

PART 2 – PRODUCTS

2.01 PILOT RELAYS

- A. Pilot relays shall be supplied with the following:
 - 1. 24 VDC or 120 VAC coils, as required.
 - 2. At a minimum, DPDT contacts rated at 5 A, 120 VAC or 28 VDC.
 - 3. Sockets for 24 VDC and 120 VAC relays shall be of different configurations.
 - 4. Clips for attachment to sockets.
 - 5. Indicator lights that glow when the relay coil is powered.
- B. Pilot relays shall be as manufactured Allen Bradley. Refer to I-05 Bill of Material for specific model.
- C. 24V Power supplies shall be sized to satisfy full load current and voltage of all loops, including all energizing of all pilot relays.

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 17070 CONTROL AND INFORMATION SYSTEM TESTING – GENERAL

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall test the Control and Information System as specified herein to demonstrate compliance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17000 – Control and Information System Scope and General Requirements
- B. Section 17072 – Field Testing
- C. Section 17073 – Final Acceptance Test

1.03 SUBMITTALS

- A. For each of the specified tests, submit a test plan to the Engineer at least one month in advance of commencement of the tests. The test plan shall contain the following at a minimum:
 - 1. A schedule of all testing to be conducted.
 - 2. A brief description of the testing to be performed
 - 3. Test objectives.
 - 4. Testing criteria per the Specifications.
 - 5. Check lists and procedures for performing each of the specified tests.
 - 6. Sample test result documentation.
 - 7. Requirements for other parties.

1.04 GENERAL REQUIREMENTS

- A. All system test activities shall follow detailed test procedures; check lists, etc., previously approved by the Engineer. The Engineer shall be notified at least 21 days in advance of any system tests and reserves the right to have his and/or the City's representatives in attendance.

- B. The Contractor shall provide the services of experienced factory trained technicians, tools and equipment to field calibrate, test, inspect, and adjust all equipment in accordance with manufacturer's specifications and instructions.
- C. The Contractor (or designee) shall maintain master logbooks for each phase of installation, and testing activities specified herein. Each logbook shall include signal, loop or control strategy tag number, equipment identification, description and space for sign-off dates, Contractor signature and Engineer signature. Example test documentation specific to each phase of testing shall be approved prior to initiation of that testing, as specified hereinabove.
- D. All test data shall be recorded on test forms, previously approved by the Engineer. When each test has been successfully completed, a certified copy of all test results shall be furnished to the Engineer together with a clear and unequivocal statement that all specified test requirements have been met and that the system is operating in accordance with the Contract Documents.
- E. The Engineer will review test documentation in accordance with the Contract Documents and will give written notice of the acceptability of the tests within 10 days of receipt of the test results.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 17072 FIELD TESTING

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall perform field testing on the Control and Information System as specified herein to demonstrate compliance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17000 – Control and Information System Scope and General Requirements
- B. Section 17070 – Control and Information System Testing – General
- C. Section 17073 – Final Acceptance Test

1.03 GENERAL REQUIREMENTS

- A. Control system testing shall be performed to ensure that all processes shall be systematically and safely placed under digital control in the following order:
 - 1. Primary elements such as transmitters and switch devices shall be calibrated and tested as specified in Sections 17600 and 17700.
 - 2. Each final control element shall be individually tested as specified hereinafter.
 - 3. Each control loop shall be tested as specified hereinafter.
 - 4. All loop and calibration sheets shall be submitted prior to final loop tests performed in the presence of the Engineer.
- B. System test activities shall include the use of water, if necessary, to establish service conditions that simulate, to the greatest extent possible, normal operating conditions in terms of applied process loads, operating ranges and environmental conditions.
- C. All bubbler system components, associated pressure transmitters, display units, and all alarm switches shall be fully tested for proper operation. Each test shall be witnessed and approved by the Engineer in writing. The Contractor and Instrumentation Subcontractor shall conduct a complete pre-test and shall submit a test report to the Engineer prior to scheduling the Engineer witnessed test and shall provide a minimum of 21 days notice to Engineer to witness the test. The test shall be conducted independent of other systems tests and shall not be combined with any other Engineer witnessed tests. Failed tests shall be repeated by Contractor at no additional cost to the City and shall be rescheduled based on Engineer availability.
- D. Each phase of testing shall be fully and successfully completed and all associated documentation submitted and approved prior to the next phase being started. Specific exceptions are allowed if written approval has been obtained in advance from the Engineer.

1.04 CONTRACTOR'S RESPONSIBILITIES

- A. The Contractor shall ensure that all mechanical equipment, equipment control panels, local control panels, field instrumentation, control system equipment and related equipment and/or systems are tested for proper installation, adjusted and calibrated on a loop-by-loop basis prior to control system startup to verify that each is ready to function as specified. Each test shall be witnessed, dated and signed off by both the Contractor (or designee) and the Engineer upon satisfactory completion.
- B. The Contractor shall be responsible for coordination of meetings with all affected trades. A meeting shall be held each morning to review the day's test schedule with all affected trades. Similarly, a meeting shall be held each evening to review the day's test results and to review or revise the next day's test schedule as appropriate.
- C. The Contractor shall ensure that the electrical subcontractor conforms to the start-up, test and sign-off procedures specified herein to assure proper function and coordination of all motor control center control and interlock circuitry and the transmission of all discrete and/or analog signals between equipment furnished by the electrical subcontractor and the control system specified herein.
- D. The Contractor shall ensure that the HVAC subcontractor conforms to the start-up, test and sign-off procedures specified herein to assure proper function of all HVAC system control and interlock circuitry and the transmission of all discrete and/or analog signals between HVAC equipment and controls and the control system specified herein.

1.05 FINAL CONTROL ELEMENT TESTING

- A. The proper control of all final control elements shall be verified by tests conducted in accordance with the requirements specified herein.
- B. All modulating final control elements shall be tested for appropriate speed or position response by applying power and input demand signals and observing the equipment for proper direction and level of reaction. Each final control element shall be tested at 0, 25, 50, 75, and 100 percent of signal input level and the results checked against specified accuracy tolerances. Final control elements, such as VFD's, that require turndown limits shall be initially set during this test.
- C. All non-modulating final control elements shall be tested for appropriate position response by applying and simulating control signals and observing the equipment for proper reaction.

1.06 LOOP CHECKOUT

- A. Prior to control system startup and functional testing, each monitoring and control loop shall be tested on an individual basis from the primary element to the final element, including the operator workstation or loop controller level, for continuity and for proper operation and calibration. At this stage, no software shall be loaded or operational in either the PLC, or the OIT; testing shall be conducted by direct verification of signals at the PLC's I/O module terminations.
- B. Signals from transducers, sensors, and transmitters shall be utilized to verify control responses. Simulated input data signals may be used subject to prior written approval by

the Engineer. All modes of control shall be exercised and checked for proper operation.

- C. The accuracy of all DAC's shall be verified by manually entering engineering unit data values at the operator workstation and then reading and recording the resulting analog output data.
- D. The accuracy of all ADC's shall be verified using field inputs or by manually applying input signals at the final controller and then reading and recording the resulting analog input data at the operator workstation.
- E. Each loop tested shall be witnessed, dated and signed off by both the Contractor (or designee) and the Engineer upon satisfactory completion.

1.07 CONTROL SYSTEM STARTUP AND TESTING

- A. Functional testing of PLC logic, OIT/SCADA screens, and simulation of normal or abnormal operating conditions will be performed by the City of Fort Lauderdale and is excluded from the Contractor's scope.

1.08 FACILITY STARTUP COORDINATION

- A. Facility start-up, including functional testing of PLC logic, OIT/SCADA graphics, and integrated process operation, will be performed by the City of Fort Lauderdale after all loop checks and hardware verification specified have been completed, documented, and accepted by the Engineer.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 17073 FINAL ACCEPTANCE TEST

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor's scope ends upon completion and acceptance of the loop checks. The Final Acceptance Test, including functional testing, startup activities, and availability demonstration, shall be performed by the City.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17000 – Control and Information System Scope and General Requirements
- B. Section 17070 – Control and Information System Testing – General
- C. Section 17072 – Field Testing

1.03 AVAILABILITY DEMONSTRATION AND FINAL SYSTEM ACCEPTANCE

- A. After the Contractor has successfully completed and documented loopchecks, the City shall perform all control system startup activities.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 17080 QUALITY ASSURANCE

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. It is the intent of these Specifications and Drawings to secure high quality in all materials, equipment and workmanship in order to facilitate operations and maintenance of the facility. The Contractor shall provide equipment and services to meet this intent.

1.02 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. All work shall be installed in accordance with the National Electric Code, National Electric Safety Code, OSHA, State, local and other applicable codes.

1.03 QUALITY ASSURANCE - GENERAL

- A. All equipment and materials shall be new and the products of reputable recognized suppliers having adequate experience in the manufacture of these particular items.
- B. For uniformity, only one manufacturer will be accepted for each type of product.
- C. All equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for all stresses that may occur during fabrication, transportation, and erection as well as during continuous or intermittent operation. They shall be adequately stayed, braced and anchored and shall be installed in a neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details.
- D. All components and devices installed shall be standard items of industrial grade, unless otherwise noted, which shall be of sturdy and durable construction and be suitable for long, trouble-free service.
- E. Electronic components shall be de-rated to assure dependability and long-term stability.
- F. Printed circuit boards in field mounted equipment shall be suitable for the specified environmental conditions.
- G. Alignment and adjustments shall be non-critical, stable with temperature changes or aging and accomplished with premium grade potentiometers.
- H. Components of specially selected values shall not be inserted into standard electronic assemblies in order to meet the performance requirements of this specification.

1.04 OPTIONAL EQUIPMENT

- A. Optional or substituted equipment or both requiring changes in details or dimensions required to maintain all structural, mechanical, electrical, control, operating, maintenance or design features incorporated in these Specifications and Drawings shall be made at no additional cost to the City. In the event that the changes are necessary, calculations and drawings showing the proposed revisions shall be submitted for approval. The Contractor shall coordinate all changes with other affected trades and contracts and pay all additional charges incurred.

1.05 GUARANTEE

- A. The instrumentation subcontractor through the Contractor shall install, maintain and guarantee the Instrumentation, Control and Information System as specified under the General Conditions and Division 1 of the Specifications. Maintenance personnel provided by the instrumentation subcontractor shall instruct the City's personnel in the operation, adjustment, calibration and repair of the equipment being serviced. All preventive and corrective activities shall be documented with service reports, which shall identify the equipment being serviced, state the condition of the equipment, describe all work performed and list materials used. A copy of all service reports shall be delivered to the City on the day the work is performed.
- B. The instrumentation subcontractor shall provide the services of factory-trained service technician(s) at least twice during the guarantee period, for the purpose of performing preventive hardware maintenance.
- C. Corrective hardware and software maintenance during the guarantee period shall be performed in accordance with the requirements of Division 1 and, in addition, shall meet the following requirements:
 - 1. Corrective hardware maintenance shall be performed by factory-trained service technician(s) specifically trained to service the digital equipment provided. Technicians possessing suitable training and experience shall be provided to perform corrective maintenance on all other equipment. The hardware service technician(s) shall be available on-site within 24 working hours after notification by the City.
 - 2. Corrective hardware maintenance performed during the guarantee period shall be performed at no cost to the City.
 - 3. As used herein, the term "working hours" shall be defined as those of the treatment facility (seven days per week, 24 hours per day). The term "business hours" shall be defined as the hours between 8:00 a.m. and 5:00 p.m., local time, Monday through Friday; excluding holidays.
 - 4. The guarantee period shall commence upon final acceptance of the completed treatment facility in accordance with the provisions of the Contract Documents.
- D. The instrumentation subcontractor shall submit to the City a proposed maintenance agreement incorporating the following features:
 - 1. Extension of preventive hardware maintenance services as described above for a period of up to five years from the expiration of the warranty period.
- E. The proposed agreement shall include provisions for payment based upon an annual fee for preventive maintenance and cost plus expenses for corrective maintenance work. The portion dealing with corrective maintenance shall be written to include corrective maintenance caused by actions of the City during the warranty period and shall contain clauses for re-negotiation of contract prices based upon changes in recognized economic indicators published by the United States Department of Commerce.

1.06 SHIPPING HANDLING AND STORAGE

- A. In addition to shipping, handling and storage requirements specified elsewhere in the Contract Documents, air conditioning/heating shall be provided for storage of all field instrumentation, panels, digital equipment and ancillary devices to maintain temperatures between 20 and 25 degrees C and relative humidity 40 to 60 percent without condensation. The air shall be filtered and free of corrosive contaminants and moisture.

1.07 FABRICATION

- A. Fabrication of all equipment shall conform to the codes and standards outlined in this Section, and other portions of the Contract Documents.
- B. The Engineer may inspect the fabricated equipment at the factory before shipment to job site. The Contractor shall provide the Engineer with sufficient prior notice so that an inspection can be arranged at the factory. Inspection of the equipment at the factory by the Engineer will be made after the manufacturer has performed satisfactory checks, adjustments, tests and operations.
- C. Equipment approval at the factory only allows the equipment to be shipped to the project site. The Contractor shall provide for the proper storage, installation and satisfactory start-up and operation of the equipment to the satisfaction of the equipment manufacturer, the instrumentation subcontractor, and the Engineer.

1.08 INSTALLATION

- A. All instrumentation and control system installation work, whether new construction or modifications to existing equipment/panels/structures, shall conform to the codes and standards outlined in this Section, and other portions of the Contract Documents.
- B. The instrumentation subcontractor shall assign a competent representative who shall provide full time coordination and supervision of all on-site instrumentation and control system construction work from commencement of construction through completion and final acceptance.
- C. All labor shall be performed by qualified craftsmen in accordance with the standards of workmanship in their profession and shall have had a minimum of three years of documented experience on similar projects.
- D. All equipment and materials shall fit properly in their installations. Any required work to correct improperly fit installations shall be performed at no additional expense to the City.
- E. All work shall be performed in a neat and workmanlike manner. All hardware and instrumentation shall be installed in accordance with requirements specified herein, in accordance with industry best practices, in accordance with manufacturers' recommendations, and in a manner suitable for ease of operation, inspection, and maintenance. All wiring shall be neatly bundled, run in wireway, and terminated. All spare wiring shall be neatly coiled and clearly labeled at both ends for future use by the City. Any work not meeting these requirements shall be corrected at no expense to the City.
- F. Sufficient common-mode and differential-mode noise rejection shall be provided to insure operation of the plant process control system to meet all specification requirements.

General practice shall include:

1. Maintaining crossings between noisy wires and signal wires at right angles.
 2. Maintaining separation between noisy wires and signal wires as wide as practical.
 3. Grounding all signals, shields and power supplies at the process control unit or local control panel.
 4. Providing passive filters on signals with time constant compatible with scan intervals and overvoltage protection.
 5. Eliminating cable splices. All splices in instrumentation and control system signal and network cables shall be approved in advance by the Engineer.
 6. Providing a floating output for transmitters that have their own power sources.
- G. DC and AC power grounding shall be performed in accordance with the digital hardware manufacturer's recommendations as well as all applicable code requirements.
- H. The case of each field instrument and control panel shall be grounded in compliance with the National Electric Code.
- I. Power wires shall be separated from parallel-running signal wires by the following minimum spacing:

<u>CIRCUIT VOLTAGE (VAC)</u>	<u>MINIMUM SPACING (IN.)</u>
120	12
240	18
480	18
2000 and above	24

- J. The Contractor shall provide all required cutting, drilling, inserts, supports, bolts, and anchors, and shall securely attach all equipment and materials to their supports. Embedded supports for equipment furnished under this Division shall be provided and installed as shown specified herein and shown on the Drawings.
- K. Following acceptance of the factory tests by the Engineer, and in accordance with the construction schedule, the Contractor shall commence installation of the digital control system hardware. Digital system equipment items shall not be installed, however, until all architectural, mechanical, HVAC and electrical work has been completed in the equipment rooms, MCC's, control rooms and all structural and/or mechanical work has been completed within 50 feet of equipment locations.
- L. Upon completion of the above construction work, the Contractor shall request an inspection of the above-named areas. The Engineer will issue a written approval to proceed with delivery and installation only after being satisfied that all work described above has been properly performed. Digital equipment shall remain at the factory site or storage prior to

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approval for delivery to the project site. Partial shipments may be required to meet construction schedule requirements.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 17100 CONTROL AND INFORMATION SYSTEM HARDWARE – GENERAL

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The process control system is physically and functionally distributed between PLC equipped control panels, motor control panels, field panels, operator interface units (OITs) and appurtenances.
- B. Although manual control facilities shall be provided adjacent to each final control element or in local control panels, such facilities are for testing, maintenance and local monitoring purposes only and shall not be regarded as backup to the PLC-based control system.
- C. Major plant control system digital equipment items are described in the Specifications and shown on the Drawings and include but are not limited to:
 - 1. Victoria Park Stormwater Pump Station Local Control Panel (LCP-SS10).
 - 2. Ethernet cables and appurtenances.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17120 – Programmable Logic Controllers

1.03 DIGITAL HARDWARE CONFIGURATIONS

- A. The digital hardware configuration shown on the Control System Architecture Drawing depicts overall system configuration requirements. System design shall be based upon this concept and shall provide an overall digital system availability of 99.8 percent under the conditions specified in Section 17073. Unless otherwise specified, designs that vary from this concept will be rejected.
- B. All discrete and analog data acquisition, pre-processing, storage and process control functions shall be performed at the PLC level. Run time and flow accumulations shall be performed at the PLC level. Except for minimal calculations related to report-specific functions such as minimum, maximum, average, etc., operator workstations shall not be used to perform calculation for the process control system.
- C. No other exceptions will be considered.

PART 2 – PRODUCTS

2.01 GENERAL SYSTEM HARDWARE REQUIREMENTS

- A. Unless otherwise specified, all hardware shall be rated for industrial use, resistant to shock, vibration, electromagnetic interference, static discharge, and suitable for the environmental conditions described elsewhere in this Division. Commercial or office grade equipment shall not be accepted.

- B. Unless otherwise specified, modular construction shall be employed to simplify maintenance and to provide for future hardware expansion. Plug-in, modular PCB's or modules shall be employed for easy removal to permit exposure of circuit wiring, components and test points. Extender boards shall be provided if necessary to permit PCB's to be completely exposed for testing purposes.
- C. Keying schemes shall be used to prevent PCB misplacement.
- D. The temperature inside each enclosure containing digital hardware (i.e., cabinet, panel or console) shall be continuously monitored and shall generate an alarm to the nearest PLC if the temperature rises to an adjustable, preset high temperature.

PART 3 – EXECUTION

3.01 REQUIREMENTS

- A. Refer to Section 17000, Part 3.

- END OF SECTION -

SECTION 17120 PROGRAMMABLE LOGIC CONTROLLERS

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish, test, install and place in satisfactory operation all programmable logic controllers, with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17000 – Control and Information System Scope and General Requirements
- B. Section 17060 – Signal Coordination Requirements
- C. Section 17100 – Control and Information System Hardware – General
- D. Section 17125 – Operator Interface Units
- E. Section 17190 – Uninterruptible Power Systems
- F. Section 17500 – Enclosures – General

1.03 TOOLS, SUPPLIES AND SPARE PARTS

- A. Tools, supplies and spare parts shall be provided as specified in Section 17050 - Tools, Supplies, and Spare Parts – General. In addition, the following specific spare parts items shall be provided:
 - 1. One of each type and size of module for PLC equipment furnished under this Contract.
 - 2. One of each type and size of PLC and equipment power supply furnished under this Contract.

PART 2 – PRODUCTS

2.01 PROGRAMMABLE LOGIC CONTROLLERS - GENERAL

- A. The instrumentation subcontractor shall furnish programmable controllers (PLC's) as specified herein and as shown on the Drawings. PLC's shall be provided complete with backplane, power supply, I/O cards, special function cards, instructions, memory, input/output capacity, and appurtenances to provide all features and functions as described herein. No substitutions will be permitted.
- B. All components of the PLC system shall be of the same manufacturer, who shall have fully tested units similar to those being furnished in an industrial environment with associated electrical noise. The PLC system shall have been tested to meet the requirements of NEMA Standard ICS 2-230 (Arc Test) and IEEE C37.90.1 (SWC). The processing unit shall perform the operations functionally described herein based on the program stored in

memory and the status of the inputs and outputs.

- C. Programmable controllers shall be designed to operate in an industrial environment. The PLC shall operate in an ambient temperature range of 0-60°C and a relative humidity of 5-95 percent, non-condensing. The PLC shall operate on supply voltages of 90-132 VAC at 4763 Hz or 24 VDC if provided with a battery backup system. An integral fuse shall be provided on the power supply for short circuit protection and shall be front panel accessible. Integral overcurrent and undervoltage protection shall be provided on the power supply.
- D. Where applicable, the minimum PLC backplane size shall be 7 slots, not including power supply slots.
- E. System configuration shall be as shown on the Network Diagram, Drawing I-02. PLC types shall be designated on the System Block Diagram Drawing and correspond to the specifications herein. Only a single type of processor shall be supplied for all PLCs of a designated type. Memory and processor shall be adequate for all control functions specified.
- F. PLCs shall be an Allen-Bradley CompactLogix 5370 L2 Controller model 1769-L24ER-QBFC1B as manufactured by Rockwell Automation, no substitutions or exceptions. PLCs shall be upgraded to increase memory capacity as required to meet Section 17120-2.02-D memory requirements. If one PLC is upgraded, all PLCs must be upgraded to the same model to ensure spare part uniformity.

2.02 PROCESSORS

- A. The processor and its associated memory shall be enclosed in a modular enclosure. A multiple-position selector switch or equivalent shall be used to select the processor operating mode. LED-type indicating lights shall be provided to indicate processor, memory, and battery status. Errors in memory shall be recognized and shall activate the memory error indicating lights. The PLC processor shall monitor the internal operation of the PLC for failure and provide an alarm output. Nonvolatile memory in the form of a manufacturer supplied industrial super capacitor or equivalent technology shall be required to maintain the entire current program and firmware of the controller in the event of power loss. The program shall be updated onto the flash memory each time a program change such as an online edit or tag value is changed.
- B. The instruction set for the PLC shall conform to the requirements of IEC 61131-3. Each PLC shall have the capability to run all five of the standard IEC 61131-3 languages simultaneously. These five languages shall be:
 - 1. Ladder Diagram
 - 2. Structured Text
 - 3. Instruction List
 - 4. Function Block Diagram
 - 5. Sequential Function Chart
- C. Additional co-processors or modules may be necessary and shall be furnished as required to meet the functions specified herein and in Section 17950 – Functional Control

Descriptions.

- D. PLC processors shall be provided with sufficient user program, data and logic memory to allow for future expansion of the overall system. The total memory used on each processor shall be less than 60% of available memory at project completion.

2.03 COMMUNICATIONS

- A. PLC communications shall be provided as specified in Section 17185 – Networks and as shown on the System Block Diagram.
- B. In addition to a communications port (RJ45 Ethernet) for the control system network, communication ports shall be provided for any other devices required (i.e., operator interface unit) plus an additional communication port for connection to a notebook computer.
- C. The PLC shall be able to support various types of communication systems for data links to field instruments (where specified) in addition to connected equipment including, but not limited to power monitors, VFDs and motor protection monitors. At a minimum, Modbus TCP client and server and Ethernet/IP shall be supported by the PLC. PLC CPU memory shall be selected as required to run all Rockwell Automation Logix 5000 Modbus TCP Add-on Instructions (AOIs) that pole ModbusTCP data from devices shown on the System Architecture Diagram. The Contractor shall coordinate the efforts of the necessary parties (instrumentation subcontractor and equipment suppliers) to accomplish the required device data table addressing between each PLC and the associated connected equipment.
- D. Additional communication modules or protocol gateways may be required to support specific communication protocols required under this Contract and shall be supplied at no extra cost to the City. Protocol gateways shall be Anybus-X protocol gateway by Anybus.

2.04 INPUT/OUTPUT SUBSYSTEMS

- A. Input/output hardware shall be plug-in modules in associated I/O backplane/chassis or DIN-rail mounting assemblies. Each unit shall handle the required number of process inputs and outputs plus a minimum of 10 percent active pre-wired spares for each I/O type furnished, plus a minimum of 20 percent spare I/O module space for the addition of future circuit cards or modules.
- B. Discrete inputs shall be 24 VDC or 120 VAC signals (integral to the PLC) from dry field contacts. Discrete outputs shall be 24 VDC or 120 VAC outputs sourced from the PLC, or dry relay contacts (2A minimum) as required. Refer to Section 17060 – Signal Coordination Requirements for further details of discrete signal type and voltage requirements. The PLC shall provide momentary and latched outputs as required to interface with motor controls and external devices. Interposing relays shall be provided where required to interface with field equipment. Interposing relays shall be as specified in Section 17550. Electrical isolation shall be provided where required. Maximum density for discrete I/O modules shall be 32 per input module and 16 per output module.
- C. Analog input circuits shall be isolated, minimum 16-bit resolution type. Analog input hardware shall be provided as required for all types of analog inputs being transmitted to

the PLC. In general, analog input modules shall be capable of receiving 4-20 mA signals. Where required, RTD input modules shall have a minimum resolution of 0.15°C and be capable of accepting signals from 100-ohm Platinum RTD's. Analog outputs shall be coordinated with the receivers but shall generally be isolated 24 VDC 420 mA outputs powered from the PLC. Each input/output circuit shall have optical isolation to protect the equipment against high voltage transients. Optical isolation shall be rated at not less than 1500 V RMS. Lightning/surge protection shall be provided as specified in Section 17560 – Surge Protection Devices. Maximum density for analog I/O modules shall be 8 per module.

- D. Input/output modules shall be configured for ease of wiring and maintenance. The modules shall be connected to wiring arms that can be disconnected to permit removal of a module without disturbing field wiring. Covers shall be provided to prevent operator personnel from inadvertently touching the terminals. The process interface modules shall be provided with screw-type terminal blocks with barriers between adjacent terminals for connection of field inputs. Terminals shall be suitable for accepting up to and including No. 14 AWG wire. All DC output circuits to the field shall include fuses, either integral or at the terminal strip. Output failure mode shall be selectable so that upon station or communication system failure all outputs shall be placed either in the non-conducting mode, or remain as were prior to failure. Light-emitting diodes shall be provided for status indication for each input and output point.
- E. External power supplies shall be provided with the PLC as required to meet specified installed I/O power requirements plus spares. Power supplies shall be modular units, shall be fully redundant and shall alarm the PLC upon failure. Power supplies shall have a line regulation of 0.05% and meet the environmental and power requirements specified herein for the PLC.

2.05 INPUT/OUTPUT CIRCUIT ARRANGEMENT

- A. Signal and control circuitry to individual input/output boards shall be arranged such that board failure shall not disable more than one half of the control loops within any group of controlled equipment (e.g., one pump out of a group of three pumps, two pumps out of four, etc.). Where possible, individual control loops and equipment shall be assigned to individual boards such that failure of the board will disable only one loop or piece of equipment.

PART 3 – EXECUTION

3.01 REQUIREMENTS

- A. PLC hardware, including I/O modules and accessories, shall be furnished and installed as specified herein and shown on the Drawings. PLC application programming, including all functions described in Section 17950 – Functional Control Descriptions shall be provided by the City. Contractor's scope is limited to providing fully operational hardware, wiring and verified loops.
- B. Refer to Section 17000, Part 3 for additional requirements.

- END OF SECTION -

SECTION 17125 OPERATOR INTERFACE UNITS

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish, test, install and place in satisfactory operation all operator interface units, with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17000 – Control and Information System Scope and General Requirements
- B. Section 17100 – Control and Information System Hardware - General
- C. Section 17120 – Programmable Logic Controllers

PART 2 – PRODUCTS

2.01 OPERATOR INTERFACE UNIT

- A. Provide an operator Interface Unit for the following panels:
 - 1. Victoria Park Stormwater Pump Station Local Control Panel (OIU-SS10).
- B. An Operator Interface Unit (OIU) shall be provided to view and change PLC monitoring and control parameters and to display alarm messages using a graphical user interface. The OIU shall provide the following features as a minimum:
 - 1. 24-bit color
 - 2. Minimum of 12.1-inch diagonal display
 - 3. 1024 x 768 XGA (4:3 format)
 - 4. Resistive film touch screen interface
 - 5. Minimum of 4 GB internal storage
 - 6. Minimum of 1 GB MB RAM application memory
 - 7. 1.6 GHz quad-core CPU
 - 8. Proprietary embedded operating system
 - 9. Battery-backed real-time clock
 - 10. SD, 2 USB-A (Host 2.0), 1 USB Client (micro USB-B), Ethernet, RS-232, RS-485.
 - 11. RJ-45 Ethernet communication interface, 10/100 Mb auto selection

12. RS-232 serial port
 13. Built-in buzzer
 14. Windows-based configuration software complete with download cable
 15. Operating Voltage: 24 VDC (external power supply required)
 16. Enclosure Rating: NEMA 12/4X to match the associated PLC cabinet rating
 17. Environment: 0-55°C, 5-95% relative humidity, non-condensing
- C. Furnish a Sandisk USB 3.0 flash drive with 256 Gigabytes of storage capacity for local data trending and alarm storage.
- D. The operator interface unit shall be Weintek (Maple Systems) model cMT2128X, no exceptions.

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS

- A. The OIU software, including screen configuration, navigation, parameter displays, alarms and trending functions, shall be provided by the City. The Contractor's scope shall be limited to furnishing, installing, wiring and properly mounting the OIT hardware in accordance with the Drawings and the specifications provided herein.
- B. Unless otherwise noted, each OIU shall be mounted between 48 and 66 inches above the floor or work platform, as shown on the Drawings.
- C. Refer to Section 17000 for additional requirements.

- END OF SECTION -

SECTION 17135 CELLULAR COMMUNICATION SYSTEM

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish, test, install and place in satisfactory operation the cellular communication system, with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.
- B. The cellular communication system shall utilize 4G LTE cellular Ethernet. The Contractor shall construct the system in accordance with all applicable FCC rules. In addition, the Contractor shall prepare and submit any other required documentation as required.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17000 – Control and Information System Scope and General Requirements
- B. Section 17500 – Enclosures – General
- C. Section 17560 – Surge Protection Devices

1.03 TOOLS, SUPPLIES AND SPARE PARTS

- A. The following tools shall be provided:
 - 1. One set of coaxial cable preparation tools required for installing coaxial cable ground clamps and all types of coaxial cable connectors supplied under this Contract. Tools shall be specifically designed for the size and type of cables supplied under this Contract.
 - 2. Cellular router remote management software as described herein.
- B. The following spare parts shall be provided:
 - 1. One (1) spare 4G LTE router of the make and model furnished under this contract.
 - 2. One (1) spare 4G LTE antenna of the make and model furnished under this contract.
 - 3. Two (2) of each type of coaxial cable connector furnished under this Contract.

1.04 SUBMITTALS

- A. In addition to submittals required under Section 17030 – Control and Information System Submittals, submit antenna installation details for antenna installations required under this Contract. The details shall include scaled drawings of the antenna, antenna mounting hardware and support structures, coaxial cables, connectors, ground clamps, fasteners, and lightning surge protectors. An equipment list shall be included identifying each component. Submit product literature for each component.

1.05 TELEMETRY SYSTEM EQUIPMENT LOCATIONS

- A. Cellular router shall be mounted on a DIN rail in the stormwater pump station LCP (Local Control Panel). Refer to the Drawings for the LCP and cellular antenna locations.

PART 2 – PRODUCTS

2.01 GENERAL

- A. The Contractor shall provide a multicarrier 4G LTE cellular communications system.
- B. All communications equipment shall be installed in accordance with the manufacturer's recommendations, FCC rules and regulations, and details on the Contract Drawings.
- C. All cellular communications equipment power and signal lines that extend or are located outside of an enclosed structure shall be protected from lightning and voltage surges in accordance with the requirements of Section 17560 – Surge Protection Devices.

2.02 OMNI-DIRECTIONAL CELLULAR ANTENNAS AND APPURTENANCES

- A. Omni-directional antennas for the remote station cellular routers shall be of two types. For remote sites with received signal strength (RSSI) greater than 20 dB above the threshold (i.e., fade margin), a low profile omni-directional antenna shall be deployed. To improve communication reliability at remote sites with lower signal strength, a higher gain omni-directional antenna shall be deployed.
- B. Low profile omni-directional cellular antenna shall be Phantom Antenna, model TRA6927M3xxN by Laird Smart Technologies; no substitutions.
- C. Omni-directional cellular antenna shall meet the following requirements:
 - 1. Rotation pattern: omni-directional
 - 2. Frequency Range: 698-2700 MHz
 - 3. Peak Gain: 698-960 MHz 0 dBi, 1710-1990 MHz 1.7 dBi, 2100-2700MHz 2.9 dBi
 - 4. Bandwidth VSWR: less than 2.5:1
 - 5. Impedance: 50 ohms
 - 6. Maximum input power rating: 1000 watts
 - 7. RF Connector: P-Mount with Type N
- D. Cellular antennas shall be supplied as a complete kit including mounting hardware, coaxial antenna cable, surge suppressor, weatherproofing kit, and other appurtenances required for a reliable installation. Refer to Instrumentation Detail Drawings for additional installation requirements.

2.03 CELLULAR ROUTERS

- A. Cellular routers shall utilize both 4G LTE Cat 6 (300/50 Mbps), cellular radio to transmit and receive Ethernet/IP PLC communications data. The routers shall be completely compatible with the control and information system's hardware and communication protocols. Cellular router shall have dual SIM card and multi-carrier support for link redundancy.
- B. Cellular routers shall have the following operation and performance specifications:

1. Environmental
 - a. Temperature Range: -30°C to +70°C
 - b. Humidity: 95% at 60°C; non-condensing
2. Standards and Certifications:
 - a. Safety: UL 60950-1
 - b. EMI: FCC Part 15B Class A or B.
 - c. Radio: FCC Rules Part 22H, FCC Part 24E.
3. General Router Requirements
 - a. Protocol Support: The router shall support the following network protocols:
 - i. HTTP, HTTPS, FTP, SFTP, SSL, SMTP, Device Cloud SNMP, SNMP (v1/v2c/v3), SSH, Telnet and CLI for web management.
 - ii. Remote management via AirLink Management Service (ALMS) by Sierra Wireless.
 - iii. Protocol analyzer (PCAP Compatible).
 - iv. QoS via TOS/DSCP/WRED.
 - b. Routing/Failover: The router shall support the following routing and failover features:
 - i. IP pass-through. NAT, NAT with IP Port Forwarding.
 - ii. Ethernet Bridging.
 - iii. GRE.
 - iv. Multicast Routing.
 - v. Routing Protocols: PPP, PPPoE, RIP (v1,v2) OSPF, SRI, BGP, iGMP routing (multicast).
 - vi. RSTP (Rapid Spanning Tree Protocol).
 - vii. IP Failover: VRRP, VRRP+TM.
 - c. Security: The router shall support the following security features:
 - i. IP filtering.
 - ii. Stateful inspection firewall with scripting address and port translation;
 - iii. VPN: IPsec with IKEv1, IKEv2, NAT Traversal.
 - iv. SSL, SSLv2, SSLv3, FIPS 197, Open VPN client and server; PPTP, L2TP.
 - v. VPN Tunnels: 5. Cryptology: SHA-1, MD5, RSA.
 - vi. Encryption: DES,3DES and AES up to 256-bit (CBC mode for IPsec).
 - vii. Authentication: RADIUS, TACACS+, SCEP for X.509.
 - viii. Certificates.
 - ix. Content Filtering(via 3rd party).

- x. MAC Address Filtering; VLAN support.
- d. Hardware Interfaces: The router shall support the following interfaces:
 - i. 1 RJ45 10/100 Ethernet port,
 - ii. 1 RS-232 serial DB-9 port
 - iii. 1 USB 2.0 Micro-B port
 - iv. Antenna connectors: SMA
- e. Cellular Modem (WWAN)
 - i. The cellular modem shall be equipped with two SIM card slots capable of supporting two different cellular service providers. The modem shall be capable of automatically switching between providers to ensure optimal cellular signal quality.
 - ii. The cellular modem shall be capable of supporting at least two of the following 4G LTE carriers through a Machine-to-Machine (M2M) data plan:
 - 1) Verizon
 - 2) AT&T
 - 3) Sprint
 - 4) T-Mobile
 - iii. Input Power: The cellular router shall be capable operating on 24V DC power.
 - iv. Remote Configuration: The user shall have the ability to configure any cellular radio over-the-air from the SCADA network.
 - v. PLC Programming: The radio shall provide the user the capability to program any remote site PLC over-the-air from any computer in the SCADA network.
 - vi. Active Ports: The radio shall have, as a minimum, two active ports that can sequentially manage the transfer of Ethernet and serial data messages: 1 serial and 1 Ethernet. In addition, router shall have 1 USB 2.0 port.
- f. Product Requirements:
 - i. Cellular routers shall be AirLink RV-50X by Sierra Wireless; no substitutions.

2.04 TRANSMISSION CABLE AND MISCELLANEOUS REQUIREMENTS:

- A. Provide all cables and connectors to connect the radio to the antenna. Provide flexible jumper cables with appropriate connectors within panels to connect the radio to the surge suppressor. Attenuation including connectors from the radio to the surge suppressor shall not exceed 0.25 dB.
- B. Provide weatherproof connections that are suitable for direct environmental exposure. Weatherproof connections shall include heat shrink tubing that provides a waterproof and corrosion resistant seal. The heat shrink tubing shall be polyolefin lined with thermoplastic adhesive as manufactured by 3M, or equal. Heat shrink tubing shall be provided for all

RF transmission cable connections located outside of panels or air-conditioned rooms.

- C. Utilize appropriate bulkhead RF transmission cable surge suppression devices at cable entrances, Polyphaser or equivalent.

PART 3 – EXECUTION

3.01 CELLULAR ROUTER TESTING

- A. Prior to the LCP Factory Acceptance Test, the instrumentation and controls subcontractor shall request one activated SIM card from the City and coordinate with the City to establish a reliable communications link with the City SCADA system. During the test the instrumentation and controls subcontractor shall demonstrate internet to M2M (machine to machine) cellular internet connectivity with the City SCADA System.
- B. After the cellular routers have been installed, the Contractor shall test the following items and make all necessary adjustments to maximum performance of the communication links:
 - 1. Signal strength
 - 2. Cellular protocol mode (LTE 4G)
 - 3. Standing wave ratio (SWR)
 - 4. Radio temperature
 - 5. Software revision
 - 6. Hardware revision
- C. The Contractor shall test the integrity of the antenna cable after installation to ensure that the insertion losses do not exceed 2.0 dBs.
- D. The Contractor shall submit all test results of the above-described tests for approval by the Engineer. The Contractor shall provide a copy of the approved test results in the final O&M Manuals.

3.02 WARRANTY

- A. Cellular routers shall be furnished with a minimum 5-year manufacturer's warranty (3 year standard plus a 2 year extension). The warranty shall cover hardware and software provided by the manufacturer.
- B. The warranty period shall begin upon Final Acceptance as described in Part 3 of Section 17000.

- END OF SECTION -

SECTION 17185 NETWORKS

PART 1 – GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall furnish, test, install and place in satisfactory operation all copper distributed control system and process information local area networks complete with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17000 – Scope and General Requirements
- B. Section 17100 – Control and Information System Hardware
- C. Section 17510 – Cabinets and Panels

1.3 TOOLS, SUPPLIES AND SPARE PARTS

- A. Tools, supplies and spare parts shall be provided as specified in Section 17050 - Tools, Supplies, and Spare Parts – General. In addition, the following specific spare parts items shall be provided:

- 1. One of each type of ethernet switch furnished under this Contract.

1.4 GENERAL INFORMATION AND DESCRIPTION

- A. These Specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the requirements of the equipment furnished. They are, however, intended to cover the furnishing, the shop testing, the delivery and complete installation and field testing, of all materials, equipment and appurtenances for complete systems herein specified, whether specifically mentioned in the specification or not.
- B. For all units there shall be furnished and installed all necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in these Specifications or not. This installation shall incorporate the highest standards for the type of service shown on the Drawings including field testing of the entire installation and instruction of operating personnel in the care, operation, and maintenance of all equipment.
- C. All Ethernet network equipment shall be of first class workmanship and shall be entirely designed and suitable for the intended services. All materials used in fabricating the equipment shall be new and undamaged.

1.5 SUBMITTALS

- A. General: The CONTRACTOR shall submit shop drawings and Operation and Maintenance instructions and other information as specified in accordance with Section 01300 – Submittals.
- B. Operations and Maintenance Manuals: The CONTRACTOR shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in

the Section 01300 – Submittals.

PART 2 – EQUIPMENT

2.1 ETHERNET NETWORKS - GENERAL

- A. The network topology shall be as shown on the Drawings, consisting of a combination of twisted pair copper to accomplish the data transmission requirements specified herein. Each connected device shall be equipped with its own network interface units.
- B. Bi-directional communications between the network and network connected equipment shall be provided by network interface units. The network interface units shall be common to all equipment and shall include all required modems, communications processors and memories to provide a transparent interface between the network(s) and the connected devices.
- C. A multilayered peer-to-peer communications protocol shall be employed. Protocol shall be CSMA/CD ("Ethernet"). Repeaters (with associated UPS systems) shall be provided where necessary to meet data highway distance or signal attenuation requirements whether or not they are specifically shown on the System Architecture Diagram, Drawing IG-GN-02.

2.2 LAN SWITCHES

- A. For LCP-SS10 furnish, install and configure an industrial, managed LAN switch with a minimum of 4 copper Fast Ethernet ports (RJ45) and 2 Gigabit combo ports (SFP slots) for multimode fiber optic cable. Fiber ports shall be SC type. LCP-SS10 LAN switch shall be Allen-Bradley Stratix 5200 Series, model 1783-CMS10P, with two (2) 1783-SFP1GSX 1000BASE-SX multi-mode fiber transceivers, no exceptions.

2.3 SHIELDED TWISTED PAIR (STP) ETHERNET CABLES FOR INSIDE CONDUIT

- A. Twisted pair patch cabling for Ethernet connections shall be 4-pair, 24 AWG solid Category 6 (CAT6) shielded twisted pair (STP) cable with 100% foil shield, professionally installed RJ-45 connectors, and strain relief boots.

2.4 TWISTED PAIR PATCH CABLES FOR INSIDE CABINETS/PANELS

- A. Patch cables shall be CAT 6, 24AWG stranded and color coded for each connected device. Patch cables shall be factory assembled with connector and PVC snag free boot. Black Box EVNSL6A, or equal.

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 17303 AIR BUBBLER LEVEL SYSTEMS

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish, test, install and place in satisfactory operation the air bubbler level systems, with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17000 – Control and Information System Scope and General Requirements
- B. Section 17700 – Powered Instruments, General

1.03 TOOLS, SUPPLIES AND SPARE PARTS

- A. Tools, supplies and spare parts shall be provided as specified in Section 17050 - Tools, Supplies, and Spare Parts – General. In addition, the following specific spare parts items shall be provided:
 - 1. One of each type of air compressor furnished under this Contract.
 - 2. One of each type of bubbler system component furnished under this Contract including but not limited to the level gauge, pressure transmitter, piping and tubing.

PART 2 – PRODUCTS

2.01 AIR BUBBLER LEVEL SYSTEMS

- A. The system shall be designed for installation within the LCP-SS10 cabinet. No separate enclosure or standalone panel shall be provided. The bubbler system block shall be provided by the City. The Contractor shall furnish and install all remaining components including, but not limited to, the compressor, tubing, pressure transmitter, gauge, and mounting hardware in accordance with the Contract Drawings.
- B. Tubing shall be Parker Parflexu per note 1 on the bubbler system detail on Drawing I-05.
- C. Air Compressor shall be Ingram Products, Model HR10WB3 with mounting bracket HRMTBKT, no substitutions.
- D. Pressure transmitter shall be 4-20 mA, 2-wire, SS316L wetted parts, 0-15 psi range, $\pm 0.5\%$ accuracy, 1/4" male NPT connection, WIKA P/N #50426397, no substitutions.
- E. Level gauge shall be 6" dial, 1/4" process connection, panel mount with front flange, 0-200" water range, no substitutions.
- F. All components shall be suitable for installation inside NEMA 4X control panel environment.

PART 3 – EXECUTION

3.01 REQUIREMENTS

- A. Refer to Section 17700, Part 3 of the specifications.
- B. Install all components in accordance with Instrumentation detail drawings and P&IDs.
- C. All components shall be tested and loop checked as part of the Pump Station Control Panel loop checkout.

