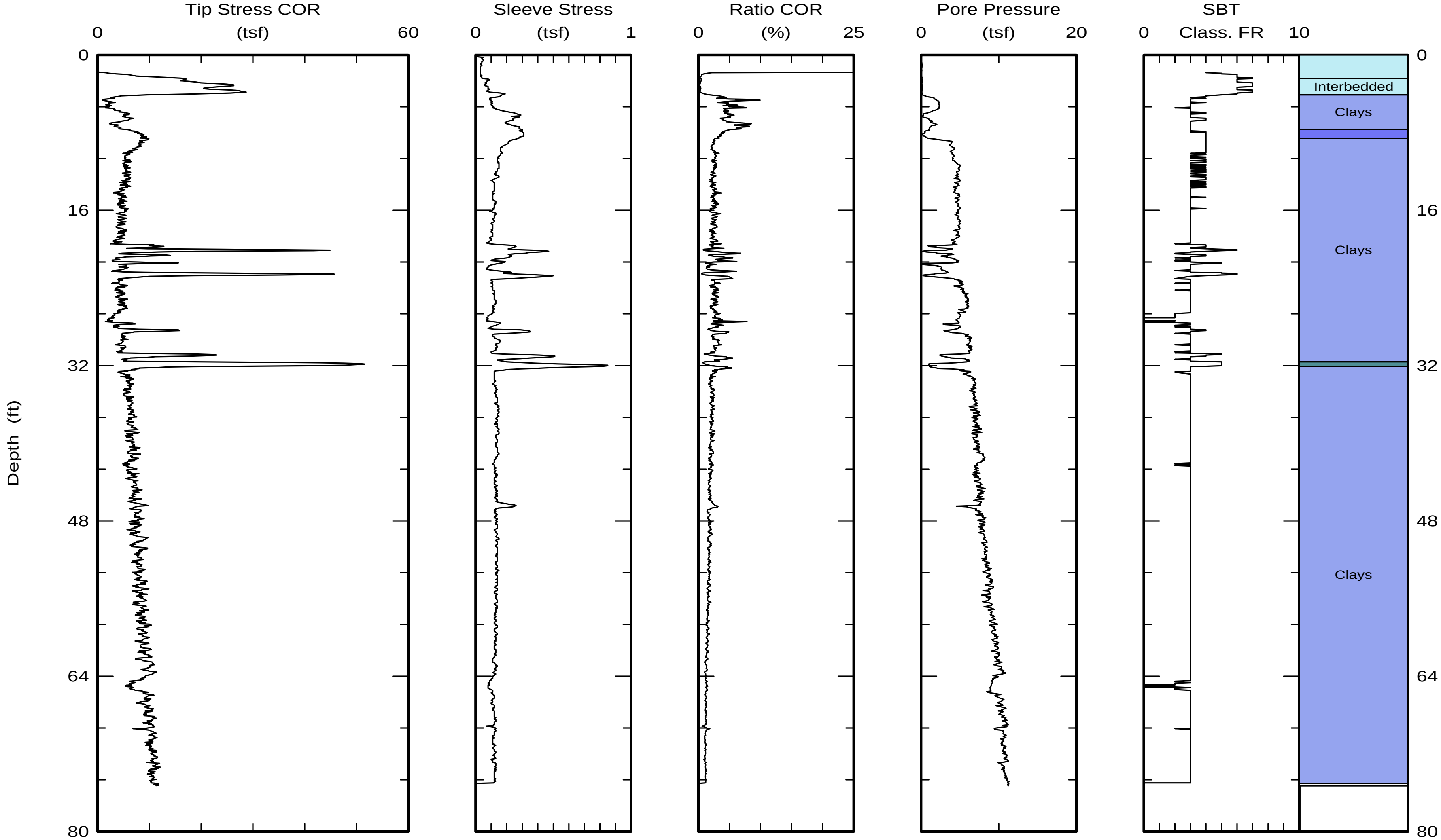


Maximum depth: 16.44 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Test ID: CP008A
File: Z25O0503C.ecp

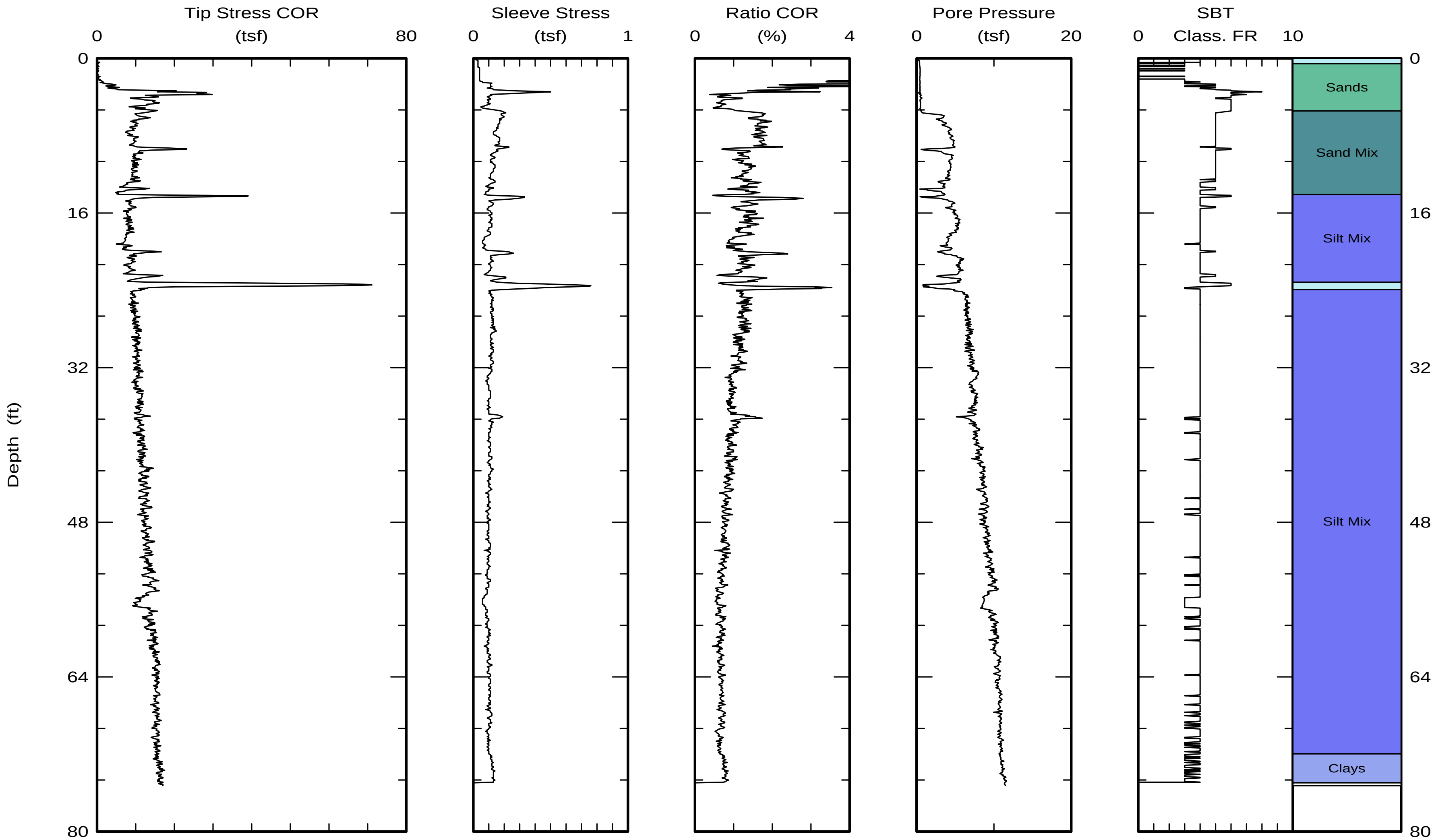
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1596350.274 Easting: 737772.273 Elevation: 117.3	Date: 31/Oct/2005 Test ID: CP009 Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 75.28 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

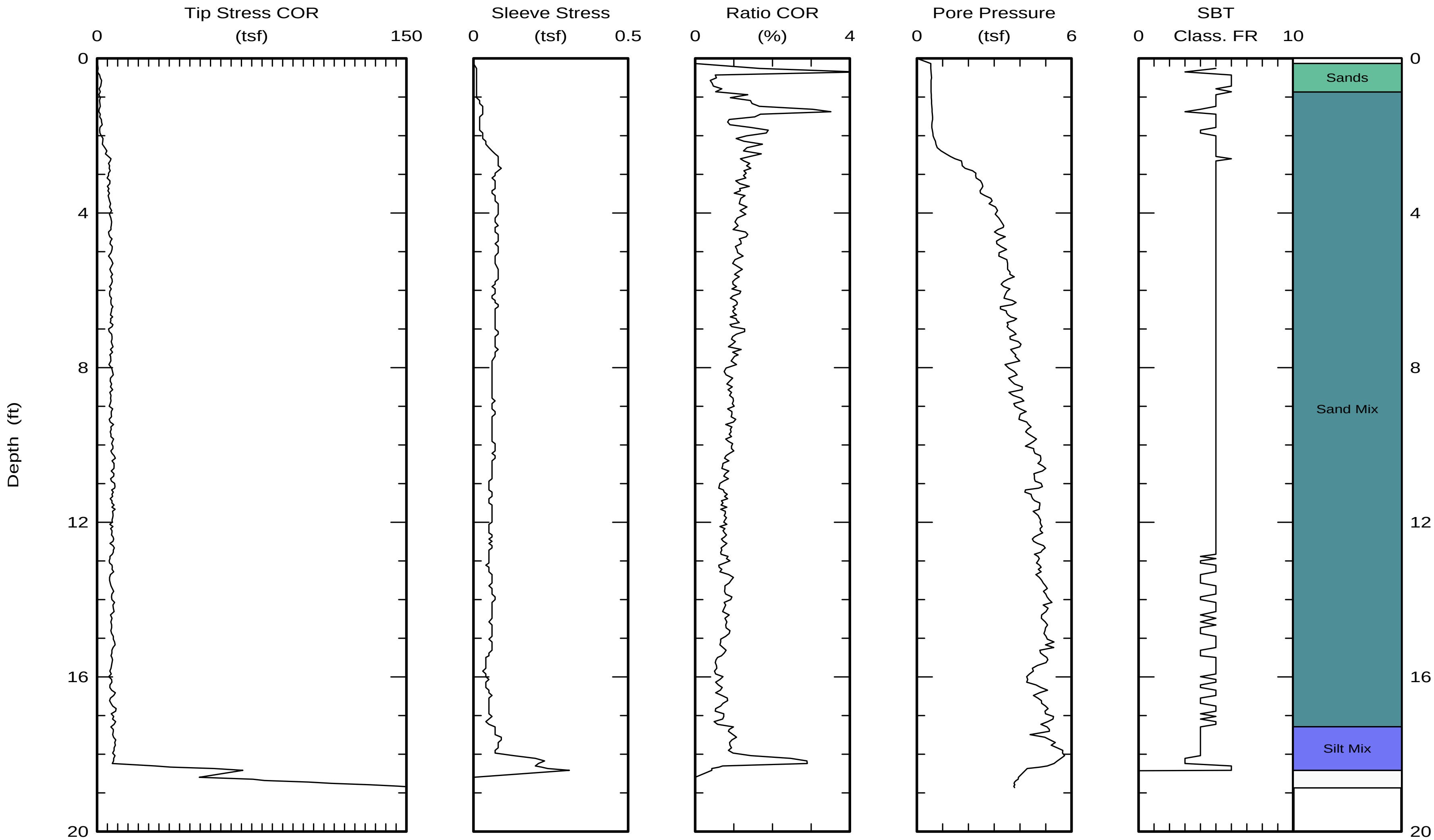
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1596304.914 Easting: 737687.425 Elevation: 108.8	Date: 31/Oct/2005 Test ID: CP010 Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 75.25 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

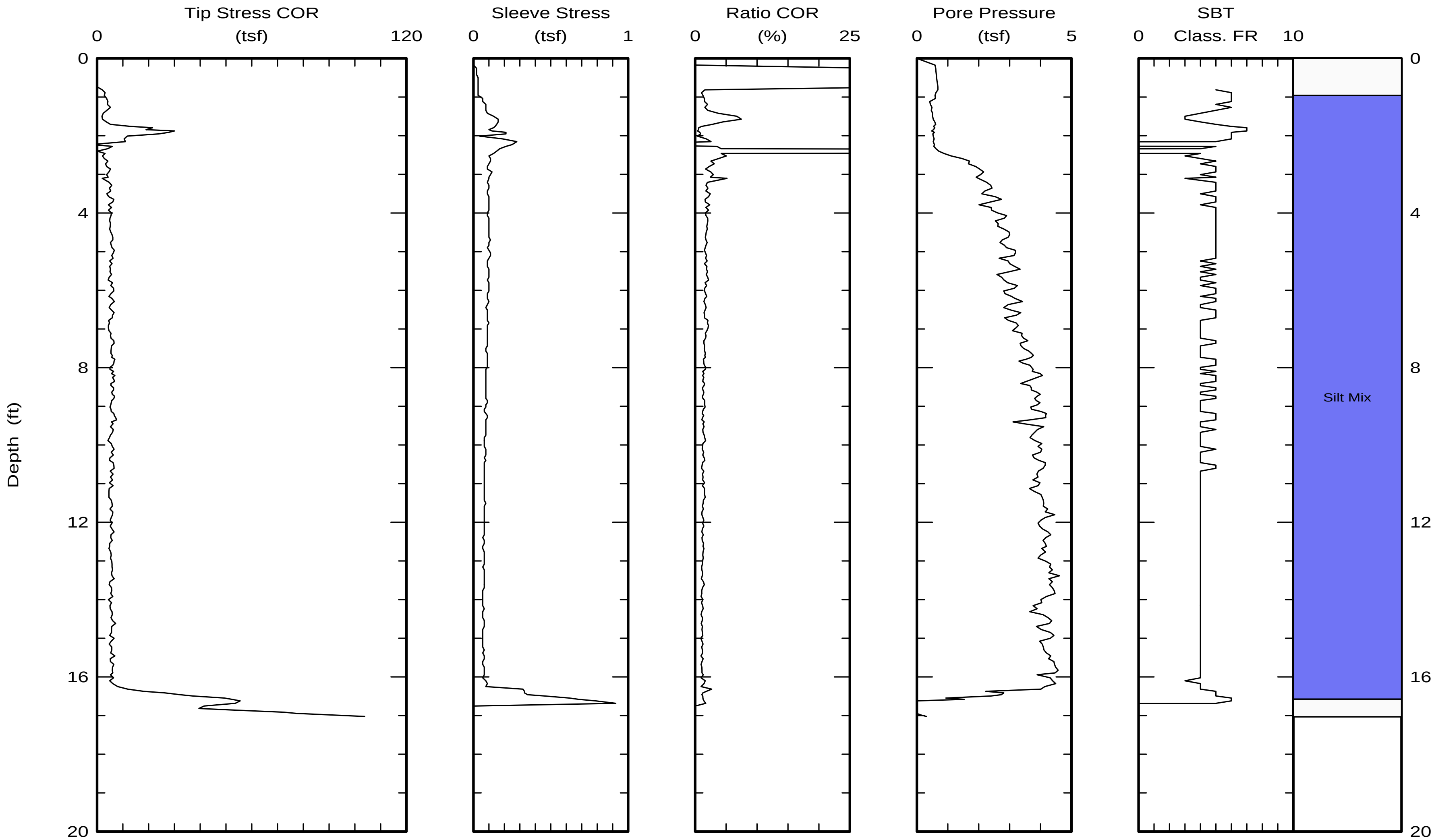
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1595926.036 Easting: 737876.075 Elevation: 105.9	Date: 31/Oct/2005 Test ID: CP011 Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 18.87 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

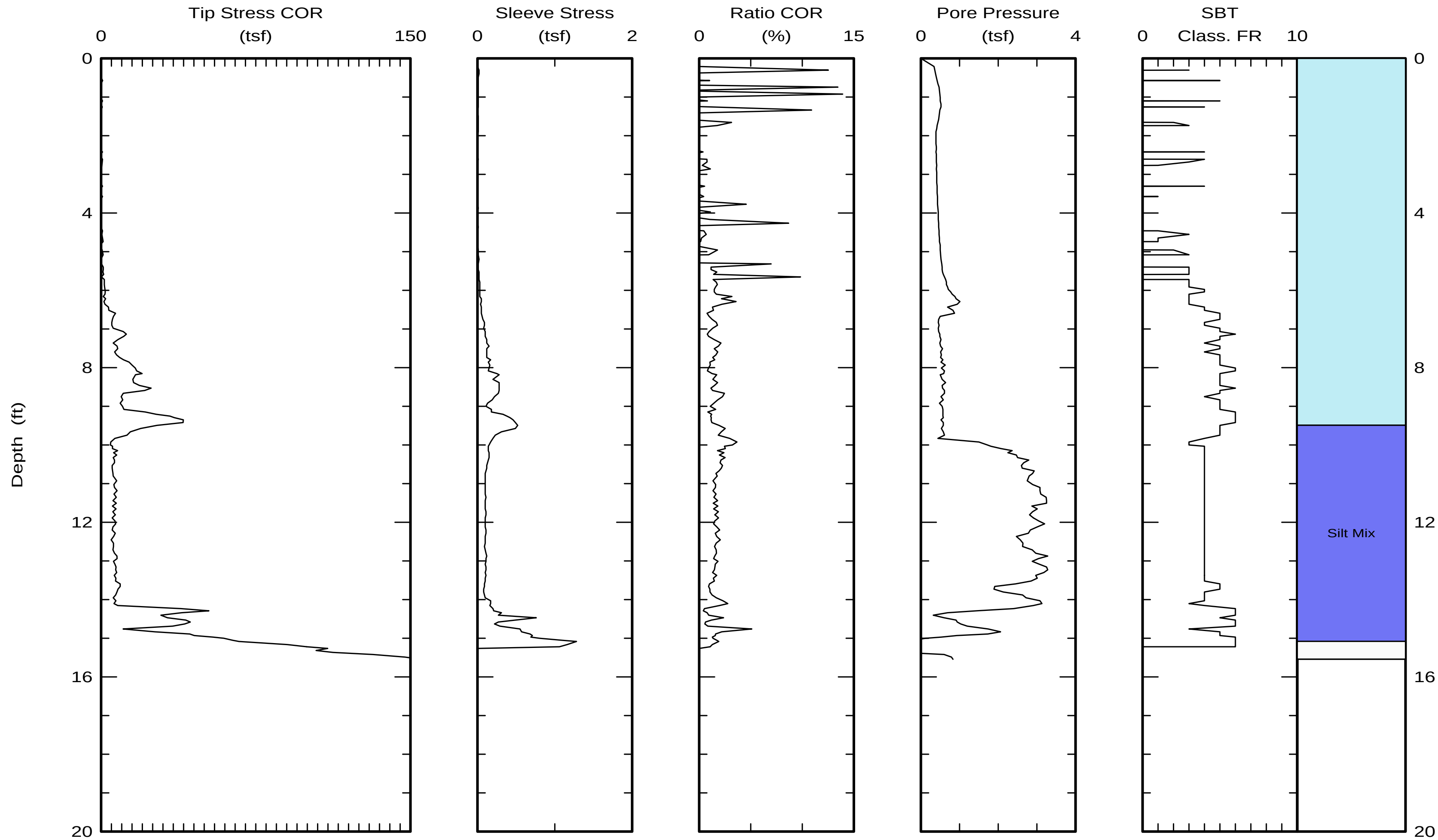
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1595917.935 Easting: 737862.109 Elevation: 102.7	Date: 31/Oct/2005 Test ID: CP011A Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 17.03 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