- END OF SECTION -

SECTION 17500 ENCLOSURES – GENERAL

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish, test, install and place in satisfactory operation the control enclosures, with all spare parts, accessories, and appurtenances as specified herein and as shown on the Drawings.
- B. Control enclosures shall be assembled, wired, and tested in the instrumentation subcontractor's own facilities, unless specified otherwise. All components and all necessary accessories such as power supplies, conditioning equipment, mounting hardware, signal input and output terminal blocks, and plug strips that may be required to complete the system shall be provided.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17000 – Control and Information System Scope and General Requirements
- B. Section 17100 – Control and Information System Hardware – General
- C. Section 17510 – Cabinets and Panels
- D. Section 17550 – Panel Instruments and Accessories
- E. Section 17560 – Surge Protection Devices
- F. Section 17600 – Unpowered Instruments – General
- G. Section 17700 – Powered Instruments – General
- H. Refer to Division 16 for additional requirements for cable, circuit breakers, disconnect switches, etc.

1.03 GENERAL INFORMATION AND DESCRIPTION

- A. The cabinet itself and all interior and exterior equipment shall be identified with nameplates. The equipment shall be mounted such that service can occur without removal of other equipment. Face mounted equipment shall be flush or semi-flush mounted with flat black escutcheons. All equipment shall be accessible such that adjustments can be made while the equipment is in service and operating. All enclosures shall fit within the allocated space as shown on the Drawings.
- B. Either manufacturer-standard or custom cabinetry may be furnished subject to the requirements of the Contract Documents and favorable review by the City.
- C. Due considerations shall be given to installation requirements for enclosures in new and existing structures. The Contractor shall examine plans and/or field inspect new and existing structures as required to determine installation requirements and shall

coordinate the installation of all enclosures with the City and all affected contractors. The Contractor shall be responsible for all costs associated with installation of enclosures, including repair of damage to structures (incidental, accidental or unavoidable).

1.04 TOOLS, SUPPLIES AND SPARE PARTS

- A. Tools, supplies and spare parts shall be provided as specified in Section 17050 - Tools, Supplies and Spare Parts. In addition, the spare parts items shall be provided as specified in the individual cabinet and panel specification sections.

PART 2 – PRODUCTS

2.01 TERMINAL BLOCKS

- A. Terminal blocks shall be assembled on non-current carrying galvanized steel DIN mounting rails securely bolted to the cabinet subpanel. Terminals shall be of the screw down pressure plate type as manufactured by Phoenix Contact, Weidmuller, Wieland, Square D, or equal. Refer to Drawing I-05 Bill of Materials for reference.
- B. Power terminal blocks for both 120 VAC and 24 VDC power shall be single tier with a minimum rating of 600 volts, 30 amps.
- C. Signal terminal blocks shall be single tier with a minimum rating of 600 volts, 20 amps.

PART 3 – EXECUTION

3.01 FABRICATION

- A. Enclosures shall provide mounting for power supplies, control equipment, input/output subsystems, panel-mounted equipment and appurtenances. Ample space shall be provided between equipment to facilitate servicing and cooling.
- B. Enclosures shall be sized to adequately dissipate heat generated by equipment mounted inside the panel. If required, one or more of the following shall be provided to facilitate cooling:
 - 1. Louvered openings near the bottom and top (NEMA 12 cabinets only).
 - 2. Thermostatically controlled, low noise internal air blowers (initial setpoint 75 °F) to circulate air within the enclosure, maintaining a uniform internal temperature.
 - 3. Thermostatically controlled, low-noise cooling fans to circulate outside air into the enclosure, exhausting through louvers near the top of the cabinet. Air velocities through the enclosure shall be minimized to assure quiet operation.
 - 4. All openings in cabinets and panels shall be fitted with dust filters and rain hoods which shall not de-rate the enclosure Rating.
- C. Enclosures shall be constructed so that no screws or bolt heads are visible when viewed from the front. Punch cutouts for instruments and other devices shall be cut, punched, or drilled and smoothly finished with rounded edges.

- D. The temperature inside each enclosure containing digital hardware (i.e., cabinet, panel or console) shall be continuously monitored and shall generate an alarm to the nearest PLC if the temperature rises to an adjustable, preset high temperature. This thermostat shall be independent and separate from the thermostat used to control the temperature in the enclosure described above. Enclosure interior temperature alarm shall be displayed on the HMI.
- E. Intrusion alarm switches shall be provided on all enclosures containing digital hardware and shall generate an alarm to the nearest PLC when any enclosure door is opened.
- F. Terminals shall be marked with a permanent, continuous marking strip. One side of each terminal shall be reserved exclusively for field incoming conductors. Common connections and jumpers required for internal wiring shall not be made on the field side of the terminal. Subject to the approval of the Engineer, a vendor's pre-engineered and prefabricated wiring termination system will be acceptable.
- G. Wiring within cabinets, panels, and consoles shall be installed neatly and shall comply with accepted standard instrumentation and electrical practices. Power, control and signal wiring shall comply with Division 16 of the Specifications, except that the minimum wire size for discrete signal wiring may be 16 AWG, and for analog wiring may be 18 AWG. For each pair of parallel terminal blocks, the field wiring shall be between the blocks.
- H. Separate terminal strips shall be provided for each type of power and signal used within each cabinet. Where applicable, terminal strips for different voltages of discrete signal wiring shall also be separated. Terminal strips shall be labeled as to voltage and function.
- I. All wiring shall be bundled and run open or enclosed in vented plastic wireway as required. Wireways shall be oversized by a minimum of 10%; overfilled wireways shall not be acceptable. All conductors run open shall be bundled and bound at regular intervals, not exceeding 12 inches, with nylon cable ties. Care shall be taken to separate electronic signal, discrete signal, and power wiring.
- J. Spare field wiring shall be bundled, tied, and labeled as specified above, and shall be neatly coiled in the bottom of the cabinet.
- K. All installed spare I/O hardware shall be wired along with live I/O wiring to the field wiring terminal blocks within the cabinet. Where space for spare I/O modules has been provided with the PLC backplane or DIN-rail mounting system, corresponding space for wiring, surge protection, and terminations shall be furnished within the cabinet.
- L. A copper ground bus shall be installed in each cabinet and shall be connected to the building power ground.
- M. Interior panel wiring shall be tagged at all terminations with machine-printed self-laminating labels. Labeling system shall be Brady TLS 2200 Printer with TLS 2200®/TLS PC Link™ labels, or equivalent system by Seton or Panduit. The wire numbering system and identification tags shall be as specified in Section 16123 - Building Wire and Cable. Field wiring terminating in panels shall be labeled in accordance with the requirements of Section 16123. Where applicable, the wire number shall be the ID number listed in the input/output schedules.

- N. Wires shall be color coded as follows:

Equipment Ground - GREEN

120 VAC Power - BLACK

120 VAC Power Neutral - WHITE

120 VAC Control (Internally Powered) - RED

120 VAC Control (Externally Powered) - YELLOW

24 VAC Control - ORANGE

DC Power (+) - RED

DC Power (-) - BLACK

DC Control - BLUE

Analog Signal – BLACK/WHITE or BLACK/RED

- O. Enclosures shall be provided with a main circuit breaker and a circuit breaker on each individual branch circuit distributed from the panel. Main breaker and branch breaker sizes shall be coordinated such that an overload in a branch circuit will trip only the branch breaker but not the main breaker.
- P. Enclosures with any dimension larger than 36 inches shall be provided with 120-volt duplex receptacles for service equipment and LED service lights. Power to these devices shall be independent from the PLC power supply and its associated uninterruptible power system.
- Q. Where applicable, enclosures shall be furnished with red laminated plastic warning signs in each section. The sign shall be inscribed "WARNING - This Device Is Connected to Multiple Sources of Power". Letters in the word "WARNING" shall be 0.75 inch high, white.
- R. The interconnection between equipment and panel shall be by means of flexible cables provided to permit withdrawal of the equipment from the cabinet without disconnecting the plugs.

3.02 PAINTING/FINISHING

- A. All steel enclosures shall be free from dirt, grease, and burrs and shall be treated with a phosphatizing metal conditioner before painting. All surfaces shall be filled, sanded, and finish coated by spraying a 1-2 mil epoxy prime coat and smooth, level, high grade textured finish between flat and semi-gloss shine. The colors shall be selected by the City from a minimum of six color samples provided. Refer to Division 9 for additional requirements.
- B. Materials and techniques shall be of types specifically designed to produce a finish of superior quality with respect to adherence, as well as impact and corrosion resistance.
- C. Panels fabricated from stainless steel shall be painted white along with corresponding sunshields.

- D. Panels fabricated from non-metallic materials (e.g., FRP) shall be gel-coated and shall not be painted.

3.03 INSTALLATION

- A. Refer to Section 17000 for additional requirements.

- END OF SECTION -

SECTION 17510 CABINETS AND PANELS

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish, test, install and place in satisfactory operation the cabinets and panels, with all spare parts, accessories, and appurtenances as specified herein and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17000 – Control and Information System Scope and General Requirements
- B. Section 17100 – Control and Information System Hardware – General
- C. Section 17500 – Enclosures – General
- D. Section 17910 – Instrument Schedule
- E. Section 17950 – Functional Control Descriptions

PART 2 – PRODUCTS

2.01 CABINETS AND PANELS

- B. Cabinets and panels shall be formed or welded construction, reinforced with Unistrut, Powerstrut, or equal to facilitate mounting of internal components or equipment. Sufficient access plates and doors shall be provided to facilitate maintenance and testing of the cabinet's equipment. Doors shall be removable. Cabinets and panels with any dimension 36 inches or greater shall be provided with removable lifting lugs designed to facilitate safe moving and lifting of the panel during installation. All doors shall be fitted with common-keyed locks.
- C. Cabinets and panels shall be minimum 14 USS gauge. Cabinets and panels with any dimension greater than 36 inches shall be 12 USS gauge.
- D. Cabinets and panels located inside buildings but located in areas other than climate controlled (heated and air conditioned) electrical or control rooms, shall be as a minimum 316 stainless steel NEMA 4X construction, or as specified or shown on the Drawings for hazardous area classification (Class, Division, Group), or submersible (NEMA 6) applications. Epoxy coated cast copper-free aluminum construction shall also be acceptable for NEMA 4, 6 and 7 applications. Cabinets located in storage/feed areas for chlorine or other applicable corrosive chemicals shall be of non-metallic construction, rated NEMA 4X, and fully compatible with the associated chemical.
- E. Cabinets and panels within climate controlled (heated and air-conditioned) electrical or control rooms shall be all steel fully enclosed NEMA 12 units with gasketed doors.

- F. Cabinets and panels shall have doors on the front and shall be designed for front access. NEMA 12 cabinets shall be fitted with three-point door latches. Doors for NEMA 4X cabinets shall be all stainless steel with three-point latches. Door hardware on NEMA 4X cabinets located in chemical storage/feed areas shall be non-corrosive in that environment.
- G. Panels and cabinets located outside fence-secured areas shall be fitted with padlockable latch kits.
- H. All cabinets and panels shall be provided with drawing pockets for as-built panel drawings. One copy of the appropriate panel as-built drawings shall be furnished and left in the pocket of each panel.
- I. Panels with any dimension greater than 36 inches that contain a programmable controller (PLC) shall be provided with a folding laptop programmer shelf on the inside of the door. When deployed, the laptop shelf shall not be greater than 48 inches above finished floor. Laptop shelf shall be fitted to door with factory applied weld-studs. Weld discoloration and enclosure penetrations will not be accepted.
- J. Unless otherwise noted, panel-mounted control devices (OIUs, hand switches, etc.) requiring operator access shall be mounted between 48 and 60 inches above the floor or work platform.
- K. Cabinets and panels shall be provided as listed in the Bill of Materials on Drawing I-05; no substitutions.

PART 3 – EXECUTION

3.01 REQUIREMENTS

- A. Refer to Section 17500 for additional requirements.

- END OF SECTION -

SECTION 17550 PANEL INSTRUMENTS AND ACCESSORIES

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish, test, install and place in satisfactory operation the panel instruments and accessories, with all spare parts, accessories, and appurtenances as specified herein and as shown on the Drawings.
- B. The Contractor shall review all Contract Instrumentation Drawings, including detail drawings and, in particular, the City of Fort Lauderdale Standard Bill of Materials shown on Drawing I-05. The Contractor shall furnish the specific instruments or devices listed in these documents in order to comply with City standards and project requirements. Only if the required instrument or device is not found in the Contract Instrumentation Drawings or in the City's Standard Bill of Materials shall the Contractor furnish the models listed in this specification section. The City Standard Bill of Materials shall take precedence over all general listings provided herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17000 – Control and Information System Scope and General Requirements
- B. Section 17100 – Control and Information System Hardware, General
- C. Section 17500 – Enclosures, General
- D. Section 17910 – Instrument Schedule
- E. Section 17950 – Functional Control Descriptions

1.03 GENERAL INFORMATION AND DESCRIPTION

- A. All equipment mounted on the face of a panel shall conform to the same NEMA rating specified for the panel construction.

1.04 TOOLS, SUPPLIES AND SPARE PARTS

- A. Tools, supplies and spare parts shall be provided as specified in Section 17050 - Tools, Supplies and Spare Parts.
- B. The Contractor shall provide, as a minimum, the following specific spare parts items:
 - 1. One spare 24VDC Panel power supply.
 - 2. Five of each type of fuse.
 - 3. Five of each type of relay.
 - 4. One of each type of panel mounted process indicator.
 - 5. Five of each type of pilot device.

PART 2 – PRODUCTS

2.01 DIGITAL DISPLAY/TRANSMITTERS

- A. Digital display/transmitters shall be 4 digit with 0.56" high red LED display. Digital display/transmitters shall be provided with nameplate and scale calibrated to match the calibration of the primary element. The unit shall be designed primarily for use with 4-20 mA current loop signal circuits. Digital display/transmitter operating voltage shall be 115 VAC 10%, 60 Hz. Digital display/transmitter controls shall include three (3) front-panel pushbuttons for modifying alarm values and device setup. A regulated and isolated 24 V excitation power supply shall be provided. Digital display/transmitters shall be suitable for outdoor service and shall be NEMA 4X, IP65 front. Digital display/transmitters shall be model PD765-6R3-10 by Precision Digital, equivalent by RedLion or Engineer approved equal.

2.02 SIGNAL CONVERTERS

- A. Signal converters shall be provided as required to provide control functions and to interface instrumentation and controls, equipment panels, motor control centers and other instrumentation and controls supplied under other Divisions to the controls provided herein.
- B. General Requirements – Converters shall be of the miniature type, utilizing all solid-state circuitry suitable for mounting within new or existing cabinetry. Where sufficient cabinet space is not available, sub panels or supplemental enclosures shall be provided. Power supply shall be 120V, 60 hertz where required by the converter. Repeatability shall be 0.1% of span, deadband shall be 0.1% span, maximum. Where specific converters are not listed, but are required to interface with the process control system, they shall comply with the general requirements stated herein.
- C. Current to Current Isolators – Current to current isolators shall be furnished where necessary to provide an isolated current loop, calculations or signal amplification between the plant process control system and instrumentation and control loops. Isolators shall be sized such that resistance of existing loops shall not exceed maximum rated resistance. Isolators shall be as manufactured by AGM, Moore Industries, Rochester Instrument Systems (RIS), Phoenix Contact, Weidmuller, Acromag, or equal.
- D. Voltage to Current Transducers – Voltage to current (or current to voltage) transducers shall convert a voltage signal of one magnitude to a 4-20 milliamp DC current signal. The output current shall be directly proportional to the input signal voltage. Transducers shall be sized such that loop resistance does not exceed maximum rated resistance. Transducers shall be as manufactured by AGM, Moore Industries, Rochester Instrument Systems (RIS), Phoenix Contact, Weidmuller, Acromag, or equal.
- E. Frequency to Current Transducers – Frequency to current transducers shall convert pulse-rate and pulse-duration signals to 4-20 mA, 24 VDC analog signals. Converters shall include field-adjustable input frequency range. Converter power shall be 120 VAC, 60 hertz. Transducers shall be sized such that loop resistance does not exceed maximum rated resistance. Transducers shall be suitable for signal transmission via leased telephone lines. Transducers shall be Series 5100 as manufactured by AGM, or equivalent by Moore Industries, Rochester Instrument Systems (RIS), Phoenix Contact, Weidmuller, Acromag, or equal.

- F. Current to Frequency Transducers – Current to frequency transducers shall convert 4-20 mA, 24 VDC analog signals to pulse-rate and pulse-duration signals. Converters shall include field-adjustable output frequency range. Converter power shall be 120 VAC, 60 hertz. Transducers shall be sized such that loop resistance does not exceed maximum rated resistance. Transducers shall be suitable for signal transmission via leased telephone lines. Transducers shall be Series 5016 as manufactured by AGM, Moore Industries, Rochester Instrument Systems (RIS), Phoenix Contact, Weidmuller, Acromag, or equal.
- G. Integrators – Integrators shall be provided as interchangeable plug-in modules with zero and span adjustment available on the front plate of the units. Output shall range from 0 to 0.1 through 0 to 10 pulses per second. Accuracy shall be + 0.1% of input span. Integrators shall convert linear analog signals to pulse rate and provide a solid-state output. Integrators shall be as manufactured by AGM Electronics, Moore Industries, Rochester Instrument Systems (RIS), Phoenix Contact, Weidmuller, Acromag, or equal.
- H. Electronic Switches (Alarm Relays) – Electronic switches shall be furnished with a calibrated dial for adjusting set points. The input to the switch shall be 4-20 mADC, and the set point shall be adjustable over the full range. Unless otherwise noted, the dead band shall be fixed at less than 2 percent of span. The set point stability shall be $\pm 0.1\%$ per degree F. The repeatability shall be $\pm 0.1\%$ of span. The units shall be furnished with SPDT relays rated at 10 amperes at 115 VAC. Electronic switches shall be as manufactured by AGM, Moore Industries, Rochester Instrument Systems (RIS), Phoenix Contact, Weidmuller, Acromag, or equal.
- I. RTD to Current Signal Converters – RTD to current signal converters shall convert a 3-wire RTD input signal to an isolated 4-20 mADC output signal. Each converter shall operate from a 120 VAC power source. Accuracy shall be 0.10 percent of span or better. Calibrated span of each converter shall be as indicated on the instrument list. The Contractor shall coordinate calibration of the signal converters with existing RTD elements. The signal converters shall be furnished in the manufacturer's standard enclosure for installation in an existing indoor electrical cabinet. Signal converters shall be as manufactured by AGM, Moore Industries, Rochester Instrument Systems (RIS), Phoenix Contact, Weidmuller, Acromag, or equal.
- J. Interposing Relays – Where required to interface between motor control centers, equipment controls, and control panels, interposing relays and associated control wiring circuitry shall be furnished and installed to provide the monitoring and/or control functions specified herein. Interposing relays shall be small format type, DPDT, minimum 10 amp, 120 VAC contact rating. Relay coils shall be 120 VAC or 24 VDC as required. Relays shall have a flag indicator to show relay status, a pushbutton to allow manual operation of the relay, and an internal pilot light to indicate power to the coil. Relays shall be as manufactured by Square D, Potter & Brumfield, Allen-Bradley, or equal.
- K. Timing Relays – Timing Relays (TR) shall be the general purpose plug-in type, Type JCK as manufactured by Square D Company, Cutler-Hammer/Westinghouse Electric Corporation equivalent, Allen-Bradley equivalent, or equal. Timing relays shall be electronic type with 120 VAC coils unless otherwise specified or indicated on the Drawings. Timers shall be provided with a minimum of two SPDT timed output contacts and instantaneous contacts where required. Contact ratings shall be the same as for interposing relays as specified above.

- L. Intrinsically Safe Relays and Barriers – Intrinsically safe relays and barriers shall be provided where required to interface with equipment such as float level switches that are located in NFPA-classified hazardous areas. Intrinsically safe relays and barriers shall be FM approved and shall be manufactured by Pepperl and Fuchs, Crouse Hinds, Square D, or equal.

2.03 TOTALIZERS

- A. Totalizing counters shall be provided for flush panel, spring-clip mounting. Face dimensions of the totalizing counters shall be no larger than 1-1/8-inches high by 2-inches wide. Totalizing counters shall contain eight digits. Height of the digits shall not be less than 5/32-inch. Numerals shall be white on a black background. The counter shall be non-resettable and shall be totally compatible for operation on the pulses supplied by the associated instrument or integrator. The totalizing counter shall be capable of a maximum count rate of 25 counts/second.
- B. Legend plates shall be provided for each of the totalizing counters with white letters on a black background with legends as specified below.
- C. Totalizing counters shall be manufactured by Kessler-Ellis, or equal.

2.04 ACCESSORIES

- A. Control operators such as pushbuttons (PB), selector switches (SS), and pilot lights (PL) shall be Cutler-Hammer/Westinghouse Type E34, Square D Company Type SK, or equal. Control operators shall be 30.5 mm, round, heavy-duty, oil tight NEMA 4X corrosion resistant.
- B. Pushbuttons shall be non-illuminated, spring release type. Pushbuttons shall include a full guard. Panic stop/alarm pushbuttons shall be red mushroom type with manual-pull release. Selector switches shall be non-illuminated, maintained contact type. Pilot lights shall be of the proper control voltage, push-to-test LED type with light lens colors as specified below.

<u>Color</u>	<u>Function</u>
Red	Running (Open)
Green	Stopped or Off (Closed)
Amber	Fault
White	Other

- C. Control operators shall have legend plates as specified herein, indicated on the Drawings, or otherwise directed by the Engineer. Legend plates shall be plastic, black field (background) with white lettering. Engraved nameplates shall be securely fastened above each control operator. If adequate space is not available, the nameplate shall be mounted below the operator.
- D. Control operators for all equipment shall be as specified herein and of the same type and manufacturer unless otherwise specified or indicated on the Drawings.
- E. Alarm horns shall be general-purpose type, panel-mounted, and shall be suitable for indoor or weatherproof service, as required. Power supply shall be either 115 VAC or 24

VDC. Horns shall be capable of producing 100 dB at 10 feet, and shall have adjustable volume. Horns shall be Vibratone series as manufactured by Federal Signal Corporation, McMaster-Carr equivalent, Edwards Signaling Company equivalent, or equal.

PART 3 – EXECUTION

3.01 REQUIREMENTS

- A. Refer to Section 17500 for additional requirements.

- END OF SECTION -

SECTION 17560 SURGE PROTECTION DEVICES

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish, install and place in satisfactory operation the transient voltage surge suppression (TVSS) devices as specified herein and as shown on the Drawings.
- B. Prior to furnishing any surge protection device listed in this Section, the Contractor shall first review all Contract Instrumentation Drawings, including any related details and, in particular, the City of Fort Lauderdale Standard Bill of Materials shown on Drawing I-05. The Contractor shall furnish and install the specific model or part number indicated in those documents to comply with City standards. Only if the required device is not identified in the Contract Instrumentation Drawings or in the City's Standard Bill of Materials shall the Contractor furnish a model as specified in this Section. The City Standard Bill of Materials shall take precedence over any general manufacturer listings contained herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17000 – Control and Information System Scope and General Requirements
- B. Section 17060 – Signal Conditioning Requirements
- C. Section 17120 – Programmable Logic Controllers
- D. Section 17500 – Enclosures – General
- E. Section 17550 – Panel Instruments and Accessories

1.03 GENERAL INFORMATION AND DESCRIPTION

- A. All surge protectors of each type provided under this Contract shall be furnished by a single manufacturer.

1.04 TOOLS, SUPPLIES AND SPARE PARTS

- A. The following specific spare parts items shall be provided:
 - 1. Five of each type of transient voltage surge suppression (TVSS) devices provided under this Contract. Surge suppressors shall be provided with base elements.

PART 2 – PRODUCTS

2.01 ELECTRICAL TRANSIENT PROTECTION, GENERAL

- A. All electrical and electronic elements shall be protected against damage due to electrical transients induced in interconnecting lines from lightning discharges and nearby electrical

systems.

- B. **Manufacturer's Requirements:** All transient voltage surge suppressor devices shall be multi stage serial devices manufactured by a company that has been engaged in the design, development, and manufacture of such devices for at least 5 years. Acceptable manufacturers shall be Phoenix Contact or Engineer approved equal. Transient voltage surge suppressor device design requirements shall include the following:
 - 1. Transient voltage surge suppression devices shall be two part, DIN rail mounted, high density, plug-and-base modular terminal block format. The two part plug and base format shall facilitate arrestor module replacement without rewiring.
 - 2. Surge suppression devices shall provide a combination of wire to ground and wire to wire protection.
 - 3. Suppression devices shall be grounded via the grounded DIN rail.
 - 4. Surge suppression devices shall be modular, single channel devices and shall utilize a combination of gas discharge tubes, varistors and suppression diodes in a multistage configuration to protect nominal voltage ranges between 5 VDC and 230 VAC.
 - 5. Each surge suppression module shall provide local LED indication of arrestor status indication to indicate when arrestor replacement is required.
 - 6. DIN rail mounted bases shall be modular type, screw or push-in wiring terminal type, with individually labeled terminals. Bases shall serve as the field terminal blocks between all panel-mounted devices and internal wiring and all field power, communications, I/O signal and ancillary wiring external to the panel.
- C. Surge protection device installations shall comply with UL 94, the National Electric Code (NEC), and all applicable local codes.
- D. Surge protection devices shall be installed as close to the equipment to be protected as practically possible.
- E. **Suppressor Locations:** As a minimum, provide surge suppressors at the following locations:
 - 1. At all connections between AC power, DC power and associated electrical and electronic equipment, including panels, cabinets, and rack assemblies, as well as at field mounted powered instruments (where new field instrumentation devices are specified to be furnished and installed).
 - 2. Where new field instrumentation is specified to be furnished and installed, provide protection at both ends of all two-wire analog signal circuits and all four wire analog power/ signal circuits.
 - 3. Where existing field instrumentation is to be reconnected to modified and new local control panels, provide protection at the panel end of all two-wire analog signal circuits and all four-wire analog power/ signal circuits.
 - 4. At the panel end of all analog inputs and outputs and all discrete input (dry contact) circuits and discrete output (24 VDC or relay contact) circuits that extend to all devices outside of the PLC enclosure. Control panel field wiring terminal blocks for all discrete and analog inputs and outputs shall be DIN rail mounted, modular type

with integral transient voltage surge suppression and other signal isolation and protective devices, as required. Terminal block wiring connections shall be screw or push-in type and shall accept 24-14 AWG wire; rated for the signals carried and labeled as manufactured by Phoenix Contact, or equal.

5. At each device termination point of copper-based communication cables (serial, parallel, Ethernet, Device Net, etc.).
6. On all telephone communications lines.
7. RF antenna cable radio terminus.

F. Surge suppressors shall be as follows:

1. 120-Volt power surge suppressor: The protector shall be PLUGTRAB series by Phoenix Contact, or Engineer approved equivalent.
2. 120-Volt powered, field mounted analog transmitter: The protector shall combine AC power protection and 4-20 mA signal line protection. The suppressor shall be SLAC series with continuous hinge Stainless Steel enclosure by EDCO or Engineer approved equivalent.
3. Two-wire field-mounted analog transmitter: 4-20 mA signal line protection shall be stainless steel pipe-type and shall be Phoenix Contact SURGETRAB S-PT1-24DC or Engineer approved equivalent.
4. 4-20 mA analog input/output signal line protection at the panel side: The protector shall be PLUGTRAB IQ series by Phoenix Contact, or Engineer approved equivalent.
5. Two-wire discrete input/output signal line protection at the panel side: The protector shall be PLUGTRAB IQ series by Phoenix Contact, or Engineer approved equivalent.
6. Surge suppressors for copper-based data communication circuits: Shall be designed for the specific data communication media and protocol to be protected (e.g., telephone, serial, parallel, DeviceNet, coax, twinaxial, twisted pair, RF, etc.), and shall provide protection of equipment to within the equipment's surge withstand levels for applicable standard test wave forms of the following standards:
 - a. IEC 60-1 / DIN VDE 0432 part 2
 - b. CCITT K17 / DIN VDE 0845 part 2
 - c. IEEE C62.31
 - d. Shall be PLUGTRAB IQ, PLUGTRAB, or DATATRAB by Phoenix Contact, or Engineer approved equivalent.
7. Surge suppressors for Ethernet shall meet the following specifications and be grounded to earth ground as recommended by the manufacturer:
 - a. Class EA (CAT6A), for Gigabit Ethernet (up to 10 Gbps), token ring, FDDI/CDDI,

ISDN, and DS1.

- b. RJ45 attachment plug with separate grounding cable and ground connection snap-on foot for NS 35 DIN rails.
- c. Shall be model DT-LAN-CAT.6+ by Phoenix Contact, or Engineer approved equivalent.

PART 3 – EXECUTION

3.01 REQUIREMENTS

- A. Install in accordance with manufacture recommended practices and applicable codes.
- B. Refer to Section entitled “Enclosures, General” for additional requirements.

- END OF SECTION -

SECTION 17600 UNPOWERED INSTRUMENTS - GENERAL

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The instrumentation subcontractor shall furnish, install, test and place in operation process instrumentation (flow elements, pressure switches, etc.) as scheduled herein together with all signal converters, transmitters, isolators, amplifiers, etc. to interface all instrumentation, panels, controls and process equipment control panels with the process controls as shown on the Drawings and as specified. The Contractor may elect to install primary elements (flowmeters, etc.) on process lines provided that the instrumentation subcontractor provides full on-site supervision during installation. Mounting of associated transmitters, indicators, power supplies, brackets and appurtenances shall be provided as specified herein and shown on the Drawings.
- B. It is the intent of the Contract Documents that all process taps, isolation valves, nipples, penetrations, embedded instrumentation supports, conduit, wiring, terminations, and the installation of process instrumentation on process lines shall be provided under this Contract. The instrumentation subcontractor shall supervise installation of equipment provided under this Division where installation is provided by others.
- C. Tapping and connections for primary process sensors shall be sized to suit each individual installation and the requirements of the instrument served. The Contractor shall ensure that the location, supports, orientation and dimensions of the connections and tapping for instrumentation furnished under this Division are such as to provide the proper bracing, the required accuracy of measurement, protection of the sensor from accidental damage and accessibility for maintenance while the plant is in operation. Isolation valves shall be provided at all process taps.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17000 – Control and Information System Scope and General Requirements
- B. Section 17500 – Enclosures, General
- C. Section 17698 – Instrumentation and Control System Accessories
- D. Section 17700 – Powered Instruments, General
- E. Unpowered instruments furnished with mechanical equipment shall be furnished, installed, tested and calibrated as specified elsewhere in the Contract Documents.

1.03 TOOLS, SUPPLIES AND SPARE PARTS

- A. Tools, supplies and spare parts shall be provided as specified in Section 17050.
- B. In addition to the above requirements, the instrumentation subcontractor shall provide spare parts as specified in individual instrument specification sections.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Unless otherwise specified, instruments shall be provided with enclosures to suit specified environmental conditions. Field-mounted devices shall be rugged and mounted on walls or pipe stanchions.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Equipment shall be located so that it is accessible for operation and maintenance. The instrumentation subcontractor shall examine the Drawings and Shop Drawings for various items of equipment in order to determine the best arrangement for the work as a whole and shall supervise the installation of process instrumentation supplied under this Division.
- B. Field equipment shall be wall mounted or mounted on two-inch diameter pipe stands welded to a 10-inch square 1/2-inch thick base plate unless shown adjacent to a wall or otherwise noted. Materials of construction shall be aluminum or 316 stainless steel. Instruments attached directly to concrete shall be spaced out from the mounting surface not less than 1/2-inch by use of phenolic spacers. Expansion anchors in walls shall be used for securing equipment or wall supports to concrete surfaces. Unless otherwise noted, field instruments shall be mounted between 48 and 60 inches above the floor or work platform.
- C. Embedded pipe supports and sleeves shall be Schedule 40, Type 316 stainless steel pipe, ASA B-36.19, with stainless steel blind flange for equipment mounting as shown on the Drawings.
- D. Materials for miscellaneous mounting brackets and supports shall be 316 stainless steel construction.
- E. Pipe stands, miscellaneous mounting brackets and supports shall comply with the requirements of Division 5 of the specifications.

3.02 ADJUSTMENT AND CLEANING

- A. The instrumentation subcontractor shall comply with the requirements of Division 1 of these Specifications and all instrumentation and control system tests, inspection, and calibration requirements for all instrumentation and controls provided under this Contract and specified herein. The Engineer, or his designated representative(s), reserves the right to witness any test, inspection, calibration or start-up activity. Acceptance by the Engineer of any plan, report or documentation relating to any testing or commissioning activity specified herein shall not relieve the Contractor of his responsibility for meeting all specified requirements.
- B. The instrumentation subcontractor shall provide the services of factory trained technicians, tools and equipment to field calibrate, test, inspect and adjust each instrument to its specified performance requirement in accordance with manufacturer's specifications and instructions. Any instrument which fails to meet any Contract requirements, or any

published manufacturer performance specification for functional and operational parameters, shall be repaired or replaced, at the discretion of the Engineer, at no cost to the City. The Contractor shall bear all costs and provide all personnel, equipment and materials necessary to implement all installation tests and inspection activities for equipment specified herein.

- C. At least 60 days before the anticipated initiation of installation testing, the Contractor shall submit to the Engineer a detailed description, of the installation tests to be conducted to demonstrate the correct operation of the instrumentation and control system.
- D. Field instrument calibration requirements shall conform to the following:
 - 1. The instrumentation subcontractor shall provide the services of factory trained instrumentation technicians, tools and equipment to field calibrate each instrument supplied under this Contract to its specified accuracy in accordance with the manufacturer's specification and instructions for calibration.
 - 2. Each instrument shall be calibrated at 0, 25, 50, 75 and 100 percent of span using test instruments to simulate inputs and read outputs. Test instruments shall be rated to an accuracy of at least five (5) times greater than the specified accuracy of the instrument being calibrated. Where applicable, such test instruments shall have accuracy's as set forth by the National Institute for Standards and Technology (NIST).
 - 3. The instrumentation subcontractor shall provide a written calibration sheet to the Engineer for each instrument, certifying that it has been calibrated to its published specified accuracy. The Contractor shall submit proposed calibration sheets for various types of instruments for Engineer approval prior to the start of calibration. This sheet shall include but not be limited to date, instrument tag numbers, calibration data for the various procedures described herein, name of person performing the calibration, a listing of the published specified accuracy, permissible tolerance at each point of calibration, calibration reading as finally adjusted within tolerance, defect noted, corrective action required and corrections made.
 - 4. If doubt exists as to the correct method for calibrating or checking the calibration of an instrument, the manufacturer's printed recommendations shall be used as an acceptable standard, subject to the approval of the Engineer.
 - 5. Upon completion of calibration, devices shall not be subjected to sudden movements, accelerations, or shocks, and shall be installed in permanent protected positions not subject to moisture, dirt, and excessive temperature variations. Caution shall be exercised to prevent such devices from being subjected to overvoltages, incorrect voltages, overpressure or incorrect air. Damaged equipment shall be replaced and recalibrated at no cost to the City.

- END OF SECTION -

SECTION 17670 LEVEL SWITCHES (SUSPENDED FLOAT TYPE)

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish, test, install and place in satisfactory operation the float level switches, with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Control and Information System – General
- B. Unpowered Instruments – General

1.03 TOOLS SUPPLIES AND SPARE PARTS

- A. The following specific spare parts items shall be provided:
 - 1. One of each type of level switches devices provided under this Contract.

PART 2 – PRODUCTS

2.01 LEVEL SWITCHES (SUSPENDED FLOAT TYPE)

- A. Level switches of the direct acting float-operated design and shall meet the following specifications:
 - 1. Casing - hermetically sealed, approximately 5-inch diameter conductive polypropylene casing float, containing microswitches. Ingress protection shall be IP 68.
 - 2. Cable - Level switches shall be flexibly supported by means of a three-conductor cable with PVC (or nitrile/PVC) and EPDM rubber sheath. Cable lengths and materials selected shall be suitable for the installed application.
 - 3. Liquid Density - Unless otherwise specified, media specific gravity is 0.95 to 1.05 g/cm³.
 - 4. Microswitches - shall be one normally open and one normally closed. Microswitch electrical range shall be 250V/10AAC or 24V/10mA min. to 6A max.
 - 5. Supports - Float hangers and supports shall be provided as shown on the installation detail drawings.
 - 6. Float switches located in non-classified areas shall be Flygt ENM-10 as manufactured by Xylem, or Engineer approved equal. Economy type plastic float switches are not acceptable. Substitutions must meet all requirements described in this specification to be approved.
 - 7. Float switches in classified areas shall be Class I Div. 1 rated. Provide an Ex-safety barrier for installation in control panels to protect against overvoltage. The Ex-safety barrier shall be of the same manufacturer as the float switch or equivalent device that

meets float switch manufacturers specifications for Ex-barriers. Float switches for classified areas shall be Flygt ENM-10 EX (black) as manufactured by Xylem, or Engineer approved equal. Economy type plastic float switches are not acceptable. Substitutions must meet all requirements described in this specification to be approved.

PART 3 – EXECUTION

3.01 REQUIREMENTS

- A. Refer to Section 17600 – Unpowered Instruments – General.

- END OF SECTION -

SECTION 17698 INSTRUMENTATION AND CONTROL SYSTEM ACCESSORIES

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish, test, install and place in satisfactory operation the instrumentation and control system accessories with all spare parts, and appurtenances as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17000 – Control and Information System Scope and General Requirements
- B. Section 17600 – Unpowered Instruments – General
- C. Section 17700 – Powered Instruments – General
- D. Section 16902 – Electric Controls and Relays

PART 2 – PRODUCTS

2.01 INSTRUMENTATION AND CONTROL SYSTEM ACCESSORIES

- A. General: Accessories include various items of equipment that may be required in the system but are not scheduled. Accessories are shown on details, flow sheets or plans. Accessories are also called out in specifications for scheduled instruments and in the installation specifications. It is not intended, however, that each piece of hardware required will be specifically described herein. This subarticle shall be used as a guide to qualify requirements for miscellaneous hardware whether the specific item is described or not.
- B. Process Tubing: Process tubing shall be 1/2 x 0.065-inch seamless, annealed, ASTM A-269 Type 316L stainless steel with Type 316 - 37 degrees stainless steel flared fittings or Swagelok or Parker-CPI flareless fittings.
- C. Power, Control and Signal Cables: Power, control and signal wiring shall be provided under Division 16 of the Specifications.
- D. Isolating Ring Seals: For solids bearing fluids, line pressure shall be sensed by a flexible cylinder lining and transmitted via a captive sensing liquid to the associated pressure sensing instrument(s).
 - 1. Full Line Size Isolating Ring Seals - For all grit/sludge/slurry/scum applications or wherever the associated pressure instrument is used for control purposes, the sensor body shall be full line size wafer design. Except where noted on the Drawings and/or Instrument Schedule, full line size ring seals will not be required for return activated sludge (RAS) lines but will have tapped ring seals as specified in Item 2, below. Full line size isolating ring seals shall have 316 stainless steel housing and assembly flanges and Buna N flexible cylinder lining for in-line mounting. The wafer

shall have through bolt holes or centerline gauge for positive alignment with the associated flanged piping. The captive liquid chamber and associated instrument(s) shall be furnished with threaded drain tap and plug. Isolating ring seals shall be RED Valve Series 40, Ronningen-Petter Iso-Ring, Moyno RKL Series W, Onyx Isolator Ring, or equal.

2. Tapped Isolating Ring Seals - For all other solids bearing fluids, pressure shall be sensed via a minimum 1/2" diameter spool-type isolating ring seal mounted on a 1/2" pipe nipple at 90° from the process piping. An isolation ball valve shall be provided between the process piping and the ring seal, and a cleanout ball valve shall be provided between the ring seal and the atmosphere. The pressure instrument shall be back or side mounted to the ring seal such that the gauge or readout may be viewed normally. Tapped isolating ring seals for solids service shall be Red Valve Series 42/742, Ronningen-Petter Iso-Spool, Onyx Isolator Ring, or equal.
- E. Filling Medium: The filling medium between instruments, isolating ring seals and diaphragm seals shall be a liquid suitable for operation in an ambient temperature ranging from -10°F to +150°F. Filling medium shall be silicone unless oxidizing agents such as sodium hypochlorite are present, where halocarbon shall be used.
- F. Isolation Valves: Isolation valves shall be 1/2 - inch diameter ball valves with 316 stainless steel body, 316 stainless steel ball, except that materials of construction shall be suitable for the associated process fluid where applicable (i.e., chemical service).
- G. Sirens: Sirens shall be UL Listed, heavy duty, AC motor driven, weatherproof type capable of producing a minimum of 111 dBA at 10 feet. Power supply shall be 120 VAC, 60 hertz. Siren shall be McMaster-Carr Model 6392T11, Federal Signal Corporation equivalent, Edwards Signaling Company equivalent, or equal.
- H. Strobe Lights: Strobe lights shall be high profile with Type 304 stainless steel base. Light is rated NEMA 4. Light shall have an outer dome to provide extra lens protection. Lens color shall be red. Surface mount hardware shall be included. Power supply shall be 120 VAC, 60 hertz. Strobe light shall be Federal Signal model LP3P-012-048R, no exceptions.

PART 3 – EXECUTION

3.01 REQUIREMENTS

- A. Refer to Section 17600, Part 3 of the specifications.

- END OF SECTION -

SECTION 17700 POWERED INSTRUMENTS – GENERAL

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The instrumentation subcontractor shall furnish, install, test and place in operation powered process instrumentation (flow elements, level transmitters, etc.) as scheduled herein together with all signal converters, transmitters, isolators, amplifiers, etc. to interface all instrumentation, panels, controls and process equipment control panels with the process control system as shown on the Drawings and as specified. Powered instruments are those instruments that require power (120 VAC or 24 VDC loop power) to operate. The Contractor may elect to install primary elements (flowmeters, etc.) on process lines provided that the instrumentation subcontractor provides full on-site supervision during installation. Mounting of associated transmitters, indicators, power supplies, brackets and appurtenances shall be provided as specified herein and shown on the Drawings.
- B. It is the intent of the Contract Documents that all process taps, isolation valves, nipples, penetrations, embedded instrumentation supports, conduit, wiring, terminations, and the installation of process instrumentation on process lines shall be provided under this Contract. The instrumentation subcontractor shall supervise installation of equipment provided under this Division where installation is provided by others.
- C. Tapping and connections for primary process sensors shall be sized to suit each individual installation and the requirements of the instrument served. The Contractor shall ensure that the location, supports, orientation and dimensions of the connections and tapping for instrumentation furnished under this Division are such as to provide the proper bracing, the required accuracy of measurement, protection of the sensor from accidental damage, and accessibility for maintenance while the plant is in operation. Isolation valves shall be provided at all process taps.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17000 – Control and Information System Scope and General Requirements
- B. Section 17500 – Enclosures, General
- C. Section 17600 – Unpowered Instruments, General
- D. Section 17698 – Instrumentation and Control System Accessories
- E. Powered instruments furnished with mechanical equipment shall be furnished, installed, tested and calibrated as specified elsewhere in the Contract Documents.

1.03 TOOLS, SUPPLIES AND SPARE PARTS

- A. Tools, supplies and spare parts shall be provided as specified in Section 17050.

PART 2 – PRODUCTS

2.01 GENERAL

- A. All instrumentation supplied shall be the manufacturer's latest design. Unless otherwise specified, instruments shall be solid state, electronic, using enclosures to suit specified environmental conditions. Microprocessor-based equipment shall be supplied unless otherwise specified. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks as shown on the Drawings, or as required.
- B. Equipment installed in a hazardous area shall meet Class, Group, and Division as shown on the Drawings, to comply with the National Electrical Code.
- C. All field instrumentation for outdoor service shall be provided with enclosures which are suitable for outdoor service, as follows:
 - 1. Where the manufacturer's enclosures are suitable for outdoor service, they shall be provided with instrument sunshades. Sunshades shall be Style E as manufactured by O'Brien Corporation, or equal. Where possible, these instruments shall be mounted in a north facing direction.
 - 2. Where the manufacturer's standard enclosures are not suitable for outdoor service, instruments shall be mounted in Field Panels in accordance with Section 17520, Field Panels, or may be furnished with Vipak instrument field enclosures as manufactured by O'Brien Corporation, equivalent by Intertec, or equal. It shall not be necessary to provide the manufacturer's NEMA 4 or 4X enclosures for instruments that will be subsequently mounted in separate field panels.
- D. All instruments shall return to accurate measurement without manual resetting upon restoration of power after a power failure.
- E. Unless otherwise shown or specified, local indicators shall be provided for all instruments. Where instruments are located in inaccessible locations, local indicators shall be provided and shall be mounted as specified in Subsection 3.01 (B) herein. All indicator readouts shall be linear in process units. Readouts of 0-100% shall not be acceptable (except for speed and valve position). Isolated outputs shall be provided for all transmitters.
- F. Unless otherwise specified, field instrument and power supply enclosures shall be 316 stainless steel, fiberglass or PVC coated copper-free cast aluminum NEMA 4X construction.
- G. Where separate elements and transmitters are required, they shall be fully matched, and unless otherwise noted, installed adjacent to the sensor. Special cables or equipment shall be supplied by the associated equipment manufacturer.
- H. Electronic equipment shall utilize printed circuitry and shall be coated (tropicalized) to prevent contamination by dust, moisture and fungus. Solid-state components shall be conservatively rated for long-term performance and dependability over ambient atmosphere fluctuations. Ambient conditions shall be -20 to 50 degrees C and 20 to 100 percent relative humidity, unless otherwise specified. Field mounted equipment and system components shall be designed for installation in dusty, humid, and corrosive service conditions.

- I. All devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, insofar as possible, and shall consist of equipment models that are currently in production. All equipment provided, where applicable, shall be of modular construction and shall be capable of field expansion.
- J. All non-loop-powered instruments and equipment shall be designed to operate on a 60 Hz AC power source at a nominal 117 V, plus or minus 10 percent, except where specifically noted. All regulators and power supplies required for compliance with the above shall be provided. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.
- K. All analog transmitter and controller outputs shall be isolated, 4-20 milliamps into a load of 0-750 ohms, unless specifically noted otherwise. All switches shall have double-pole, double-throw contacts rated at a minimum of 600 VA, unless specified otherwise.
- L. Materials and equipment used shall be UL approved wherever such approved equipment and materials are available.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General

- 1. Equipment shall be located so that it is accessible for operation and maintenance. The instrumentation subcontractor shall examine the Drawings and shop drawings for various items of equipment in order to determine the best arrangement for the work as a whole and shall supervise the installation of process instrumentation supplied under this Division.
- 2. Electrical work shall be performed in compliance with all applicable local codes and practices. Where the Contract Documents do not delineate precise installation procedures, API RP550 shall be used as a guide to installation procedures.

B. Equipment Mounting and Support

- 1. Field equipment shall be wall mounted or mounted on two-inch diameter pipe stands welded to a 10-inch square by 1/2-inch thick base plate unless shown adjacent to a wall or otherwise noted. Materials of construction shall be aluminum or 316 stainless steel. Instruments attached directly to concrete shall be spaced out from the mounting surface not less than 1/2-inch by use of phenolic spacers. Expansion anchors in walls shall be used for securing equipment or wall supports to concrete surfaces. Unless otherwise noted, field instruments shall be mounted between 48 and 60 inches above the floor or work platform.
- 2. Embedded pipe supports and sleeves shall be schedule 40, 316 stainless steel pipe, ASA B-36.19, with stainless steel blind flange for equipment mounting as shown on the Drawings.
- 3. Materials for miscellaneous mounting brackets and supports shall be 316 stainless steel construction.

4. Pipe stands, miscellaneous mounting brackets and supports shall comply with the requirements of Division 5 of the specifications.
5. Transmitters shall be oriented such that output indicators are readily visible.

C. Control and Signal Wiring

1. Electrical, control and signal wiring connections to transmitters and elements mounted on process piping or equipment shall be made through liquid-tight flexible conduit. Conduit seals shall be provided where conduits enter all field instrument enclosures and all cabinetry housing electrical or electronic equipment.

3.02 ADJUSTMENT AND CLEANING

A. General

1. The instrumentation subcontractor shall comply with the requirements of Division 1 of these Specifications and all instrumentation and control system tests, inspection, and calibration requirements for all instrumentation and controls provided under this Contract and specified herein. The Engineer, or his designated representative(s), reserves the right to witness any test, inspection, calibration or start-up activity. Acceptance by the Engineer of any plan, report or documentation relating to any testing or commissioning activity specified herein shall not relieve the Contractor of his responsibility for meeting all specified requirements.
2. The instrumentation subcontractor shall provide the services of factory trained technicians, tools and equipment to field calibrate, test, inspect and adjust each instrument to its specified performance requirement in accordance with manufacturer's specifications and instructions. Any instrument which fails to meet any Contract requirements, or any published manufacturer performance specification for functional and operational parameters, shall be repaired or replaced, at the discretion of the Engineer, at no cost to the City. The Contractor shall bear all costs and provide all personnel, equipment and materials necessary to implement all installation tests and inspection activities for equipment specified herein.
3. At least 60 days before the anticipated initiation of installation testing, the Contractor shall submit to the Engineer a detailed description, of the installation tests to be conducted to demonstrate the correct operation of the instrumentation supplied hereunder.

B. Field Instrument Calibration Requirements

1. The instrumentation subcontractor shall provide the services of factory trained instrumentation technicians, tools and equipment to field calibrate each instrument supplied under this Contract to its specified accuracy in accordance with the manufacturer's specification and instructions for calibration.
2. If the manufacturer's recommendations require calibration, each instrument shall be calibrated at 0, 25, 50, 75 and 100 percent of span using test instruments to simulate inputs and read outputs. Test instruments shall be rated to an accuracy of at least five (5) times greater than the specified accuracy of the instrument being calibrated. Where applicable, such test instruments shall have accuracy's as set forth by the

National Institute for Standards and Technology (NIST).

3. The instrumentation subcontractor shall provide a written calibration sheet to the Engineer for each instrument, certifying that it has been calibrated to its published specified accuracy. The Contractor shall submit proposed calibration sheets for various types of instruments for Engineer approval prior to the start of calibration. This sheet shall include but not be limited to date, instrument tag numbers, calibration data for the various procedures described herein, name of person performing the calibration, a listing of the published specified accuracy, permissible tolerance at each point of calibration, calibration reading as finally adjusted within tolerance, defect noted, corrective action required and corrections made.
4. If doubt exists as to the correct method for calibrating or checking the calibration of an instrument, the manufacturer's printed recommendations shall be used as an acceptable standard, subject to the approval of the Engineer.
5. Upon completion of calibration, devices calibrated hereunder shall not be subjected to sudden movements, accelerations, or shocks, and shall be installed in permanent protected positions not subject to moisture, dirt, and excessive temperature variations. Caution shall be exercised to prevent such devices from being subjected to overvoltages, incorrect voltages, overpressure or incorrect air. Damaged equipment shall be replaced and recalibrated at no cost to the City.
6. After completion of instrumentation installation, the instrumentation subcontractor shall perform a loop check. The Contractor shall submit final loop test results with all instruments listed in the loop. Loop test results shall be signed by all representatives involved for each loop test.

- END OF SECTION -

SECTION 17910 INSTRUMENT SCHEDULE

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall furnish, test, install and place in satisfactory operation all instrumentation as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17920 – Control System Input/Output Schedule
- B. Section 17950 – Functional Control Descriptions

PART 2 – INSTRUMENT SCHEDULE

2.01 REQUIREMENTS

- A. Refer to Table 17910A following this section for a listing of the Division 17 furnished instrumentation.

- END OF SECTION -

**TABLE 17910A
INSTRUMENT SCHEDULE**

TAG No.	SERVICE DESCRIPTION	STATE/SPAN	P&ID	REMARKS
---------	---------------------	------------	------	---------

SECTION - 17670 LEVEL SWITCHES (SUSPENDED FLOAT TYPE)

LSHH-1010	WETWELL - HIGH HIGH SWITCH LEVEL ALARM	FIELD ADJUSTABLE	I-03	
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SECTION - 17303 AIR BUBBLER LEVEL SYSTEMS

PI-1010	WETWELL - PRESSURE GAUGE	0-200 IN	I-03	
PT-1010	WETWELL - PRESSURE TRANSMITTER	0-15 PSI	I-03	

SECTION 17920 CONTROL SYSTEM INPUT/OUTPUT SCHEDULE

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish, install, test, and place into satisfactory operation all PLC input and outputs as herein specified and as required for a complete functioning system.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17950 – Functional Control Descriptions – General

PART 2 – CONTROL SYSTEM INPUT / OUTPUT SCHEDULE

2.01 REQUIREMENTS

- A. Refer to Tables 17920A following this section for a listing of the hardwired process I/O points.

PART 3 – EXECUTION

3.01 INPUT/OUTPUT TYPES

- A. Signals transmitted or received via PLC input/output cards are as follows:

DO – Discrete Output

DI – Discrete Input

AO – Analog Output

AI – Analog Input

- B. All PLC data shall be made available to the HMI via its data link using similar tag names and numbers to facilitate consistency between the PLC and HMI databases.

- END OF SECTION -

TABLE 17920A
INPUT/OUTPUT SCHEDULE

TAG	SERVICE DESCRIPTION	PLC	I/O TYPE	P&ID	NOTES
-----	---------------------	-----	----------	------	-------

ANALOG INPUTS

LI-1010	WETWELL - LEVEL	PLC-SS10	AI	I-03	
II-1001	STORMWATER PUMP No. 1 - CURRENT	PLC-SS10	AI	I-03	
II-1002	STORMWATER PUMP No. 2 - CURRENT	PLC-SS10	AI	I-03	

DISCRETE INPUTS

LAHH-1010	WETWELL - LEVEL ALARM HIGH-HIGH	PLC-SS10	DI	I-03	
YA-1001	STORMWATER PUMP No. 1 - FAIL	PLC-SS10	DI	I-03	
YL-1001	STORMWATER PUMP No. 1 - IN REMOTE	PLC-SS10	DI	I-03	
YLR-1001	STORMWATER PUMP No. 1 - RUNNING	PLC-SS10	DI	I-03	
TAH-1001	STORMWATER PUMP No. 1 - MOTOR HIGH TEMP ALARM	PLC-SS10	DI	I-03	
MAH-1001	STORMWATER PUMP No. 1 - MOTOR SEAL LEAK ALARM	PLC-SS10	DI	I-03	
YA-1002	STORMWATER PUMP No. 2 - FAIL	PLC-SS10	DI	I-03	
YL-1002	STORMWATER PUMP No. 2 - IN REMOTE	PLC-SS10	DI	I-03	
YLR-1002	STORMWATER PUMP No. 2 - RUNNING	PLC-SS10	DI	I-03	
TAH-1002	STORMWATER PUMP No. 2 - MOTOR HIGH TEMP ALARM	PLC-SS10	DI	I-03	
MAH-1002	STORMWATER PUMP No. 2 - MOTOR SEAL LEAK ALARM	PLC-SS10	DI	I-03	
YAX-1010	STATION INTRUSION	PLC-SS10	DI	I-03	

DISCRETE OUTPUTS

YCR-1001	STORMWATER PUMP No. 1 - START/STOP	PLC-SS10	DO	I-03	
YR-1001	STORMWATER PUMP No. 1 - IN REMOTE PILOT LIGHT	PLC-SS10	DO	I-03	
YCR-1002	STORMWATER PUMP No. 2 - START/STOP	PLC-SS10	DO	I-03	
YR-1002	STORMWATER PUMP No. 2 - IN REMOTE PILOT LIGHT	PLC-SS10	DO	I-03	
LAHH-1010	WETWELL - LEVEL ALARM HIGH HIGH PILOT LIGHT	PLC-SS10	DO	I-03	

SECTION 17950 FUNCTIONAL CONTROL DESCRIPTIONS

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish, test, install and place in satisfactory operation all equipment as herein specified and as shown on the Drawings. PLC application programming, Operator Interface Unit (OIU) configuration, and SCADA HMI development will be supplied by the City of Fort Lauderdale; the Contractor's scope is limited to providing complete, wired, and tested hardware that is ready for the City-supplied software.

Where the functional descriptions reference monitoring or control functions, the Contractor shall provide the associated hardware only; all related software logic and screen development will be furnished by the City.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 17910 – Instrument Schedule
B. Section 17920 - Control System Input/Output Schedule

PART 2 – FUNCTIONAL CONTROL DESCRIPTIONS – GENERAL

2.01 DEFINITIONS

- A. RUNNING status signals shall be from auxiliary contacts (or data link registers) provided with the motor control equipment (i.e., starter, SSRVS, etc.), which shall close (or change value) when the equipment is running.
- B. AUTO status signals shall be defined as HAND-OFF-AUTO switch in the AUTO position where LOCAL hardwired automatic control is provided. Alternatively, the AUTO status may be a virtual input where the process control system control strategy is in the AUTO (versus MANUAL) mode where equipment is remotely controlled by the process control system.
- C. FAULT status signals shall be defined as motor overload and/or any other shut down mode such as over torque, over temperature, low oil pressure, high vibration, etc.
- D. REMOTE (versus LOCAL) status signal shall be defined as a dry contact (or data link registers) which indicates that equipment control power is energized and the HAND-OFF-REMOTE switch is in the REMOTE position to permit remote control by the process control system.

2.02 CONVENTIONS

- A. Indicator lights on all MCC's, control panels, starter enclosures, etc. shall conform to the following color convention:

<u>Condition</u>	<u>Color</u>
Running	Red
In Remote	Yellow

2.03 PROCESS CONTROL

- A. All PLC application code, OIU/HMI configuration, historian logging, alarm handling, and final tuning will be supplied, loaded, and commissioned by the City of Fort Lauderdale.

PART 3 – FUNCTIONAL CONTROL DESCRIPTIONS

3.01 VICTORIA PARK STORMWATER PUMP STATION (SS-10)

Drawing I-03

A. Process Overview

1. The Victoria Park stormwater pump station will discharge the collected stormwater to the intracoastal waterway abutting the east side of the property. The pump station shall be equipped with two (2) submersible vertical column pumps powered by SSRVSS (solid state reduced voltage starters) and controlled by an LCP (Local Control Panel), LCP-SS10, equipped with a programmable logic controller, PLC- SS10.
2. The pumps shall operate in a duty/standby configuration. PLC-SS10 shall allow only one pump to operate at a time and shall provide automatic pump alternation for each pumping cycle.
3. PLC-SS10 shall monitor wetwell level via an air bubbler level system, and automatically start and stop pumps based on set-point adjustable wetwell elevations.
4. A high-high wetwell level alarm shall be initiated by level switch LSH-1010, mounted in the wetwell.
5. The LCP shall be equipped with an OIU (Operator Interface Unit) for pump station status monitoring, control and set-point adjustment.

B. Control Operation

1. Cellular modem configuration, PLC and OIU programming software shall be provided by the City. The Contractor's scope is limited to supplying, wiring and loop checking the associated hardware.

- END OF SECTION -

APPENDIX A – GEOTECHNICAL SERVICES REPORT

APPENDIX A – GEOTECHNICAL SERVICES REPORT



February 8, 2018

Hazen and Sawyer
4000 Hollywood Blvd., Suite 750N
Hollywood, Florida 33201

Attn: Mr. Robert B. Taylor, Jr., P.E.
Office: (954) 987- 0066
Cell: (772) 595- 2535
Email: rbtaylor@hazenandsawyer.com

**RE: Geotechnical Services Report
City of Fort Lauderdale
Stormwater Master Plan Modeling and Design Implementation
Broward County, Florida
RADISE Project No: 170901**

Dear Mr. Taylor,

RADISE International, LC (RADISE) is pleased to submit this *Geotechnical Services Report* for the above-referenced project. The purpose of this report is to provide geotechnical information and recommendations to aid in the design and construction of the project. This report describes the field exploration and laboratory testing performed, presents the data obtained, and provides our recommendations regarding geotechnical aspects of the of the proposed project.

The study was performed in general accordance with our agreement executed on August 30, 2017 and our scope of work for geotechnical services.

We appreciate the opportunity to work with Hazen and Sawyer on this project, and trust that the information presented is clear. Should you have any questions regarding this report, or if we can be of additional assistance as this project develops, please contact us at (561) 841-0103.

Sincerely,

RADISE International
Infrastructure Engineers & Software Developers

Akash Bissoon, P.E.
Project Engineer
Florida Registration No. 74582



Thomas F Mullin Digitally signed by
Thomas F Mullin
Date: 2018.06.11
15:08:59 -04'00'

This document has been digitally signed and sealed by Thomas F. Mullin, P.E. on June 11, 2018 using Identrust. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

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ATTACHMENTS

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Sheets 2A through 2Q – Boring Location Plan

Sheets 3A and 3B – Durrs Subsurface Profiles

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Sheets 9A through 9L – Seawalls Subsurface Profiles

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APPENDIX A

**Table A-1 – Laboratory Test Results Summary
Grain Size Distribution**

APPENDIX B

Preliminary Design Geotechnical Services Report

1.0 INTRODUCTION

RADISE understands that the City of Fort Lauderdale is performing a study for seawall replacement designs, stormwater master plan modeling, and design implementation within the City of Fort Lauderdale. To aid in the evaluation and design of the project, RADISE was requested to provide subsoil investigation and evaluation services that included drilling of exploratory borings to determine the subsurface stratigraphy, groundwater levels and physical properties of the soils underlying the site.

The information presented in this report is based upon our interpretation of the subsurface information revealed by the test borings. The report does not reflect variations in subsurface conditions that may exist between or beyond these borings. Variations in soil and groundwater conditions should be expected, the nature and extent of which might not become evident until construction is undertaken. If variations are encountered, and/or the scope of the project altered, we should be consulted for additional recommendations.

2.0 PROJECT DESCRIPTION

The project is located in the City of Fort Lauderdale, Florida and includes seven (7) neighborhoods and twelve (12) seawall segments located east of interstate highway (I-95) and between the Port Everglades Expressway and Sunrise Boulevard. The approximate locations and limits of the seawall and neighborhood projects are shown on the attached *Vicinity Map*, Sheet 1.

The stormwater systems for the seven (7) neighborhoods are proposed to provide improved flood protection and enhanced water quality treatment by using Best Management Practices (BMPs). The proposed stormwater collection and conveyance systems will include, but are not limited to:

- Swales
- Inlets and catch basins
- Exfiltration trenches
- Dry and wet retention systems (basins)
- Backflow prevention valves
- Underdrain systems
- Stormwater pump stations
- Electrical equipment buildings
- Outfalls
- Control structures
- Drainage wells
- Green infrastructure such as bio-swales and precast porous pavement

In addition, detailed designs for twelve (12) seawall segments are proposed. Seawall and neighborhood boring location information is summarized in Table 1 and Table 2.

Table 1 – Seawall Location Information

Seawall	Boring No.	Boring Location Remarks	Asphalt Thickness (inches)	Base Course Thickness* (inches)
Seawall 9	S-28	Inside Victoria Park. At the intersection of Broward Boulevard and North Victoria Park Road.	-	-
Seawall 10	S-29	At the intersection of SE 23 rd Avenue and Del Mar Place. Approximately 450 feet north of E Las Olas Boulevard.	3.75	4.5
Seawall 12	S-15	South side of E Las Olas Boulevard, between Lido Drive and San Marco Drive.	-	-
Seawall 13	S-14	South side of E Las Olas Boulevard, between San Marco Drive and Coral Way.	-	-
Seawall 14	S-13	South side of E Las Olas Boulevard, between Coral Way and Royal Plaza Drive.	-	-
Seawall 15	S-9	On the east side of Isle of Palms Drive. Approximately 800 feet south of E Las Olas Boulevard.	4.5	6.0
	S-10	On the east side of Isle of Palms Drive. Approximately 570 feet south of E Las Olas Boulevard.	5.25	4.0
	S-11	On the east side of Isle of Palms Drive. Approximately 350 feet south of E Las Olas Boulevard.	5.75	6.0
	S-12	On the east side of Isle of Palms Drive. Approximately 120 feet south of E Las Olas Boulevard.	6.25	6.0
Seawall 17	S-8	On the south side of SE 5 th Street. Approximately 75 feet west of the intersection of Riviera Isle Drive and SE 5 th Street.	6.5	6.0
Seawall 29	S-17	On the east side of Cordova Road. Between SE 7 th Street and SE 8 th Street. Approximately 230 feet south of the intersection of Cordova Road and SE 7 th Street.	12.0	6.0
	S-18	On the east side of Cordova Road. Between SE 8 th Street and SE 9 th Street. Approximately 175 feet south of the intersection of Cordova Road and SE 8 th Street.	9.5	5.0
	S-19	On the east side of Cordova Road. Between SE 8 th Street and SE 9 th Street. Approximately 400 feet south of the intersection of Cordova Road and SE 8 th Street.	8.25	6.0
	S-20	On the east side of Cordova Road. Between SE 8 th Street and SE 9 th Street. Approximately 175 feet south of the intersection of Cordova Road and SE 8 th Street.	9.0	5.0
	S-21	On the east side of Cordova Road. Between SE 8 th Street and SE 9 th Street. Approximately 220 feet south of the intersection of Cordova Road and SE 9 th Street.	5.75	6.0

Seawall	Boring No.	Boring Location Remarks	Asphalt Thickness (inches)	Base Course Thickness* (inches)
	S-22	On the east side of Cordova Road. Between SE 10th Street and SE 11th Street. Approximately 215 feet south of the intersection of Cordova Road and SE 10th Street.	5.0	5.0
	S-23	On the east side of Cordova Road. Between SE 11th Street and SE 12th Street. Approximately 160 feet south of the intersection of Cordova Road and SE 11th Street.	5.0	8.0
Seawall 30	S-26	On the south side of SE 10th Street. Approximately 2,000 feet east of the intersection of Cordova Road and SE 10th Street.	5.25	6.0
	S-27	On the south side of SE 10th Street. Approximately 2,250 feet east of the intersection of Cordova Road and SE 10th Street.	3.75	5.0
Seawall 32	S-16	On Mola Avenue. Approximately 775 feet south of the intersection of SE 17 th Way and Mola Avenue.	-	-
Seawall 34	S-30	Located on the north side of Barcelona Drive. At the northeast quadrant of Barcelona Drive and NE 26 th Terrace.	3.5	6.0
Seawall 35	S-24	Located on the south side of SE 8 th Street. Approximately 1,000 feet east of Cordova Road.	4.5	6.0
	S-25	Located on the south side of SE 8 th Street. Approximately 1,335 feet east of Cordova Road.	4.5	6.0

*Base course thicknesses were measured in the field to the nearest half inch.

Table 2 – Neighborhood Location Information

Neighborhood	Boring No.	Boring Location Remarks	Asphalt Thickness (inches)	Base Course Thickness* (inches)
Durrs	D-1	Intersection of NW 9 th Street and NW 17 th Avenue.	4.0	5.0
	D-2	Intersection of NW 16 th Avenue and NW 8 th Street.	7.0	3.0
	D-3	On NW 19th Avenue. Approximately 60 feet south of the intersection of NW 19th Avenue and NW 7th Street.	4.0	8.0
	D-4	Intersection of NW 8 th Street and NW 13 th Terrace.	1.3	3.0
	D-5	On the west side of NW 14 th Way. Approximately 170 feet north of the intersection of NW 14 th Way and NW 6 th Street.	3.2	3.0

Neighborhood	Boring No.	Boring Location Remarks	Asphalt Thickness (inches)	Base Course Thickness* (inches)
Dorsey Riverbend	DR-1	Approximately 160 feet north of NW 5 th Street, between NW 15 th Terrace and NW 15 th Avenue.	-	-
	DR-2	On the east side of NW 15 th Avenue. Approximately 200 feet north of the intersection of NW 15 th Street and NW 15 th Avenue.	-	-
	DR-3	Intersection of NW 4 th Street and NW 15 th Avenue.	5.0	6.0
	DR-4	Approximately 75 feet north of the intersection of NW 4 th Street and NW 18 th Avenue.	5.2	1.0
	DR-5	On the west side of NW 18 th Avenue, approximately 130 feet south of the intersection of NW 6 th Street and NW 18 th Avenue.	1.0	2.0
Edgewood	E-1	Intersection of SW 15th Avenue and SW 32 nd Court.	1.2	4.0
	E-2	Intersection of SW 15th Avenue and SW 31 st Street.	3.7	4.0
	E-3	Intersection of SW 15th Avenue and SW 29 th Street.	2.2	4.0
	E-4	On SW 30 th Street. Approximately 400 feet east of the intersection of SW 15 th Avenue and SW 30 th Street.	3.2	4.0
	E-5	On SW 32 nd Street. Approximately 400 feet east of the intersection of SW 15th Avenue and SW 32 nd Street.	2.0	6.0
	E-6	Intersection of SW 14th Avenue and SW 28th Street.	1.7	9.0
	E-7	On SW 28th Street. Approximately 620 feet east of the intersection of SW 12th Avenue and SW 28 th Street.	4.7	6.0
	E-8	On SW 12 th Avenue, between SW 31 st Street and SW 32 nd Street.	1.5	4.0
	E-9	On SW 29 th Street. Approximately 240 feet east of the intersection of SW 12 th Avenue and SW 29 th Street.	-	-
	E-10	On SW 9th Avenue, between SW 30st Street and SW 31st Street.	6.0	3.0

Neighborhood	Boring No.	Boring Location Remarks	Asphalt Thickness (inches)	Base Course Thickness* (inches)
	E-11	Intersection of SW 8 th Avenue and SW 30 th Street.	3.7	4.0
	E-12	Intersection of SW 8 th Avenue and SW 28 th Street.	5.0	4.0
	E-13	On SW 9 th Avenue, between SW 26 th Court and SW 27 th Court.	1.7	6.0
	E-14	On the west side of S Andrews Avenue. Near the intersection of S Andrews Avenue and SE 26 th Street.	3.5	4.0
	E-15	On S Andrews Avenue. Between SE 30 th Street and SE 31 st Street.	3.0	4.0
Progresso	P-1	On the east side of SW 4 th Avenue. Approximately 100 feet north of the intersection of Himmarshee Street and SW 4 th Avenue.	3.0	4.0
	P-2	On NW 5 th Avenue. Approximately 150 feet north of the intersection of Broward Boulevard and NW 5 th Avenue.	3.2	2.0
	P-3	Intersection of NW 2 nd Street and NW 4 th Avenue.	2.7	6.0
	P-4	Intersection of NW 7 th Street and NW 3 rd Avenue.	1.2	8.0
	P-5	Intersection of NW 7 th Street and NW 3 rd Avenue.	-	-
	P-6	Approximately 130 feet north of NW 8 th Street and between NW 4 th Avenue and NW 3 rd Avenue.	-	-
	P-7	On NW 7 th Avenue. Between NW 5 th Street and NW 4 th Street.	2.0	7.0
	P-8	Intersection of NW 7 th Street and NW 7 th Terrace.	1.7	7.0
River Oaks	R-1	On SW 15 th Avenue. Approximately 100 feet north of the intersection of SW 15 th Avenue and Marina Boulevard.	2.7	6.0
	R-2	On SW 15 th Avenue. Between SW 22 nd Avenue and SW 23 rd Street.	1.5	8.0
	R-3	On SW 24 th Street. Between SW 18 th Terrace and SW 24 th Street.	1.5	6.0
	R-4	At the intersection of SW 17 th Avenue and SW 22 nd Street.	1.0	6.0

Neighborhood	Boring No.	Boring Location Remarks	Asphalt Thickness (inches)	Base Course Thickness* (inches)
	R-5	On SW 19 th Avenue. Between SW 21 st Street and SW 22 nd Street.	1.7	6.0
	R-6	On SW 20 th Street. Between SW 15 th Avenue and Coconut Drive.	5.0	10.0
	R-7	At the intersection of SW 18 th Court and SW 14 th Avenue.	2.0	8.0
	R-8	At the intersection of SW 17 th Street and SW 13 th Avenue.	1.2	9.0
	R-9	Approximately 610 feet west of the intersection of SW 19 th Avenue and SW 21 st Street. Near a wooded area.	-	-
	R-10	Approximately 550 feet west of the intersection of SW 19 th Avenue and SW 21 st Street. Near a wooded area.	-	-
	R-11	Approximately 150 feet north west of the intersection of SW 19 th Avenue and SW 23 rd Court.	-	-
	R-12	Approximately 240 feet north west of the intersection of SW 19 th Avenue and SW 23 rd Court.	-	-
	R-13	Intersection of SW 18 th Court and SW 10 th Avenue.	1.7	9.0
Southeast Isles	S-1	Approximately 65 feet west of the intersection of SE 17 th Way and Mola Avenue.	-	-
	S-2	On the south side of E Las Olas Boulevard, between SE 18 th Avenue and Lido Drive.	-	-
	S-3	On the west side of Lido Drive, approximately 130 feet south of the intersection of E Las Olas Boulevard and Lido Drive.	-	-
	S-4	On the south side of E Las Olas Boulevard, between Royal Plaza Drive and Isle of Palms Drive.	-	-
	S-5	On the south side of E Las Olas Boulevard. Approximately 100 feet west of the intersection of E Las Olas Boulevard and Sunset Drive.	-	-

Neighborhood	Boring No.	Boring Location Remarks	Asphalt Thickness (inches)	Base Course Thickness* (inches)
	S-6	In the south east quadrant of the intersection of E Las Olas Boulevard and Poinciana Drive. In Merle Fogg Park.	-	-
	S-7	In the south east quadrant of the intersection of E Las Olas Boulevard and Poinciana Drive. In Merle Fogg Park.	-	-
Victoria Park	V-1	Intersection of NE 6 th Street and NE 10 th Avenue.	3.0	7.0
	V-2	Intersection of NE 6 th Street and NE 16 th Avenue.	7.0	4.0
	V-3	Intersection of NE 9 th Street and NE 15 th Avenue.	2.0	6.0
	V-4	Intersection of NE 8 th Street and NE 16 th Terrace.	3.8	3.0
	V-5	Intersection of NE 7 th Street and NE 17 th Way.	1.0	7.0
	V-6	On Victoria Trace. Approximately 250 feet north of the intersection of NE 5 th Street and Victoria Way.	2.0	7.0
	V-7	Intersection of NE 20 th Avenue and NE 19 th Avenue.	3.0	6.0
	V-8	Intersection of NE 20 th Avenue and NE 7 th Street.	5.0	6.0
	V-9	Approximately 160 feet east of the intersection of NE 20 th Avenue and NE 7 th Street.	-	-
	V-10	On NE 20 th Avenue. Approximately 900 feet north of the intersection of NE 20 th Avenue and NE 7 th Street.	2.2	9.0

*Base course thicknesses were measured in the field to the nearest half inch.

A review of the asphalt and base rock thicknesses data tabulated in Tables 1 and 2 for the various Seawall and Neighborhood projects, indicates that there are a number of apparent cores with either thin or thick pavement layers. Discussion of the nature and locations of deficient cores along with comparisons to more current day pavement design sections, is included in Section 7.4 - Pavement Design Considerations of this report.

3.0 PURPOSE AND SCOPE OF WORK

The purpose of this study was to perform a limited exploration of the subsurface conditions within the project proposed areas, to aid in the planning and design of the overall neighborhood site drainage infrastructure and seawalls.

More specifically, the purpose of the work included the following:

- Development of the anticipated soil profiles and the subsurface conditions within the depth of influence at the seawall structure locations and anticipated stormwater management infrastructure improvements.
- Identification of critical geotechnical design or construction considerations based on the soil and groundwater conditions encountered in the borings.

RADISE performed the following services in accordance with the proposed scope of work:

1. Visited the sites to field mark (paint or/and stake) the planned soil boring test locations and observe existing site conditions.
2. Contacted Sunshine 811 to request the field location and clearance of underground utilities in the areas of the proposed borings, as per Florida Statutes.
3. Set up Maintenance of Traffic (MOT) safety controls prior to and during the field drilling operations.
4. Mobilized drilling equipment to the site to perform:
 - Fifty (50) Standard Penetration Test (SPT) soil borings within the various seven (7) neighborhoods. Borings were drilled to depths of fifteen (15) feet
 - Thirty-six (36) SPT borings within the seawall and pump station locations. Borings were drilled to depths of 50 feet below the existing ground surface.
 - Asphalt pavement cores at sixty- eight (68) of the SPT boring locations.

Samples of the subsurface soils encountered in the SPT borings were obtained and placed in labeled air-tight containers. The depth to the groundwater level was measured and recorded for each of the borings. Following completion of the groundwater measurements, the boreholes were backfilled with neat cement grout.

5. Visually classified the SPT soil samples retrieved from the soil borings in accordance with the Unified Soil Classification System (USCS) using the Visual-Manual Procedure in general accordance with the American Society of Testing and Materials (ASTM) test method D 2488, *Description and Identification of Soils*.

6. Reviewed, assigned and performed a limited laboratory testing program for soil index property determinations on selected SPT samples to aid in the classification process in general accordance with the ASTM test method D 2487, *Classification of Soils for Engineering Purposes*.
7. Prepared this Geotechnical Services Report to summarize the results of the field exploration and laboratory testing, and to present our findings, evaluations and design recommendations.
8. Reviewed and incorporated our Geotechnical Services Report prepared for the preliminary design of this project. The preliminary design Geotechnical Services Report is included in Appendix B of this report.

4.0 FIELD EXPLORATION

During this work phase, MOT was used to protect our field personnel, equipment, and the general public. The MOT was designed and set up in accordance with the FDOT Design Standards.

4.1 CORING

The field exploration program to evaluate the existing asphalt pavement thicknesses consisted of a total of sixty-eight (68) Pavement Cores, sampled at each of the sixty-eight of the SPT borings locations. The approximate boring locations are shown on the attached *Boring Location Plan*, Sheets 2A through 2Q.

Tables 1 and 2 in Section 1.0 presents a summary of the measured asphalt section thickness and the base thickness at the boring locations. Latitude and Longitude coordinates of the boring locations were obtained by the field crew using hand-held GPS equipment.

Pavement Core samples were obtained at sixty-eight (68) locations using a portable electric stand-up core drill with a 6-inch diameter diamond tipped core drill bit. Upon removal of the asphalt core, a hand-held power auger and a hand operated bucket-type auger were used to loosen the base course material and to clean out the borehole. Subsequent down-hole field measurements were made using a surveyor's tape to document the approximate thickness and composition of the encountered pavement base course materials.

Representative samples of the base course, obtained from the hand bucket-type auger, were placed in moisture proof bags and transported to our laboratory. The samples were then examined by a geotechnical engineer in the lab to confirm the field classifications.

4.2 SOIL BORINGS

The field exploration program to evaluate the existing subsurface conditions consisted of drilling eighty-six (86) SPT borings. Fifty (50) of the SPT soil borings were drilled to depths of fifteen (15) feet below the existing ground surface within the various seven (7) neighborhoods and thirty-six (36) of the SPT borings were drilled to depths of 50 feet in the vicinity of the seawall and pump station locations. The approximate locations of the SPT borings are depicted on the attached Boring Location Plan, Sheets 2A through 2Q. Latitude and Longitude coordinates of the test locations were obtained by the field crew using hand-held GPS equipment and are listed on the attached Subsurface Profiles, Sheets 3A through 10D.

The SPT borings were performed in general accordance with ASTM D 1586, “Standard Test Method for the Standard Penetration Test and Split-Barrel Sampling”. Upon retrieval, the split-spoon, soil samples were visually classified and placed in moisture proof containers for transportation to our laboratory. Each borehole was backfilled with neat cement grout to the ground surface after the completion of drilling, sampling and monitoring operations.

4.3 GROUNDWATER LEVEL MEASUREMENTS

After completion of the borings and after a short stabilization period, the depth to the groundwater was measured from the existing ground surface in each boring. The measured groundwater depth/elevation is plotted adjacent to the soil profiles shown on the attached *Subsurface Profiles*, Sheets 3A through 10D.

5.0 LABORATORY TESTING

5.1 GENERAL

Representative soils samples collected from the borings were visually reviewed in the laboratory by a RADISE Geotechnical Engineer to confirm field classifications. The samples were classified in general accordance with the Unified Soil Classification System (USCS). The classifications were based on visual observations supplemented by laboratory test results performed on selected representative SPT samples. Laboratory index tests consisting of Full Sieve Analysis, Percent Passing No. 200 Sieve, Moisture, Atterberg limits, and Organics Content tests were performed on selected samples to further confirm and finalize field soils classifications.

5.2 LABORATORY TEST RESULTS

Test assignments were provided by a Geotechnical Engineer during the laboratory review of secured soil samples. Laboratory assignments were made to supplement and confirm soil classification at each general boring location.

The following list summarizes the types and numbers of laboratory tests performed.

- Ninety-six (96) Moisture Content Tests (ASTM D 2216).
- Sixty-two (62) Organics Content Tests (ASTM 2216 D).
- Twenty-six (26) Full Sieve Analysis Test (ASTM D422).
- Fifteen (15) Percent Passing No. 200 Sieve Tests (ASTM D 1140).
- Three (3) Atterberg limits tests (ASTM D 4318).

All of the laboratory test results are presented on the attached *Subsurface Profiles*, Sheet 3A through 10D, and on Table A - *Laboratory Test Results Summary* in Appendix A.

6.0 SURFACE AND SUBSURFACE EXPLORATION

6.1 STRATIGRAPHY

Stratification of the explored soils is based on visual examination of the recovered soil samples, index testing, laboratory classification and interpretation of the field boring logs by a geotechnical engineer in accordance with the Unified Soil Classification System (USCS). Subsurface profiles showing the soil stratification at the boring locations were developed and are presented on the attached *Subsurface Profiles*, Sheets 3A through 10D. Stratification lines represent approximate boundaries between soil types, but the actual transition between layers may be gradual or abrupt. Additionally, soil and groundwater conditions will vary between boring locations.

The soils encountered in all eighty-six (86) of the soil borings generally consist of sand with varying amounts of silt and limestone fragments mostly underlain by limestone. Some of the borings encountered a layer of soil containing appreciable amounts of organic matter. Generalized descriptions of the soil stratigraphy are provided in Table 3:

TABLE 3 - STRATIGRAPHY

Stratum No.	Description	USCS Class.
1	Brown, fine to medium SAND, occasionally with Gravel, Limestone fragments, and Silt	SP, SP-SM
2	Gray, fine to medium Silty SAND, occasionally with Gravel and Limestone fragments	SM
3	Gray, Sandy SILT	ML
4	Tan to gray, LIMESTONE	-
5	Tan, Sandy LIMESTONE	-
6	Dark Brown Organic Material	PT

It is noted that the Layer 6 Dark Brown Organic Material were primarily encountered in the borings performed in the River Oaks, Seven Isles, and Victoria Park neighborhoods. Review of the boring logs and boring locations for the River Oaks neighborhood area indicates organic material was encountered in the borings performed in an undeveloped, wooded area adjacent to the east side of Interstate I-95 and just south of the South Fork New River. It appears this area contains a layer of fill soils placed over organic soils along the south side of the South Fork New River. Review of the boring logs and boring locations for the Seven Isles and Victoria Park neighborhood areas indicates there appear to be layers of fill soils which were placed over remnant buried mangrove preserve areas along the Intracoastal Waterway. This land reclamation occurred during early development periods in the history of the coastal Ft. Lauderdale area.

Table 4 summarizes the borings, depths and thickness of the Stratum 6 soils that contain 5.3 to 67.3 percent organics encountered:

TABLE 4 – STRATUM 6 SOILS (PEAT)

Boring No.	Depth from (feet)	Depth to (feet)	Organic layer thickness (feet)
R-9	2	6	4
R-10	2	4	2
R-12	4	6	2
S-2	4	10	6
S-3	6	8	2
S-4	4	8	4
S-5	4	10	6
S-8	2	6	4
S-14	4	9	5
S-15	4	9	5
S-16	4	6	2
S-17	4	12	8
S-18	4	12	8
S-19	4	12	8
S-20	4	8	4
S-21	4	6	2
S-22	8	12	4
S-23	8	12	4
S-23	8	10	2
S-27	8	10	2
S-28	0	2	2
S-29	6	10	4
S-30	2	6	4

Boring No.	Depth from (feet)	Depth to (feet)	Organic layer thickness (feet)
S-30	10	15	5
V-1	4	8	4
V-7	4	8	4
V-8	4	10	6
V-10	8	10	2

6.2 GROUNDWATER LEVELS

Groundwater was encountered in each of the SPT borings. The groundwater level varied between 0.5 to 6.5 feet below the existing ground surface. It is our recommendation that the seasonal high groundwater table levels along the various project infrastructure alignments, be based on the normal high tide water levels of the adjacent waterways existing near the various neighborhood project areas and with additional geotechnical explorations. In inland areas not directly influenced by the water levels in the adjacent waterways and canals, normal high groundwater levels can be expected to be on the order of as much as two feet above the measured groundwater levels in the borings. It should be noted that the groundwater levels will fluctuate with variations of precipitation.

Borings P-4 and P-7 encountered groundwater at 0.5 feet below the existing ground surface. These two borings were performed in the Progresso neighborhood and the high groundwater is suspected to be caused by adjacent exfiltration trenches which were filled up from recent storm events.

7.0 ENGINEERING CONSIDERATIONS AND RECOMMENDATIONS

The soils encountered in the majority of the borings performed for this study will be suitable for the proposed construction. However, it was previously noted that the portions of the River Oaks, Victoria Park and Seven Isles areas are likely historical land reclamation areas. These areas as well as several others in the surrounding region, were infilled sometime in the historical past to facilitate the construction of the present residential communities.

The presence of the buried organics will be problematic to the installation of underground utilities especially when the inverts of such systems are founded in the organic layers. Such organics have very low shear strengths and will not support significant excavations made within or through them. As such, it is anticipated that the significant use of sliding trench boxes/shoring/sheet piling will be required to install infrastructure systems in this area.

Lift station structures are anticipated to be constructed well into the underlying sands and limestones. Uplift flotation resistance may be a concern for their design and construction. The buried organics encountered are expected to have little effect on the stability of the wet well structures in the ground since the bottom of the wet wells will be bearing in the sand and limestone layers. Sheet piling will likely be required to support excavations for these deep structures.

Valve vault and pavement structures are anticipated to be constructed above the buried organics. The organic material can remain in-place and a geogrid layer can be placed below the bottom of the valve vault and pavement bedding materials during construction.

7.1 SEAWALL STRUCTURE DESIGN RECOMMENDATIONS

We understand new seawalls are proposed on to be constructed within 18 inches on the water side of the existing seawalls. A #57 stone backfill is proposed for filling between the existing seawalls and the new seawalls. Twelve (12) separate seawall segments are proposed. Twenty-three (23) SPT borings were performed for the seawall structures. The adjacent roadway or park, approximate wall length, and borings performed for each wall are presented in Table 5:

Table 5 – Sea Wall Locations and Lengths

Seawall Number	Adjacent to	Approximate Length of Wall (feet)	Borings
Seawall 9	Victoria Park	110	S-28
Seawall 10	NE 23 rd Avenue	275	S-29
Seawall 12	E Las Olas Boulevard	90	S-15
Seawall 13	E Las Olas Boulevard	80	S-14
Seawall 14	E Las Olas Boulevard	90	S-13
Seawall 15	Isle of Palms Drive	910	S-9 through S-12
Seawall 17	SE 5 th Street	170	S-8
Seawall 29	Cordova Road	2,440	S-17 through S-23
Seawall 30	SE 10 th Street	360	S-26 and S-27
Seawall 32	Mola Avenue	215	S-16
Seawall 34	Barcelona Drive	110	S-30
Seawall 35	SE 8 th Street	550	S-24 and S-25

7.1.1 SOIL DESIGN PARAMETERS FOR SEAWALLS

Geotechnical soil design parameters for the seawall systems were derived based on field data, laboratory test data, established empirical correlations based on SPT N-values, and our experience. The design soil parameters were developed on an average boring soil profile/per wall basis.

The proposed seawalls will be subjected to lateral earth pressures. The final design elevation of the wall base was not decided and provided at the time of this study. The seawalls will be subjected to lateral at-rest or active earth pressures acting in the direction of the adjacent canal. We have also assumed that adequate drainage provisions will be incorporated into the wall design as needed to prevent hydrostatic build up behind the walls where practical.

The lateral active earth pressures acting on the roadway side of the seawalls, will primarily be resisted by the lateral wall resistance resulting from the wall embedment below the canal side ground elevation exterior face of the wall. The recommend soil parameters with respect to strata are presented in Tables 6 through 17. Input parameters for LPILE are also included in Tables 6 through 17. LPILE is a special-purpose program published by ENSOFT Inc and is used for analyzing a single pile (or drilled shaft) under lateral loading using the p-y method.