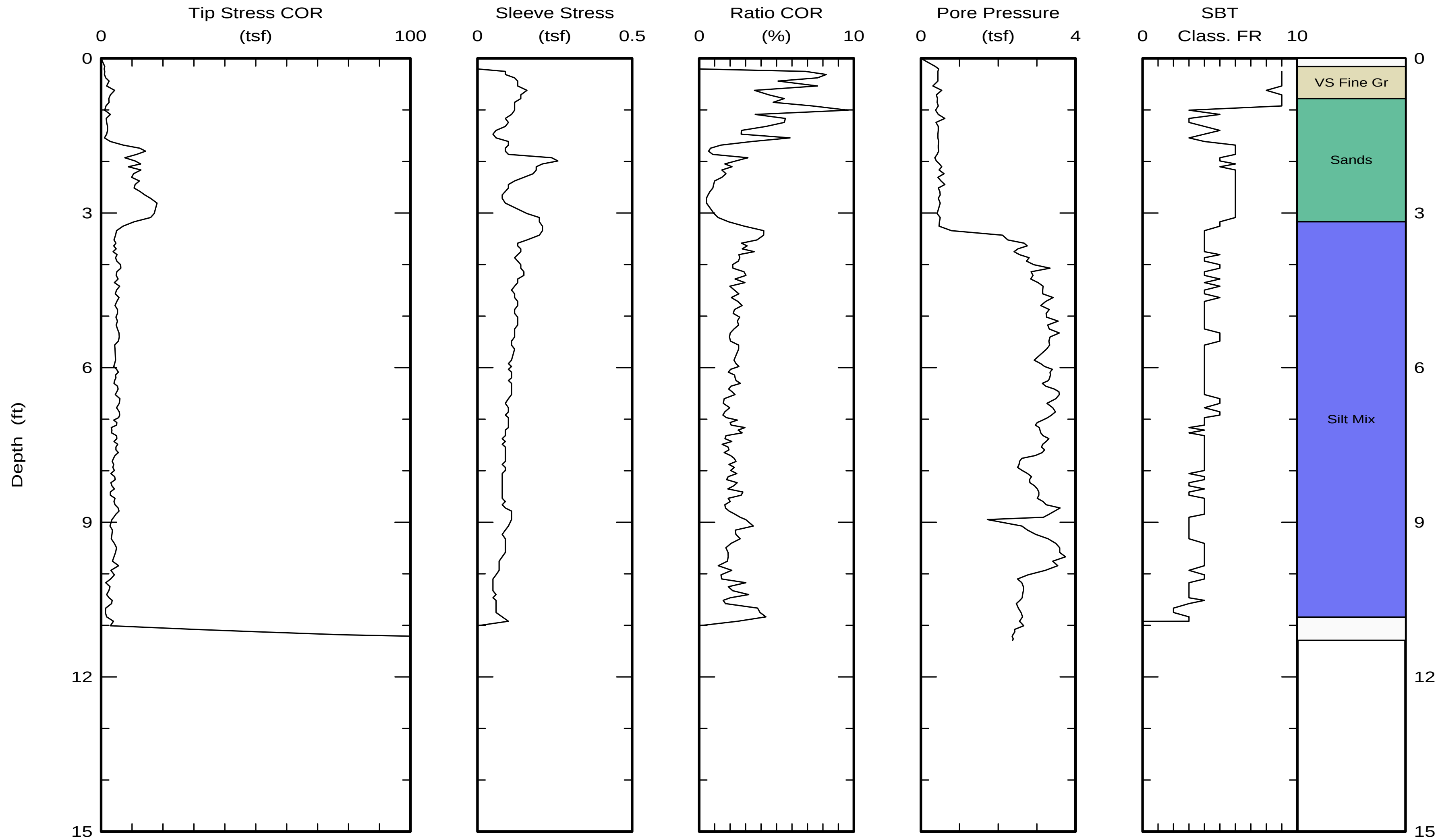
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1595930.177 Easting: 737847.010 Elevation: 103.9	Date: 31/Oct/2005 Test ID: CP011B Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 15.54 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

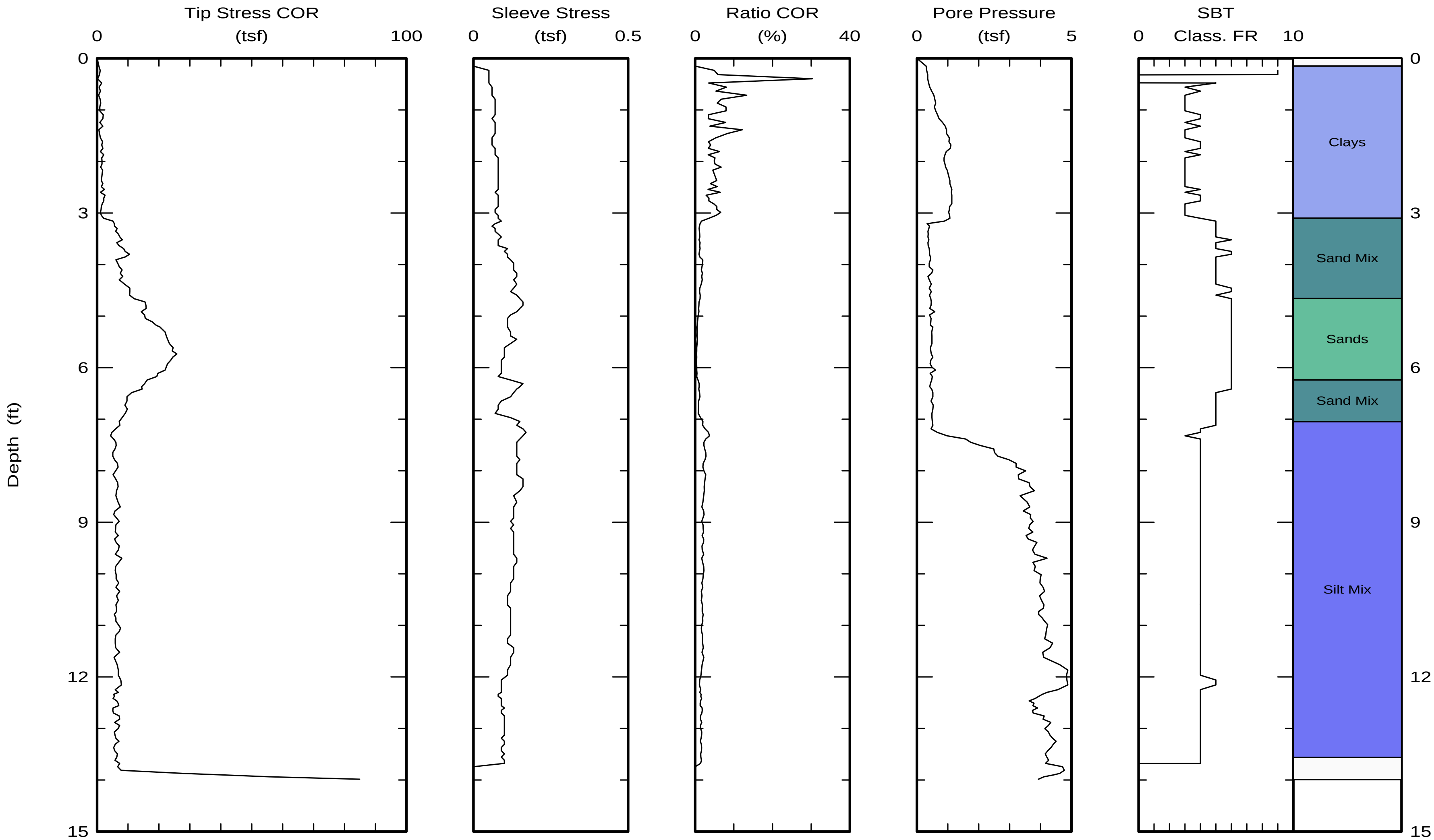
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1595917.388 Easting: 737825.472 Elevation: 106.6	Date: 01/Nov/2005 Test ID: CP012 Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 11.29 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