Table 6 – Recommended Soil Parameters for Seawall #9 (Boring S-28)

Depth ¹ (ft. – ft.)	Average N _{ES}	Recommended Values					Earth Pressure (Rankine's) Coefficients			LPILE Parameters			Soil Class. (USCS/ Soil Type)
		Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Wall Friction Angle (Degrees)		Active, K _a	Passive, K _p	At rest, K _o	Cohesion (psf)	Subgrade Modulus (k, pci)	E50 ²	
0 – 2	4	22	75	13	11	14	0.455	2.198	0.625	–	5	–	PT
2 – 4	4	29	102	40	16	22	0.347	2.882	0.515	–	10	–	SM
4 – 6	14	36	110	48	19	26	0.260	3.852	0.412	–	30	–	Limestone
6 – 10	6	30	105	43	16	23	0.333	3.000	0.500	–	12	–	Limestone
10 – 20	15	37	110	48	20	26	0.249	4.023	0.398	–	35	–	Limestone
20 – 25	1	28	105	43	15	21	0.361	2.770	0.531	–	5	–	Limestone
25 – 30	29	40	115	53	22	26	0.217	4.599	0.357	4,000	1,000	0.004	Limestone ³
30 – 40	76	38	115	53	17	22	0.238	4.204	0.384	–	125	–	SP
40 – 45	4	29	105	43	16	22	0.347	2.882	0.515	–	10	–	Limestone
45 – 50	12	36	110	48	19	26	0.260	3.852	0.412	–	25	–	Limestone

Note: 1. Depth below the existing ground surface.

2. E50 is soil stain parameters for LPILE software analysis.

3. Hard Limestone layer should be modeled as Hard to Stiff Clay in LPILE software analysis.

4. Wall friction angle is based on Table 3-3 in the US Army Corps of Engineers Manual (Design of Sheet Pile Walls, EM 1110-2-2504).

Table 7 – Recommended Soil Parameters for Seawall #10 (Boring S-29)

Depth ¹ (ft. – ft.)	Average N _{ES}	Recommended Values					Earth Pressure (Rankine's) Coefficients			LPILE Parameters			Soil Class. (USCS/ Soil Type)
		Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Wall Friction Angle (Degrees)		Active, K _a	Passive, K _p	At rest, K _o	Cohesion (psf)	Subgrade Modulus (k, pci)	E50 ²	
0 – 6	17	32	114	52	17	22	0.307	3.255	0.470	–	40	–	SP, SP-SM
6 – 10	11	24	82	20	12	15	0.422	2.371	0.593	–	10	–	PT
10 – 40	18	38	110	48	21	26	0.238	4.204	0.384	–	45	–	Limestone
40 – 50	34	40	115	53	22	26	0.217	4.599	0.357	4,000	1,000	0.004	Limestone ³

Note: 1. Depth below the existing ground surface.

2. E50 is soil stain parameters for LPILE software analysis.

3. Hard Limestone layer should be modeled as Hard to Stiff Clay in LPILE software analysis.

4. Wall friction angle is based on Table 3-3 in the US Army Corps of Engineers Manual (Design of Sheet Pile Walls, EM 1110-2-2504).

Table 8 – Recommended Soil Parameters for Seawall #12 (Boring S-15)

Depth ¹ (ft. – ft.)	Average NES	Recommended Values					Earth Pressure (Rankine's) Coefficients			LPILE Parameters			Soil Class. (USCS/ Soil Type)
		Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Wall Friction Angle (Degrees)		Active, Ka	Passive, Kp	At rest, Ko	Cohesion (psf)	Subgrade Modulus (k, pci)	E50 ²	
0 – 4	14	31	110	48	17	22	0.320	3.124	0.485	–	30	–	SP, SP-SM
4 – 9	5	22	75	13	11	14	0.455	2.198	0.625	–	5	–	PT
9 – 50	17	37	110	48	20	26	0.249	4.023	0.398	–	40	–	Limestone

Note: 1. Depth below the existing ground surface.

2. E50 is soil stain parameters for LPILE software analysis.

3. Wall friction angle is based on Table 3-3 in the US Army Corps of Engineers Manual (Design of Sheet Pile Walls, EM 1110-2-2504).

Table 9 – Recommended Soil Parameters for Seawall #13 (Boring S-14)

Depth ¹ (ft. – ft.)	Average NES	Recommended Values					Earth Pressure (Rankine's) Coefficients			LPILE Parameters			Soil Class. (USCS/ Soil Type)
		Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Wall Friction Angle (Degrees)		Active, Ka	Passive, Kp	At rest, Ko	Cohesion (psf)	Subgrade Modulus (k, pci)	E50 ²	
0 – 4	14	32	114	52	17	22	0.307	3.255	0.470	–	30	–	SP, SP-SM
4 – 9	6	22	75	13	11	14	0.455	2.198	0.625	–	5	–	PT
9 – 50	15	37	110	48	20	26	0.249	4.023	0.398	–	35	–	Limestone

Note: 1. Depth below the existing ground surface.

2. E50 is soil stain parameters for LPILE software analysis.

3. Wall friction angle is based on Table 3-3 in the US Army Corps of Engineers Manual (Design of Sheet Pile Walls, EM 1110-2-2504).

Table 10 – Recommended Soil Parameters for Seawall #14 (Boring S-13)

Depth ¹ (ft. – ft.)	Average N _{ES}	Recommended Values					Earth Pressure (Rankine's) Coefficients			LPILE Parameters			Soil Class. (USCS/ Soil Type)
		Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Wall Friction Angle (Degrees)		Active, K _a	Passive, K _p	At rest, K _o	Cohesion (psf)	Subgrade Modulus (k, pci)	E50 ²	
0 – 2	17	32	114	52	17	22	0.307	3.255	0.470	–	40	–	SP
2 – 8	10	30	106	44	16	22	0.333	3.000	0.500	–	20	–	SP-SM (Gravelly Sand)
8 – 10	6	30	106	44	16	22	0.333	3.000	0.500	–	12	–	SM
10 – 35	18	38	110	48	21	26	0.238	4.204	0.384	–	45	–	Limestone
35 – 40	10	30	105	43	16	22	0.333	3.000	0.500	–	20	–	Limestone
40 – 50	26	40	115	53	22	26	0.217	4.599	0.357	4,000	1,000	0.004	Limestone ³

- Note: 1. Depth below the existing ground surface.
2. E50 is soil stain parameters for LPILE software analysis.
3. Hard Limestone layer should be modeled as Hard to Stiff Clay in LPILE software analysis.
4. Wall friction angle is based on Table 3-3 in the US Army Corps of Engineers Manual (Design of Sheet Pile Walls, EM 1110-2-2504).

Table 11 – Recommended Soil Parameters for Seawall #15 (Boring S-10)

Depth ¹ (ft. – ft.)	Average N _{ES}	Recommended Values					Earth Pressure (Rankine's) Coefficients			LPILE Parameters			Soil Class. (USCS/ Soil Type)
		Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Wall Friction Angle (Degrees)		Active, K _a	Passive, K _p	At rest, K _o	Cohesion (psf)	Subgrade Modulus (k, pci)	E50 ²	
0 – 4	17	32	114	52	17	22	0.307	3.255	0.470	–	40	–	SP-SM
4 – 8	9	30	106	44	16	22	0.333	3.000	0.500	–	17	–	SP
8 – 20	15	37	110	48	20	26	0.249	4.023	0.398	–	35	–	Limestone
20 – 25	10	30	105	43	16	22	0.333	3.000	0.500	–	20	–	Limestone
25 – 45	13	36	110	48	19	26	0.260	3.852	0.412	–	30	–	Limestone
9 – 50	10	30	105	43	16	22	0.333	3.000	0.500	–	20	–	Limestone

- Note: 1. Depth below the existing ground surface.
2. E50 is soil stain parameters for LPILE software analysis.
3. Wall friction angle is based on Table 3-3 in the US Army Corps of Engineers Manual (Design of Sheet Pile Walls, EM 1110-2-2504).
4. Wall friction angle is based on Table 3-3 in the US Army Corps of Engineers Manual (Design of Sheet Pile Walls, EM 1110-2-2504).

Table 12 – Recommended Soil Parameters for Seawall #17 (Boring S-8)

Depth ¹ (ft. – ft.)	Average N _{ES}	Recommended Values					Earth Pressure (Rankine's) Coefficients			LPILE Parameters			Soil Class. (USCS/ Soil Type)
		Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Wall Friction Angle (Degrees)		Active, K _a	Passive, K _p	At rest, K _o	Cohesion (psf)	Subgrade Modulus (k, pci)	E50 ²	
0 – 2	14	31	110	48	17	22	0.320	3.124	0.485	–	32	–	SP
2 – 6	5	22	75	13	11	14	0.455	2.198	0.625	–	5	–	PT
6 – 10	10	30	106	44	16	22	0.333	3.000	0.500	–	20	–	SP-SM
10 – 15	19	31	110	48	11	14	0.320	3.124	0.485	–	30	–	ML
15 – 40	17	37	110	48	20	26	0.249	4.023	0.398	–	40	–	Limestone
40 – 50	33	40	115	53	22	26	0.217	4.599	0.357	4,000	1,000	0.004	Limestone ³

Note: 1. Depth below the existing ground surface.

2. E50 is soil stain parameters for LPILE software analysis.

3. Hard Limestone layer should be modeled as Hard to Stiff Clay in LPILE software analysis.

4. Wall friction angle is based on Table 3-3 in the US Army Corps of Engineers Manual (Design of Sheet Pile Walls, EM 1110-2-2504).

Table 13 – Recommended Soil Parameters for Seawall #29 (Boring S-22)

Depth ¹ (ft. – ft.)	Average N _{ES}	Recommended Values					Earth Pressure (Rankine's) Coefficients			LPILE Parameters			Soil Class. (USCS/ Soil Type)
		Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Wall Friction Angle (Degrees)		Active, K _a	Passive, K _p	At rest, K _o	Cohesion (psf)	Subgrade Modulus (k, pci)	E50 ²	
0 – 4	11	31	110	48	17	22	0.320	3.124	0.485	–	22	–	SP
4 – 12	1	20	66	70	8	14	0.490	2.040	0.658	–	2	–	PT/CL
12 – 20	20	38	110	48	21	26	0.238	4.204	0.384	–	50	–	Limestone
20 – 25	10	30	105	43	16	23	0.333	3.000	0.500	–	20	–	Limestone
25 – 38	11	31	110	48	17	22	0.320	3.124	0.485	–	22	–	SP
38 – 50	14	36	110	48	19	26	0.260	3.852	0.412	–	32	–	Limestone

Note: 1. Depth below the existing ground surface.

2. E50 is soil stain parameters for LPILE software analysis.

3. Wall friction angle is based on Table 3-3 in the US Army Corps of Engineers Manual (Design of Sheet Pile Walls, EM 1110-2-2504).

Table 14 – Recommended Soil Parameters for Seawall #30 (Boring S-26)

Depth ¹ (ft. – ft.)	Average N _{ES}	Recommended Values					Earth Pressure (Rankine's) Coefficients			LPILE Parameters			Soil Class. (USCS/ Soil Type)
		Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Wall Friction Angle (Degrees)		Active, K _a	Passive, K _p	At rest, K _o	Cohesion (psf)	Subgrade Modulus (k, pci)	E50 ²	
0 – 4	26	35	120	58	17	22	0.271	3.690	0.426	–	68	–	SP
4 – 8	15	32	114	52	17	22	0.307	3.255	0.470	–	35	–	SP-SM
8 – 10	4	22	75	13	11	14	0.455	2.198	0.625	–	5	–	PT
10 – 20	27	40	115	53	22	26	0.217	4.599	0.357	4,000	1,000	0.004	Limestone ³
20 – 25	4	29	105	43	16	22	0.347	2.882	0.515	–	10	–	Limestone
25 – 35	14	37	110	48	20	26	0.249	4.023	0.398	–	32	–	Limestone
35 – 40	10	30	105	43	16	23	0.333	3.000	0.500	–	20	–	Limestone
40 – 50	12	36	110	48	19	26	0.260	3.852	0.412	–	25	–	Limestone

Note: 1. Depth below the existing ground surface.

2. E50 is soil stain parameters for LPILE software analysis.

3. Hard Limestone layer should be modeled as Hard to Stiff Clay in LPILE software analysis.

4. Wall friction angle is based on Table 3-3 in the US Army Corps of Engineers Manual (Design of Sheet Pile Walls, EM 1110-2-2504).

Table 15 – Recommended Soil Parameters for Seawall #32 (Boring S-16)

Depth ¹ (ft. – ft.)	Average N _{ES}	Recommended Values					Earth Pressure (Rankine's) Coefficients			LPILE Parameters			Soil Class. (USCS/ Soil Type)
		Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Wall Friction Angle (Degrees)		Active, K _a	Passive, K _p	At rest, K _o	Cohesion (psf)	Subgrade Modulus (k, pci)	E50 ²	
0 – 4	12	31	110	48	17	22	0.320	3.124	0.485	–	25	–	SP
4 – 6	9	24	82	20	12	15	0.422	2.371	0.593	–	10	–	PT
6 – 10	6	30	106	44	16	22	0.333	3.000	0.500	–	12	–	SP
10 – 30	16	37	110	48	20	26	0.249	4.023	0.398	–	38	–	Limestone
30 – 35	29	40	115	53	22	26	0.217	4.599	0.357	4,000	1,000	0.004	Limestone ³
35 – 50	20	38	110	48	21	26	0.238	4.204	0.384	–	50	–	Limestone

Note: 1. Depth below the existing ground surface.

2. E50 is soil stain parameters for LPILE software analysis.

3. Hard Limestone layer should be modeled as Hard to Stiff Clay in LPILE software analysis.

4. Wall friction angle is based on Table 3-3 in the US Army Corps of Engineers Manual (Design of Sheet Pile Walls, EM 1110-2-2504).

Table 16 – Recommended Soil Parameters for Seawall #34 (Boring S-30)

Depth ¹ (ft. – ft.)	Average N _{ES}	Recommended Values					Earth Pressure (Rankine's) Coefficients			LPILE Parameters			Soil Class. (USCS/ Soil Type)
		Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Wall Friction Angle (Degrees)		Active, K _a	Passive, K _p	At rest, K _o	Cohesion (psf)	Subgrade Modulus (k, pci)	E50 ²	
0 – 2	16	32	114	52	17	22	0.307	3.255	0.470	–	37	–	SP
2 – 6	12	24	82	20	11	14	0.422	2.371	0.593	–	10	–	PT
6 – 10	4	29	102	40	16	22	0.347	2.882	0.515	–	10	–	SP
10 – 15	21	25	86	24	11	14	0.406	2.464	0.577	–	15	–	PT
15 – 20	15	37	110	48	20	26	0.249	4.023	0.398	–	35	–	Limestone
20 – 30	26	40	115	53	22	26	0.217	4.599	0.357	4,000	1,000	0.004	Limestone ³
30 – 50	19	38	110	48	21	26	0.238	4.204	0.384	–	47	–	Limestone

Note: 1. Depth below the existing ground surface.
2. E50 is soil stain parameters for LPILE software analysis.
3. Hard Limestone layer should be modeled as Hard to Stiff Clay in LPILE software analysis.
4. Wall friction angle is based on Table 3-3 in the US Army Corps of Engineers Manual (Design of Sheet Pile Walls, EM 1110-2-2504).

Table 17 – Recommended Soil Parameters for Seawall #35 (Boring S-25)

Depth ¹ (ft. – ft.)	Average N _{ES}	Recommended Values					Earth Pressure (Rankine's) Coefficients			LPILE Parameters			Soil Class. (USCS/ Soil Type)
		Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Wall Friction Angle (Degrees)		Active, K _a	Passive, K _p	At rest, K _o	Cohesion (psf)	Subgrade Modulus (k, pci)	E50 ²	
0 – 4	17	32	114	52	17	22	0.307	3.255	0.470	–	40	–	SP
4 – 10	11	31	110	48	17	22	0.320	3.124	0.485	–	22	–	SP
10 – 50	16	37	110	48	20	26	0.249	4.023	0.398	–	37	–	Limestone

Note: 1. Depth below the existing ground surface.
2. E50 is soil stain parameters for LPILE software analysis.
3. Wall friction angle is based on Table 3-3 in the US Army Corps of Engineers Manual (Design of Sheet Pile Walls, EM 1110-2-2504).

7.2 FOUNDATION RECOMMENDATIONS FOR PUMP STATIONS

Based on the geotechnical exploration and providing the subgrade preparation procedures presented below are followed, it is our opinion that the sites are suitable for the planned pump station construction. The proposed structures may be supported on a mat foundation.

Following the in-situ foundation preparation recommendations below, the proposed structure foundations may bear within the prepared existing sands and limestones beneath the organic materials. The net allowable soil bearing pressures are provided in Tables 18 through 29. The net bearing pressure is defined as the soil bearing pressure at the foundation bearing level in excess of the natural overburden pressure at that level. To verify suitable bearing, we recommend that the foundation excavation subgrade be checked by a geotechnical engineer just prior to mat rebar placement. The excavation bottom should be kept as dry as practically possible during construction.

Resistance to lateral loads can be derived from 1) passive pressure acting on the sides of the foundations and any grade beams, and 2) lateral resistance along the base of the foundations. Lateral resistance derived from friction between the soil and the bases of the footings should be calculated based on a friction factor of 0.35 times the base contact bearing pressure. Passive resistance of the upper foot of soil should be neglected, unless it is confined by a slab or pavement. Passive resistance on the sides of the foundations should be ignored if these soils can be hypothetically washed away during a hurricane storm event.

A subgrade modulus of 250 psi/in may be used in the design of a mat/raft foundation provided that the subgrade and subsequent engineered granular fill is prepared as described below. A 6-inch leveling layer of clean (less than 5% passing a #200 sieve) granular fill is recommended to be placed directly below slab-on-grade floors where appropriate. The granular fill should be compacted until densities of at least 95% of the maximum dry density as determined by ASTM D1557, the Modified Proctor method. Based on our assumption of a structure supported on a shallow footing or mat foundation system, the total settlement should be less than 1.0 inches, and differential settlements should be less than 0.50 inches.

7.2.1 RECOMMENDED SOIL PARAMETERS FOR PUMP STATION DESIGN

Underground pump stations for this project will need to be designed to resist pressures exerted by the adjacent soils and hydrostatic uplift head conditions on the base of the structure. For walls that are not restrained during backfilling but are free to rotate at the top, active earth pressure should be used in design. Walls that are restrained should be designed assuming at-rest pressures. Recommended soil parameters for the soils encountered at the sites are given in Tables 18 through 29.

Table 18 – SPT BORING DR-1

Boring depth (ft - ft)	Average N _{AUTO}	Average N _{ES}	Recommended Values			Earth Pressure Coefficients			Bearing Capacity (psf)
			Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Active, K _a	Passive, K _p	At rest, K _o	
0 - 8	7	8	30	108	46	0.333	3.000	0.500	1250
8 - 10	2	2	29	106	44	0.347	2.882	0.515	400
10 - 25	15	18	33	114	52	0.295	3.392	0.455	2500
25 - 30	13	16	32	112	50	0.307	3.255	0.470	3000
30 - 50	28	34	40	128	66	0.217	4.599	0.357	4000

Table 19 – SPT BORING DR-2

Boring depth (ft - ft)	Average N _{AUTO}	Average N _{ES}	Recommended Values			Earth Pressure Coefficients			Bearing Capacity (psf)
			Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Active, K _a	Passive, K _p	At rest, K _o	
0 - 2	7	9	30	108	46	0.333	3.000	0.500	1250
2 - 4	9	11	31	110	48	0.320	3.124	0.485	1800
4 - 6	6	7	30	108	46	0.333	3.000	0.500	1200
6 - 10	3	4	29	106	44	0.347	2.882	0.515	500
10 - 30	13	16	32	112	50	0.307	3.255	0.470	3000
30 - 50	23	29	40	128	66	0.217	4.599	0.357	4000

Table 20 – SPT BORING P-5

Boring depth (ft - ft)	Average N _{AUTO}	Average N _{ES}	Recommended Values			Earth Pressure Coefficients			Bearing Capacity (psf)
			Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Active, K _a	Passive, K _p	At rest, K _o	
0 - 2	7	9	30	108	46	0.333	3.000	0.500	1200
2 - 4	11	14	31	110	48	0.320	3.124	0.485	2000
4 - 10	7	9	30	108	46	0.333	3.000	0.500	1500
10 - 30	13	16	32	112	50	0.307	3.255	0.470	3000
30 - 50	19	24	39	126	64	0.228	4.395	0.371	4000

Table 21 – SPT BORING P-6

Boring depth (ft - ft)	Average N _{AUTO}	Average N _{ES}	Recommended Values			Earth Pressure Coefficients			Bearing Capacity (psf)
			Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Active, K _a	Passive, K _p	At rest, K _o	
0 - 2	4	5	29	106	44	0.347	2.882	0.515	750
2 - 4	9	11	31	110	48	0.320	3.124	0.485	1500
4 - 10	6	7	30	108	46	0.333	3.000	0.500	1000
10 - 30	13	16	32	112	50	0.307	3.255	0.470	3000
30 - 50	19	24	39	126	64	0.228	4.395	0.371	4000

Table 22 – SPT BORING R-9

Boring depth (ft - ft)	Average N _{AUTO}	Average N _{ES}	Recommended Values			Earth Pressure Coefficients			Bearing Capacity (psf)
			Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Active, K _a	Passive, K _p	At rest, K _o	
0 - 2	9	11	31	110	48	0.320	3.124	0.485	1500
2 - 6	7	9	27	102	40	0.376	2.663	0.546	1000
6 - 8	3	4	29	106	44	0.347	2.882	0.515	500
8 - 15	7	9	30	108	46	0.333	3.000	0.500	1500
15 - 25	14	17	32	112	50	0.307	3.255	0.470	2500
25 - 30	7	9	30	108	46	0.333	3.000	0.500	2500
30 - 50	10	12	31	110	48	0.320	3.124	0.485	3000

Table 23 – SPT BORING R-10

Boring depth (ft - ft)	Average N _{AUTO}	Average N _{ES}	Recommended Values			Earth Pressure Coefficients			Bearing Capacity (psf)
			Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Active, K _a	Passive, K _p	At rest, K _o	
0 - 2	9	11	31	110	48	0.320	3.124	0.485	1500
2 - 4	6	7	27	102	40	0.376	2.663	0.546	1000
4 - 6	9	11	31	110	48	0.320	3.124	0.485	1500
6 - 8	5	6	30	108	46	0.333	3.000	0.500	750
8 - 10	3	4	29	106	44	0.347	2.882	0.515	500
10 - 15	7	9	30	108	46	0.333	3.000	0.500	1250
15 - 20	9	11	31	110	48	0.320	3.124	0.485	1750
20 - 25	8	10	30	108	46	0.333	3.000	0.500	1750
25 - 50	11	14	31	110	48	0.320	3.124	0.485	2500

Table 24 – SPT BORING R-11

Boring depth (ft - ft)	Average N _{AUTO}	Average N _{ES}	Recommended Values			Earth Pressure Coefficients			Bearing Capacity (psf)
			Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Active, K _a	Passive, K _p	At rest, K _o	
0 - 4	7	8	30	108	46	0.333	3.000	0.500	1100
4 - 6	3	4	29	106	44	0.347	2.882	0.515	500
6 - 15	7	9	30	108	46	0.333	3.000	0.500	1250
15 - 30	19	24	34	116	54	0.283	3.537	0.441	3000
30 - 40	28	35	37	122	60	0.249	4.023	0.398	4000
40 - 50	19	24	34	116	54	0.283	3.537	0.441	4000

Table 25 – SPT BORING R-12

Boring depth (ft - ft)	Average N _{AUTO}	Average N _{ES}	Recommended Values			Earth Pressure Coefficients			Bearing Capacity (psf)
			Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Active, K _a	Passive, K _p	At rest, K _o	
0 - 4	8	10	30	108	46	0.333	3.000	0.500	1500
4 - 6	2	2	10	68	6	0.704	1.420	0.826	0
6 - 8	9	11	31	110	48	0.320	3.124	0.485	1500
8 - 15	6	7	30	108	46	0.333	3.000	0.500	1000
15 - 35	20	25	34	116	54	0.283	3.537	0.441	3000
35 - 40	29	36	35	118	56	0.271	3.690	0.426	4000
40 - 50	20	25	34	116	54	0.283	3.537	0.441	4000

Table 26 – SPT BORING S-6

Boring depth (ft - ft)	Average N _{AUTO}	Average N _{ES}	Recommended Values			Earth Pressure Coefficients			Bearing Capacity (psf)
			Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Active, K _a	Passive, K _p	At rest, K _o	
0 - 2	5	6	30	108	46	0.333	3.000	0.500	800
2 - 6	12	15	32	112	50	0.307	3.255	0.470	2100
6 - 8	7	9	30	108	46	0.333	3.000	0.500	1250
8 - 10	2	2	29	106	44	0.347	2.882	0.515	250
10 - 35	26	32	35	118	56	0.271	3.690	0.426	3000
35 - 50	6	7	30	108	46	0.333	3.000	0.500	2000

Table 27 – SPT BORING S-7

Boring depth (ft - ft)	Average N _{AUTO}	Average N _{ES}	Recommended Values			Earth Pressure Coefficients			Bearing Capacity (psf)
			Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Active, K _a	Passive, K _p	At rest, K _o	
0 - 2	5	6	30	108	46	0.333	3.000	0.500	800
2 - 6	10	12	31	110	48	0.320	3.124	0.485	1750
6 - 10	6	7	30	108	46	0.333	3.000	0.500	1000
10 - 20	31	38	40	128	66	0.217	4.599	0.357	3500
20 - 25	9	11	31	110	48	0.320	3.124	0.485	2500
25 - 35	15	19	38	124	62	0.238	4.204	0.384	2750
35 - 40	7	9	30	108	46	0.333	3.000	0.500	2500
40 - 50	12	15	37	122	60	0.249	4.023	0.398	3000

Table 28 – SPT BORING V-8

Boring depth (ft - ft)	Average N _{AUTO}	Average N _{ES}	Recommended Values			Earth Pressure Coefficients			Bearing Capacity (psf)
			Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Active, K _a	Passive, K _p	At rest, K _o	
0 - 4	14	17	32	112	50	0.307	3.255	0.470	2500
4 - 10	3	4	10	68	6	0.704	1.420	0.826	0
10 - 20	10	12	36	120	58	0.260	3.852	0.412	1500
20 - 30	12	15	32	112	50	0.307	3.255	0.470	2500
30 - 50	35	43	40	128	66	0.217	4.599	0.357	4000

Table 29 – SPT BORING V-9

Boring depth (ft - ft)	Average N _{AUTO}	Average N _{ES}	Recommended Values			Earth Pressure Coefficients			Bearing Capacity (psf)
			Friction Angle (Degrees)	Total Unit Weight (pcf)	Submerged Unit Weight (pcf)	Active, K _a	Passive, K _p	At rest, K _o	
0 - 6	3	3	29	106	44	0.347	2.882	0.515	400
6 - 8	11	14	31	110	48	0.320	3.124	0.485	1500
8 - 15	6	7	30	108	46	0.333	3.000	0.500	1000
15 - 35	7	9	30	108	46	0.333	3.000	0.500	1500
35 - 50	11	14	36	120	58	0.260	3.852	0.412	2000

Design should incorporate hydrostatic effects. In order to avoid wall damage due to excessive compaction, hand operated mechanical tampers should be used to densify backfill soils. Heavy vibratory compaction equipment should not be allowed within five feet of walls. The soils behind walls should consist of clean sands as described in the Select Fill Composition, Placement and Compaction section of this report and should be compacted to approximately 95 percent of the material's modified Proctor (ASTM D-1557) maximum dry density.

7.2.2 AUGER CAST PILE RECOMMENDATIONS FOR LIFT STATION DESIGN

At the time of this report, three lift stations were proposed. The proposed locations and depths of the lift stations are presented in the following Table 30:

Table 30 – Lift Station Information

Lift Station Location	Bottom Depth from existing ground surface (feet)	Borings
Merle Fogg Park	12	S-6 and S-7
River Oaks Outfall	19	R-9 through R-12
Victoria Park	16	S-28

Due to the depth of the lift stations, buoyancy is a potential concern where the weight of concrete structure is not sufficient to resist uplift without using piles in tension. Auger cast piles are reportedly being proposed to counter act the buoyancy forces. An Augered Cast-In Place (ACIP) cast pile tension capacity of 35 tons is necessary to counteract the buoyancy forces.

The pile capacity estimate considers 16-inch diameter Auger Cast Piles. Estimates indicate the following:

- For the Merle Fogg Park lift station, ACIP piles tipped 50 feet below the existing ground surface can achieve approximately fifteen (15) tons of design tension capacity each.
- For the River Oaks lift station, piles tipped 50 feet below the existing ground surface can achieve approximately eight (8) tons of tension capacity each.
- For the Victoria Park lift station, piles tipped 50 feet below the existing ground surface can achieve approximately eight (8) tons of tension capacity each.

It should also be noted that additional uplift capacity can be achieved by overbuilding the Lift Station mat so that it protrudes a few to several feet beyond the walls of the structure. Under such a design, the submerged unit weight of the soils above the outer extending foundation mat lip will help hold the structure down. If the mat is enlarged enough, the weight of the exterior submerged soils above the extending lip may be able to resist a significant portion of the uplift. For analysis purposes, an average submerged unit weight of 62.4 pcf can be used for the Lift Station backfill for that soil volume directly around the structure and above the mat. Additionally, if the Lift station were to begin to rise, it would also have to shear the soil in a box type vertical plane surrounding the structure mat perimeter. This shear will add additional uplift resistance to the structure and can be calculated using a soil Φ (ϕ) value of 32 degrees times the average normal in-situ horizontal (K_o) effective (i.e. submerged) soil pressure along the vertical plane surrounding the structure.

7.3 FOUNDATION RECOMMENDATIONS FOR ELECTRICAL EQUIPMENT BUILDINGS

Our recommendations for foundation design and construction of the electrical equipment buildings are based on the following:

1. Two buildings are proposed,
 - a. One building is proposed at Merle Fogg Park, in the southeast quadrant of the intersection of E. Las Olas Boulevard and Poinciana Drive in the Southeast Isles Neighborhood. Borings S-6 and S-7 are located in this area.
 - b. The second building is proposed at the River Oaks-Outfall. The River Oaks Outfall is located in the west side of the River Oaks neighborhood, adjacent to the east side of I-95 and just south of the South Fork New River. Borings R-9 through R-12 are located in this area.
2. The buildings will be one-story in height, and will house electrical equipment.
3. The floor elevation of the buildings will be approximately 6 feet above current grade.
4. The anticipated foundation system will be a combination of continuous strip footings under walls and isolated spread footing under columns.

If this information is incorrect or changes, we should be notified so we can review our recommendations and revise them if necessary.

Based on the geotechnical exploration and providing that the subgrade preparation procedures presented below are followed, it is our opinion that the site is suitable for the planned building construction.

The proposed structure may be supported on shallow footings or preferably a raft mat type of foundation.

Following the in-situ foundation preparation recommendations herein, the proposed structure foundation may be designed using a net allowable soil bearing pressure of up to 1500 pounds per square foot (psf) bearing when founded within the densified existing sands. When founded within a well compacted, elevated fill pad constructed with select engineered granular fill, a net allowable soil bearing pressure of up to 2500 pounds per square foot (psf) bearing may be utilized.

The net bearing pressure is defined as the soil bearing pressure at the foundation bearing level more than the natural overburden pressure at that level. To verify suitable bearing, we recommend that the foundation excavation subgrade be checked by a RADISE geotechnical engineer just prior to concreting. The excavation bottom should be kept as dry as practical during construction.

A subgrade modulus of 200 psi/in may be used in the design of a mat/raft foundation if the subgrade and subsequent engineered granular fill is prepared as described below. A 6-inch layer of clean (less than 5% passing a #200 sieve) granular fill is recommended to be placed directly below slab-on-grade floors where appropriate. The granular fill should be compacted until densities of at least 95% of the maximum dry density as determined by ASTM D1557, the Modified Proctor method. This layer will aid in providing a capillary moisture break below the concrete slab. We also recommend a moisture vapor barrier be placed under all areas especially

where floors will have moisture sensitive coverings, or where stored materials are moisture sensitive.

To assure an adequate factor of safety against a shearing failure in the subsoils:

- Footing base should be at a depth of at least 18 inches below lowest adjacent grades.
- Continuous footings should be at least 16 inches wide.
- Isolated foundations should not be less than 30 inches wide.
- The required embedment depth may be reduced to 12 inches if a monolithic raft/ mat slab type of foundations is used.

7.3.1 RIVER OAKS OUTFALL ELECTRICAL EQUIPMENT BUILDING

For Merle Fogg Park, none of the borings performed in this location encountered any organic material. For the River Oaks Outfall, three of the four soil borings (R-9, R-10, and R-12) performed in the area of the proposed electrical equipment building encountered a 2 to 4 feet thick layer of organic material at depths ranging from 2 to 5 feet below the existing ground surface. The evaluation of the organic material layer is only relevant for the electrical equipment building, since the bearing depth of the foundation for the lift station structure is well below the organic material layer.

The foundation for the electrical equipment building is expected to bear above the organic material layer encountered in the borings. If the organic material layer is left in place below the electrical equipment building, some total and differential settlement (both short-term “immediate-type” will occur. Such settlements result from the weight of the structural fill and structure placed above the organic material and the associated short term primary settlement and long term “creep-type” secondary settlement inherent to compressible organic soil material. Settlement caused by the encountered organic material layer beneath the structure is expected to moderately affect the proposed electrical equipment building.

If moderate settlements of the electrical equipment building on the order of 3-4 inches is considered problematic, then we recommend that to eliminate settlement related issues, the organic material encountered in the borings be excavated and removed prior to construction of the electrical equipment building. Alternatively, the organic material can be left in place and the area preloaded with 5 feet of dumped and stacked fill to induce settlement similar to the increased stress caused by the construction of the proposed control building. Excavated organic material is generally not appropriate for reuse in other construction as it has a tendency to consolidate, erode and generally bio-degrade with time. Therefore, excavated organic material should be disposed of at a suitable on or off-site location.

7.4 PAVEMENT DESIGN CONSIDERATIONS

The following information is provided and intended as a guideline only, as the roadway or any replacements/repairs thereof, should be designed specifically for the vehicle load intensities for the respective roadways and frequencies anticipated during the life of the project. Flexible pavement systems in this south Florida geographic area, typically consist of an asphaltic concrete wearing course, limerock base course and a stabilized pavement subgrade. Based on our preliminary findings and analysis and experience in the area, the typical pavement section thicknesses shown in the following Table 30, are commonly used by local pavement design engineers.

TABLE 30: TYPICAL FLEXIBLE AND RIGID PAVEMENT DESIGN

TYPE OF PAVEMENT	LAYER	MATERIAL DESCRIPTION	LAYER THICKNESS		
			LIGHT DUTY	MEDIUM DUTY	HEAVY DUTY
Flexible	Asphaltic concrete	Florida DOT Asphalt Type S	1.5	1.75	2.0
	Base course	Crushed limerock with minimum LBR of 100, compacted to 98% of the Modified Proctor maximum dry density	6.0	7.0	8.0
	Stabilized subbase	Stabilized sub-base fill with a minimum LBR of 40 compacted to 95% of the Modified Proctor maximum dry density	12.0	12.0	12.0
Rigid	Concrete	Florida DOT Portland Cement Concrete	6.0	7.0	8.0
	Compacted subgrade	Natural in place soils compacted to at least 95 percent of the materials Modified Proctor maximum dry density	12.0	12.0	12.0

Comparison of the above typical design thicknesses with asphalt pavement measurements provided in Tables 1 and 2, Pages 1 through 6, indicates that most of the asphalt cores measured thickness would comply with or exceed the above typical design thicknesses for light duty pavements. The asphalt cores that do not comply with the above typical asphalt design thickness for light duty asphalt pavement were encountered at borings D-4, DR-5, E-1, P-4, R-4, R-8, and V-5. We suspect that the substandard asphalt thicknesses were likely adequate for the design traffic loading conditions at the time of the initial roadway design and construction. For the asphalt thickness that exceed the above recommended thicknesses, we suspect that asphalt mill and resurfacing overlays were installed over the original asphalt to repair distress.

From a base thickness perspective, thirty-eight (38) of the sixty-eight (68) base rock thickness measurements meet or exceeds a base rock thicknesses of 6 inches and are considered acceptable for light duty pavement design and use in light duty trafficked areas. However, given the thickness of the asphalt cores and a general rule of thumb that one inch of asphalt is equivalent to two inches of compacted limerock base, the combination of both of the measured base and asphalt material thicknesses would appear to provide a suitable pavement section thickness in most areas such that a pavement mill and re-surface program may prove cost effective. Further analyses of the pavement section will need to be provided by a civil pavement design engineer experienced with such evaluations. We suspect that the substandard base course thicknesses were adequate for the traffic loading during the initial roadway construction.

From a subgrade perspective, in our opinion the nature and composition of the subgrade soils at the location of the borings performed for this study would essentially be in compliance with typical pavement construction designs for light duty pavement section design.

Any new or re-constituted base course material should consist of crushed limestone having a minimum Limerock Bearing Ratio (LBR) of 100. Base materials should meet the requirements presented in the latest revisions of the Florida Department of Transportation "Specifications for Road and Bridge Construction", Section 911 (limestone). The base course should be compacted to at least ninety-eight (98) percent of its maximum dry modified proctor density (AASHTO T 180).

We recommend that any new pavement subgrade be stabilized to a depth of twelve (12) inches to achieve a minimum LBR of 40. If necessary, this LBR value can be achieved by blending base material (limerock) with the existing sandy subgrade soils. The required mixing ratio should be determined by laboratory testing. The stabilized subgrade should be compacted to at least ninety-eight (98) percent of its maximum dry as determined per ASTM D 1557, the Modified Proctor Method.

A Portland concrete pavement thickness in the range of eight (8) inches would also be recommended for the project if a rigid pavement is to be employed (the thickness would depend on specific pavement use). Any concrete pavement should be reinforced to withstand the anticipated traffic loadings and jointed to reduce the chances for rigid pavement crack development. The minimum rigid pavement thickness recommended above is based upon concrete with an unconfined compressive strength of at least 3,000 psi and a modulus of rupture of at least 450 psi. It should be noted that this recommendation is intended for the street pavement and not for concrete driveway aprons or sidewalks.

Actual pavement section thickness should be determined by the Design Civil Engineer based on traffic loads, volume, and the Owner's design life requirements. The above sections represent minimum thickness representative of typical local construction practices and, as such, periodic maintenance should be anticipated. All pavement materials and construction procedures should conform to FDOT, American Concrete Institute (ACI), and/or appropriate City or County requirements for roadway pavement construction.

7.4.1 PERVIOUS PAVEMENT DESIGN CONSIDERATIONS

The soil borings and laboratory test results indicate that most of the existing sands encountered are suitable for subgrade use in pervious pavement areas, as defined by the South Florida Water Management District (SFWMD). The sand subgrade soils should be compacted to a maximum density of 95% of the maximum dry density as determined by ASTM D1557, or AASHTO T180, to a minimum depth of 24 inches. As per the SFWMD specifications, subgrade stabilization is not required for sand type of soils (SP). If additional fill material is required to bring the subgrade to final elevation, it should be hydraulically clean (maximum of 10% silt or clay), and free of deleterious materials.

For redevelopment projects where the existing pavement section is to be removed; the compacted base should also be removed and the underlying subgrade soils scarified to a minimum depth of 20 inches. The subgrade should be re-graded and filled with clean (hydraulically clean and free of deleterious material) soils. The clean soils should be placed in 8-inch maximum layers and compacted to a maximum density of 95% of the Modified Proctor density within 3% of the optimum moisture content (ASTM D-1557, or AASHTO T180).

It is recommended by SFWMD that the Seasonal High Groundwater Table (SHGWT) elevation be greater than 24 inches below the bottom of any pervious pavement system. The pervious pavement system is suggested to include an underlying storage reservoir consisting of pea rock, #57 stone, etc. If utilized, the underlying storage reservoir should be wrapped with geo-fabric. SFWMD recommends that the underlying storage reservoir layer be no more than 36 inches thick. Runoff from adjacent landscaped areas should not be directed onto any pervious pavement system unless the adjacent landscape areas that drain onto the pervious pavement, will not increase sediment, silt, sand, or organic debris deposition on the pavement that increases the potential for clogging of the pervious pavement section. The site design should include measures to reduce the likelihood of silts and sands from entering and plugging the pervious pavement system void spaces.

Periodic vacuum sweeping of pervious pavements can be used and is recommended. For areas where wind transported soil (i.e. near sand dunes or other coastal areas), or other conditions where excessive soil or other material deposition can occur, vacuum sweeping should be utilized a minimum of twice a year.

7.5 CLEARING AND GRUBBING

Clearing and grubbing may be required in some of the proposed construction areas. Clearing and grubbing where required should include the complete removal and disposal of surficial grasses, associated root systems, topsoil, rubbish, debris, any demolition material/pavement and all other obstructions resting on or protruding through the surface of the existing ground and the surface of excavated areas.

7.6 UNDERGROUND UTILITIES

Existing underground utilities and structures are likely to be present in the proposed construction areas. These utilities need to be properly identified, and located and/or relocated as necessary to construct the new components of the project. The excavation bottoms of any relocated or replacement utilities should be cleaned of any undesirable materials prior to placing any engineered backfill.

Site preparation, excavation, and backfilling for new utilities or re-aligned utilities should follow all of the applicable recommendations of this report.

7.7 EXCAVATIONS

The project construction Contractor is solely responsible for making any utility or other excavations in a safe manner and to provide appropriate measures to retain side slopes to ensure that persons working in or near the excavation are protected. Any structural retaining walls shall be designed and sealed by a structural engineer registered in the State of Florida.

Excavations shall comply with Occupational Health and Safety Administration (OHSA) stipulations for Trench Excavation Safety including all temporary design and safety requirements. The soils encountered in the majority borings outside of the Victoria Park and Southeast Isles area, generally consist of relatively clean sands. OSHA 29 CFR part 1926 (Subpart P, Excavations) defines such soils as Type C soils. As such, the granular deposits encountered in the borings are readily capable of being excavated to a depth of several feet with standard backhoe construction equipment. As such, temporary side slopes in fully dewatered excavations could be made at a 1½H:1V inclination or flatter. Adjustment to this inclination and/or the use of sheeting, shoring or sliding trench boxes should be evaluated by the Contractor if other soil strata are encountered.

It is noted that in the Victoria Park, River Oaks, and Southeast Isles areas, that significant Muck deposits were encountered in the borings performed for these areas. Correspondingly, utilities installed in these areas are likely to encounter organic Muck deposits during the utility excavation and installation process requiring cleaning or removing of the Muck deposits prior to placing any engineered backfill as mentioned in section 7.10.

7.8 DEWATERING

At the time of the field exploration (i.e. September and October 2017), the groundwater encountered varied between 0.5 to 6.5 feet below the existing ground surface. In-the-dry construction of the underground utilities may require groundwater lowering and control of groundwater seepage depending on the design installation depths. Dewatering of the excavations may necessitate the use of sumps, wells, wellpoints or combinations thereof. Control of groundwater should be accomplished in a manner that preserves the integrity of the in-situ soils and limestones and does not cause instability of the excavation sidewalls. The dewatering system employed should be capable of maintaining a pre-drained surface a minimum of 24 inches below the excavation bottoms.

7.9 PIPE BEDDING

Most of the sands encountered in the borings are expected to provide good support for utility pipelines without the need for bedding when the invert elevations are at least 24 inches above the groundwater level (natural or pre-drained by dewatering). Should or where organics or other deleterious materials be encountered at or within 2 feet below the pipe invert, such soils shall be considered compressible and unsuitable for pipe support. These soils should be over-excavated and replaced with compacted clean sand or FDOT No. 57 coarse aggregate or an approved equivalent. If FDOT No. 57 stone or an approved equivalent is utilized, such stone material will need to be encapsulated and/or covered with a geosynthetic fabric especially beneath pavement areas. Such fabric material is needed to prevent granular excavation soils and trench backfill from penetrating/settling into the void volumes of the open stone resulting in loss of ground and eventual settlement of the ground surface above the piping.

The bedding surface should be uniformly compacted to a density of not less than 95 percent of the maximum dry density in accordance with ASTM D 1557, the Modified Proctor Method.

7.10 TRENCH BACKFILL AND COMPACTION

Soils used to backfill utility excavations should consist of clean sands having no materials larger than one inch in size, not more than ten (10) percent passing the U.S. Standard No. 200 sieve, and not more than three (3) percent organics or other deleterious materials by weight. Some of the subsurface soils encountered at these neighborhood sites appear to meet these criteria and are suitable for reuse as backfill once inspected, tested and approved.

Granular backfill should be placed at a moisture content within three (3) percent of its ASTM D 1557 determined optimum moisture and in level lifts whose thickness does not exceed eight (8) inches. Each fill lift should be stable, unyielding and uniformly compacted to at least 95 percent of the maximum dry density in accordance with ASTM D 1557, the Modified Proctor Method. We recommend the use of only relatively light, hand-held compaction equipment in the densification operations around utilities to limit the potential damage to the pipelines and buried structures.

7.11 SITE PREPARATION

The site preparation for any roadway modifications should consist of necessary clearing and grubbing in general accordance with Section 110 of the FDOT Standard Specifications for Road and Bridge Construction or any similar City/County standard design criteria applicable to the project. Any topsoil or other deleterious material encountered in proposed pavement areas, will need to be stripped, removed and replaced with embankment or roadway fill. If buried organic soils, debris or other unsuitable materials are encountered during the construction, which are or are not disclosed by the borings, they should be removed and replaced with a backfill material as described in following sections.

The Stratum 1 soils are select granular soils and are satisfactory to use in the subgrade and embankment when utilized in general accordance with FDOT Standard Index 505 or any similar City/County standard design criteria applicable to the project. Soils exposed at the stripped grades will require moisture conditioning to near the optimum moisture content prior to initiating the densification operations. In residential areas, the use of such heavy vibratory compaction equipment may prove problematic and disruptive or even damaging to existing/adjacent home owner's properties. In such cases, the compaction will need to be performed and achieved with lighter weight, less vibration generation capable equipment such as walk behind (e.g. Whacker) ground pounder or small vibratory rolling equipment.

Each section of the stripped grade should be subjected to multiple, overlapping coverages of the compactor as it operates at a travel speed of no more than 1.5 miles per hour (normal walking speed). Compaction should be continued until no further settlement can be visually discerned at the ground surface. The densified areas should include a 3-foot perimeter along proposed new pavement areas.

Density control should be exercised for the exposed subgrade for any roadway repairs. Soils in this interval should be compacted to not less than 95 percent of the maximum dry density in accordance with ASTM D 1557, the Modified Proctor Method. Subgrade soils that noticeably pump or deflect under the weight of the passing compaction equipment, could indicate the presence of soft, weak, overly saturated soils or compressible and loose soil zones existing in the near surface subgrade within the depth of influence of the roller. In such cases, those areas should be remedied by appropriate means to be determined by the inspecting field representative in consultation with representatives of the design team.

7.12 SELECT FILL COMPOSITION, PLACEMENT AND COMPACTION

Site structural and pavement embankment fill and backfill required for construction should consist of clean, granular materials that are free of debris, cinders, combustibles and organic matter. The fines content (i.e., material passing U.S. Standard No. 200 sieve) should not be more than ten (10) percent by weight, no particle sizes larger than one (1) inches in any direction and the organic content should not exceed three (3) percent by dry weight. The on-site sand soils appear to meet the above criteria and are suitable for use as structural fill and backfill material. Organic laidened soils encountered in several of the borings soils beneath the upper sand layer such as those encountered in the River Oaks, Victoria Park and Southeast Isles area, will not be suitable for use of Select Fill.

The granular fill should be placed at a moisture content within three (3) percent of its Modified Proctor (ASTM D 1557) determined optimum in level lifts whose loose thickness does not exceed twelve (12) inches. In areas where heavy equipment cannot be operated for compaction, the fill should be placed in six (6) inch thick level lifts. Each fill lift should be stable, unyielding and uniformly compacted to 95 percent of the ASTM D 1557 maximum dry density, as verified by the designated site construction inspecting representative.

Select fill soils will require moisture conditioning to near the optimum moisture content prior to initiating the densification operations. Similar to the subgrade preparation, the fill densification should normally be accomplished using a self-propelled vibratory compactor which imparts a dynamic drum force of not less than 44,000 pounds. However, in residential areas, the use of such heavy vibratory compaction equipment may prove problematic and disruptive or even damaging to existing/adjacent home owner's properties. In such cases, the compaction will need to be performed and achieved with lighter weight, less vibration generation capable equipment such as walk behind (e.g. Whacker) ground pounder or small vibratory rolling equipment.

7.13 OBSERVATION AND TESTING

It is recommended that a geotechnical engineer be retained to provide soil engineering inspection services during the construction excavation phase of the project. This is to observe compliance with the design concept, specifications and recommendations, and to allow design changes in the event subsurface conditions differ from those anticipated. In addition, an inspection and testing representative of a geotechnical engineer should be present to provide monitoring and testing of both fill and concrete placement during the construction phase of the project.

8.0 EXISTING UTILITIES

Existing utilities could potentially be present within or near the proposed seawalls. Precautionary measures should be taken to identify and locate any such systems impacted by the planned construction. Where encountered, mitigative design details should be provided accordingly. Consideration should be given as to what kind of utilities are present (i.e. nature and composition), and what the utility or other owner's guidelines and specifications are regarding their re-location etc. Utility locates should be in general accordance with the FDOT Plans Preparation Manual, Section 5.3 – Utility Locates.

9.0 PROTECTION OF EXISTING STRUCTURES

Ground vibrations induced upon adjacent structures, primarily by soil compaction equipment or any other construction activities such as pile driving, should be monitored to assure that they do not reach levels which prove damaging to any adjacent/nearby structures. Vibration Monitoring should be performed in general accordance with "Section 108, Protection of Existing Structures" of the current FDOT Standard Specifications for Road and Bridge Construction or other similar local City/County regulations or ordinances.

Vibration levels on adjacent facilities should generally be maintained below a 0.25 inches/second peak particle velocity level however, more restrictive/lessor levels as low as 0.10 inches/second may be specified for highly sensitive residential or historical areas. The construction Contractor will need to inventory and provide a pre-construction inspection of adjacent structures and determine suitable vibration monitoring programs and impact limits for their construction activities. Such monitoring will be particularly important for the Victoria Park and Southeast Isles

area as the ground conditions will have a higher tendency and capability to transmit vibrations horizontally from the construction activities.

It is noted that the residential homes in the Victoria Park and Southeast Isles area are likely founded on short driven piles installed to sound bearing conditions beneath the buried organics. Vibrations in the lower soil/rock layers beneath the organics, from construction activities such as sheet piling installation, will have the potential to be transmitted into the residences via the piling foundations installed for the structures. Typically, for sheet piling and driven pile installations, a maximum allowable peak particle velocity of 0.10 inches/second has been used in the construction specifications for areas of similar natured residential and commercial structures that exist in this project area.

10.0 LIMITATIONS

This report is intended for geotechnical purposes only, and not to document or detect the presence, or absence of any environmental conditions at the site, or to perform an environmental assessment of the site.

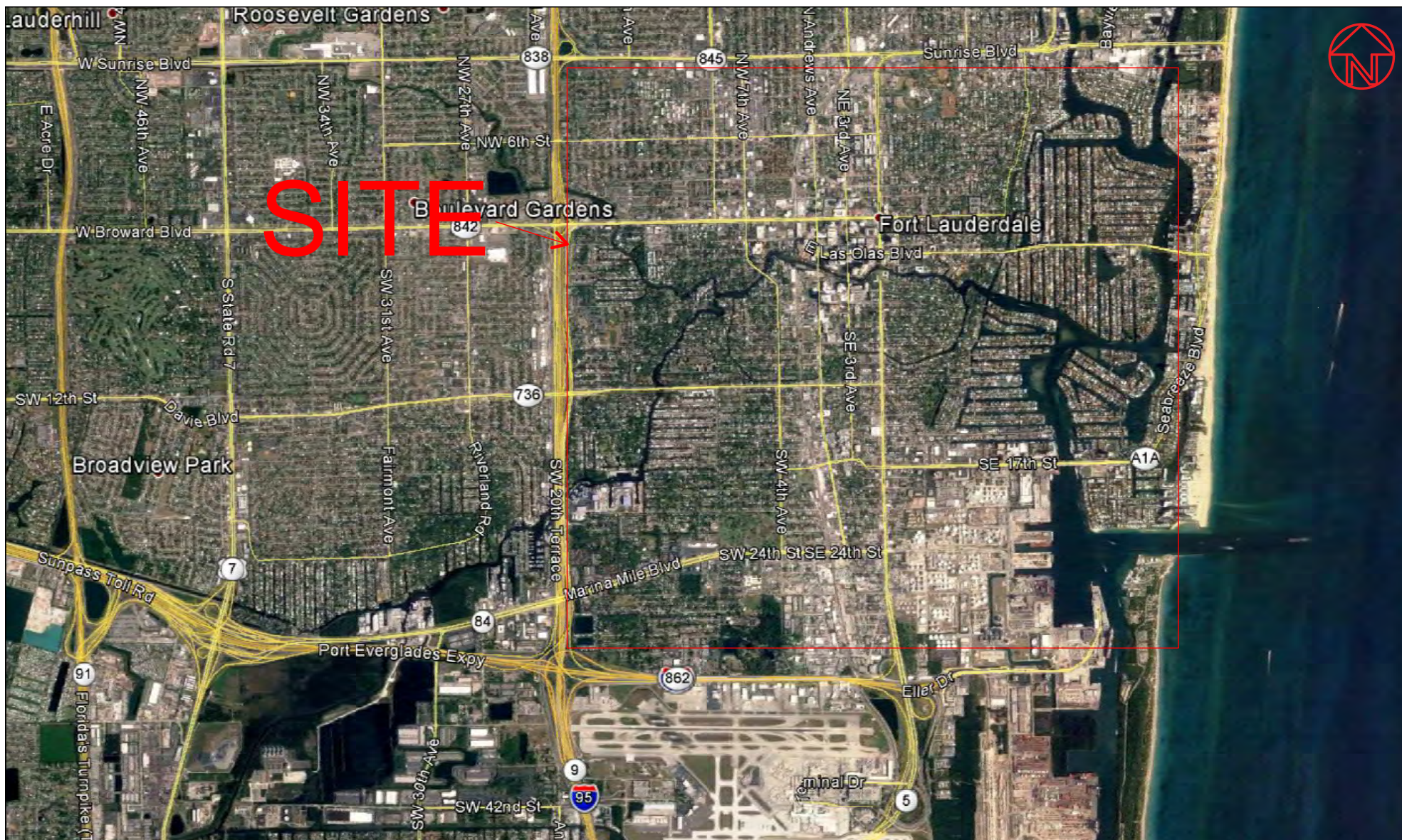
The analysis and recommendations presented in this report are based upon our interpretation of the subsurface information revealed by the test borings. The report does not reflect variations in subsurface conditions that may exist between or beyond these borings. Variations in soil and groundwater conditions should be expected, the nature and extent of which might not become evident until construction is undertaken. If variations are encountered, and/or the scope of the project altered, we should be consulted for additional recommendations.

RADISE International warrants that the professional services performed and presented in this report are prepared for Hazen and Sawyer, and are based upon typical standard of care recognized principles and practices in the discipline of geotechnical engineering and hydrogeology at this place and point in time, for this project site. No other warranties are expressed or implied.

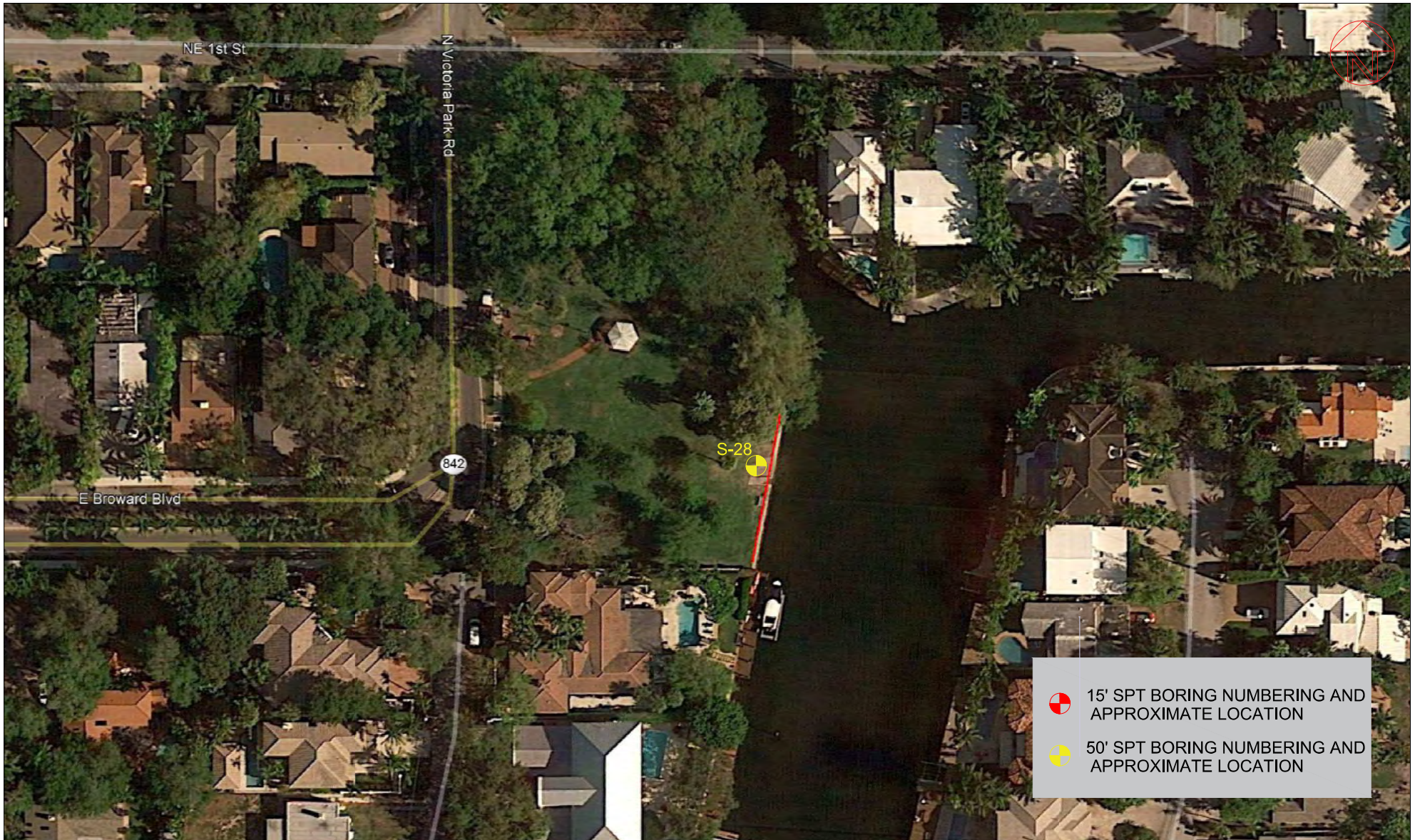
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RADISE appreciates the opportunity to be of service to you. Please feel free to contact us at 561-841-0103 if you have any questions or comments regarding this report.

Respectfully submitted
RADISE International, L.C.

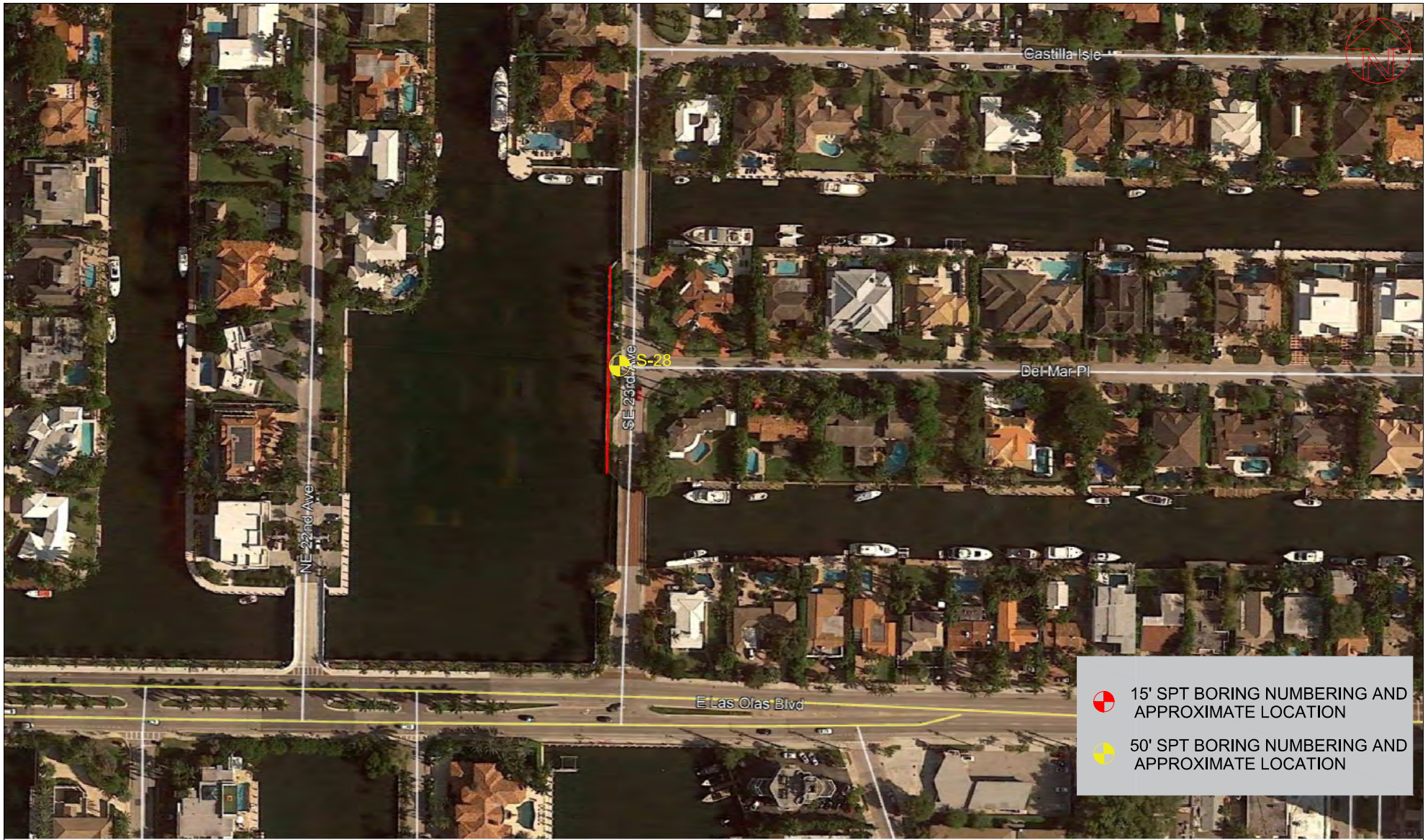


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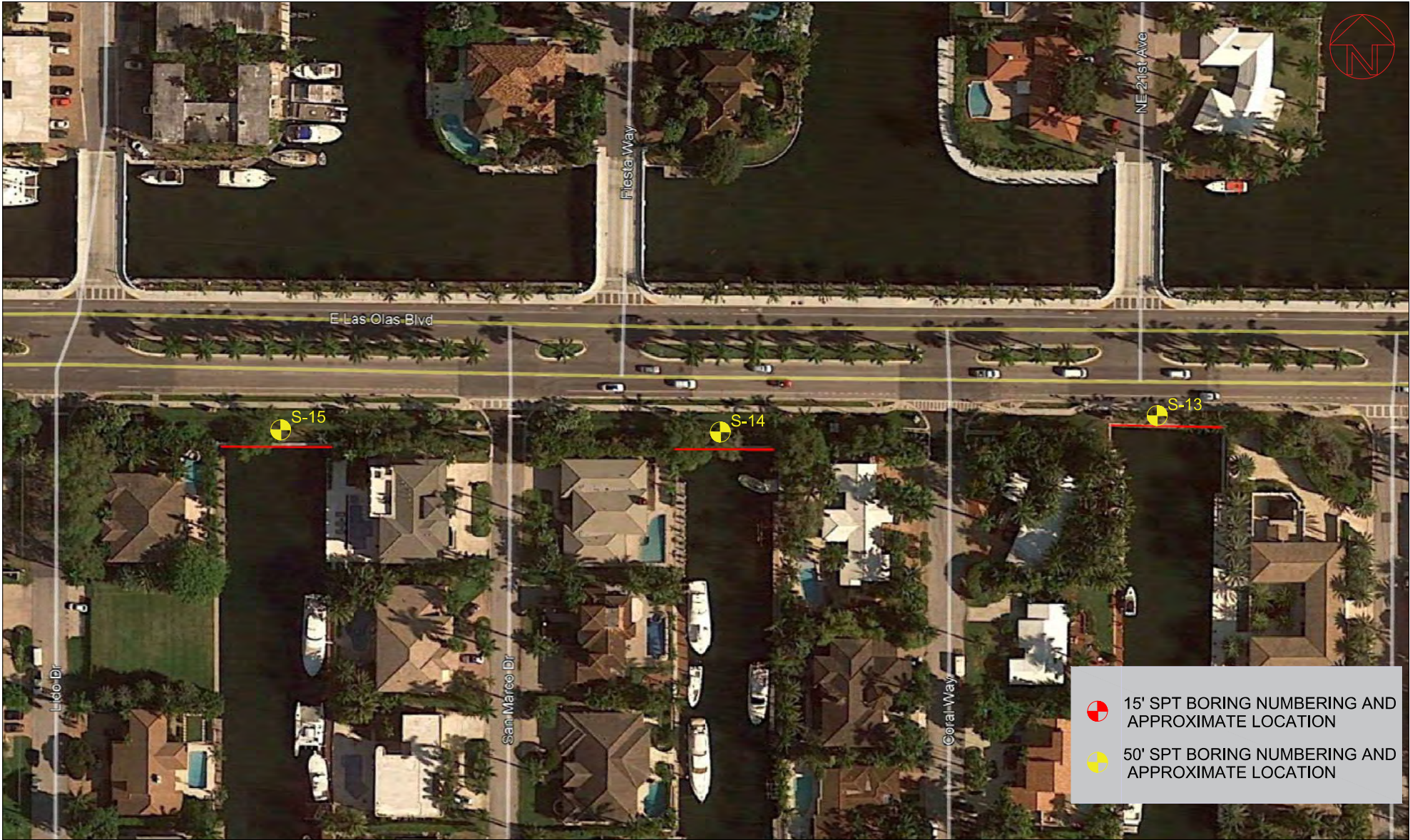


 15' SPT BORING NUMBERING AND APPROXIMATE LOCATION
 50' SPT BORING NUMBERING AND APPROXIMATE LOCATION

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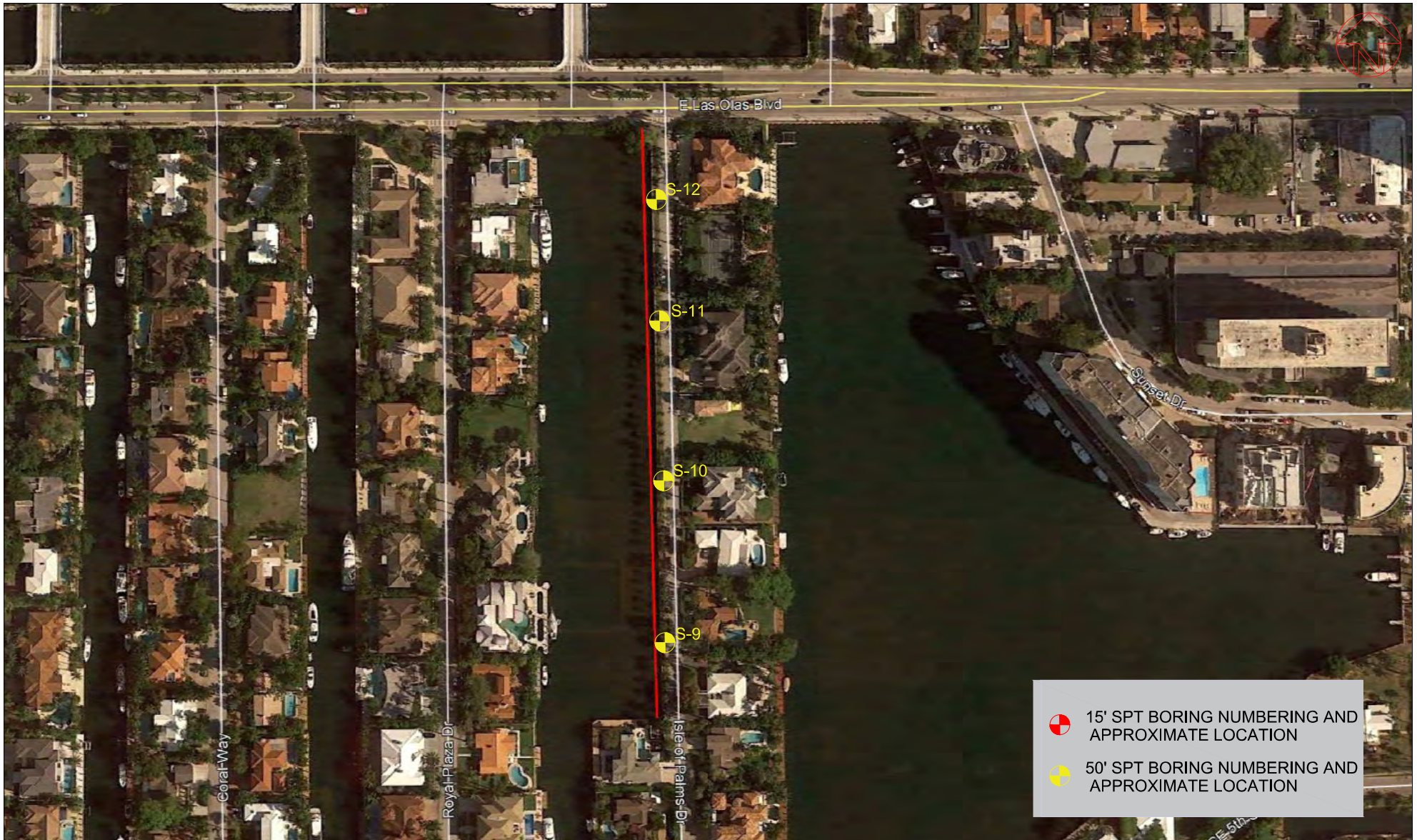


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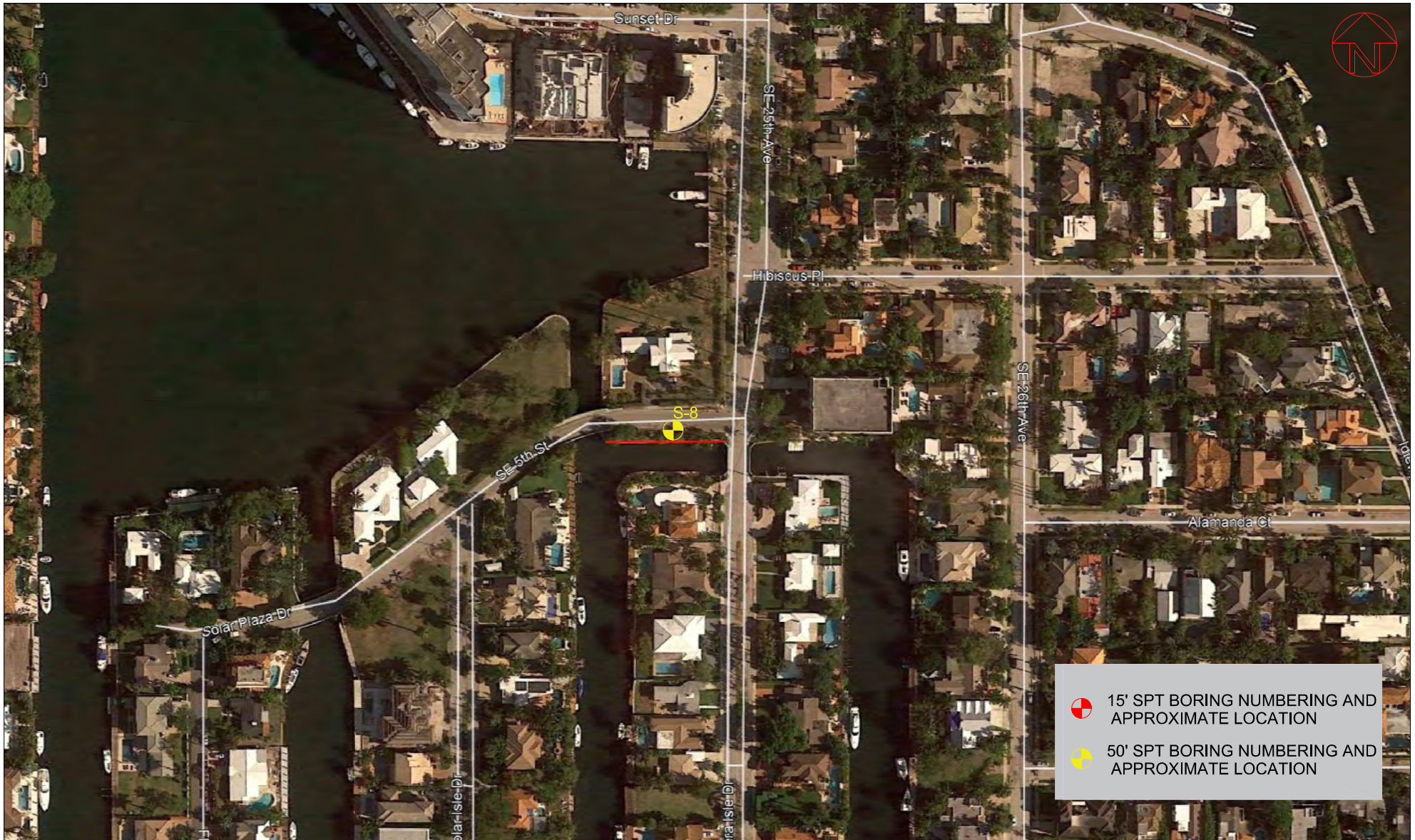
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15' SPT BORING NUMBERING AND APPROXIMATE LOCATION



50' SPT BORING NUMBERING AND APPROXIMATE LOCATION

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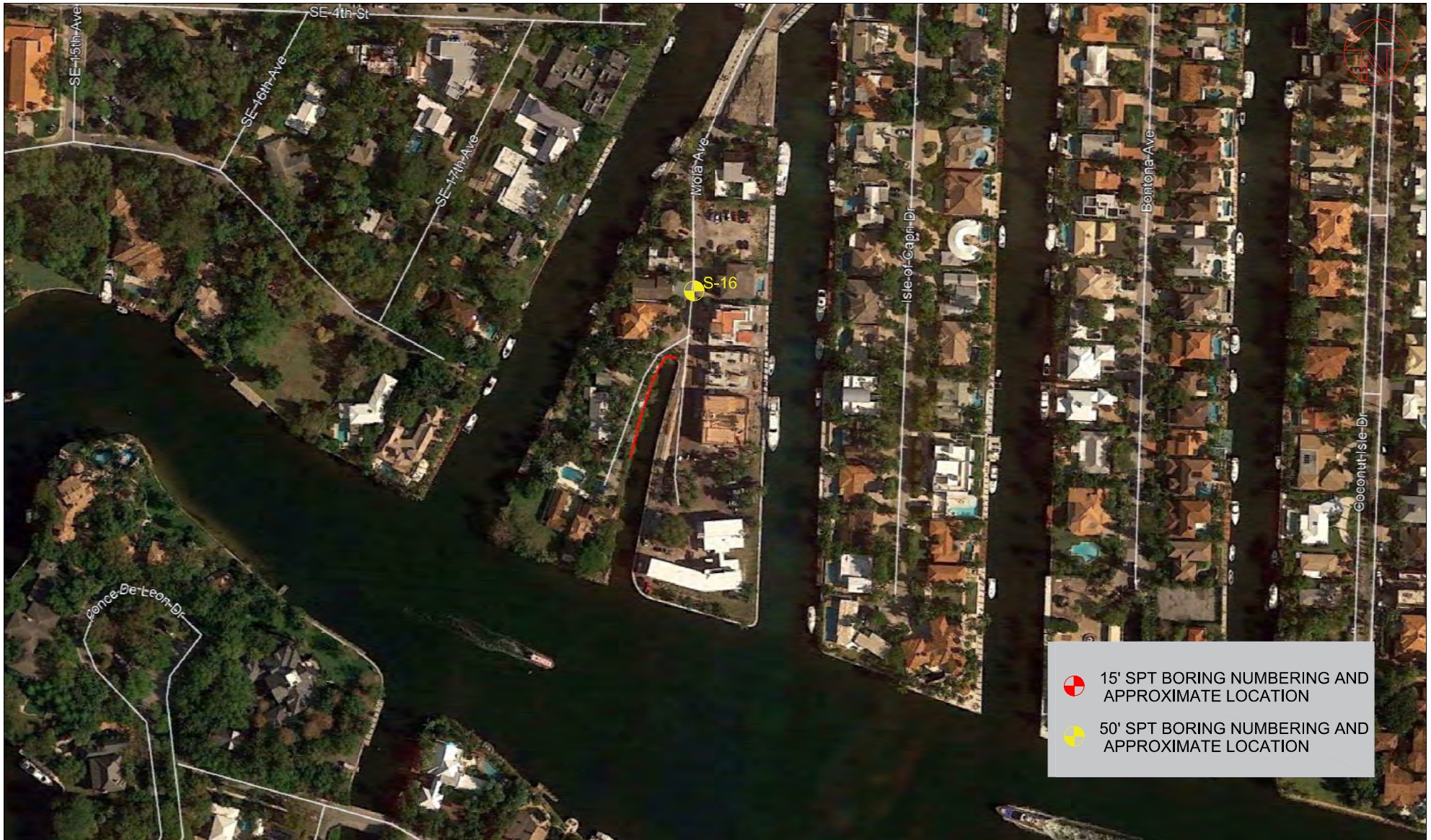




**15' SPT BORING NUMBERING AND APPROXIMATE LOCATION**

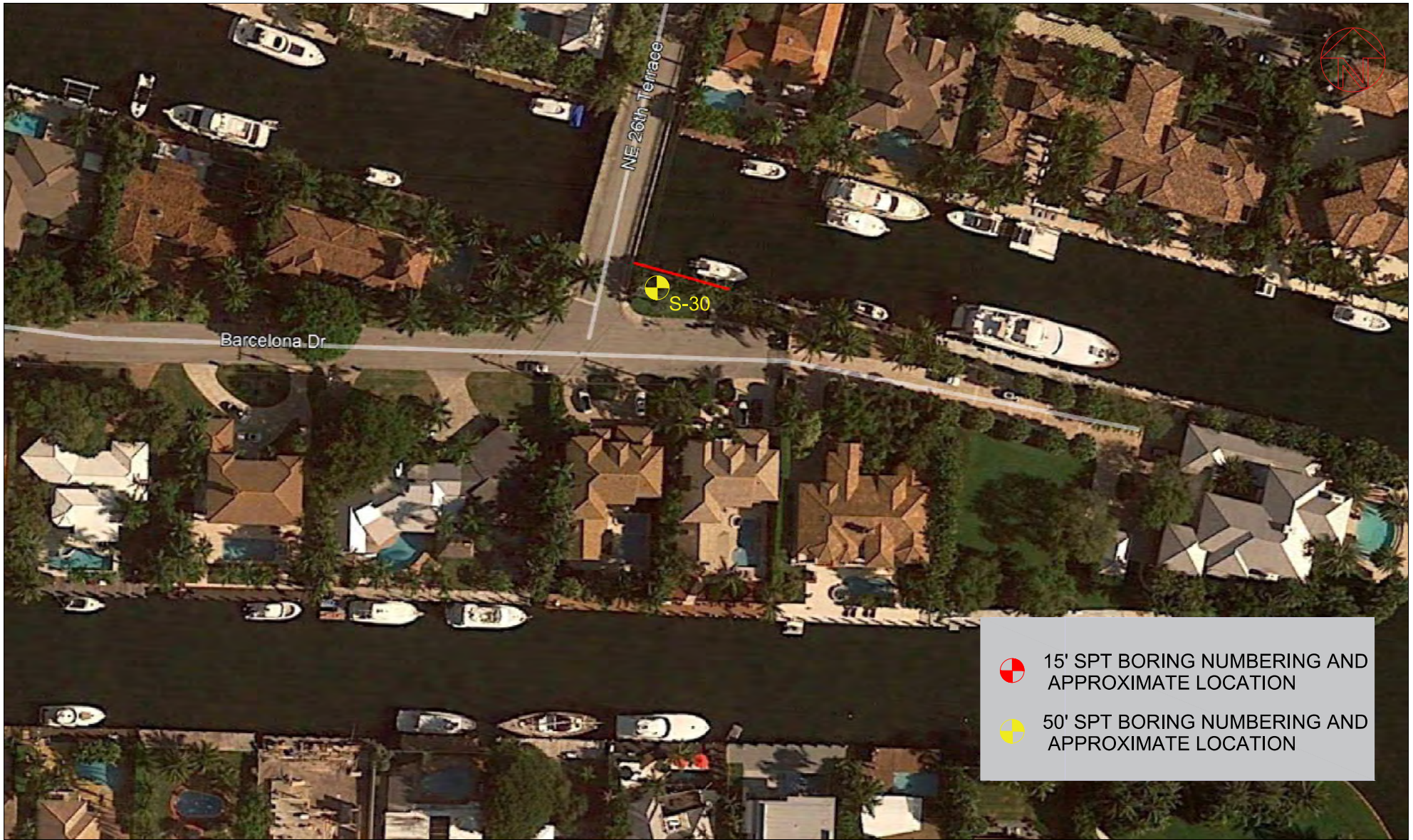
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						Checked by												
						Approved by				LICENSE NO. - 8901								





15' SPT BORING NUMBERING AND APPROXIMATE LOCATION



50' SPT BORING NUMBERING AND APPROXIMATE LOCATION

REVISIONS						Names		Dates		 ENGINEER OF RECORD RADISE International 4152 West Blue Heron Boulevard, Suite 1114 Riviera Beach, Florida, 33404 TEL 561-841-0103 FAX 561-841-0104 URL : http://www.radise.net	CITY OF FORT LAUDERDALE PUBLIC WORKS DEPARTMENT		SCALE: VERTICAL N.T.S.		SHEET TITLE: BORING LOCATION PLAN (SEAWALL 34)		SHEET NO. 21	
Date	By	Descriptions	Date	By	Descriptions	Drawn by	KA	11/16/17	11/16/17		COUNTY	CLIENT	SCALE: HORIZONTAL N.T.S.		PROJECT NAME: STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION		RADISE PROJECT NO: 170901	
						Checked by	AB	11/16/17			BROWARD	HAZEN AND SAWYER						
						Designed by												
						Checked by												
						Approved by				LICENSE NO. - 8901								



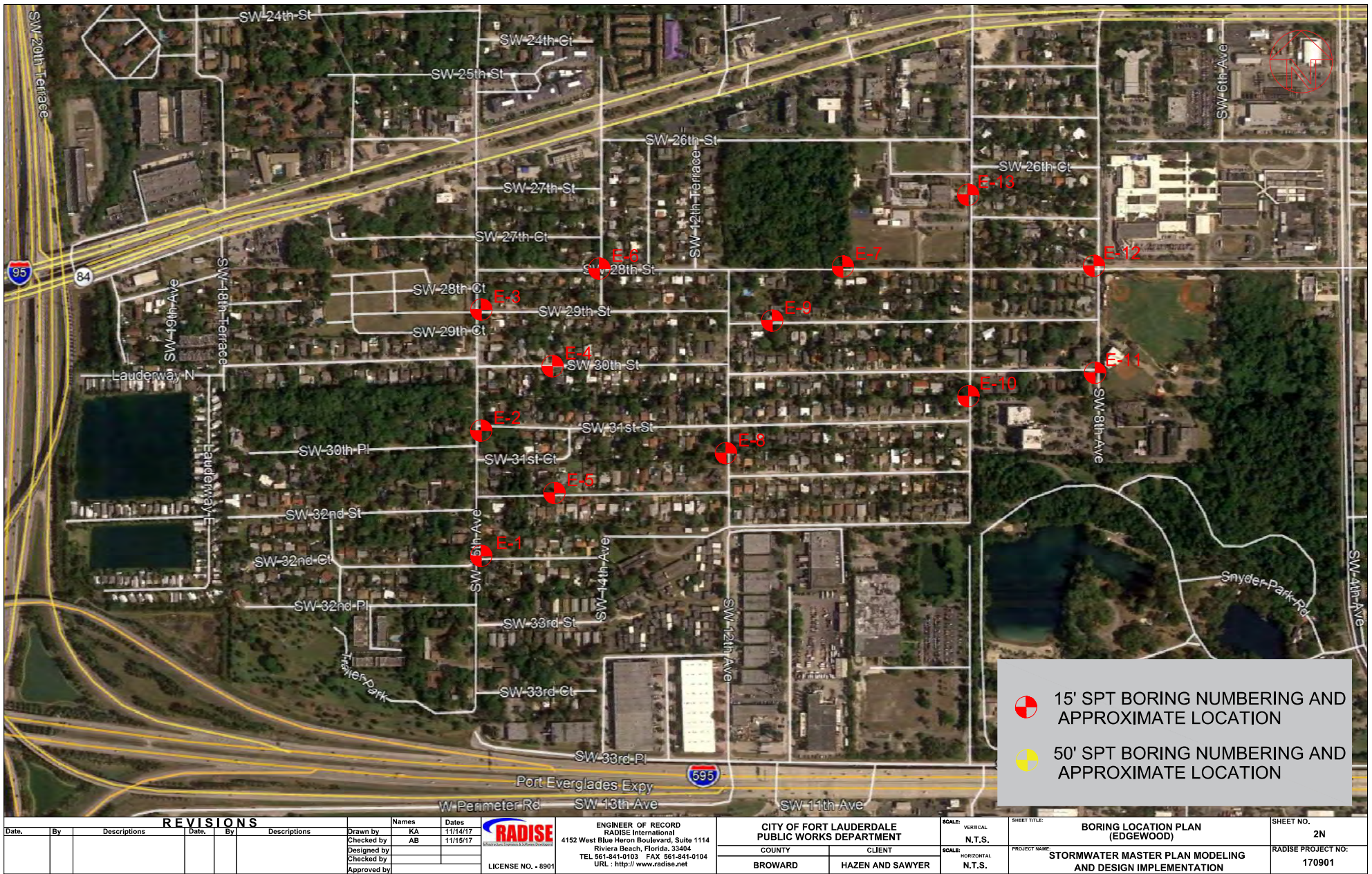
REVISIONS						 ENGINEER OF RECORD RADISE International 4152 West Blue Heron Boulevard, Suite 1114 Riviera Beach, Florida, 33404 TEL 561-841-0103 FAX 561-841-0104 URL : http://www.radise.net LICENSE NO. - 8901	CITY OF FORT LAUDERDALE PUBLIC WORKS DEPARTMENT		SCALE:	SHEET TITLE:	SHEET NO. 2J	
Date	By	Descriptions	Date	By	Descriptions				VERTICAL	BORING LOCATION PLAN (SEAWALL 35)		
					Drawn by KA Checked by AB Designed by Checked by Approved by				N.T.S. <th>PROJECT NAME:</th>	PROJECT NAME:		
								COUNTY	CLIENT	HORIZONTAL <th>STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION</th> <th>RADISE PROJECT NO: 170901</th>	STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION	RADISE PROJECT NO: 170901
								BROWARD	HAZEN AND SAWYER	N.T.S.		