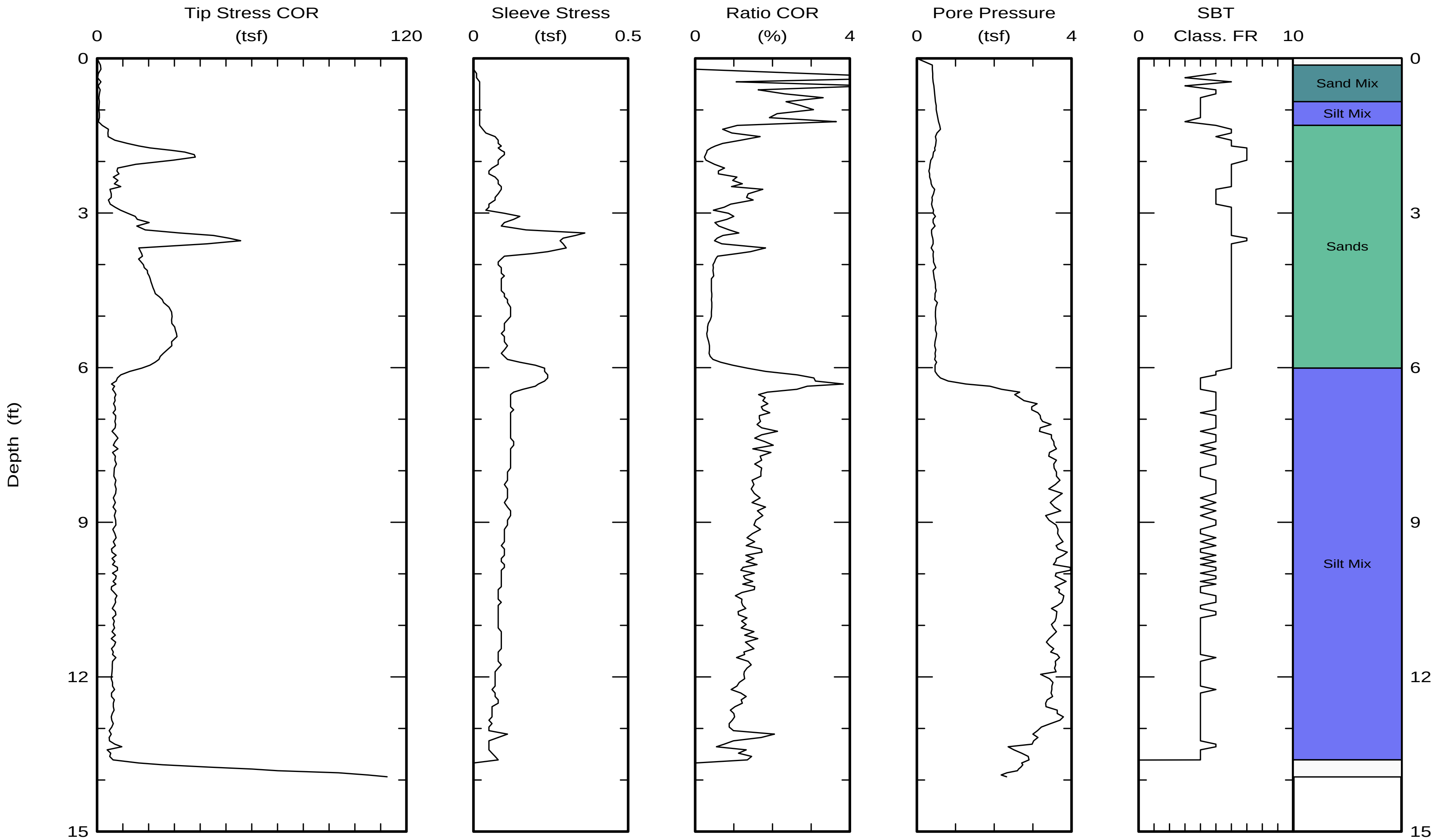
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1595915.722 Easting: 737806.691 Elevation: 106.6	Date: 01/Nov/2005 Test ID: CP012A Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 13.99 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

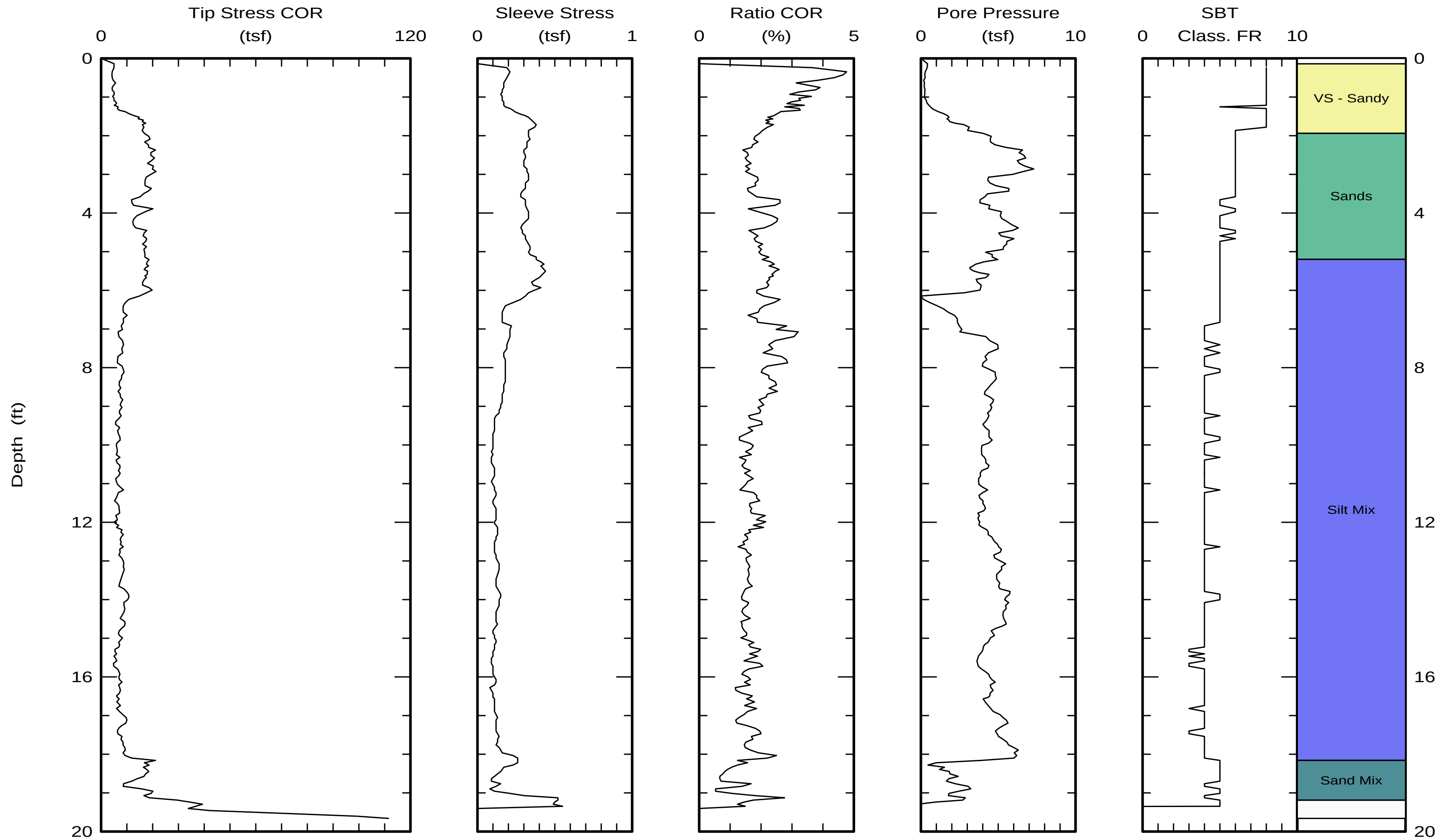
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1595915.722 Easting: 737806.691 Elevation: 106.6	Date: 01/Nov/2005 Test ID: CP012B Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 13.94 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