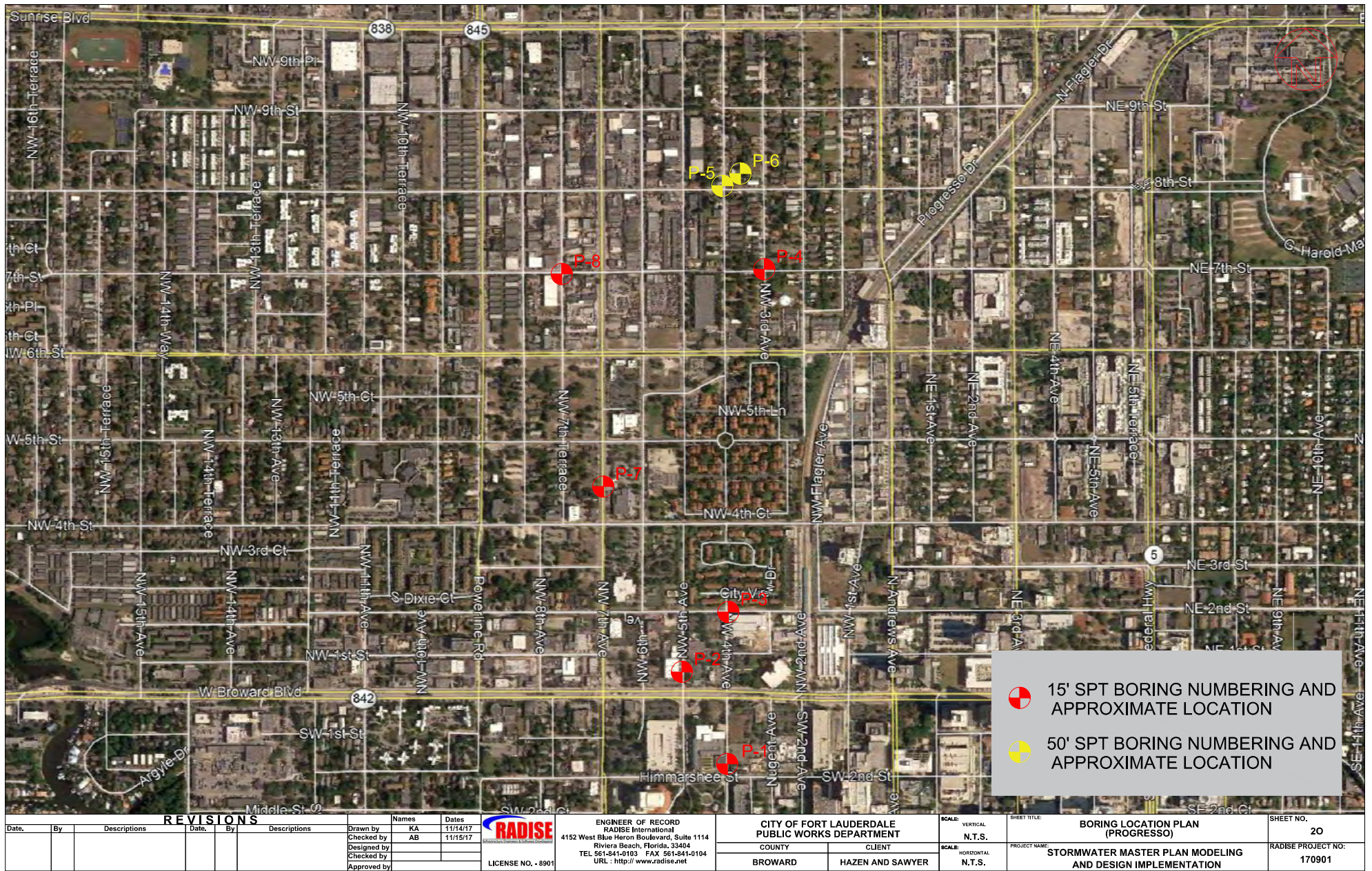


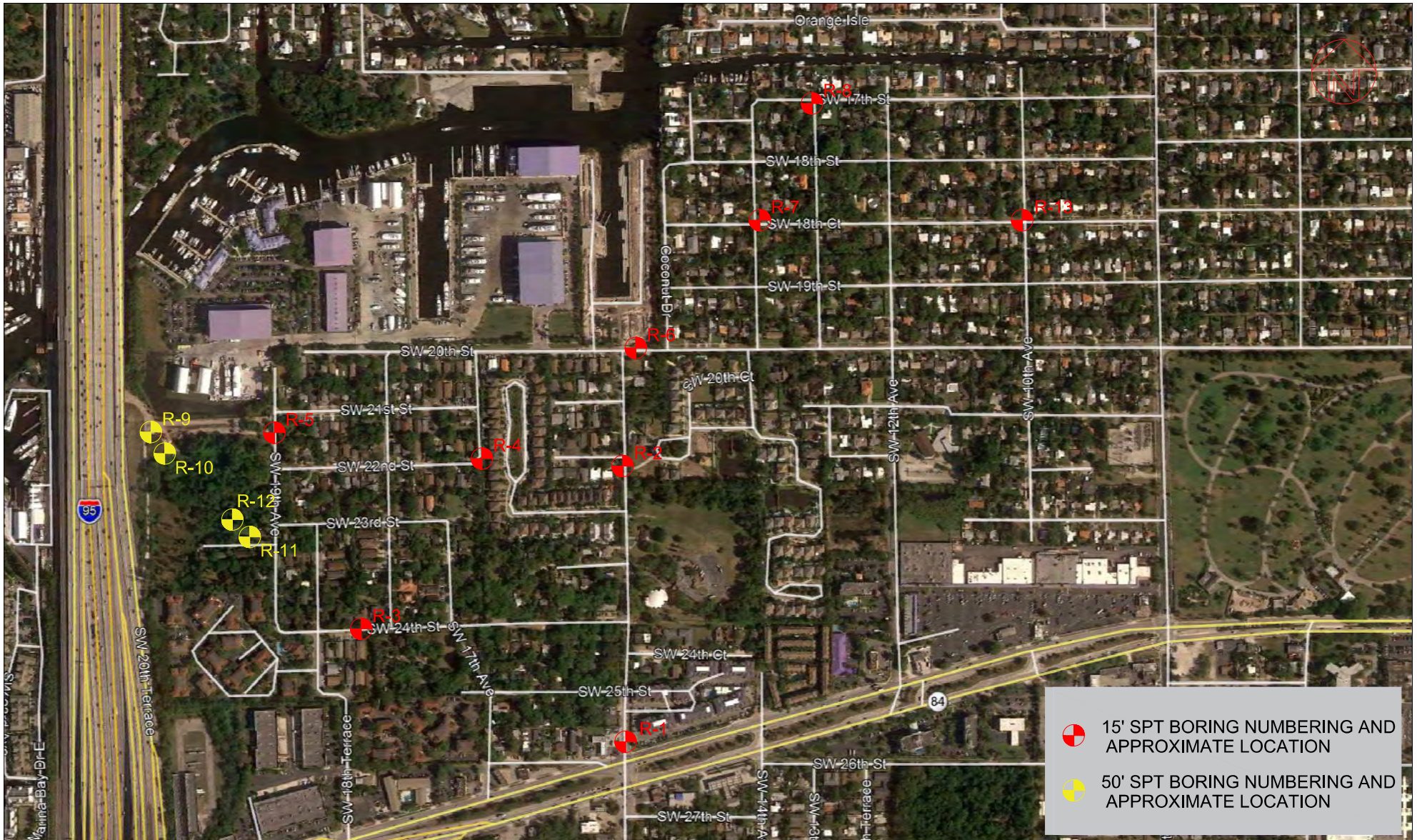
REVISIONS						RADISE		ENGINEER OF RECORD		CITY OF FORT LAUDERDALE		SCALE: VERTICAL		SHEET TITLE:		SHEET NO.	
Date	By	Descriptions	Date	By	Descriptions	Drawn by	Names	Dates	4152 West Blue Heron Boulevard, Suite 1114	COUNTY	CLIENT	N.T.S.		PROJECT NAME:		2K	
						Checked by	KA	11/15/17	Riviera Beach, Florida, 33404	BROWARD	HAZEN AND SAWYER			STORMWATER MASTER PLAN MODELING			
						Designed by	AB	11/15/17	TEL 561-841-0103 FAX 561-841-0104			SCALE: HORIZONTAL		AND DESIGN IMPLEMENTATION			
						Checked by			URL : http://www.radise.net			N.T.S.					
						Approved by											



REVISIONS						Names		Dates		 ENGINEER OF RECORD RADISE International 4152 West Blue Heron Boulevard, Suite 1114 Riviera Beach, Florida, 33404 TEL 561-841-0103 FAX 561-841-0104 URL : http://www.radise.net LICENSE NO. - 8901	CITY OF FORT LAUDERDALE PUBLIC WORKS DEPARTMENT		SCALE:	SHEET TITLE:	SHEET NO.
Date	By	Descriptions	Date	By	Descriptions	Drawn by									
						KA	11/14/17						VERTICAL		
						AB	11/15/17						N.T.S.		2M
						Designed by									
						Checked by									
						Approved by									







15' SPT BORING NUMBERING AND APPROXIMATE LOCATION

50' SPT BORING NUMBERING AND APPROXIMATE LOCATION

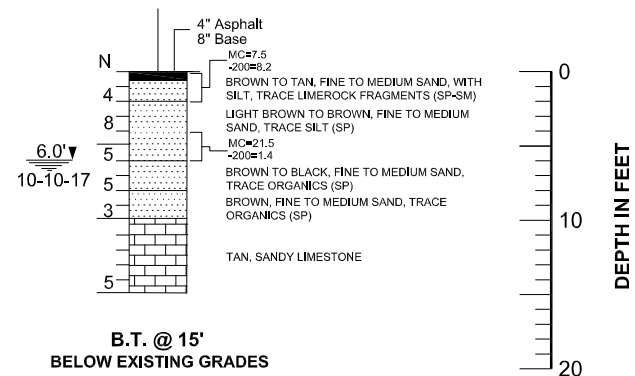
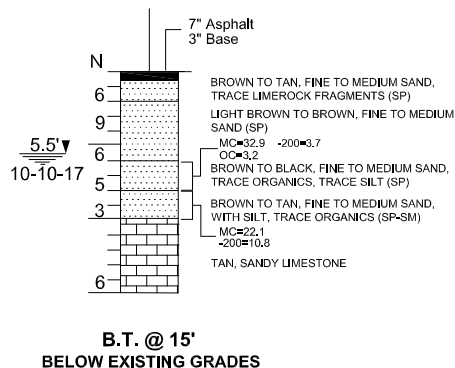
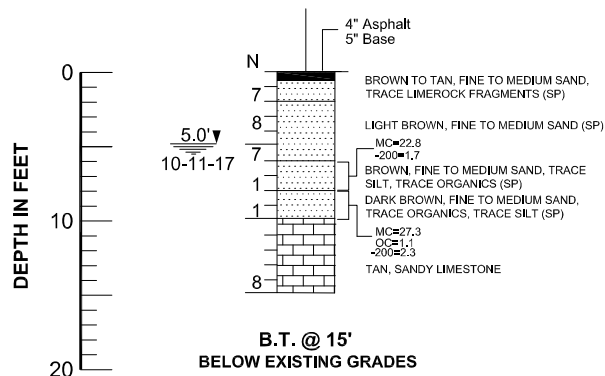
REVISIONS						Names		Dates		 ENGINEER OF RECORD RADISE International 4152 West Blue Heron Boulevard, Suite 1114 Riviera Beach, Florida, 33404 TEL 561-841-0103 FAX 561-841-0104 URL : http://www.radise.net	CITY OF FORT LAUDERDALE PUBLIC WORKS DEPARTMENT		SCALE: VERTICAL N.T.S. SCALE: HORIZONTAL N.T.S.	SHEET TITLE: BORING LOCATION PLAN (RIVER OAKS)		SHEET NO. 2P	
Date	By	Descriptions	Date	By	Descriptions	Drawn by	KA	11/14/17			COUNTY	CLIENT		PROJECT NAME: STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION		RADISE PROJECT NO: 170901	
						Checked by	AB	11/15/17			BROWARD	HAZEN AND SAWYER					
						Designed by											
						Checked by											
						Approved by				LICENSE NO. - 8901							

BORING NO.
ELEVATION (NAVD 88):
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

D-1
N/A
26.1345°
-80.1653°
10/11/2017
T. FICKLING
CME 45

D-2
N/A
26.1327°
-80.1639°
10/10/2017
T. FICKLING
CME 45

D-3
N/A
26.1307°
-80.1671°
10/10/2017
T. FICKLING
CME 45



LEGEND

ASPHALT AND BASE	LIMESTONE
SAND	GRAVEL
SILTY SAND	ORGANIC MATERIAL
5.0'▼	GROUNDWATER DEPTH IN FEET
10-11-17	AND DRILLING DATE
N	STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER

SP, SP-SM, SM	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
D-1	STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
MC	MOISTURE CONTENT (%)
-200	AMOUNT PASSING US STANDARD # 200 SIEVE (%)
OC	ORGANIC CONTENTS (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
B.T. @ 15'	BORING TERMINATED AT 15 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- BORINGS WERE DRILLED ON OCTOBER, 2017
USING A CENTRAL MINING EQUIPMENT MODEL 45
(CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT
SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE
LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL
THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE
PROFILES REPRESENT GROUNDWATER SURFACES ON
THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE
THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED
IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK
FILLED WITH GROUT.

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE BLOWS/FOOT
VERY LOOSE	LESS THAN 3
LOOSE	3 - 8
MEDIUM	8 - 24
DENSE	24 - 40
VERY DENSE	GREATER THAN 40

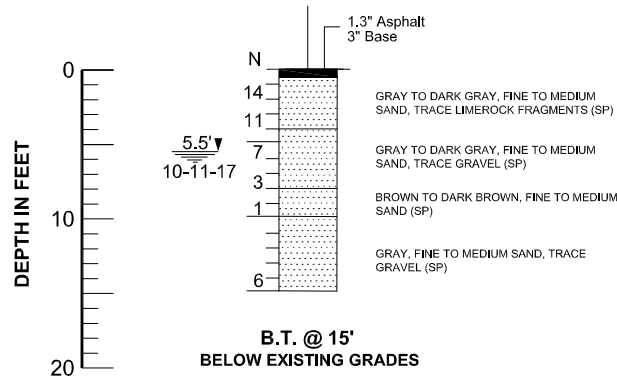
STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

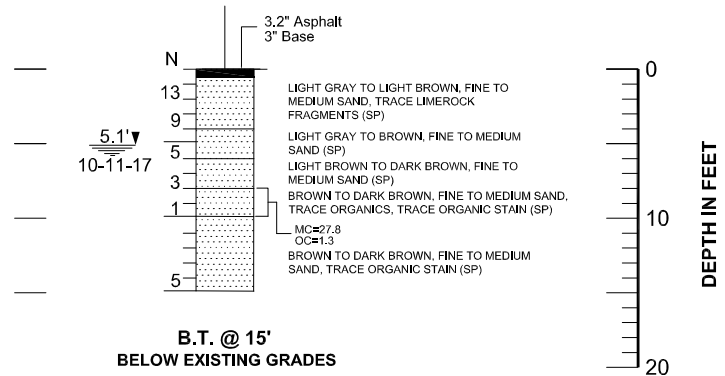
REVISIONS

Date.	By	Descriptions	Date.	By	Descriptions	Names	Dates	ENGINEER OF RECORD	CITY OF FORT LAUDERDALE	SCALE: VERTICAL	SHEET TITLE:	SHEET NO.
						Drawn by	KA	11/07/17	RADISE International	N.T.S.	SUBSURFACE PROFILES	3A
						Checked by	AB	11/07/17	4152 West Blue Heron Boulevard, Suite 1114		(DURRS)	
						Designed by			Riviera Beach, Florida, 33404			
						Checked by			TEL 961-841-0103 FAX 961-841-0104	SCALE: HORIZONTAL	PROJECT NAME:	RADISE PROJECT NO:
						Approved by			URL : http://www.radise.net	N.T.S.	STORMWATER MASTER PLAN MODELING	170901
											AND DESIGN IMPLEMENTATION	

BORING NO. D-4
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1328°
LONGITUDE: -80.1590°
DATE: 10/11/2017
DRILLER: T. FICKLING
RIG: CME 45



BORING NO. D-5
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1297°
LONGITUDE: -80.1613°
DATE: 10/11/2017
DRILLER: T. FICKLING
RIG: CME 45



LEGEND

	ASPHALT AND BASE		LIMESTONE
	SAND		GRAVEL
	SILTY SAND		ORGANIC MATERIAL
	GROUNDWATER DEPTH IN FEET		
	STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER		

SP, SP-SM, SM	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
D-1	STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
MC	MOISTURE CONTENT (%)
-200	AMOUNT PASSING US STANDARD # 200 SIEVE (%)
OC	ORGANIC CONTENTS (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
B.T. @ 15'	BORING TERMINATED AT 15 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- BORINGS WERE DRILLED ON OCTOBER, 2017
USING A CENTRAL MINING EQUIPMENT MODEL 45
(CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT
SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE
LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL
THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE
PROFILES REPRESENT GROUNDWATER SURFACES ON
THE DATES SHOWN, GROUNDWATER LEVELS WILL FLUCTUATE
THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED
IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK
FILLED WITH GROUT.

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER
VERY LOOSE	SPT N-VALUE
LOOSE	BLOWS/FOOT
MEDIUM	LESS THAN 3
DENSE	3 - 8
VERY DENSE	8 - 24
	24 - 40
	GREATER THAN 40

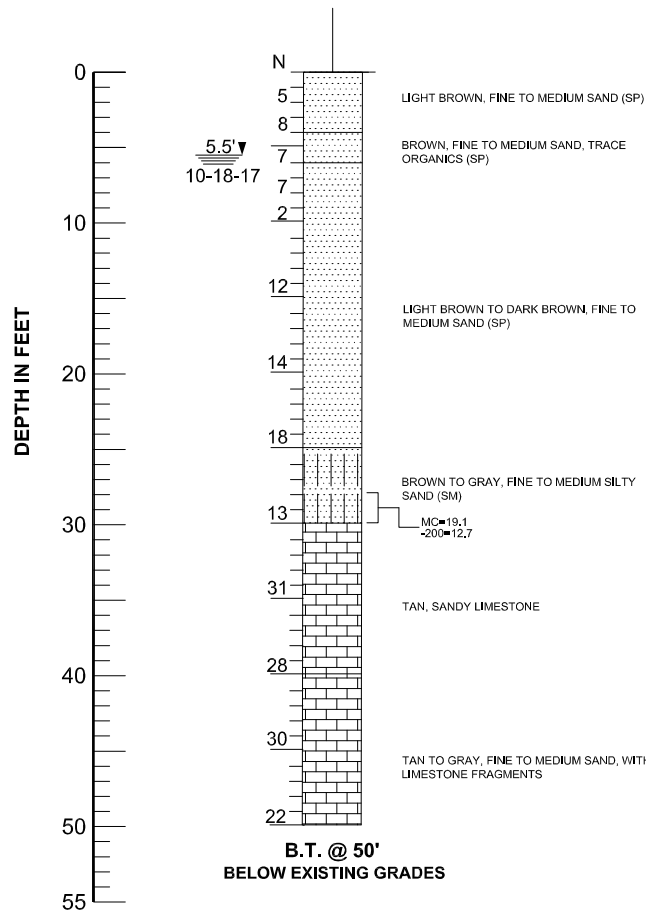
STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

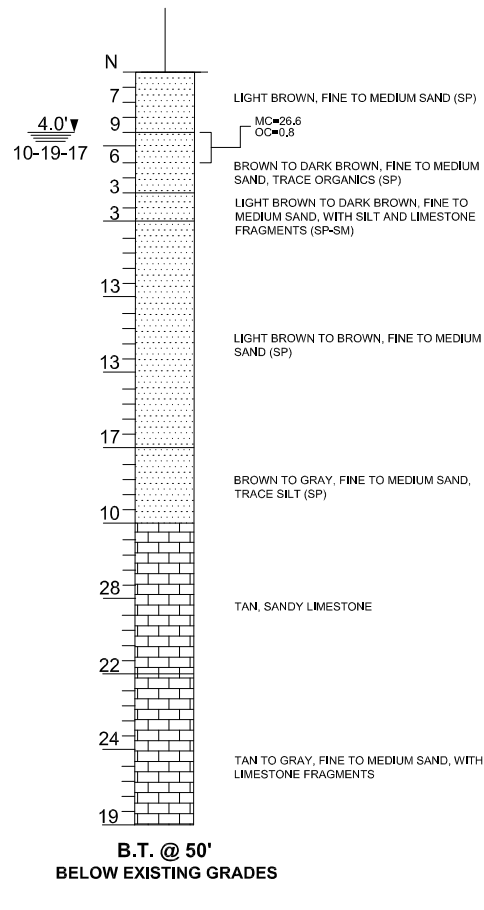
REVISIONS

Date.	By	Descriptions	Date.	By	Descriptions	Names	Dates	ENGINEER OF RECORD	CITY OF FORT LAUDERDALE	SCALE: VERTICAL	SHEET TITLE:	SHEET NO.
						Drawn by	KA	11/09/17	RADISE International	N.T.S.	SUBSURFACE PROFILES (DRRUS)	3B
						Checked by	AB	11/09/17	4152 West Blue Heron Boulevard, Suite 1114			
						Designed by			Riviera Beach, Florida, 33404			
						Checked by			TEL 961-941-0103 FAX 961-941-0104	SCALE: HORIZONTAL	PROJECT NAME:	RADISE PROJECT NO:
						Approved by			URL : http://www.radise.net	N.T.S.	STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION	170901

BORING NO. DR-1
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1278°
LONGITUDE: -80.1621°
DATE: 10/18/2017
DRILLER: R. RAMSEWACK
RIG: CME 45



BORING NO. DR-2
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1279°
LONGITUDE: -80.1619°
DATE: 10/19/2017
DRILLER: R. RAMSEWACK
RIG: CME 45



LEGEND

- 5.5'▼
10-18-17
- N
- SP, SP-SM, SM
- DR-1
- MC
- 200
- OC
- LL
- PI
- B.T. @ 50'
- GROUNDWATER DEPTH IN FEET AND DRILLING DATE
- STANDARD PENETRATION RESISTANCE-BLOWS PER FOOT USING AUTOMATIC HAMMER
- UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
- STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
- MOISTURE CONTENT (%)
- AMOUNT PASSING US STANDARD # 200 SIEVE
- ORGANIC CONTENTS (%)
- LIQUID LIMIT (%)
- PLASTICITY INDEX (%)
- BORING TERMINATED AT 50 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- BORINGS WERE DRILLED ON OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

STANDARD PENETRATION TEST DATA
SPOON INSIDE DIA. 1.375 INCH
SPOON OUTSIDE DIA. 2.0 INCHES
AVG. HAMMER DROP 30 INCHES
HAMMER WEIGHT 140 POUNDS

RELATIVE DENSITY
VERY LOOSE
LOOSE
MEDIUM
DENSE
VERY DENSE

AUTOMATIC HAMMER
SPT N-VALUE
BLOWS/FOOT
LESS THAN 3
3 - 8
8 - 24
24 - 40
GREATER THAN 40

REVISIONS

Date.	By	Descriptions	Date.	By	Descriptions

Names	Dates
Drawn by ML	10/26/17
Checked by AB	10/26/17
Designed by	
Checked by	
Approved by	



ENGINEER OF RECORD
RADISE International
4152 West Blue Heron Boulevard, Suite 1114
Riviera Beach, Florida, 33404
TEL 561-841-0103 FAX 561-841-0104
URL : <http://www.radise.net>

LICENSE NO. - 8901

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT

COUNTY CLIENT
BROWARD HAZEN AND SAWYER

SCALE: VERTICAL
N.T.S.

SCALE: HORIZONTAL
N.T.S.

SHEET TITLE:

SUBSURFACE PROFILES
(DORSEY RIVERBEND)

PROJECT NAME:

STORMWATER MASTER PLAN MODELING
AND DESIGN IMPLEMENTATION

SHEET NO.

4A

RADISE PROJECT NO:

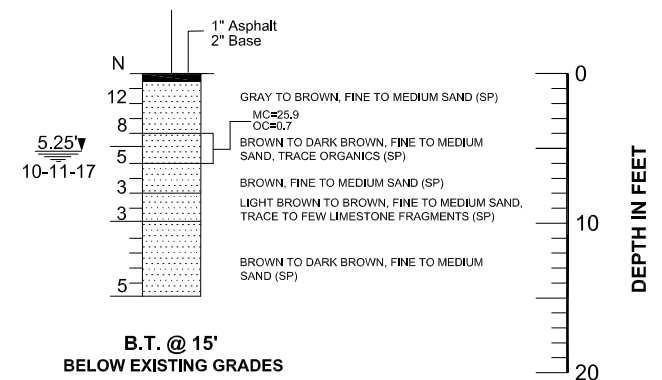
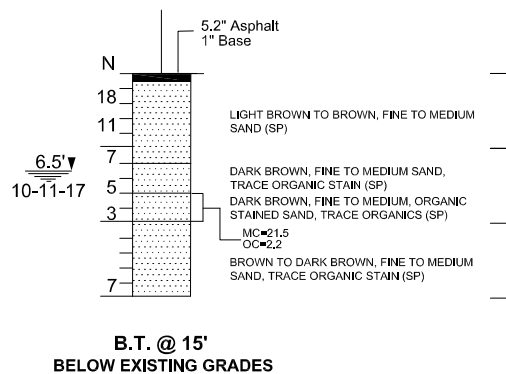
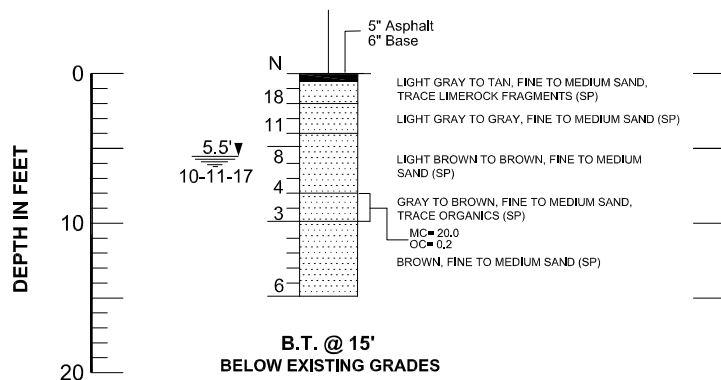
170901

BORING NO.
ELEVATION (NAVD 88):
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

DR-3
N/A
26.1256°
-80.1617°
10/11/2017
T. FICKLING
CME 45

DR-4
N/A
26.1256°
-80.1658°
10/11/2017
T. FICKLING
CME 45

DR-5
N/A
26.1288°
-80.1660°
10/11/2017
T. FICKLING
CME 45



LEGEND

	ASPHALT AND BASE		LIMESTONE
	SAND		GRAVEL
	SILTY SAND		ORGANIC MATERIAL
5.5'▼	GROUNDWATER DEPTH IN FEET		
10-11-17	AND DRILLING DATE		
N	STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER		

SP, SP-SM, SM	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
DR-1	STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
MC	MOISTURE CONTENT (%)
-200	AMOUNT PASSING US STANDARD # 200 SIEVE (%)
OC	ORGANIC CONTENTS (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
B.T. @ 15'	BORING TERMINATED AT 15 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- BORINGS WERE DRILLED ON OCTOBER, 2017
USING A CENTRAL MINING EQUIPMENT MODEL 45
(CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT
SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE
LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL
THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE
PROFILES REPRESENT GROUNDWATER SURFACES ON
THE DATES SHOWN, GROUNDWATER LEVELS WILL FLUCTUATE
THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED
IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK
FILLED WITH GROUT.

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE BLOWS/FOOT
VERY LOOSE	LESS THAN 3
LOOSE	3 - 8
MEDIUM	8 - 24
DENSE	24 - 40
VERY DENSE	GREATER THAN 40

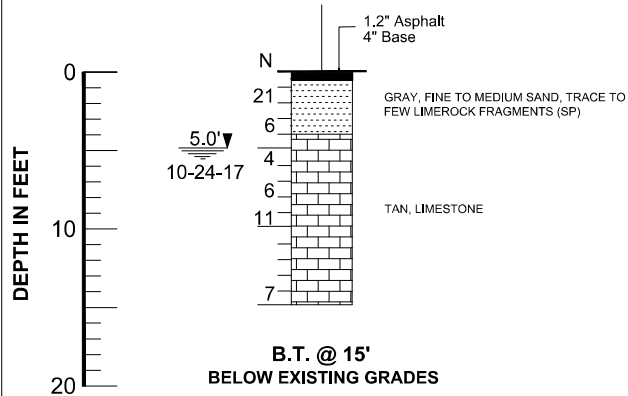
STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

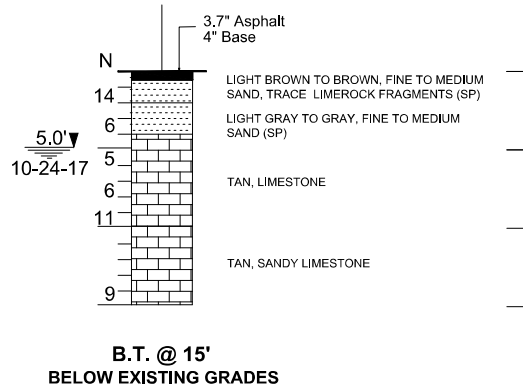
REVISIONS

Date.	By	Descriptions	Date.	By	Descriptions	Names	Dates	ENGINEER OF RECORD	CITY OF FORT LAUDERDALE	SCALE: VERTICAL	SHEET TITLE:	SHEET NO.
						Drawn by	KA	11/09/17	RADISE International	N.T.S.	SUBSURFACE PROFILES (DORSEY RIVERBEND)	4B
						Checked by	AB	11/09/17	4152 West Blue Heron Boulevard, Suite 1114			
						Designed by			Riviera Beach, Florida, 33404			
						Checked by			TEL 561-841-0103 FAX 561-841-0104			
						Approved by			URL : http://www.radise.net	SCALE: HORIZONTAL	PROJECT NAME:	RADISE PROJECT NO:
										N.T.S.	STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION	170901
									BROWARD	HAZEN AND SAWYER		

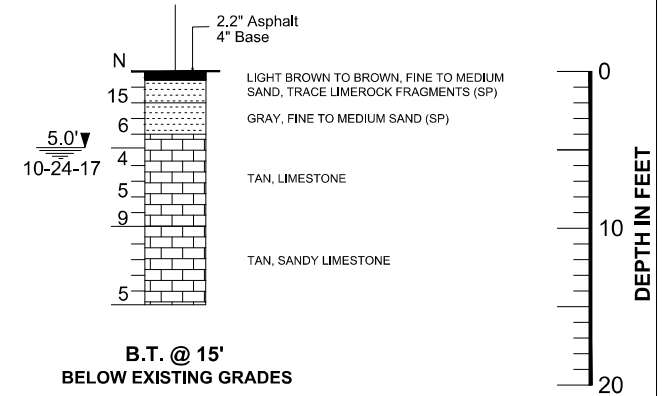
BORING NO. E-1
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0845°
LONGITUDE: -80.1607°
DATE: 10/24/2017
DRILLER: T. FICKLING
RIG: CME 45



BORING NO. E-2
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0864°
LONGITUDE: -80.1607°
DATE: 10/24/2017
DRILLER: T. FICKLING
RIG: CME 45



BORING NO. E-3
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0881°
LONGITUDE: -80.1607°
DATE: 10/24/2017
DRILLER: T. FICKLING
RIG: CME 45



NOTES

- BORINGS WERE DRILLED ON OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER
VERY LOOSE	SPT N-VALUE
LOOSE	BLOWS/FOOT
MEDIUM DENSE	LESS THAN 3
VERY DENSE	3 - 8
	8 - 24
	24 - 40
	GREATER THAN 40

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

LEGEND

ASPHALT AND BASE	LIMESTONE
SAND	GRAVEL
SILTY SAND	ORGANIC MATERIAL
5.0'▼	GROUNDWATER DEPTH IN FEET
10-24-17	AND DRILLING DATE
N	STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER

SP, SP-SM, PT UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)

E-1 STANDARD PENETRATION TEST (SPT) BORING AND NUMBER

MC MOISTURE CONTENT (%)
-200 AMOUNT PASSING US STANDARD # 200 SIEVE (%)

OC ORGANIC CONTENTS (%)

LL LIQUID LIMIT (%)

PI PLASTICITY INDEX (%)

B.T. @ 15' BORING TERMINATED AT 15 FEET BELOW THE EXISTING GROUND SURFACE

REVISIONS

Date	By	Descriptions	Date	By	Descriptions



ENGINEER OF RECORD
RADISE International
4152 West Blue Heron Boulevard, Suite 1114
Riviera Beach, Florida, 33404
TEL 561-841-0193 FAX 561-841-0104
URL : http://www.radise.net

LICENSE NO. - 8901

CITY OF FORT LAUDERDALE PUBLIC WORKS DEPARTMENT

COUNTY	CLIENT
BROWARD	HAZEN AND SAWYER

SCALE: VERTICAL
N.T.S.
SCALE: HORIZONTAL
N.T.S.

SHEET TITLE:

SUBSURFACE PROFILES (EDGEWOOD)

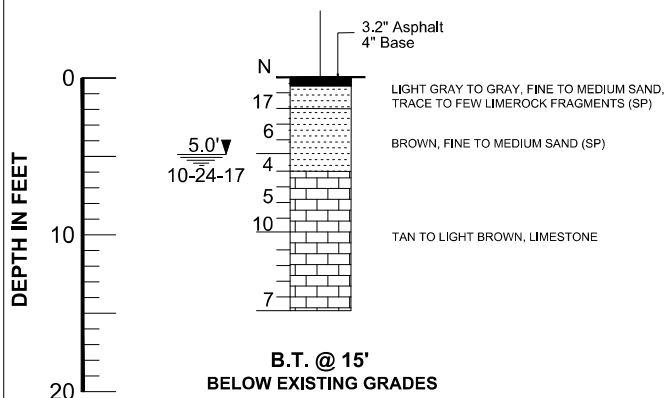
PROJECT NAME:
STORMWATER MASTER PLAN MODELING
AND DESIGN IMPLEMENTATION

SHEET NO.
5A

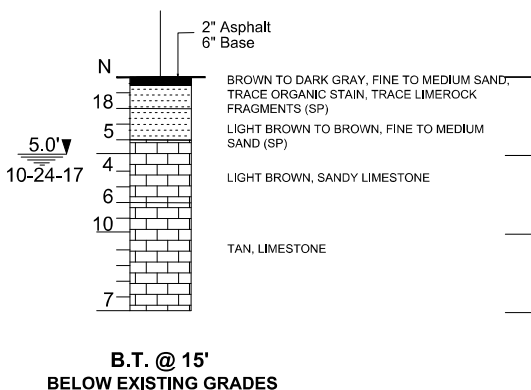
RADISE PROJECT NO:
170901

BORING NO.
ELEVATION (NAVD 88):
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

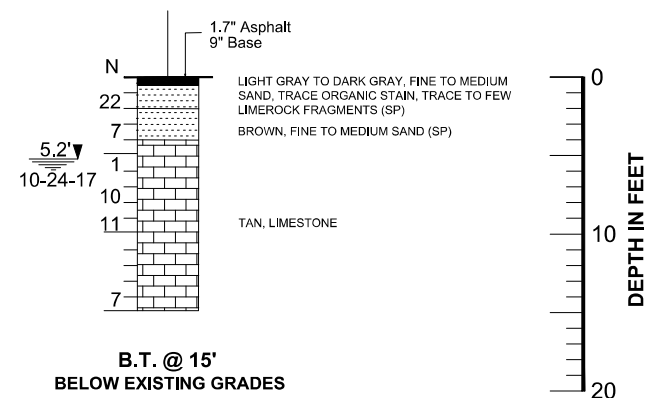
E-4
N/A
26.0873°
-80.1595°
10/24/2017
T. FICKLING
CME 45



E-5
N/A
26.0855°
-80.1595°
10/24/2017
T. FICKLING
CME 45



E-6
N/A
26.0888°
-80.1588°
10/24/2017
T. FICKLING
CME 45



LEGEND

ASPHALT AND BASE	LIMESTONE
SAND	GRAVEL
SILTY SAND	ORGANIC MATERIAL
5.0'▼ 10-24-17	GROUNDWATER DEPTH IN FEET AND DRILLING DATE
N	STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER

SP, SP-SM, PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
E-1	STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
MC	MOISTURE CONTENT (%)
-200	AMOUNT PASSING US STANDARD # 200 SIEVE (%)
OC	ORGANIC CONTENTS (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
B.T. @ 15'	BORING TERMINATED AT 15 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- BORINGS WERE DRILLED ON OCTOBER, 2017
USING A CENTRAL MINING EQUIPMENT MODEL 45
(CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT
SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE
LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL
THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE
PROFILES REPRESENT GROUNDWATER SURFACES ON
THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE
THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED
IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK
FILLED WITH GROUT.

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE BLOWS/FOOT
VERY LOOSE	LESS THAN 3
LOOSE	3 - 8
MEDIUM DENSE	8 - 24
VERY DENSE	24 - 40
	GREATER THAN 40

STANDARD PENETRATION TEST DATA

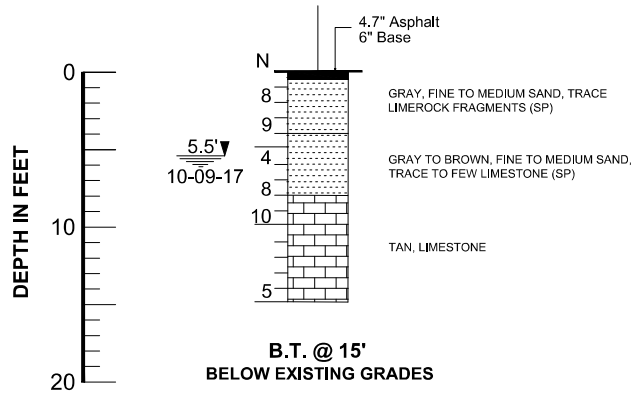
SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

REVISIONS

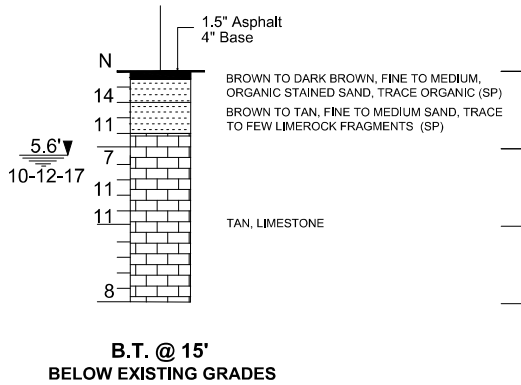
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						Drawn by	KA	11/06/17	RADISE International	N.T.S.	SUBSURFACE PROFILES (EDGEWOOD)	5B
						Checked by	AB	11/06/17	4152 West Blue Heron Boulevard, Suite 1114			
						Designed by			Riviera Beach, Florida, 33404	SCALE: HORIZONTAL	PROJECT NAME:	RADISE PROJECT NO:
						Checked by			TEL 561-941-0103 FAX 561-941-0104	N.T.S.	STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION	170901
						Approved by			URL : http://www.radise.net			

BORING NO.
ELEVATION (NAVD 88):
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

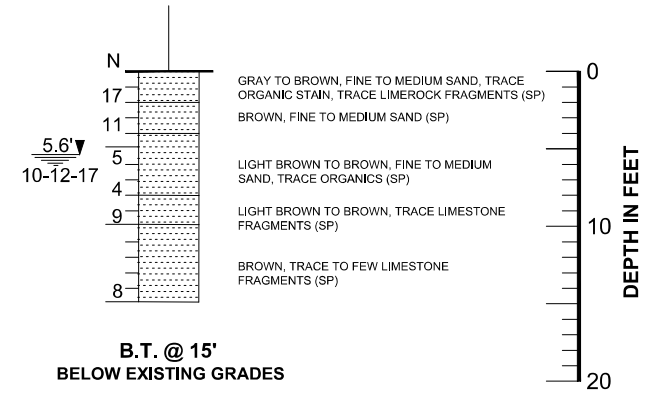
E-7
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26.0888°
-80.1548°
10/09/2017
T. FICKLING
CME 45



E-8
N/A
26.0861°
-80.1567°
10/12/2017
T. FICKLING
CME 45



E-9
N/A
26.0880°
-80.1560°
10/12/2017
T. FICKLING
CME 45



LEGEND

ASPHALT AND BASE	LIMESTONE
SAND	GRAVEL
SILTY SAND	ORGANIC MATERIAL
5.0'	GROUNDWATER DEPTH IN FEET AND DRILLING DATE
N	STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER

SP, SP-SM, PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
E-1	STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
MC	MOISTURE CONTENT (%)
-200	AMOUNT PASSING US STANDARD # 200 SIEVE (%)
OC	ORGANIC CONTENTS (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
B.T. @ 15'	BORING TERMINATED AT 15 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- BORINGS WERE DRILLED ON OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER
VERY LOOSE	SPT N-VALUE
LOOSE	BLOWS/FOOT
MEDIUM DENSE	LESS THAN 3
VERY DENSE	3 - 8
	8 - 24
	24 - 40
	GREATER THAN 40

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

REVISIONS

Date	By	Descriptions	Date	By	Descriptions	Names	Dates	ENGINEER OF RECORD	CITY OF FORT LAUDERDALE	SCALE: VERTICAL	SHEET TITLE:	SHEET NO.
						Drawn by	KA	11/06/17	PUBLIC WORKS DEPARTMENT	N.T.S.	SUBSURFACE PROFILES (EDGEWOOD)	5C
						Checked by	AB	11/06/17				
						Designed by						
						Checked by						
						Approved by						



ENGINEER OF RECORD
RADISE International
4152 West Blue Heron Boulevard, Suite 1114
Riviera Beach, Florida, 33404
TEL 561-841-0103 FAX 561-841-0104
URL : http://www.radise.net

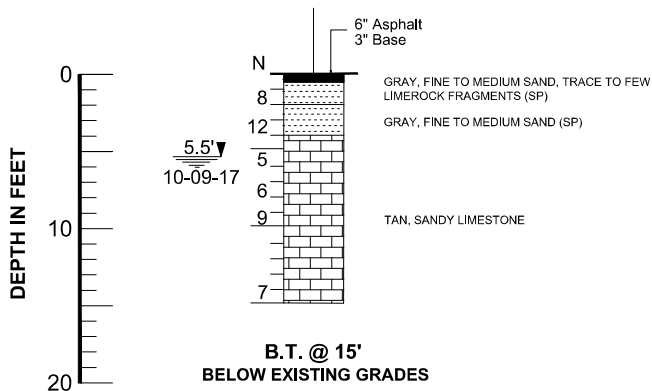
COUNTY	CLIENT
BROWARD	HAZEN AND SAWYER

SCALE: HORIZONTAL
N.T.S.

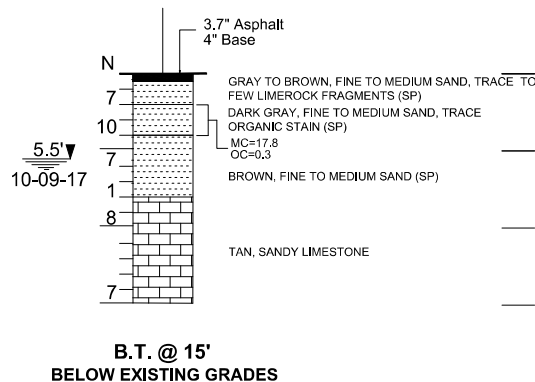
PROJECT NAME:
STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION

RADISE PROJECT NO:
170901

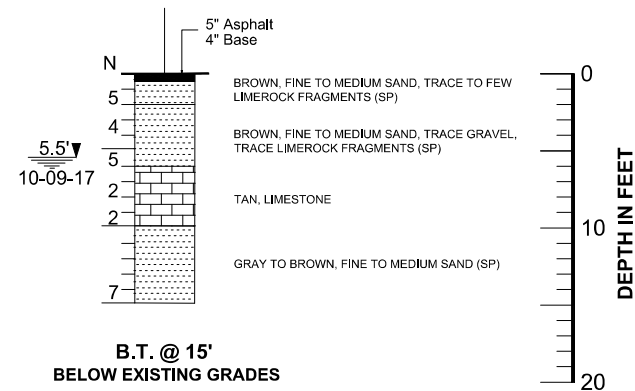
BORING NO. E-10
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0870°
LONGITUDE: -80.1528°
DATE: 10/09/2017
DRILLER: T. FICKLING
RIG: CME 45



BORING NO. E-11
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0874°
LONGITUDE: -80.1507°
DATE: 10/09/2017
DRILLER: T. FICKLING
RIG: CME 45



BORING NO. E-12
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0889°
LONGITUDE: -80.1507°
DATE: 10/09/2017
DRILLER: T. FICKLING
RIG: CME 45



LEGEND

ASPHALT AND BASE	LIMESTONE
SAND	GRAVEL
SILTY SAND	ORGANIC MATERIAL
5.0' 10-24-17	GROUNDWATER DEPTH IN FEET AND DRILLING DATE
N	STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER

SP, SP-SM, PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
E-1	STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
MC	MOISTURE CONTENT (%)
-200	AMOUNT PASSING US STANDARD # 200 SIEVE (%)
OC	ORGANIC CONTENTS (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
B.T. @ 15'	BORING TERMINATED AT 15 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- BORINGS WERE DRILLED ON OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER
VERY LOOSE	SPT N-VALUE
LOOSE	BLOWS/FOOT
MEDIUM DENSE	LESS THAN 3
DENSE	3 - 8
VERY DENSE	8 - 24
	24 - 40
	GREATER THAN 40

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

REVISIONS

Date	By	Descriptions	Date	By	Descriptions	Names	Dates	ENGINEER OF RECORD	CITY OF FORT LAUDERDALE	SCALE: VERTICAL	SHEET TITLE:	SHEET NO.
						Drawn by	KA	11/06/17	PUBLIC WORKS DEPARTMENT	N.T.S.	SUBSURFACE PROFILES (EDGEWOOD)	5D
						Checked by	AB	11/06/17				
						Designed by						
						Checked by						
						Approved by						

RADISE

ENGINEER OF RECORD
RADISE International
4152 West Blue Heron Boulevard, Suite 1114
Riviera Beach, Florida, 33404
TEL: 561-941-0103 FAX: 561-941-0104
URL: http://www.radise.net

LICENSE NO. - 8901

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT

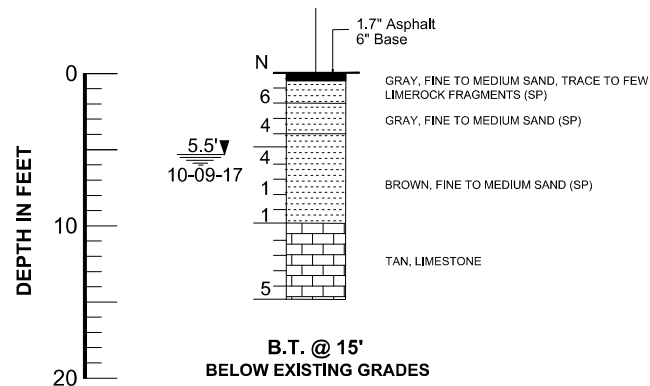
COUNTY: BROWARD
CLIENT: HAZEN AND SAWYER

SCALE: HORIZONTAL
N.T.S.

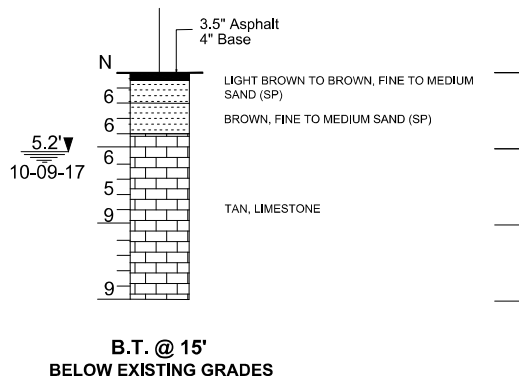
PROJECT NAME:
STORMWATER MASTER PLAN MODELING
AND DESIGN IMPLEMENTATION

RADISE PROJECT NO:
170901

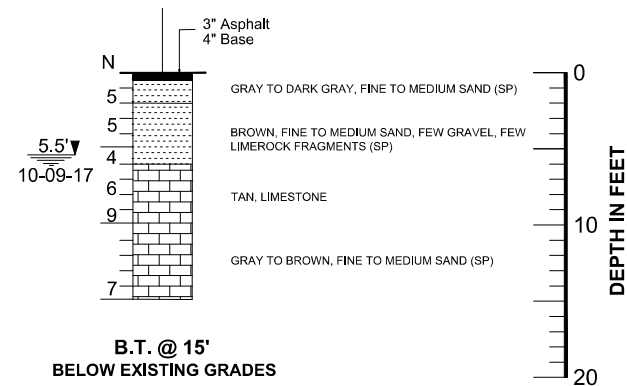
BORING NO. E-13
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0899°
LONGITUDE: -80.1528°
DATE: 10/09/2017
DRILLER: T. FICKLING
RIG: CME 45



BORING NO. E-14
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0907°
LONGITUDE: -80.1401°
DATE: 10/09/2017
DRILLER: T. FICKLING
RIG: CME 45



BORING NO. E-15
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0868°
LONGITUDE: -80.1391°
DATE: 10/09/2017
DRILLER: T. FICKLING
RIG: CME 45



LEGEND

	ASPHALT AND BASE		LIMESTONE
	SAND		GRAVEL
	SILTY SAND		ORGANIC MATERIAL
	GROUNDWATER DEPTH IN FEET		
	AND DRILLING DATE		
	STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER		

SP, SP-SM, PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
E-1	STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
MC	MOISTURE CONTENT (%)
-200	AMOUNT PASSING US STANDARD # 200 SIEVE (%)
OC	ORGANIC CONTENTS (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
B.T. @ 15'	BORING TERMINATED AT 15 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- BORINGS WERE DRILLED ON OCTOBER, 2017
USING A CENTRAL MINING EQUIPMENT MODEL 45
(CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT
SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE
LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL
THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE
PROFILES REPRESENT GROUNDWATER SURFACES ON
THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE
THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED
IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK
FILLED WITH GROUT.

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
VERY LOOSE	BLOWS/FOOT LESS THAN 3
LOOSE	3 - 8
MEDIUM DENSE	8 - 24
VERY DENSE	24 - 40
	GREATER THAN 40

STANDARD PENETRATION TEST DATA

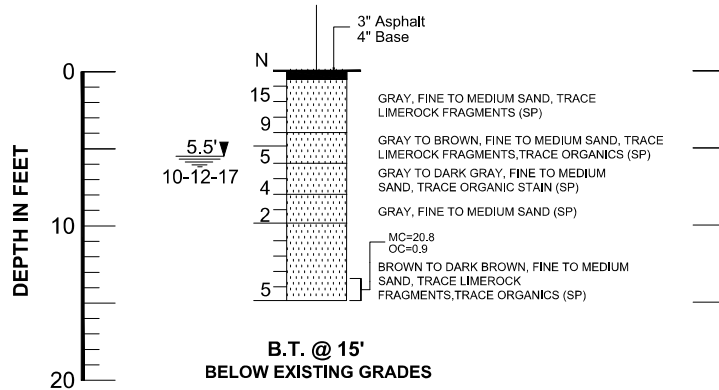
SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

REVISIONS

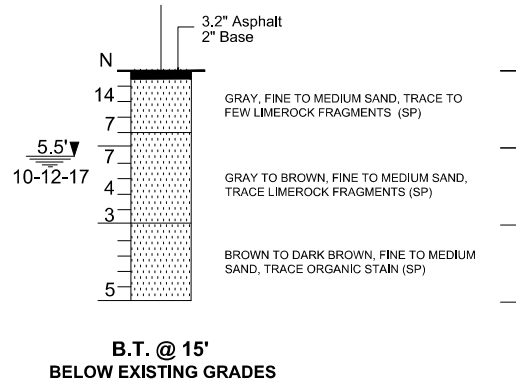
Date.	By	Descriptions	Date.	By	Descriptions	Names	Dates	ENGINEER OF RECORD	CITY OF FORT LAUDERDALE	SCALE: VERTICAL	SHEET TITLE:	SHEET NO.
						Drawn by	KA	11/06/17	RADISE International	N.T.S.	SUBSURFACE PROFILES (EDGEWOOD)	5E
						Checked by	AB	11/06/17	4152 West Blue Heron Boulevard, Suite 1114			
						Designed by			Riviera Beach, Florida, 33404			
						Checked by			TEL 561-841-0103 FAX 561-841-0104	SCALE: HORIZONTAL	PROJECT NAME:	RADISE PROJECT NO:
						Approved by			URL : http://www.radise.net	N.T.S.	STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION	170901

BORING NO.
ELEVATION (NAVD 88):
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

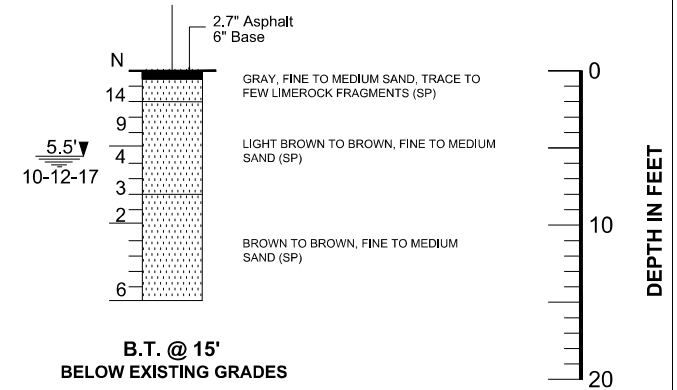
P-1
N/A
26.1207°
-80.1474°
10/12/2017
T. FICKLING
CME 45



P-2
N/A
26.1223°
-80.1485°
10/12/2017
T. FICKLING
CME 45



P-3
N/A
26.1239°
-80.1475°
10/12/2017
T. FICKLING
CME 45



LEGEND

	ASPHALT AND BASE		LIMESTONE
	SAND		GRAVEL
	SILTY SAND		ORGANIC MATERIAL
	GROUNDWATER DEPTH IN FEET AND DRILLING DATE		
	STANDARD PENETRATION RESISTANCE-BLOWS PER FOOT USING AUTOMATIC HAMMER		

SP, SP-SM, PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
P-1	STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
MC	MOISTURE CONTENT (%)
-200	AMOUNT PASSING US STANDARD # 200 SIEVE (%)
OC	ORGANIC CONTENTS (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
B.T. @ 15'	BORING TERMINATED AT 15 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- (1) BORING WERE DRILLED ON OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- (2) STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- (3) GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- (4) LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- (5) ELEVATIONS WERE NOT AVAILABLE
- (6) AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER
VERY LOOSE	SPT N-VALUE
LOOSE	BLOWS/FOOT
MEDIUM	LESS THAN 3
DENSE	3 - 8
VERY DENSE	8 - 24
	24 - 40
	GREATER THAN 40

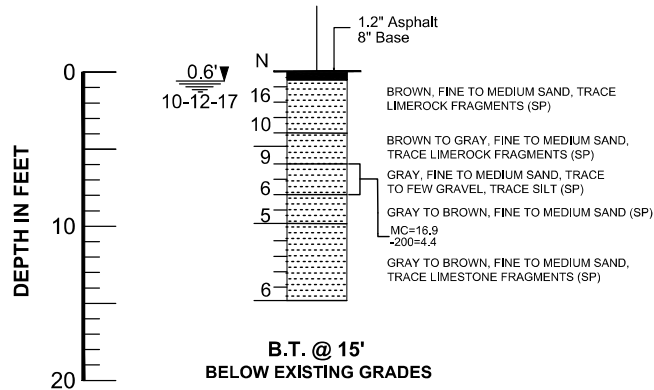
STANDARD PENETRATION TEST DATA	
SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

REVISIONS

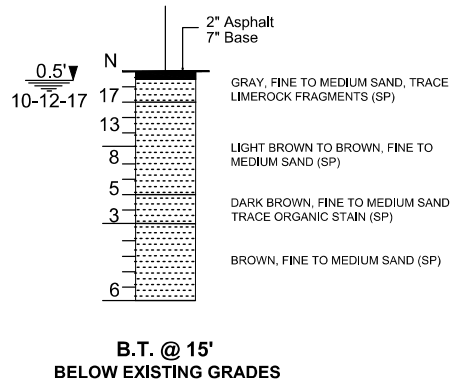
Date	By	Descriptions	Date	By	Descriptions	Names	Dates	ENGINEER OF RECORD	CITY OF FORT LAUDERDALE	SCALE: VERTICAL	SHEET TITLE:	SHEET NO.
						Drawn by	KA	11/09/17	RADISE International	N.T.S.	SUBSURFACE PROFILES (PROGRESSO)	6A
						Checked by	AB	11/09/17	4152 West Blue Heron Boulevard, Suite 1114			
						Designed by			Riviera Beach, Florida, 33404			
						Checked by			TEL 561-841-0103 FAX 561-841-0104	COUNTY	CLIENT	RADISE PROJECT NO:
						Approved by			URL: http://www.radise.net	BROWARD	HAZEN AND SAWYER	170901
										SCALE: HORIZONTAL	PROJECT NAME:	
										N.T.S.	STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION	

BORING NO.
ELEVATION (NAVD 88):
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

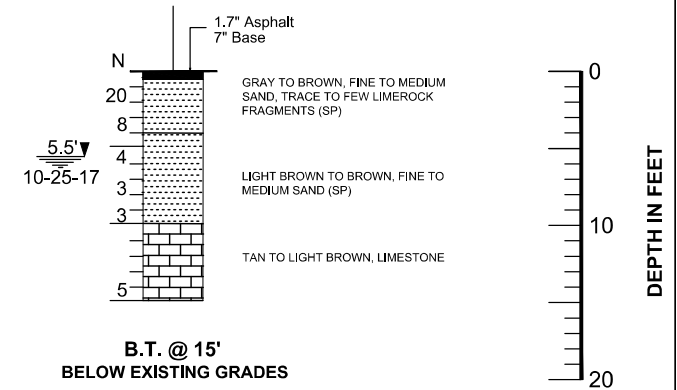
P-4
N/A
26.1315°
-80.1469°
10/12/2017
T. FICKLING
CME 45



P-7
N/A
26.1266°
-80.1506°
10/12/2017
T. FICKLING
CME 45



P-8
N/A
26.1312°
-80.1517°
10/25/2017
T. FICKLING
CME 45



LEGEND

ASPHALT AND BASE	LIMESTONE
SAND	GRAVEL
SILTY SAND	ORGANIC MATERIAL
5.5'▼ 10-12-17 N	GROUNDWATER DEPTH IN FEET AND DRILLING DATE STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER

SP, SP-SM, PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
P-1	STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
MC	MOISTURE CONTENT (%)
-200	AMOUNT PASSING US STANDARD # 200 SIEVE (%)
OC	ORGANIC CONTENTS (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
B.T. @ 15'	BORING TERMINATED AT 15 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- BORING WERE DRILLED ON OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER
VERY LOOSE	SPT N-VALUE
LOOSE	BLOWS/FOOT
MEDIUM	LESS THAN 3
DENSE	3 - 8
VERY DENSE	8 - 24
	24 - 40
	GREATER THAN 40

STANDARD PENETRATION TEST DATA

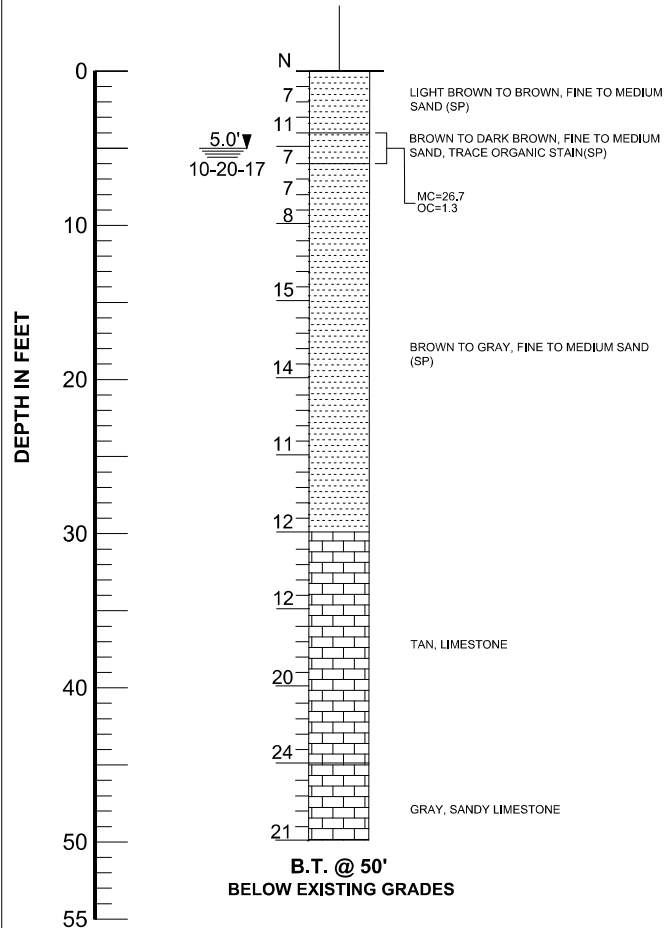
SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

REVISIONS

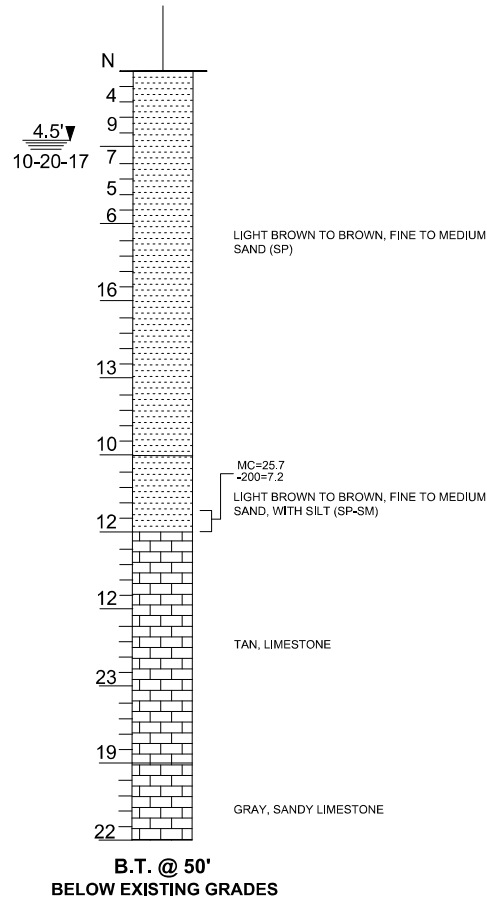
Date	By	Descriptions	Date	By	Descriptions	Names	Dates	ENGINEER OF RECORD	CITY OF FORT LAUDERDALE	SCALE: VERTICAL	SHEET TITLE:	SHEET NO.
						Drawn by	KA	11/09/17	PUBLIC WORKS DEPARTMENT	N.T.S.	SUBSURFACE PROFILES (PROGRESSO)	6B
						Checked by	AB	11/09/17				
						Designed by			COUNTY	CLIENT	PROJECT NAME:	RADISE PROJECT NO:
						Checked by			BROWARD	HAZEN AND SAWYER	STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION	170901
						Approved by						

BORING NO.
ELEVATION (NAVD 88):
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

P-5
N/A
26.1332°
-80.1479°
10/20/2017
R. RAMSEWACK
CME 45



P-6
N/A
26.1335°
-80.1476°
10/20/2017
R. RAMSEWACK
CME 45



LEGEND



5.0'▼
10-20-17
AND DRILLING DATE
N
STANDARD PENETRATION RESISTANCE-
BLOWS PER FOOT USING AUTOMATIC HAMMER

SP, SP-SM, PT
UNIFIED SOIL CLASSIFICATION SYSTEM
GROUP SYMBOL (ASTM D 2488)
P-5
STANDARD PENETRATION TEST (SPT)
BORING AND NUMBER
MC
MOISTURE CONTENT (%)
-200
AMOUNT PASSING US STANDARD # 200
SIEVE
OC
ORGANIC CONTENTS (%)
LL
LIQUID LIMIT (%)
PI
PLASTICITY INDEX (%)
B.T. @ 50'
BORING TERMINATED AT 50 FEET
BELOW THE EXISTING GROUND SURFACE

NOTES

- (1) BORINGS WERE DRILLED ON OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMERDRILL RIG.
- (2) STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- (3) GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- (4) LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- (5) ELEVATIONS WERE NOT AVAILABLE
- (6) AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

STANDARD PENETRATION TEST DATA
SPOON INSIDE DIA. 1.375 INCH
SPOON OUTSIDE DIA. 2.0 INCHES
AVG. HAMMER DROP 30 INCHES
HAMMER WEIGHT 140 POUNDS

RELATIVE DENSITY
VERY LOOSE
LOOSE
MEDIUM DENSE
VERY DENSE
AUTOMATIC HAMMER
SPT N-VALUE
BLOWS/FOOT
LESS THAN 3
3 - 8
8 - 24
24 - 40
GREATER THAN 40

REVISIONS

Date	By	Descriptions	Date	By	Descriptions

Names	Dates
Drawn by ML	10/13/17
Checked by AB	10/13/17
Designed by	
Checked by	
Approved by	



ENGINEER OF RECORD
RADISE International
4152 West Blue Heron Boulevard, Suite 1114
Riviera Beach, Florida, 33404
TEL: 561-941-0103 FAX: 561-941-0104
URL: http://www.radise.net

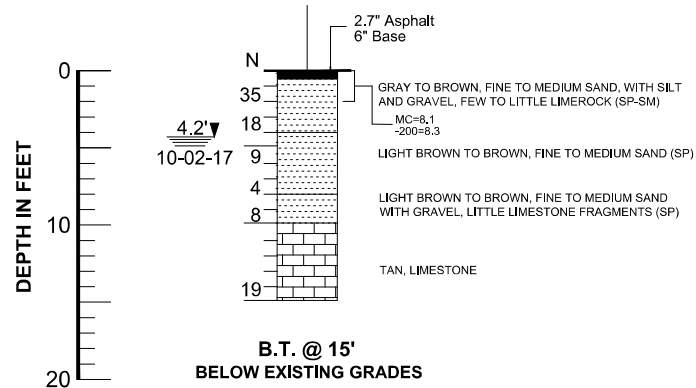
CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
COUNTY
BROWARD
CLIENT
HAZEN AND SAWYER

SCALE: VERTICAL
N.T.S.
SCALE: HORIZONTAL
N.T.S.

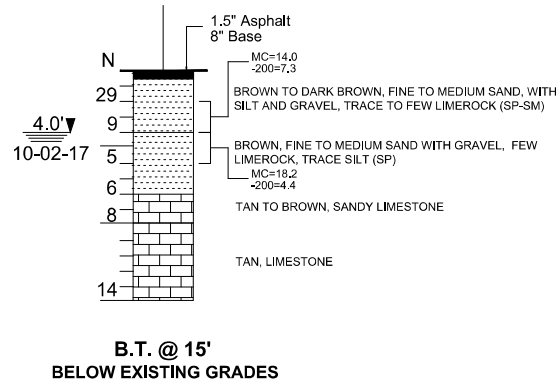
SHEET TITLE:
SUBSURFACE PROFILES
(PROGRESSO)
PROJECT NAME:
STORMWATER MASTER PLAN MODELING
AND DESIGN IMPLEMENTATION

SHEET NO.
6C
RADISE PROJECT NO:
170901

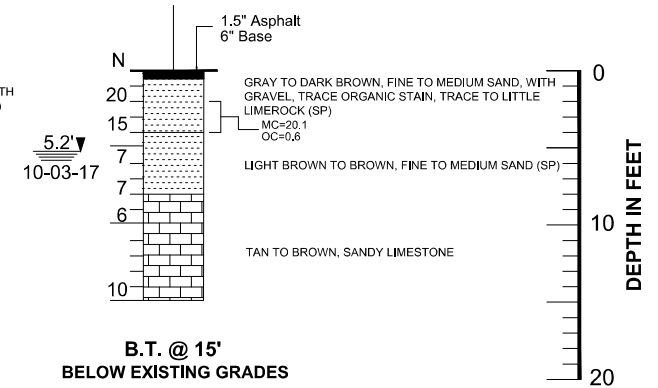
BORING NO. R-1
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0909°
LONGITUDE: -80.1608°
DATE: 10/02/2017
DRILLER: P. RAMSEWACK
RIG: CME 45



BORING NO. R-2
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0945°
LONGITUDE: -80.1609°
DATE: 10/02/2017
DRILLER: P. RAMSEWACK
RIG: CME 45



BORING NO. R-3
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0924°
LONGITUDE: -80.1648°
DATE: 10/03/2017
DRILLER: P. RAMSEWACK
RIG: CME 45



LEGEND

ASPHALT AND BASE	LIMESTONE
SAND	GRAVEL
SILTY SAND	ORGANIC MATERIAL
GROUNDWATER DEPTH IN FEET AND DRILLING DATE	
STANDARD PENETRATION RESISTANCE-BLOWS PER FOOT USING AUTOMATIC HAMMER	

SP, SP-SM, PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
R-1	STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
MC	MOISTURE CONTENT (%)
-200	AMOUNT PASSING US STANDARD # 200 SIEVE (%)
OC	ORGANIC CONTENTS (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
B.T. @ 15'	BORING TERMINATED AT 15 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- BORING WERE DRILLED ON OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER
VERY LOOSE	SPT N-VALUE
LOOSE	BLOWS/FOOT
MEDIUM DENSE	LESS THAN 3
DENSE	3 - 8
VERY DENSE	8 - 24
	24 - 40
	GREATER THAN 40

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

REVISIONS

Date	By	Descriptions	Date	By	Descriptions

RADISE
ENGINEER OF RECORD
RADISE International
4152 West Blue Heron Boulevard, Suite 1114
Riviera Beach, Florida, 33404
TEL 561-841-0103 FAX 561-841-0104
URL: http://www.radise.net

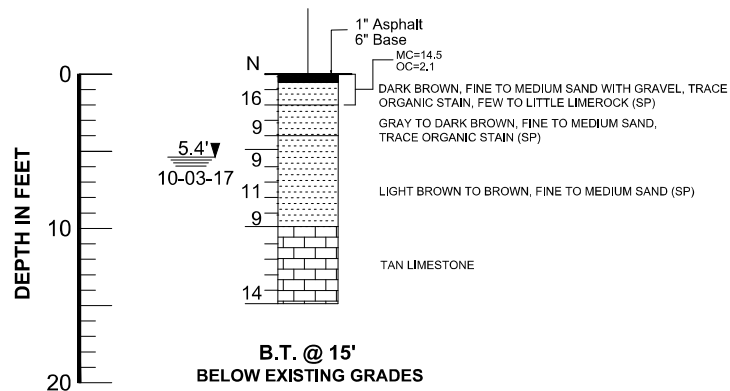
CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
COUNTY
BROWARD
CLIENT
HAZEN AND SAWYER

SCALE: VERTICAL
N.T.S.
SCALE: HORIZONTAL
N.T.S.

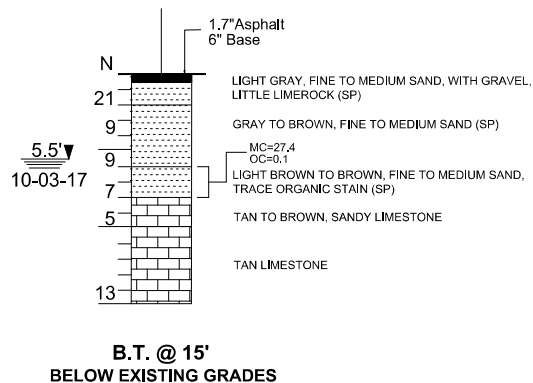
SHEET TITLE:
SUBSURFACE PROFILES
(RIVER OAKS)
PROJECT NAME:
STORMWATER MASTER PLAN MODELING
AND DESIGN IMPLEMENTATION

SHEET NO.
7A
RADISE PROJECT NO:
170901

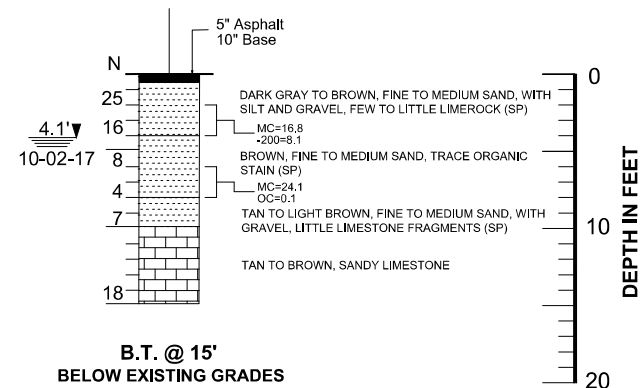
BORING NO. R-4
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0946°
LONGITUDE: -80.1630°
DATE: 10/03/2017
DRILLER: P. RAMSEWACK
RIG: CME 45



BORING NO. R-5
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0950°
LONGITUDE: -80.1661°
DATE: 10/03/2017
DRILLER: T. FICKLING
RIG: CME 45



BORING NO. R-6
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0961°
LONGITUDE: -80.1608°
DATE: 10/02/2017
DRILLER: T. FICKLING
RIG: CME 45



LEGEND

	ASPHALT AND BASE		LIMESTONE
	SAND		GRAVEL
	SILTY SAND		ORGANIC MATERIAL
	GROUNDWATER DEPTH IN FEET AND DRILLING DATE		
	STANDARD PENETRATION RESISTANCE - BLOWS PER FOOT USING AUTOMATIC HAMMER		

SP, SP-SM, PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
R-1	STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
MC	MOISTURE CONTENT (%)
-200	AMOUNT PASSING US STANDARD # 200 SIEVE (%)
OC	ORGANIC CONTENTS (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
B.T. @ 15'	BORING TERMINATED AT 15 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- BORING WERE DRILLED ON OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER
VERY LOOSE	SPT N-VALUE
LOOSE	BLOWS/FOOT
MEDIUM DENSE	LESS THAN 3
DENSE	3 - 8
VERY DENSE	8 - 24
	24 - 40
	GREATER THAN 40

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

REVISIONS

Date	By	Descriptions	Date	By	Descriptions

Names	Date
Drawn by KA	11/09/17
Checked by AB	11/09/17
Designed by	
Checked by	
Approved by	



ENGINEER OF RECORD
 RADISE International
 4152 West Blue Heron Boulevard, Suite 1114
 Riviera Beach, Florida, 33404
 TEL 561-841-0103 FAX 561-841-0104
 URL : http://www.radise.net

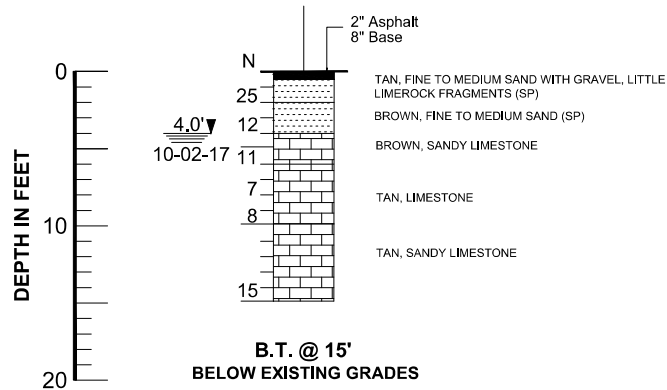
CITY OF FORT LAUDERDALE PUBLIC WORKS DEPARTMENT	
COUNTY	CLIENT
BROWARD	HAZEN AND SAWYER

SCALE: VERTICAL	N.T.S.
SCALE: HORIZONTAL	N.T.S.

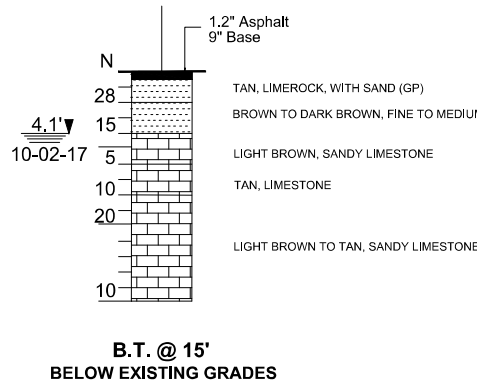
SHEET TITLE:	SUBSURFACE PROFILES (RIVER OAKS)
PROJECT NAME:	STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION

SHEET NO.	7B
RADISE PROJECT NO:	170901

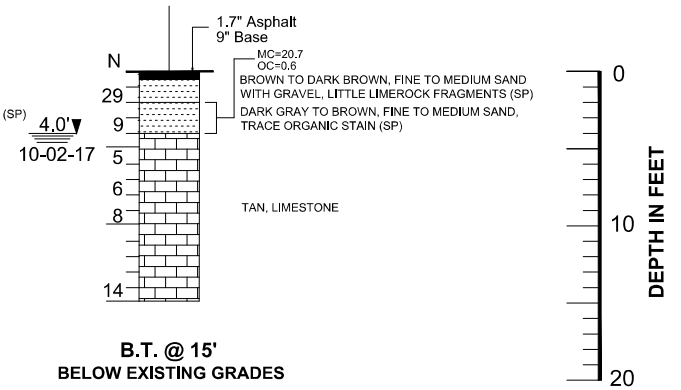
BORING NO. R-7
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0979°
LONGITUDE: -80.1589°
DATE: 10/02/2017
DRILLER: P. RAMSEWACK
RIG: CME 45



BORING NO. R-8
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0994°
LONGITUDE: -80.1582°
DATE: 10/02/2017
DRILLER: P. RAMSEWACK
RIG: CME 45



BORING NO. R-13
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0979°
LONGITUDE: -80.1550°
DATE: 10/02/2017
DRILLER: P. RAMSEWACK
RIG: CME 45



LEGEND

ASPHALT AND BASE	LIMESTONE
SAND	GRAVEL
SILTY SAND	ORGANIC MATERIAL
GROUNDWATER DEPTH IN FEET AND DRILLING DATE	
N	STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER

SP, SP-SM, PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
R-1	STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
MC	MOISTURE CONTENT (%)
-200	AMOUNT PASSING US STANDARD # 200 SIEVE (%)
OC	ORGANIC CONTENTS (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
B.T. @ 15'	BORING TERMINATED AT 15 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- BORING WERE DRILLED ON OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER
VERY LOOSE	SPT N-VALUE
LOOSE	BLOWS/FOOT
MEDIUM	LESS THAN 3
DENSE	3 - 8
VERY DENSE	8 - 24
	24 - 40
	GREATER THAN 40

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

REVISIONS

Date	By	Descriptions	Date	By	Descriptions	Names	Dates	ENGINEER OF RECORD	CITY OF FORT LAUDERDALE	SCALE: VERTICAL	SHEET TITLE:	SHEET NO.
						Drawn by KA	11/09/17	RADISE International	PUBLIC WORKS DEPARTMENT	N.T.S.	SUBSURFACE PROFILES (RIVER OAKS)	7C
						Checked by AB	11/09/17	4152 West Blue Heron Boulevard, Suite 1114	COUNTY	CIENT	PROJECT NAME:	RADISE PROJECT NO:
						Designed by		Riviera Beach, Florida, 33404	BROWARD	HAZEN AND SAWYER	STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION	170901
						Checked by		TEL 561-941-0103 FAX 561-941-0104				
						Approved by		URL : http://www.radise.net				

BORING NO.
ELEVATION (NAVD 88):
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

R-9
N/A
26.0949°
-80.1679°
09/26/2017
T. FICKLING
CME 45

R-10
N/A
26.0947°
-80.1677°
09/26/2017
T. FICKLING
CME 45

LEGEND

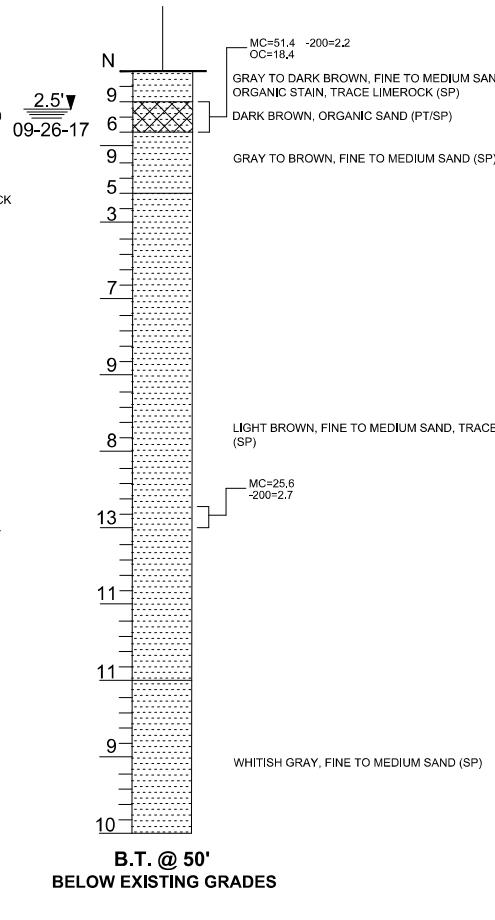
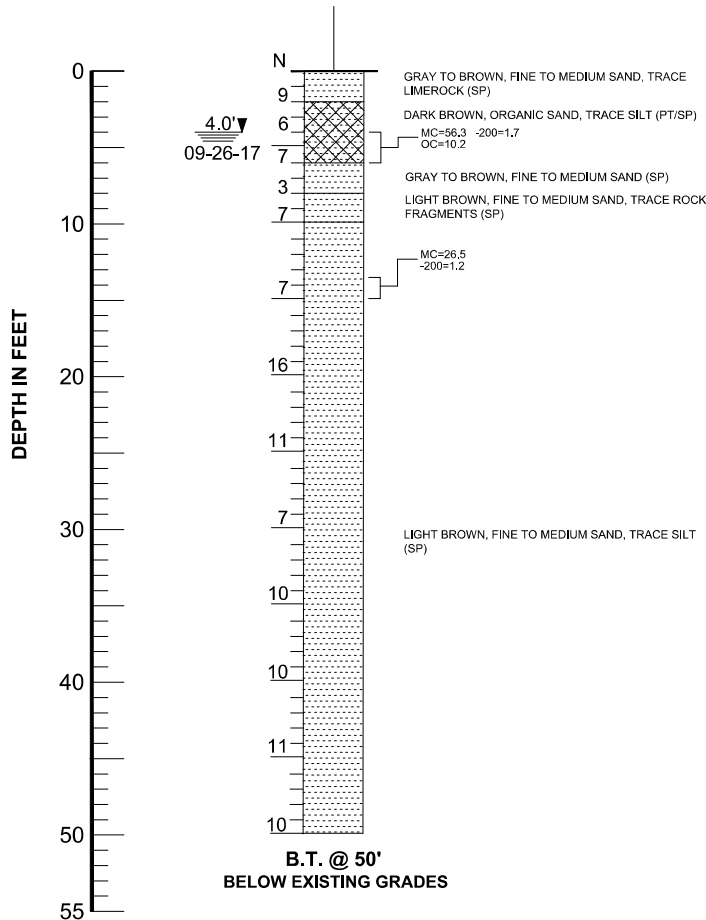
- 1.5' ▽ GROUNDWATER DEPTH IN FEET AND DRILLING DATE
09-21-17
N STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER
SP UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
S-9 STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
MC MOISTURE CONTENT (%)
-200 AMOUNT PASSING US STANDARD # 200 SIEVE
OC ORGANIC CONTENTS (%)
LL LIQUID LIMIT (%)
PI PLASTICITY INDEX (%)
B.T. @ 50' BORING TERMINATED AT 50 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- (1) BORINGS WERE DRILLED ON SEPTEMBER AND OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- (2) STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- (3) GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- (4) LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- (5) ELEVATIONS WERE NOT AVAILABLE
- (6) AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

STANDARD PENETRATION TEST DATA	RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
SPOON INSIDE DIA. 1.375 INCH	VERY LOOSE	BLOWS/FOOT LESS THAN 3
SPOON OUTSIDE DIA. 2.0 INCHES	LOOSE	3 - 8
AVG. HAMMER DROP 30 INCHES	MEDIUM	8 - 24
HAMMER WEIGHT 140 POUNDS	DENSE	24 - 40
	VERY DENSE	GREATER THAN 40



REVISIONS

Date	By	Descriptions	Date	By	Descriptions

Names	Dates
Drawn by ML	10/13/17
Checked by AB	10/13/17
Designed by	
Checked by	
Approved by	



ENGINEER OF RECORD
RADISE International
4152 West Blue Heron Boulevard, Suite 1114
Riviera Beach, Florida, 33404
TEL 561-841-0103 FAX 561-841-0104
URL : http://www.radise.net

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT

COUNTY	CLIENT
BROWARD	HAZEN AND SAWYER

SCALE: VERTICAL N.T.S.	SCALE: HORIZONTAL N.T.S.
---------------------------	-----------------------------

SHEET TITLE:	SUBSURFACE PROFILES (RIVER OAKS)
PROJECT NAME:	STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION

SHEET NO.	7D
RADISE PROJECT NO:	170901

BORING NO. R-11
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0936°
LONGITUDE: -80.1665°
DATE: 10/04/2017
DRILLER: P. RAMSEWACK
RIG: CME 45

BORING NO. R-12
ELEVATION (NAVD 88): N/A
LATITUDE: 26.0938°
LONGITUDE: -80.1667°
DATE: 10/04/2017
DRILLER: P. RAMSEWACK
RIG: CME 45

LEGEND

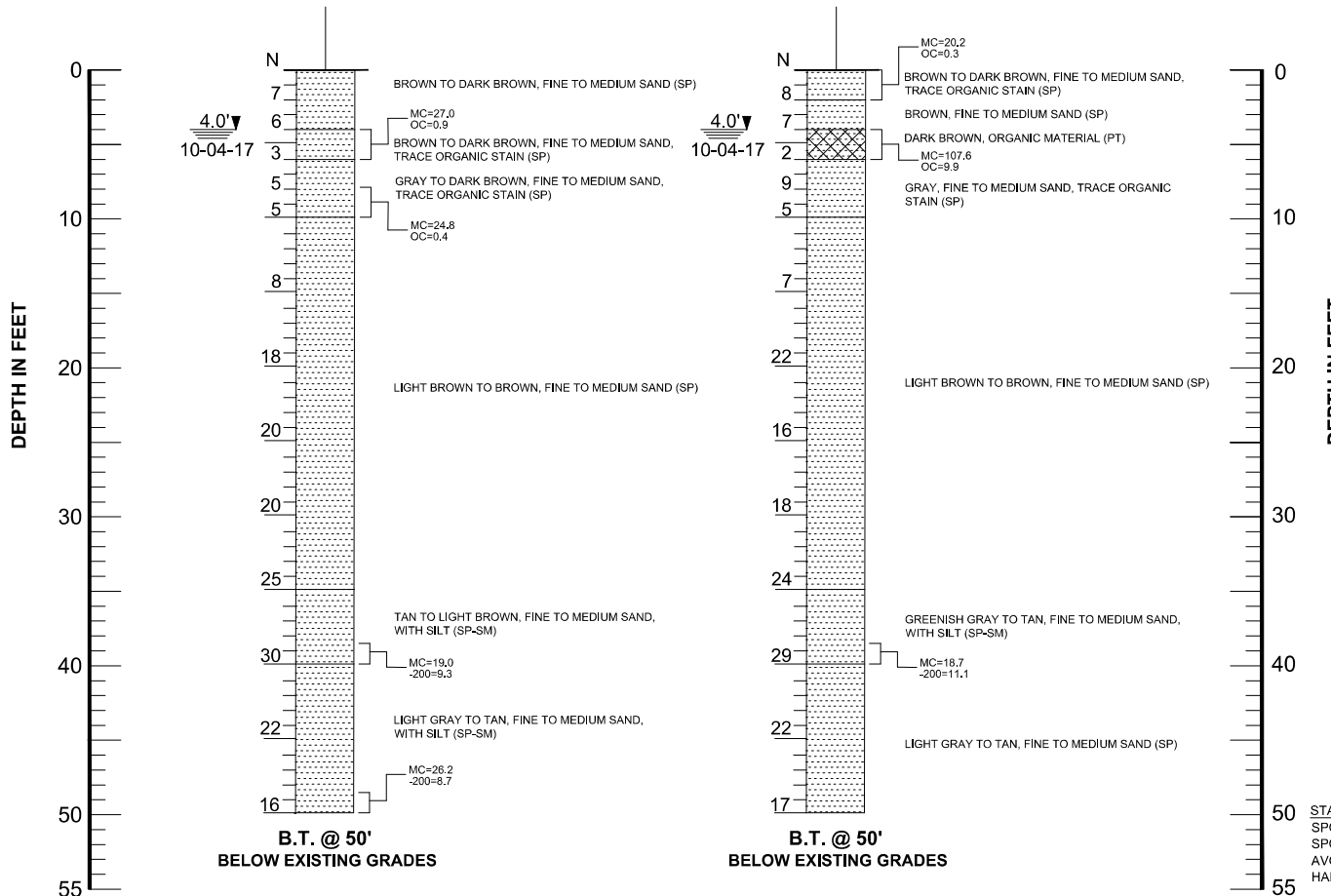
- 1.5'▼
09-21-17
N
SP
S-9
MC
-200
OC
LL
PI
B.T. @ 50'
- SAND
SILT
ORGANIC MATERIAL
SHELLY SAND
LIMESTONE
GRAVEL
- GROUNDWATER DEPTH IN FEET AND DRILLING DATE
STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER
UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
MOISTURE CONTENT (%)
AMOUNT PASSING US STANDARD # 200 SIEVE
ORGANIC CONTENTS (%)
LIQUID LIMIT (%)
PLASTICITY INDEX (%)
BORING TERMINATED AT 50 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- BORINGS WERE DRILLED ON SEPTEMBER AND OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

STANDARD PENETRATION TEST DATA		RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
SPOON INSIDE DIA.	1.375 INCH	VERY LOOSE	BLOWS/FOOT LESS THAN 3
SPOON OUTSIDE DIA.	2.0 INCHES	LOOSE	3 - 8
AVG. HAMMER DROP	30 INCHES	MEDIUM	8 - 24
HAMMER WEIGHT	140 POUNDS	DENSE	24 - 40
		VERY DENSE	GREATER THAN 40



REVISIONS

Date	By	Descriptions	Date	By	Descriptions

RADISE
ENGINEERING & SURVEYING
LICENSE NO. - 8901

ENGINEER OF RECORD
RADISE International
4152 West Blue Heron Boulevard, Suite 1114
Riviera Beach, Florida, 33404
TEL 561-861-0103 FAX 561-861-0104
URL : http://www.radise.net

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT

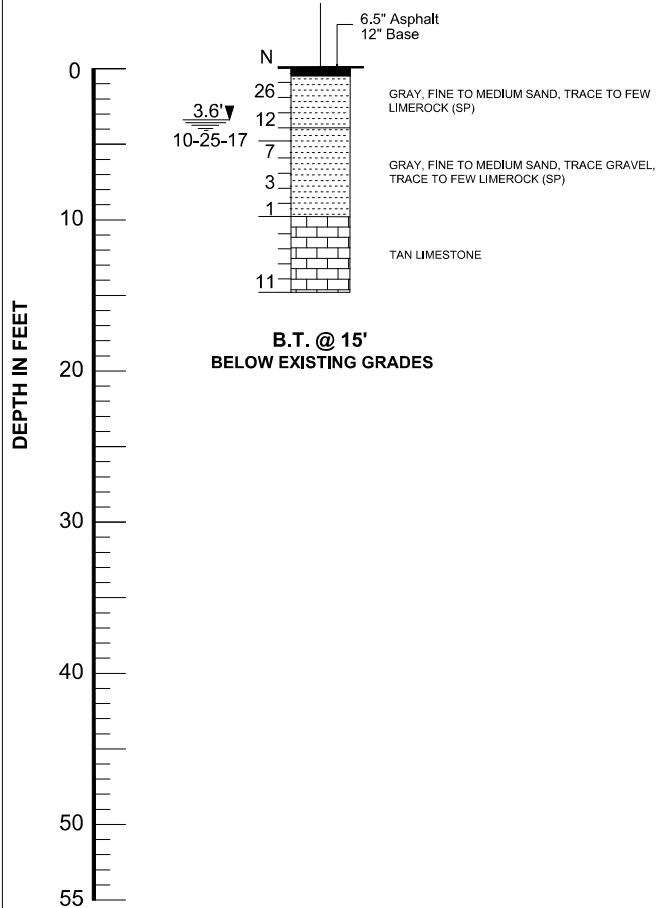
COUNTY: BROWARD
CLIENT: HAZEN AND SAWYER

SCALE: VERTICAL
N.T.S.
SCALE: HORIZONTAL
N.T.S.