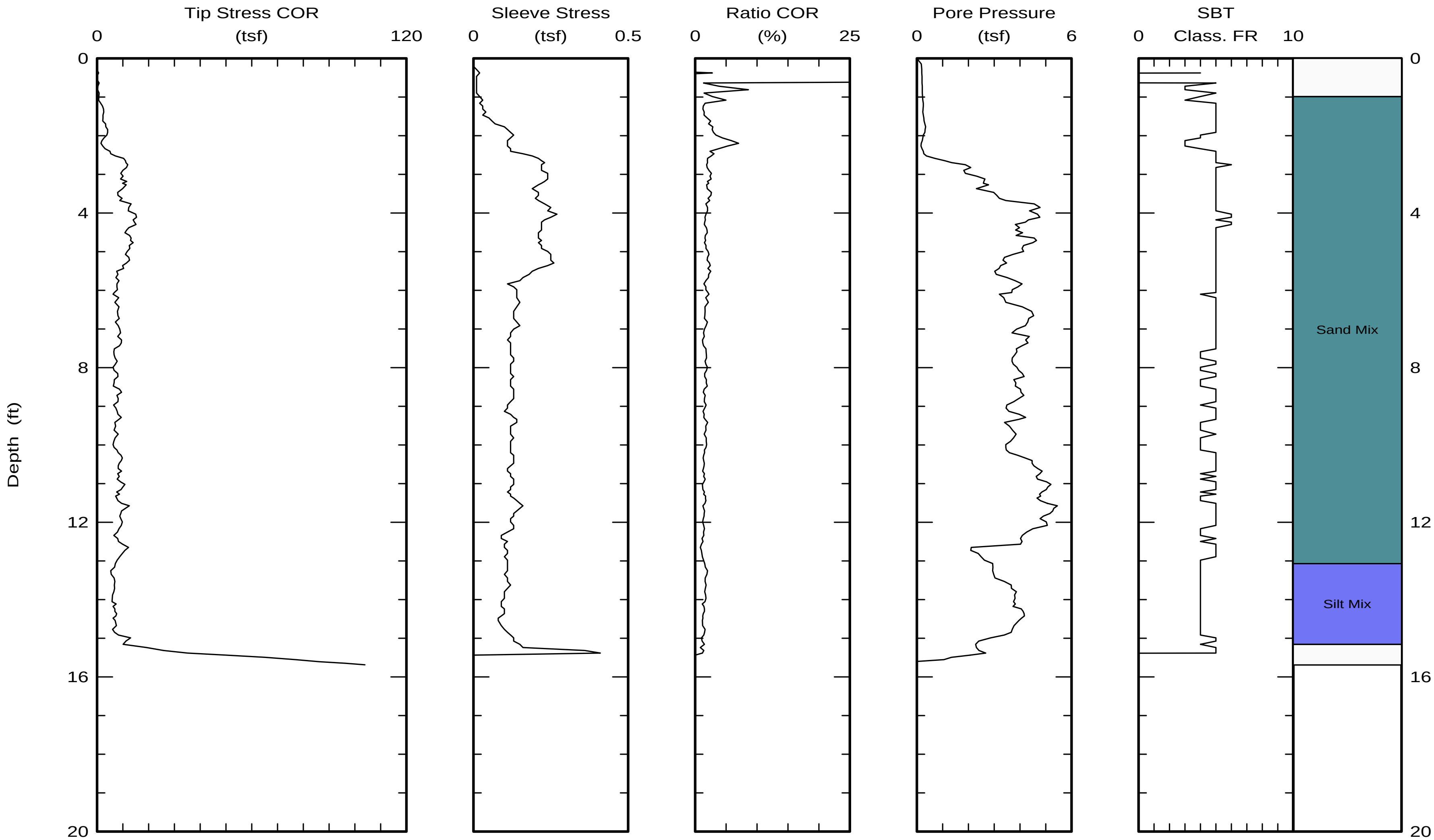
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1595709.477 Easting: 737993.583 Elevation: 117.5	Date: 01/Nov/2005 Test ID: CP013 Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 19.66 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1595711.463 Easting: 737979.353 Elevation: 116.5	Date: 01/Nov/2005 Test ID: CP013A Project: CD2518
	Client: BBL Job Site: River Section 1	

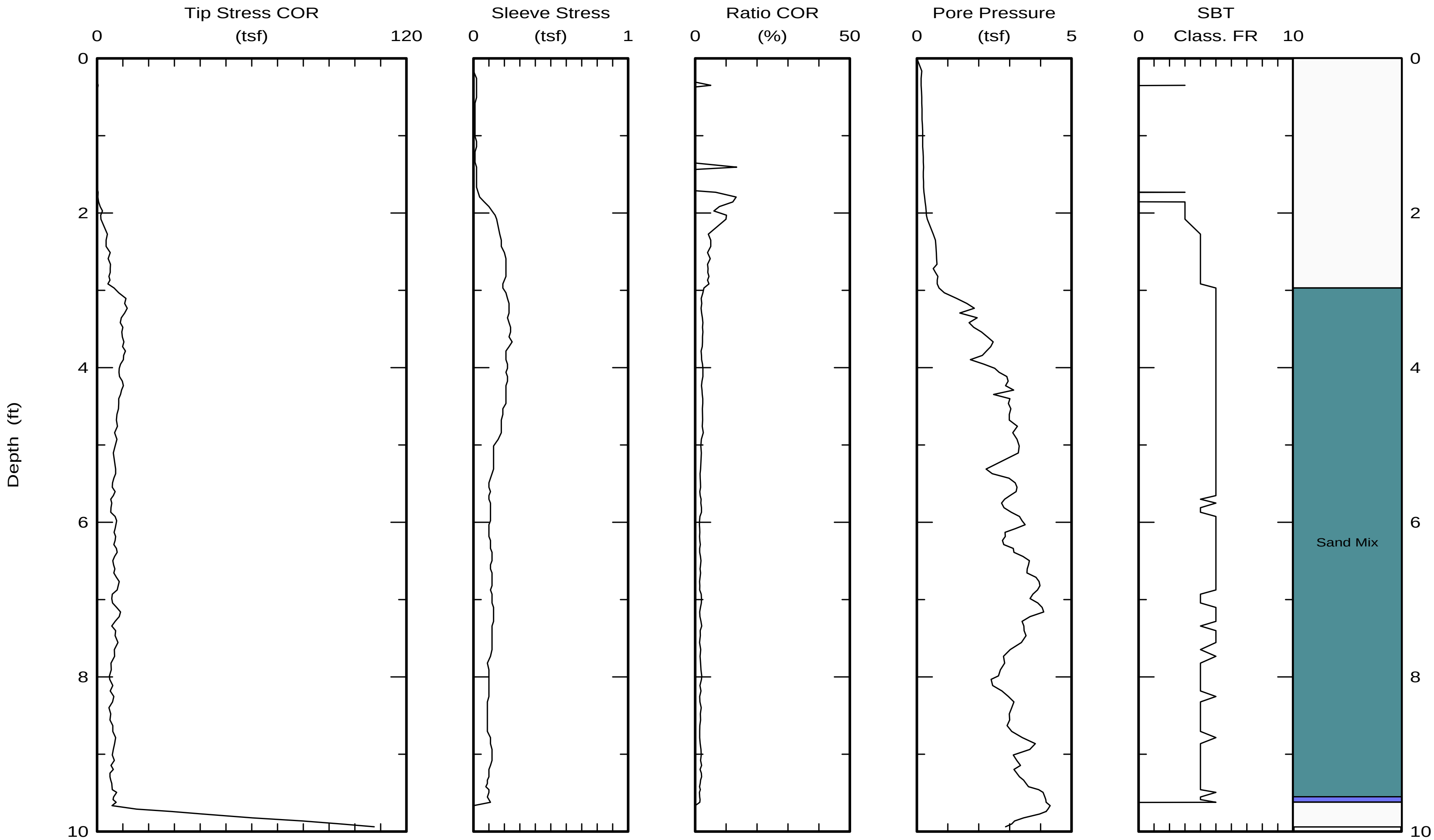


Maximum depth: 15.69 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Test ID: CP013A
File: Z01N0506C.ECP

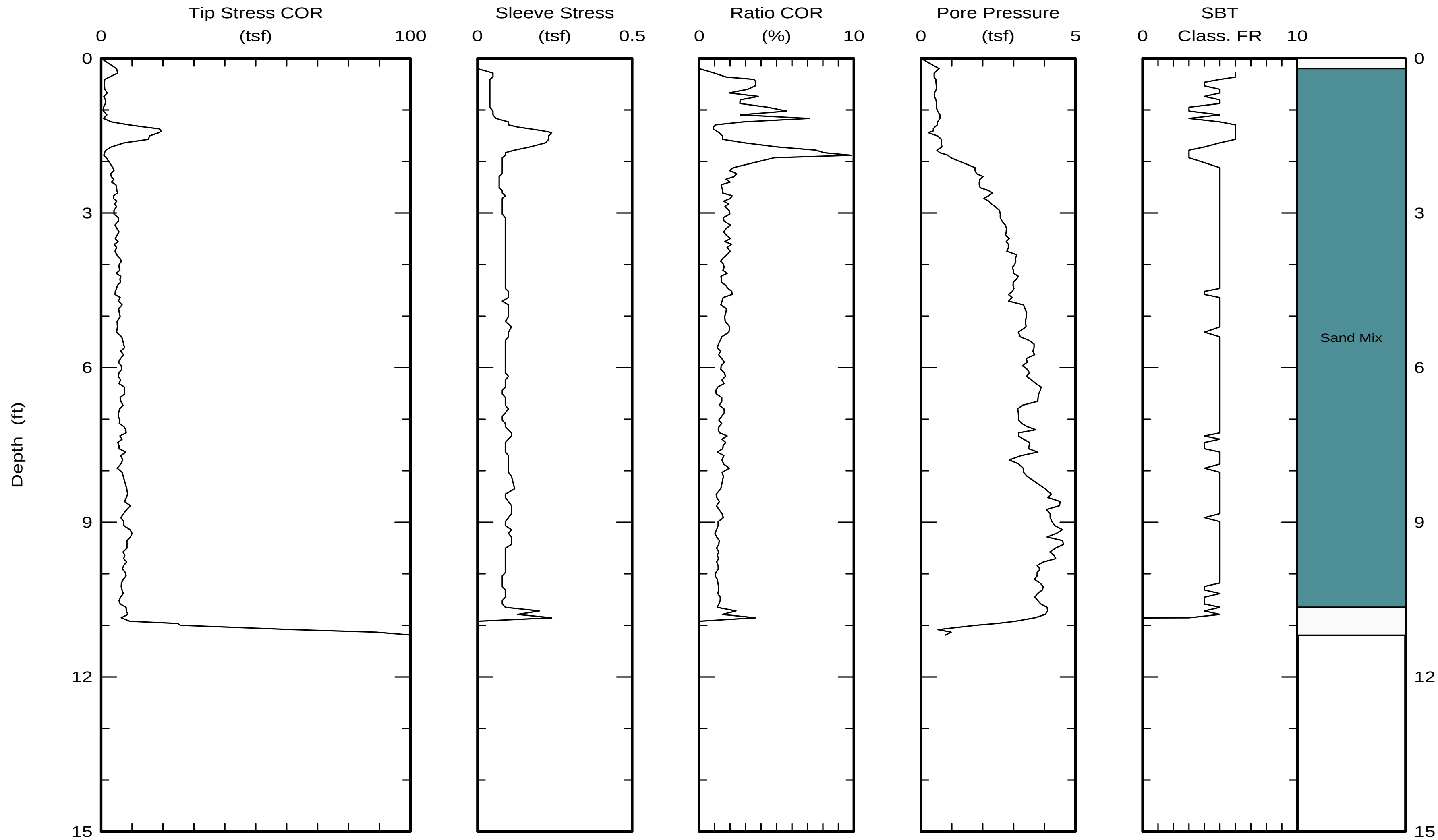
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1595719.135 Easting: 737966.016 Elevation: 115.4	Date: 01/Nov/2005 Test ID: CP013B Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 9.94 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

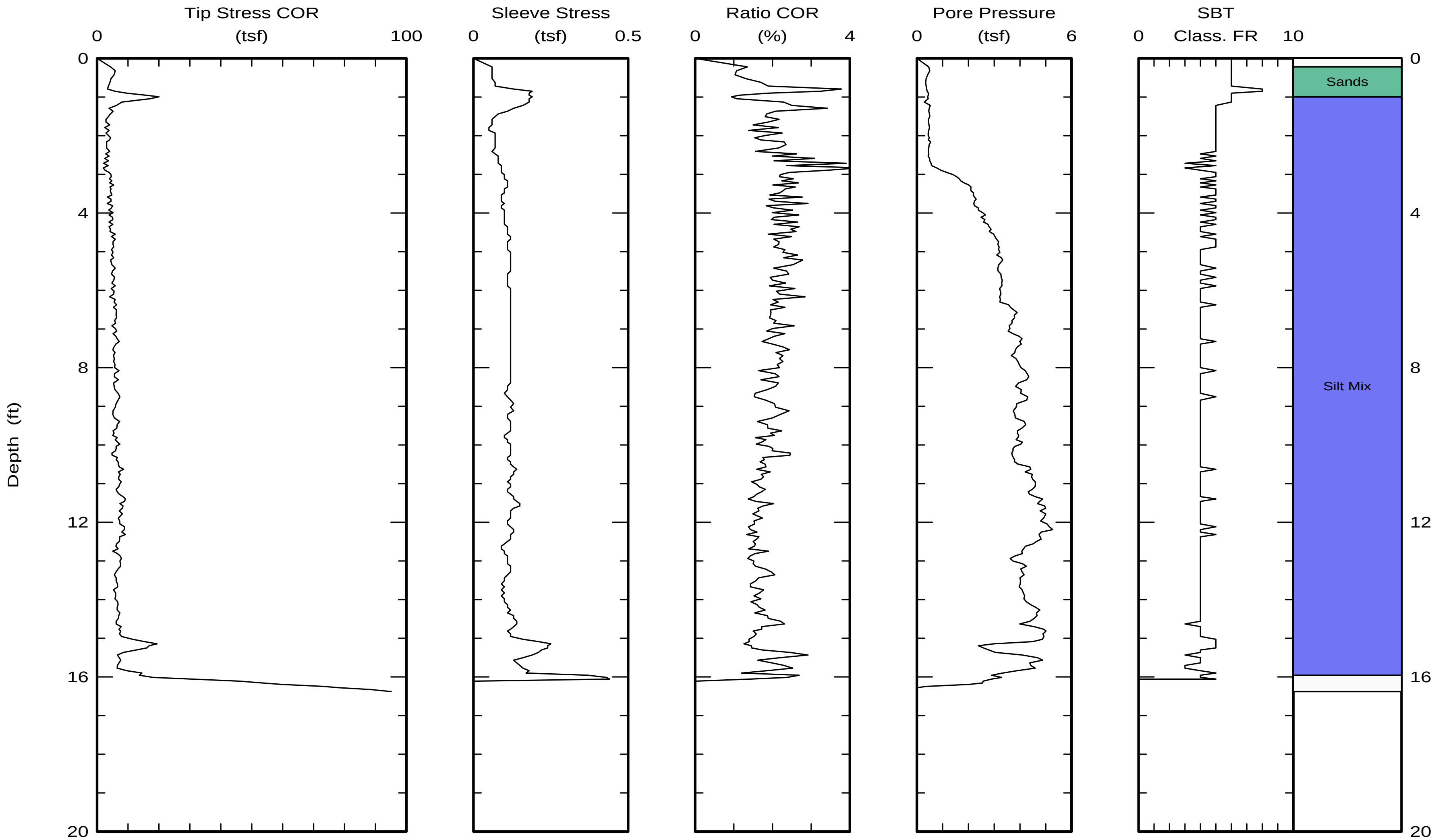
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1595705.555 Easting: 737918.723 Elevation: 105.2	Date: 01/Nov/2005 Test ID: CP014 Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 11.19 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

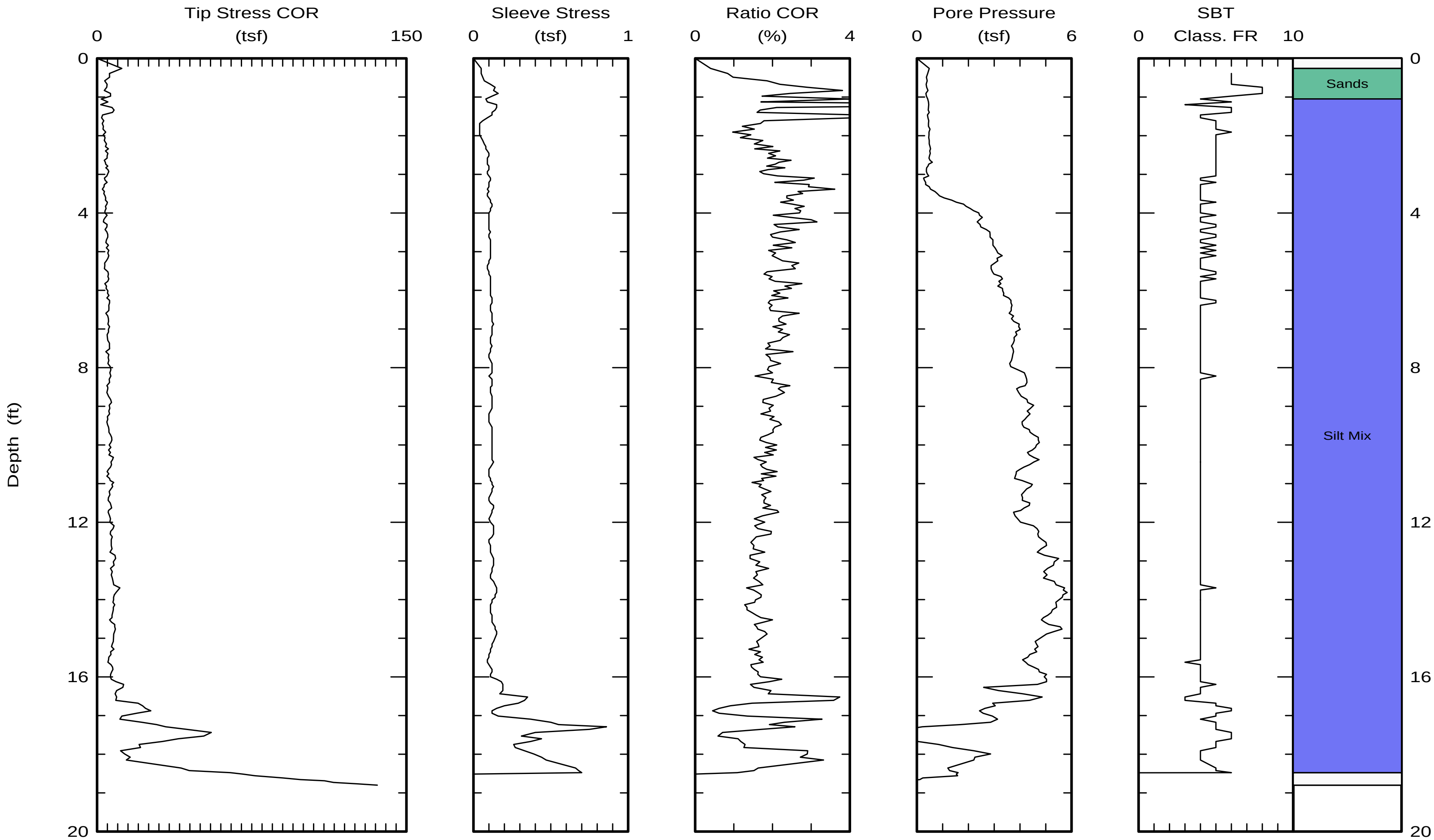
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1595708.429 Easting: 737105.966 Elevation: 105.2	Date: 01/Nov/2005 Test ID: CP014A Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 16.38 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

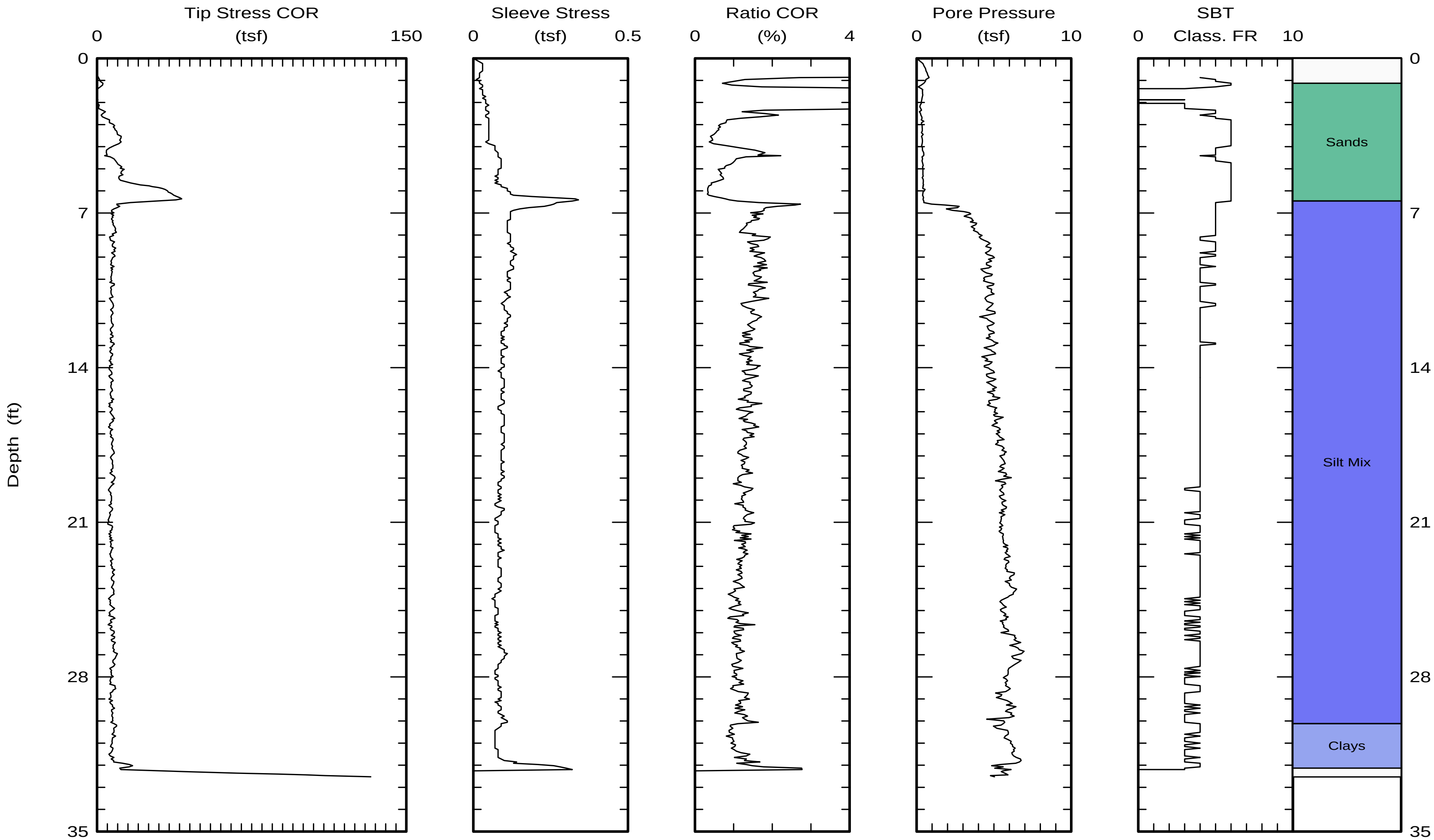
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1595722.558 Easting: 737905.705 Elevation: 105.9	Date: 01/Nov/2005 Test ID: CP014B Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 18.80 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1595475.923 Easting: 737721.493 Elevation: 109.6	Date: 01/Nov/2005 Test ID: CP015 Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 32.53 (ft)

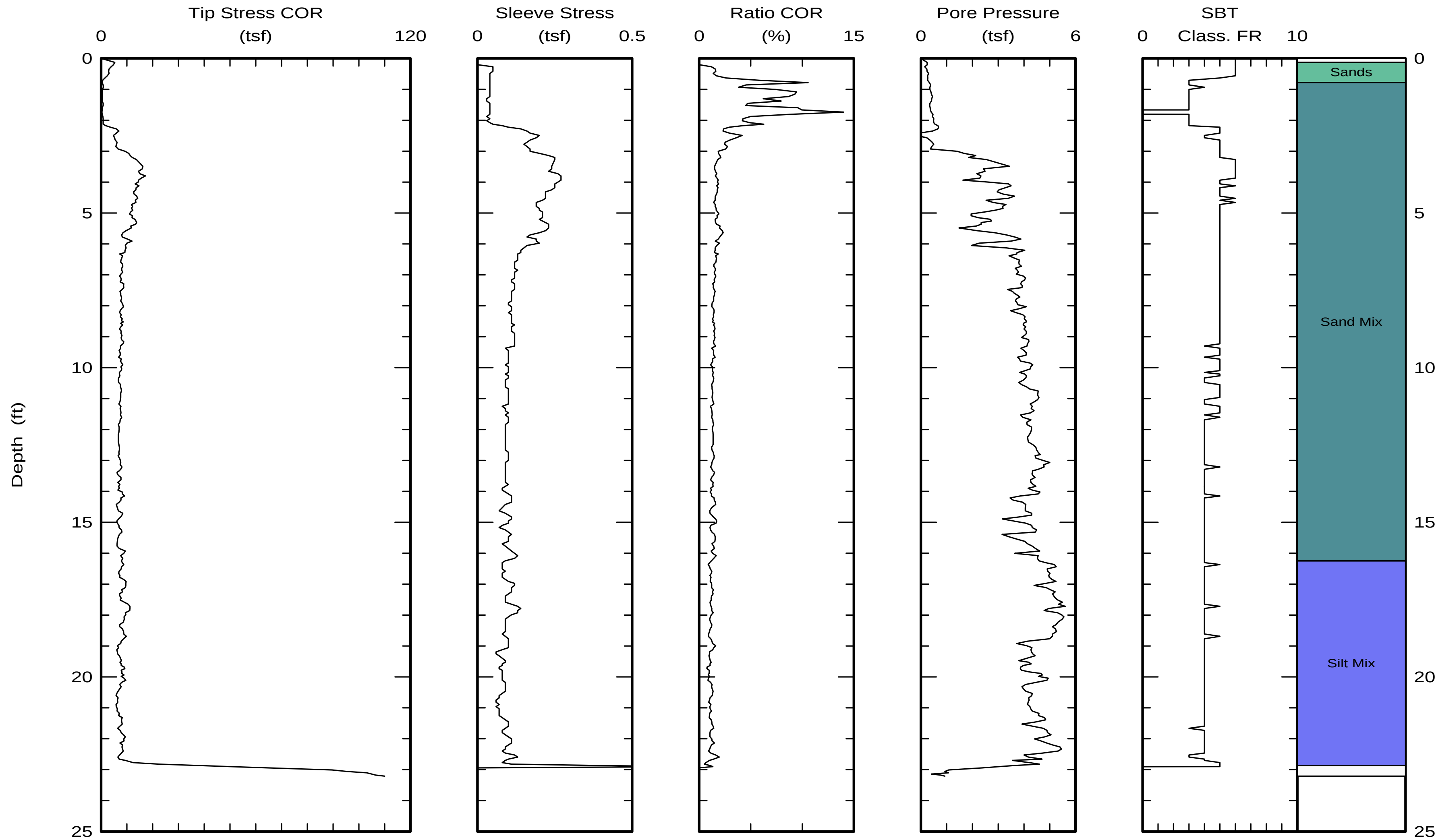
Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Atlantic Testing Laboratories, Limited
Canton, New York 13617
315-386-4578
info@AtlanticTesting.com
www.AtlanticTesting.com

Northing: 1595432.087
Easting: 737996.134
Elevation: 117.7

Date: 01/Nov/2005
Test ID: CP016
Project: CD2518

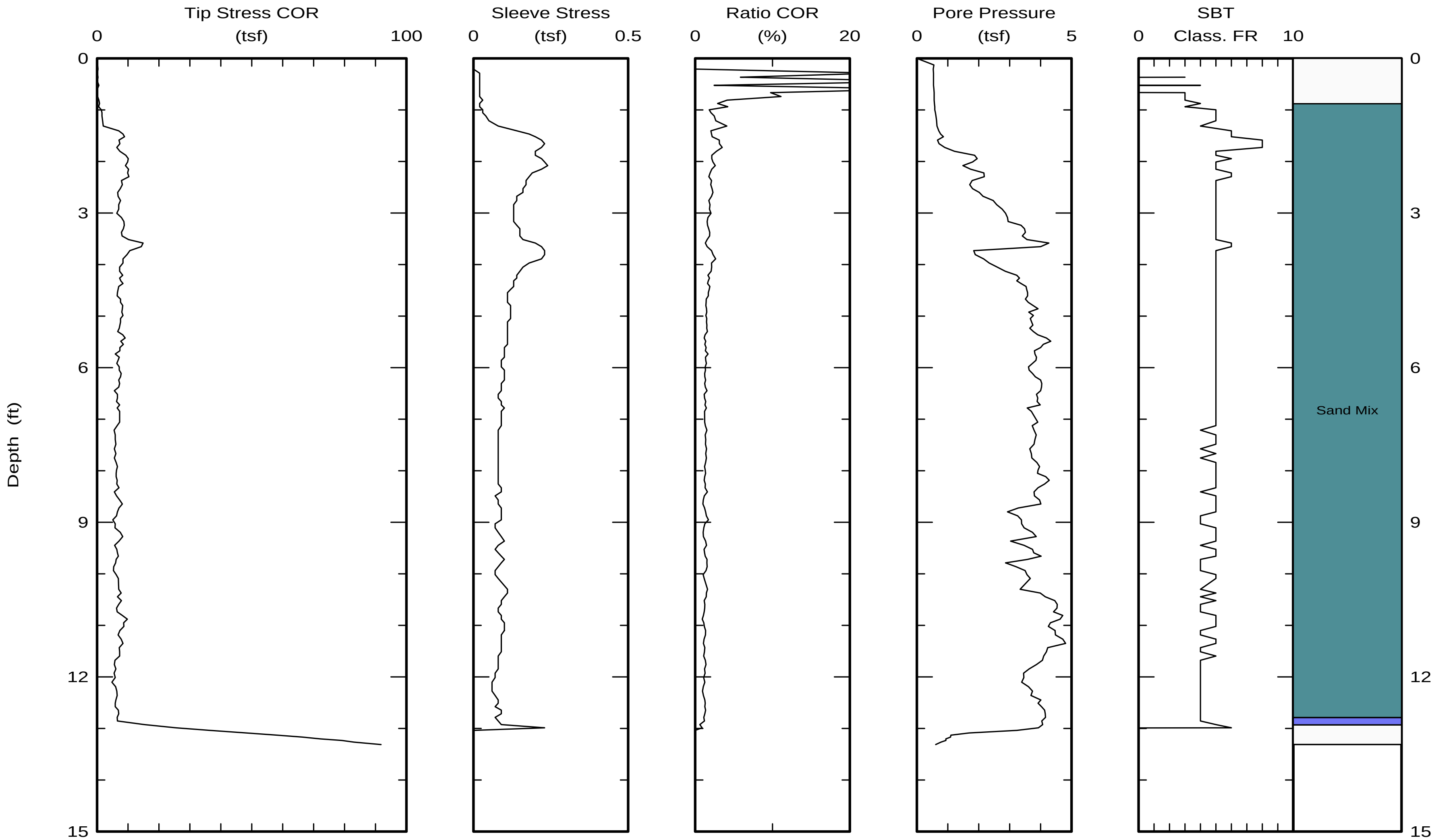
Client: BBL
Job Site: River Section 1



Maximum depth: 23.21 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

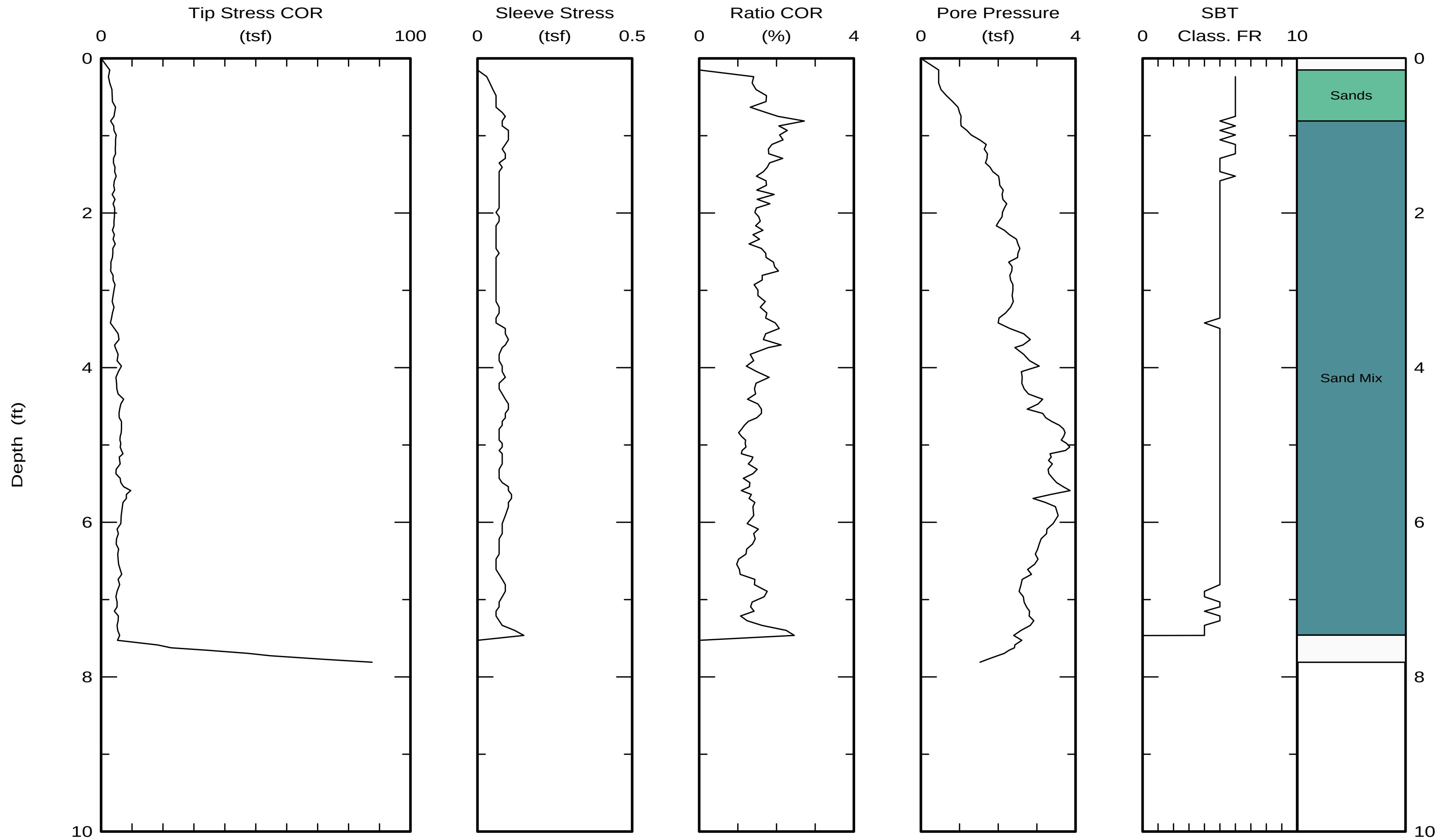
Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1595436.580 Easting: 737976.749 Elevation: 113.9	Date: 01/Nov/2005 Test ID: CP016A Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 13.31 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Atlantic Testing Laboratories, Limited Canton, New York 13617 315-386-4578 info@AtlanticTesting.com www.AtlanticTesting.com	Northing: 1595431.791 Easting: 737959.23 Elevation: 110.5	Date: 01/Nov/2005 Test ID: CP016B Project: CD2518
	Client: BBL Job Site: River Section 1	



Maximum depth: 7.81 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)