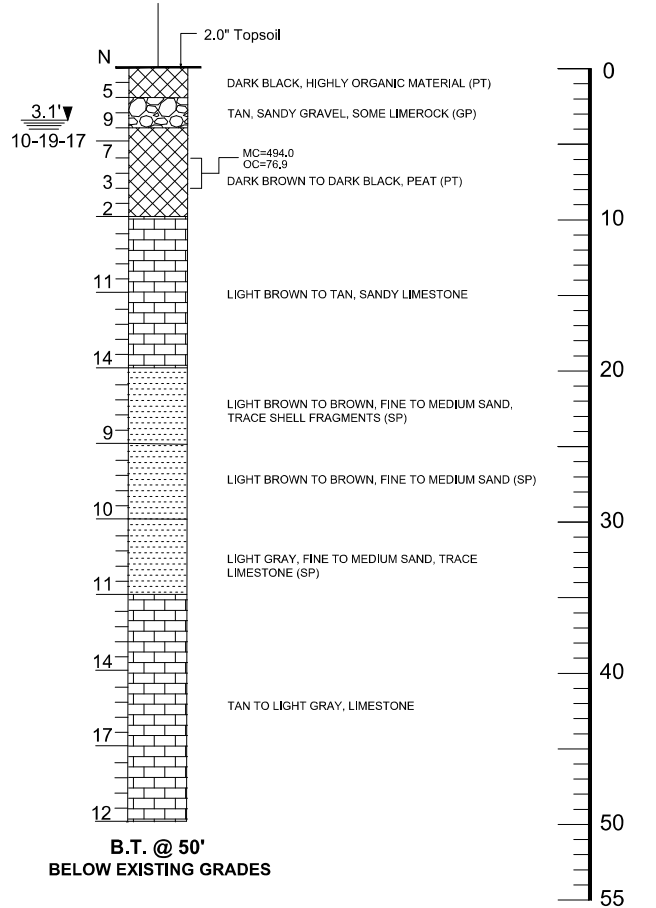
SHEET TITLE:
SUBSURFACE PROFILES
(RIVER OAKS)
PROJECT NAME:
STORMWATER MASTER PLAN MODELING
AND DESIGN IMPLEMENTATION

SHEET NO.
7E
RADISE PROJECT NO:
170901

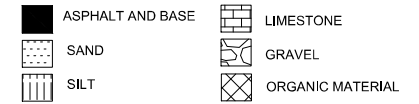
BORING NO. S-1
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1188°
LONGITUDE: -80.1244°
DATE: 10/25/2017
DRILLER: T. FICKLING
RIG: CME 45



BORING NO. S-2
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1199°
LONGITUDE: -80.1208°
DATE: 10/19/2017
DRILLER: T. FICKLING
RIG: CME 45



LEGEND



1.5' GROUNDWATER DEPTH IN FEET
09-21-17 AND DRILLING DATE
N STANDARD PENETRATION RESISTANCE-
BLOWS PER FOOT USING AUTOMATIC HAMMER
SP, SP-SM, GP, PT UNIFIED SOIL CLASSIFICATION SYSTEM
GROUP SYMBOL (ASTM D 2488)
S-1 STANDARD PENETRATION TEST (SPT)
BORING AND NUMBER
MC MOISTURE CONTENT (%)
-200 AMOUNT PASSING US STANDARD # 200
SIEVE
OC ORGANIC CONTENTS (%)
LL LIQUID LIMIT (%)
PI PLASTICITY INDEX (%)
B.T. @ 50' BORING TERMINATED AT 50 FEET
BELOW THE EXISTING GROUND SURFACE

NOTES

- BORINGS WERE DRILLED ON SEPTEMBER AND OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

STANDARD PENETRATION TEST DATA
SPOON INSIDE DIA. 1.375 INCH
SPOON OUTSIDE DIA. 2.0 INCHES
AVG. HAMMER DROP 30 INCHES
HAMMER WEIGHT 140 POUNDS

RELATIVE DENSITY
VERY LOOSE
LOOSE
MEDIUM
DENSE
VERY DENSE
AUTOMATIC HAMMER
SPT N-VALUE
BLOWS/FOOT
LESS THAN 3
3 - 8
8 - 24
24 - 40
GREATER THAN 40

REVISIONS

Date	By	Descriptions	Date	By	Descriptions

Names	Dates
Drawn by KA	11/06/17
Checked by AB	11/06/17
Designed by	
Checked by	
Approved by	



ENGINEER OF RECORD
RADISE International
4152 West Blue Heron Boulevard, Suite 1114
Riviera Beach, Florida, 33404
TEL 561-841-0103 FAX 561-841-0104
URL : http://www.radise.net

LICENSE NO. - 8901

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT

COUNTY	CLIENT
BROWARD	HAZEN AND SAWYER

SCALE:	VERTICAL
	N.T.S.
SCALE:	HORIZONTAL
	N.T.S.

SHEET TITLE:

SUBSURFACE PROFILES
(SOUTHEAST ISLES)

PROJECT NAME:

STORMWATER MASTER PLAN MODELING
AND DESIGN IMPLEMENTATION

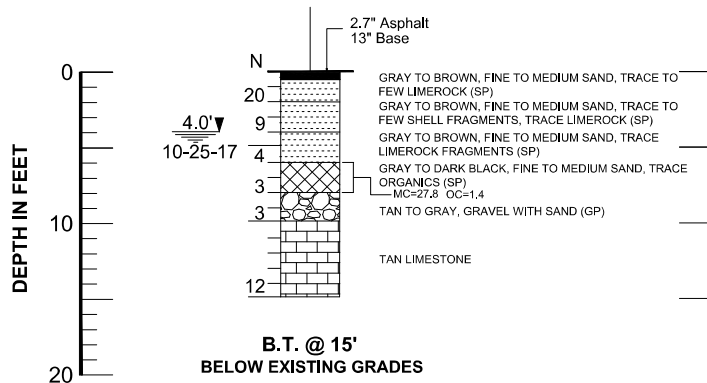
SHEET NO.

8A

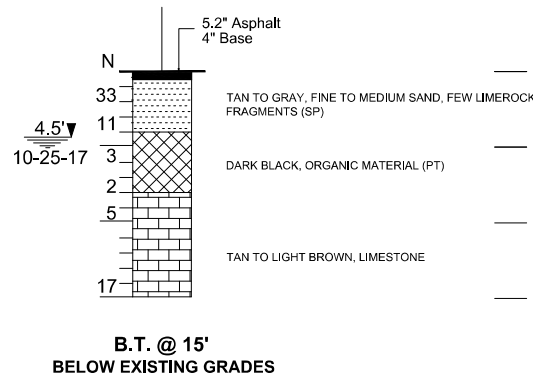
RADISE PROJECT NO:

170901

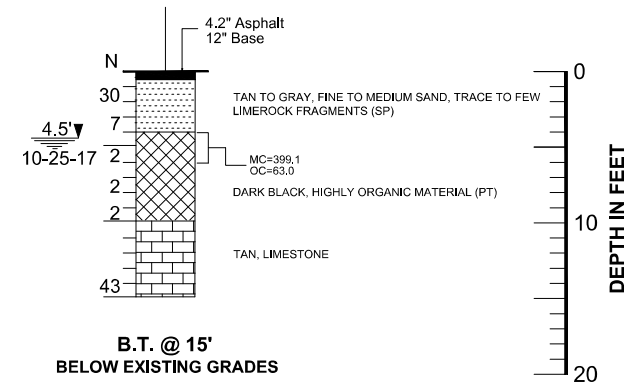
BORING NO. S-3
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1196°
LONGITUDE: -80.1209°
DATE: 10/25/2017
DRILLER: T. FICKLING
RIG: CME 45



BORING NO. S-4
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1199°
LONGITUDE: -80.1169°
DATE: 10/25/2017
DRILLER: T. FICKLING
RIG: CME 45



BORING NO. S-5
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1200°
LONGITUDE: -80.1149°
DATE: 10/23/2017
DRILLER: T. FICKLING
RIG: CME 45



LEGEND

	ASPHALT AND BASE		LIMESTONE
	SAND		GRAVEL
	SILT		ORGANIC MATERIAL
	GROUNDWATER DEPTH IN FEET AND DRILLING DATE		
N	STANDARD PENETRATION RESISTANCE-BLOWS PER FOOT USING AUTOMATIC HAMMER		

SP, SP-SM, GP, PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
S-1	STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
MC	MOISTURE CONTENT (%)
-200	AMOUNT PASSING US STANDARD # 200 SIEVE (%)
OC	ORGANIC CONTENTS (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
B.T. @ 15'	BORING TERMINATED AT 15 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- BORINGS WERE DRILLED ON SEPTEMBER AND OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
VERY LOOSE	BLOWS/FOOT LESS THAN 3
LOOSE	3 - 8
MEDIUM DENSE	8 - 24
VERY DENSE	24 - 40
	GREATER THAN 40

STANDARD PENETRATION TEST DATA

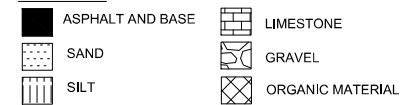
SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

REVISIONS				Names	Dates		ENGINEER OF RECORD RADISE International 4152 West Blue Heron Boulevard, Suite 1114 Riviera Beach, Florida, 33404 TEL 561-841-0103 FAX 561-841-0104 URL : http://www.radise.net	CITY OF FORT LAUDERDALE PUBLIC WORKS DEPARTMENT		SCALE: VERTICAL N.T.S.	SHEET TITLE: SUBSURFACE PROFILES (SOUTHEAST ISLES)	SHEET NO. 8B
Date	By	Descriptions	Date	By	Descriptions			COUNTY	CLIENT	SCALE: HORIZONTAL N.T.S.	PROJECT NAME: STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION	RADISE PROJECT NO: 170901
								BROWARD	HAZEN AND SAWYER			

BORING NO. S-6
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1198°
LONGITUDE: -80.1115°
DATE: 10/21/2017
DRILLER: T. FICKLING
RIG: CME 45

BORING NO. S-7
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1196°
LONGITUDE: -80.1114°
DATE: 10/21/2017
DRILLER: T. FICKLING
RIG: CME 45

LEGEND



1.5'▼ GROUNDWATER DEPTH IN FEET
09-21-17 AND DRILLING DATE
N STANDARD PENETRATION RESISTANCE-
BLOWS PER FOOT USING AUTOMATIC HAMMER

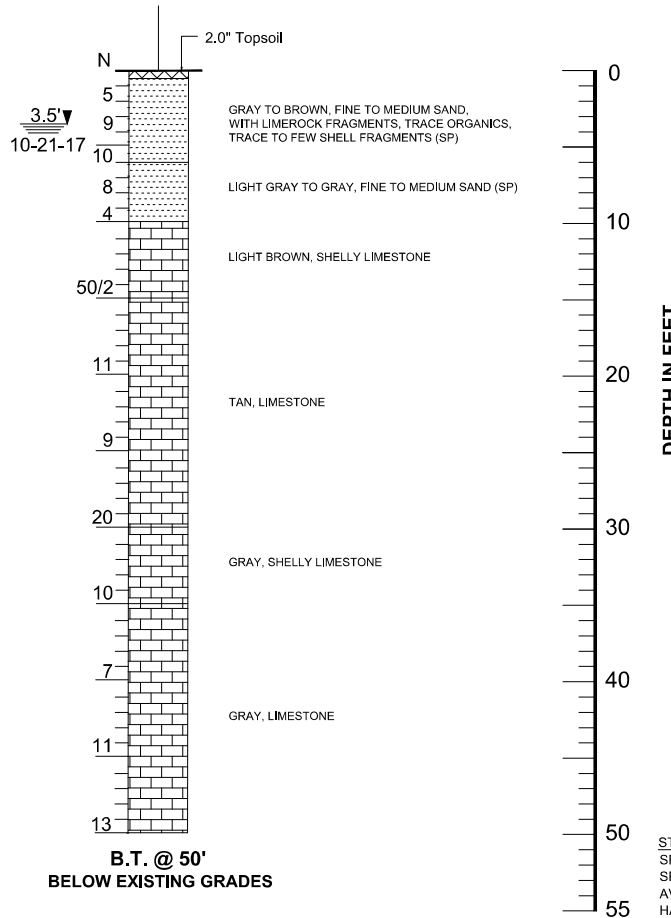
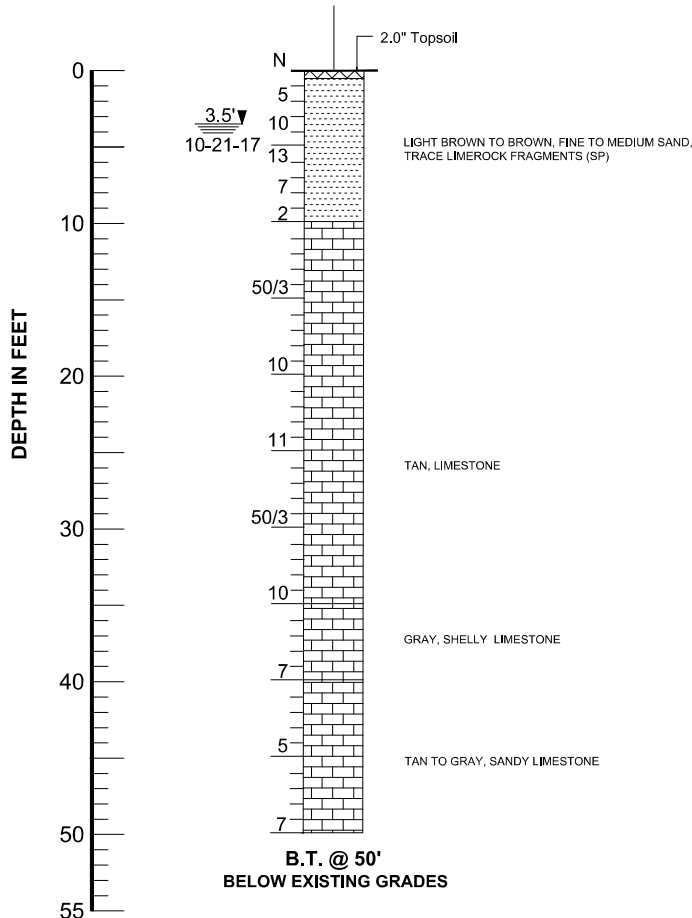
SP, SP-SM, GP, PT UNIFIED SOIL CLASSIFICATION SYSTEM
GROUP SYMBOL (ASTM D 2488)
S-1 STANDARD PENETRATION TEST (SPT)
BORING AND NUMBER
MC MOISTURE CONTENT (%)
-200 AMOUNT PASSING US STANDARD # 200
SIEVE
OC ORGANIC CONTENTS (%)
LL LIQUID LIMIT (%)
PI PLASTICITY INDEX (%)
B.T. @ 50' BORING TERMINATED AT 50 FEET
BELOW THE EXISTING GROUND SURFACE

NOTES

- (1) BORINGS WERE DRILLED ON SEPTEMBER AND OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- (2) STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
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- (4) LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- (5) ELEVATIONS WERE NOT AVAILABLE
- (6) AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

STANDARD PENETRATION TEST DATA		RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
SPOON INSIDE DIA.	1.375 INCH	VERY LOOSE	BLOWS/FOOT LESS THAN 3
SPOON OUTSIDE DIA.	2.0 INCHES	LOOSE	3 - 8
AVG. HAMMER DROP	30 INCHES	MEDIUM	8 - 24
HAMMER WEIGHT	140 POUNDS	DENSE	24 - 40
		VERY DENSE	GREATER THAN 40



REVISIONS

Date	By	Descriptions	Date	By	Descriptions

Names	Dates
Drawn by ML	10/13/17
Checked by AB	10/13/17
Designed by	
Checked by	
Approved by	



ENGINEER OF RECORD
RADISE International
4152 West Blue Heron Boulevard, Suite 1114
Riviera Beach, Florida, 33404
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URL : http://www.radise.net

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
COUNTY BROWARD
CLIENT HAZEN AND SAWYER

SCALE: VERTICAL N.T.S.
SCALE: HORIZONTAL N.T.S.

SHEET TITLE: SUBSURFACE PROFILES (SOUTHEAST ISLES)
PROJECT NAME: STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION

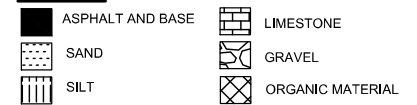
SHEET NO. 8C
RADISE PROJECT NO: 170901

BORING NO.
ELEVATION (NAVD 88):
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

S-8
N/A
26.1171°
-80.1129°
09/27/2017
T. FICKLING
CME 45

S-9
N/A
26.1178°
-80.1163°
09/21/2017
T. FICKLING
CME 45

LEGEND



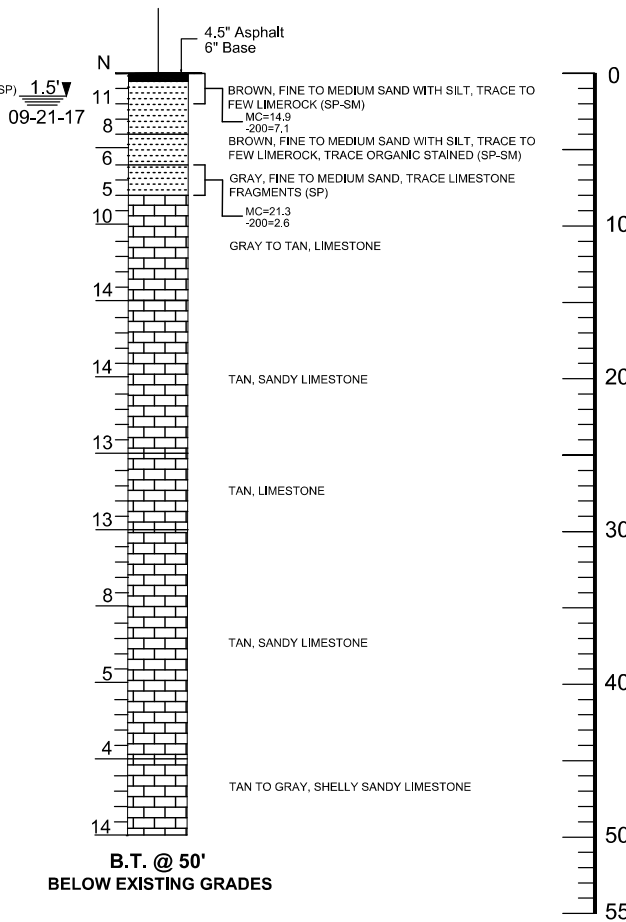
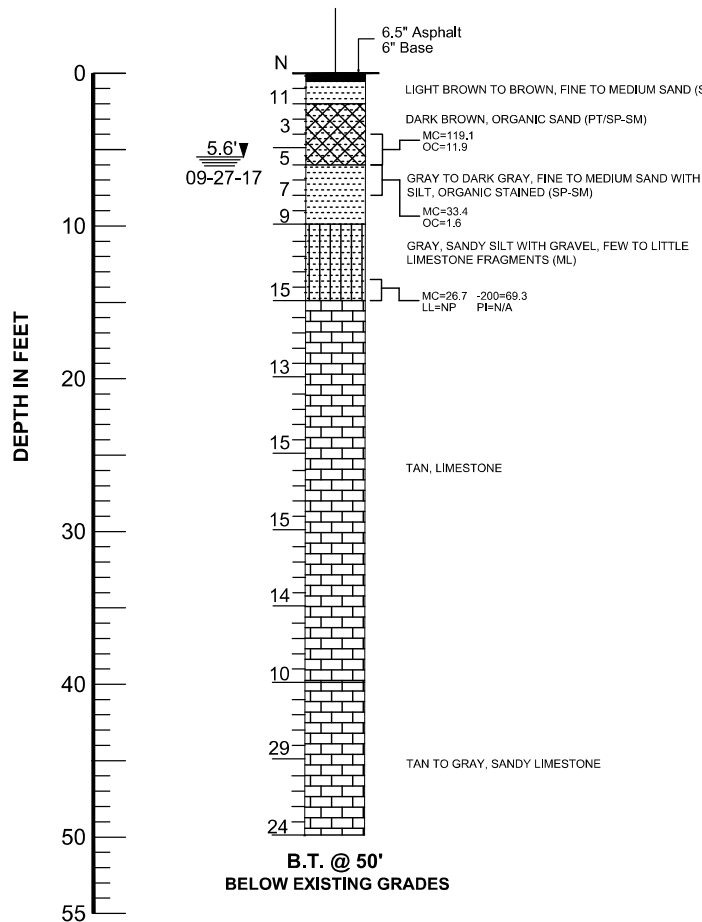
1.5' ▼ GROUNDWATER DEPTH IN FEET
09-21-17 AND DRILLING DATE
N STANDARD PENETRATION RESISTANCE-
BLOWS PER FOOT USING AUTOMATIC HAMMER
SP, SP-SM, GP, PT UNIFIED SOIL CLASSIFICATION SYSTEM
GROUP SYMBOL (ASTM D 2488)
S-1 STANDARD PENETRATION TEST (SPT)
BORING AND NUMBER
MC MOISTURE CONTENT (%)
-200 AMOUNT PASSING US STANDARD # 200
SIEVE
OC ORGANIC CONTENTS (%)
LL LIQUID LIMIT (%)
PI PLASTICITY INDEX (%)
B.T. @ 50' BORING TERMINATED AT 50 FEET
BELOW THE EXISTING GROUND SURFACE

NOTES

- (1) BORINGS WERE DRILLED ON SEPTEMBER AND OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- (2) STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
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- (5) ELEVATIONS WERE NOT AVAILABLE
- (6) AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

STANDARD PENETRATION TEST DATA		RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
SPoon INSIDE DIA.	1.375 INCH	VERY LOOSE	LESS THAN 3
SPoon OUTSIDE DIA.	2.0 INCHES	LOOSE	3 - 8
AVG. HAMMER DROP	30 INCHES	MEDIUM	8 - 24
HAMMER WEIGHT	140 POUNDS	DENSE	24 - 40
		VERY DENSE	GREATER THAN 40



REVISIONS

Date	By	Descriptions	Date	By	Descriptions



ENGINEER OF RECORD
RADISE International
4152 West Blue Heron Boulevard, Suite 1114
Riviera Beach, Florida, 33404
TEL 561-941-0103 FAX 561-941-0104
URL : http://www.radise.net

LICENSE NO. - 8901

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT

COUNTY CLIENT
BROWARD HAZEN AND SAWYER

SCALE: VERTICAL
N.T.S.

SCALE: HORIZONTAL
N.T.S.

SHEET TITLE:
SUBSURFACE PROFILES
(SEAWALLS)

PROJECT NAME:
STORMWATER MASTER PLAN MODELING
AND DESIGN IMPLEMENTATION

SHEET NO.
9A

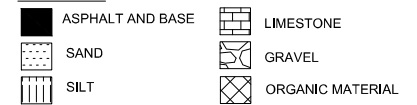
RADISE PROJECT NO:
170901

BORING NO.
ELEVATION (NAVD 88):
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

S-10
N/A
26.1184°
-80.1163°
09/21/2017
T. FICKLING
CME 45

S-11
N/A
26.1190°
-80.1163°
09/20/2017
T. FICKLING
CME 45

LEGEND



1.5' AND DRILLING DATE
N STANDARD PENETRATION RESISTANCE-
BLOWS PER FOOT USING AUTOMATIC HAMMER
SP, SP-SM, GP, PT UNIFIED SOIL CLASSIFICATION SYSTEM
GROUP SYMBOL (ASTM D 2488)
S-1 STANDARD PENETRATION TEST (SPT)
BORING AND NUMBER
MC MOISTURE CONTENT (%)
-200 AMOUNT PASSING US STANDARD # 200
SIEVE
OC ORGANIC CONTENTS (%)
LL LIQUID LIMIT (%)
PI PLASTICITY INDEX (%)
B.T. @ 50' BORING TERMINATED AT 50 FEET
BELOW THE EXISTING GROUND SURFACE

NOTES

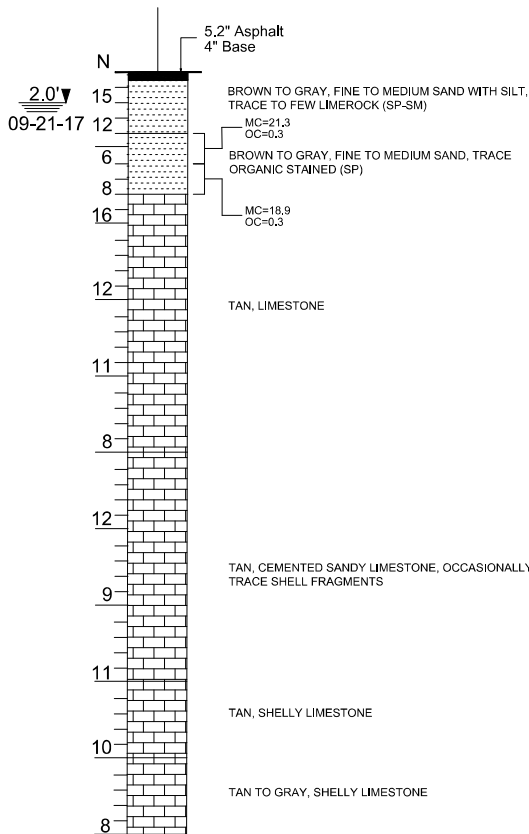
- BORINGS WERE DRILLED ON SEPTEMBER AND OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
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- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

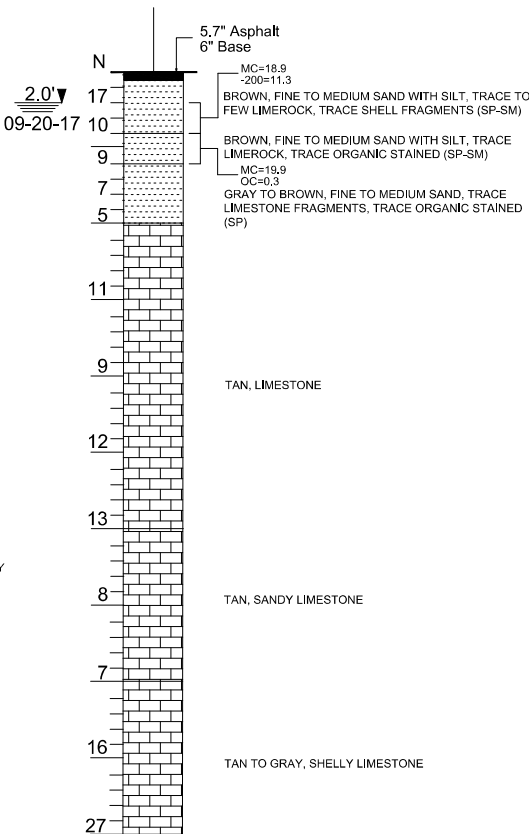
STANDARD PENETRATION TEST DATA		RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
SPoon INSIDE DIA.	1.375 INCH	VERY LOOSE	BLOWS/FOOT LESS THAN 3
SPoon OUTSIDE DIA.	2.0 INCHES	LOOSE	3 - 8
AVG. HAMMER DROP	30 INCHES	MEDIUM	8 - 24
HAMMER WEIGHT	140 POUNDS	DENSE	24 - 40
		VERY DENSE	GREATER THAN 40

DEPTH IN FEET

DEPTH IN FEET



B.T. @ 50'
BELOW EXISTING GRADES



B.T. @ 50'
BELOW EXISTING GRADES

REVISIONS

Date	By	Descriptions	Date	By	Descriptions

Names	Dates
Drawn by ML	10/13/17
Checked by AB	10/13/17
Designed by	
Checked by	
Approved by	



ENGINEER OF RECORD
RADISE International
4152 West Blue Heron Boulevard, Suite 1114
Riviera Beach, Florida, 33404
TEL 561-841-0103 FAX 561-841-0104
URL : http://www.radise.net

LICENSE NO. - 8901

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT

COUNTY	CLIENT
BROWARD	HAZEN AND SAWYER

SCALE: VERTICAL N.T.S.	SCALE: HORIZONTAL N.T.S.
---------------------------	-----------------------------

SHEET TITLE: SUBSURFACE PROFILES (SEAWALLS)	PROJECT NAME: STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION
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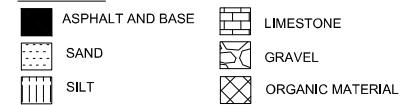
SHEET NO. 9B	RADISE PROJECT NO: 170901
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BORING NO.
ELEVATION (NAVD 88):
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

S-12
N/A
26.1196°
-80.1163°
09/20/2017
T. FICKLING
CME 45

S-13
N/A
26.1199°
-80.1179°
09/17/2017
T. FICKLING
CME 45

LEGEND



1.5' GROUNDWATER DEPTH IN FEET
09-21-17 AND DRILLING DATE
N STANDARD PENETRATION RESISTANCE-
BLOWS PER FOOT USING AUTOMATIC HAMMER

SP, SP-SM, GP, PT UNIFIED SOIL CLASSIFICATION SYSTEM
GROUP SYMBOL (ASTM D 2488)

S-1 STANDARD PENETRATION TEST (SPT)
BORING AND NUMBER

MC MOISTURE CONTENT (%)

-200 AMOUNT PASSING US STANDARD # 200
SIEVE

OC ORGANIC CONTENTS (%)

LL LIQUID LIMIT (%)

PI PLASTICITY INDEX (%)

B.T. @ 50' BORING TERMINATED AT 50 FEET
BELOW THE EXISTING GROUND SURFACE

NOTES

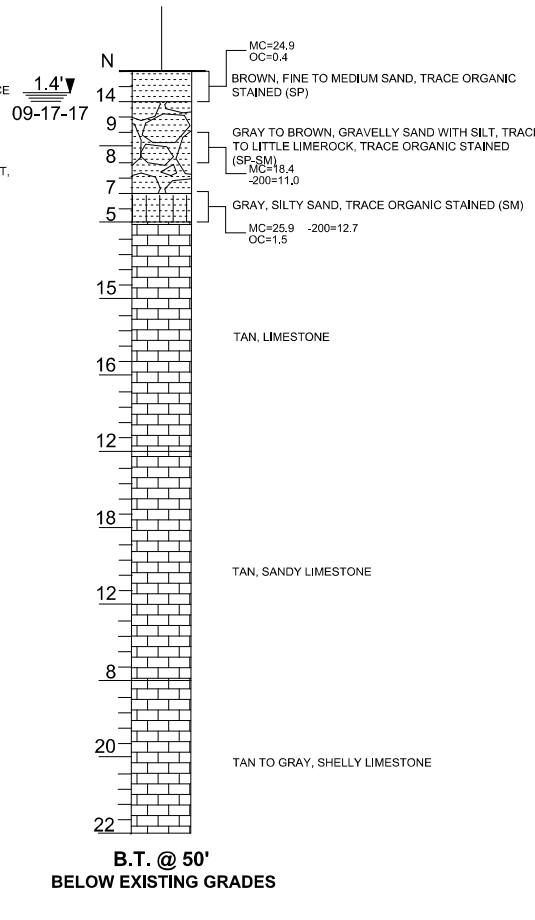
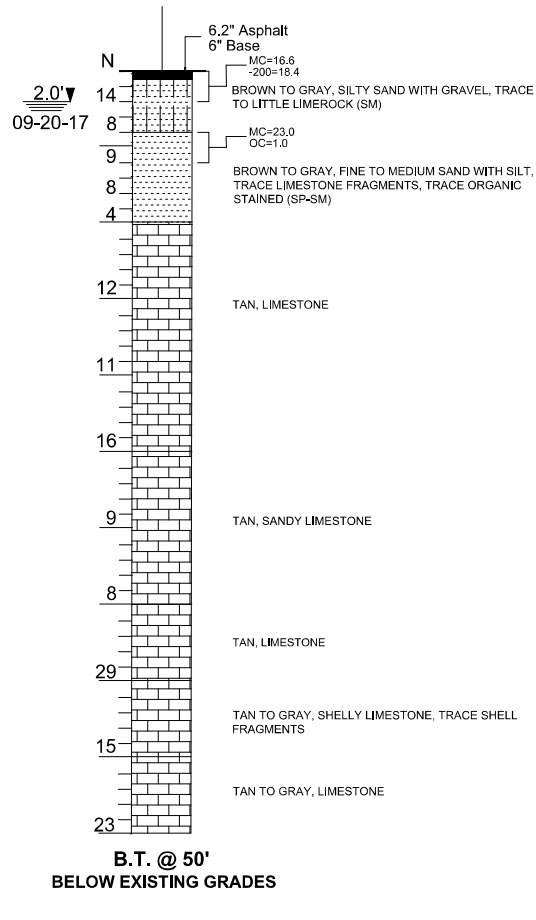
- (1) BORINGS WERE DRILLED ON SEPTEMBER AND OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- (2) STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- (3) GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- (4) LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- (5) ELEVATIONS WERE NOT AVAILABLE
- (6) AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

STANDARD PENETRATION TEST DATA		RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
SPOON INSIDE DIA.	1.375 INCH	VERY LOOSE	BLOWS/FOOT LESS THAN 3
SPOON OUTSIDE DIA.	2.0 INCHES	LOOSE	3 - 8
AVG. HAMMER DROP	30 INCHES	MEDIUM	8 - 24
HAMMER WEIGHT	140 POUNDS	DENSE	24 - 40
		VERY DENSE	GREATER THAN 40

DEPTH IN FEET

DEPTH IN FEET



REVISIONS

Date	By	Descriptions	Date	By	Descriptions



ENGINEER OF RECORD
RADISE INTERNATIONAL
4152 West Blue Heron Boulevard, Suite 1114
Riviera Beach, Florida, 33404
TEL 561-941-0103 FAX 561-941-0104
URL : http://www.radise.net

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
COUNTY
CLIENT

SCALE: VERTICAL
N.T.S.
SCALE: HORIZONTAL
N.T.S.

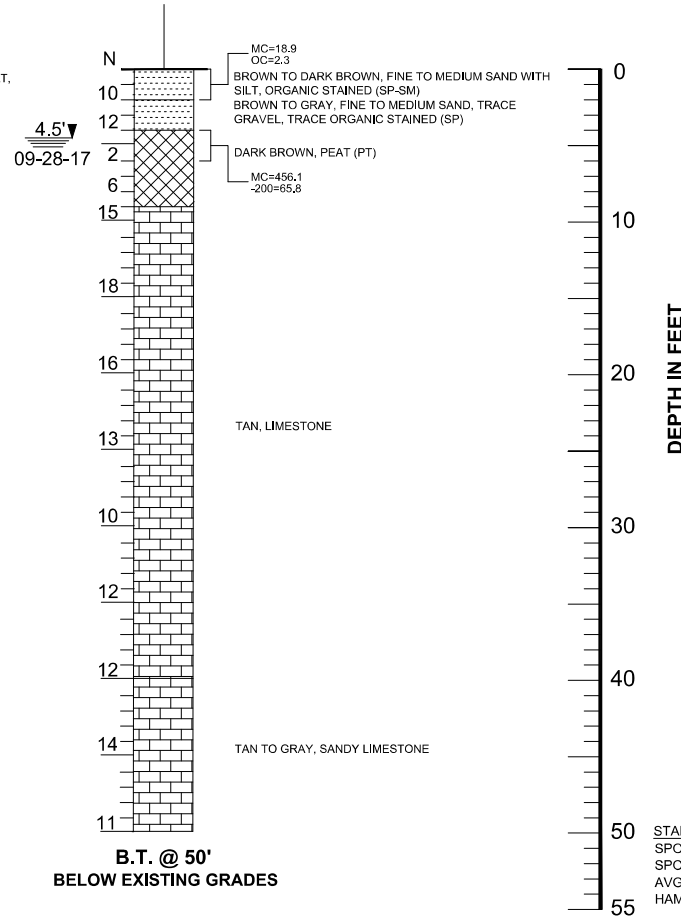
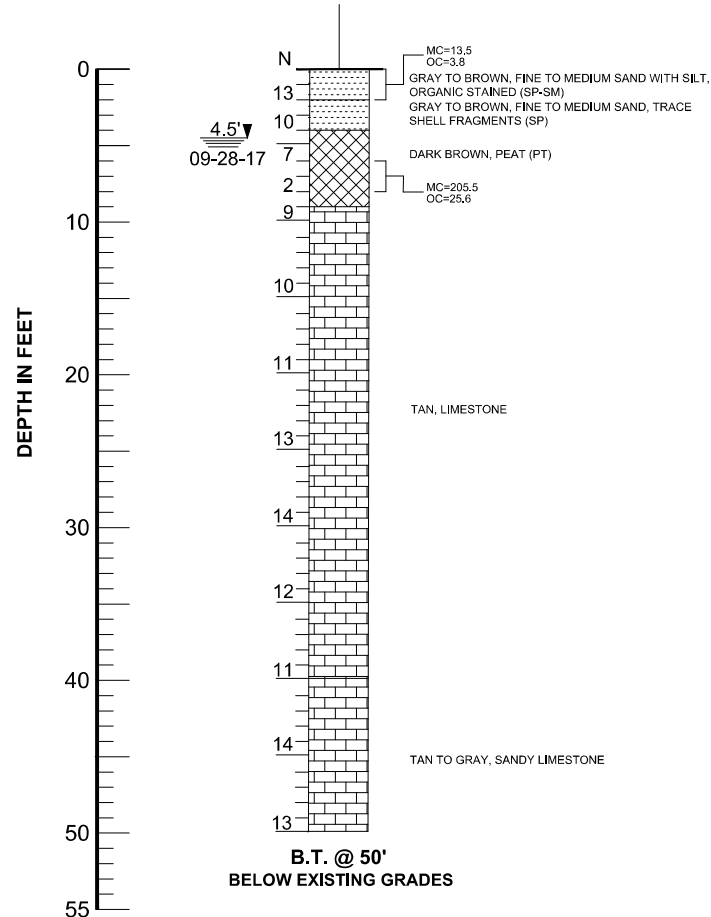
SHEET TITLE:
SUBSURFACE PROFILES
(SEAWALLS)
PROJECT NAME:
STORMWATER MASTER PLAN MODELING
AND DESIGN IMPLEMENTATION

SHEET NO.
9C
RADISE PROJECT NO:
170901

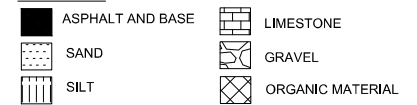
BORING NO.
ELEVATION (NAVD 88):
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

S-14
N/A
26.1198°
-80.1189°
09/28/2017
T. FICKLING
CME 45

S-15
N/A
26.1198°
-80.1200°
09/28/2017
T. FICKLING
CME 45



LEGEND



1.5'▼
09-21-17
AND DRILLING DATE

N
STANDARD PENETRATION RESISTANCE-
BLOWS PER FOOT USING AUTOMATIC HAMMER

SP, SP-SM, GP, PT
UNIFIED SOIL CLASSIFICATION SYSTEM
GROUP SYMBOL (ASTM D 2488)

S-1
STANDARD PENETRATION TEST (SPT)
BORING AND NUMBER

MC
MOISTURE CONTENT (%)

-200
AMOUNT PASSING US STANDARD # 200
SIEVE

OC
ORGANIC CONTENTS (%)

LL
LIQUID LIMIT (%)

PI
PLASTICITY INDEX (%)

B.T. @ 50'
BORING TERMINATED AT 50 FEET
BELOW THE EXISTING GROUND SURFACE

NOTES

- (1) BORINGS WERE DRILLED ON SEPTEMBER AND OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- (2) STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- (3) GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- (4) LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- (5) ELEVATIONS WERE NOT AVAILABLE
- (6) AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

STANDARD PENETRATION TEST DATA	RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
SPoon INSIDE DIA.	VERY LOOSE	BLOWS/FOOT
SPoon OUTSIDE DIA.	LOOSE	LESS THAN 3
AVG. HAMMER DROP	MEDIUM	3 - 8
HAMMER WEIGHT	DENSE	8 - 24
	VERY DENSE	24 - 40
		GREATER THAN 40

REVISIONS

Date.	By	Descriptions	Date.	By	Descriptions

Names	Dates
Drawn by	ML
Checked by	AB
Designed by	
Checked by	
Approved by	



ENGINEER OF RECORD
RADISE International
4152 West Blue Heron Boulevard, Suite 1114
Riviera Beach, Florida, 33484
TEL 561-841-0103 FAX 561-841-0104
URL : http://www.radise.net

LICENSE NO. - 8901

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT

COUNTY
BROWARD

CLIENT
HAZEN AND SAWYER

SCALE: VERTICAL
N.T.S.

SCALE: HORIZONTAL
N.T.S.

SHEET TITLE:
SUBSURFACE PROFILES
(SEAWALLS)

PROJECT NAME:
STORMWATER MASTER PLAN MODELING
AND DESIGN IMPLEMENTATION

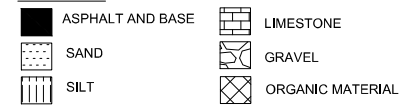
SHEET NO.
9D

RADISE PROJECT NO:
170901

BORING NO. S-16
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1172°
LONGITUDE: -80.1252°
DATE: 09/29/2017
DRILLER: T. FICKLING
RIG: CME 45

BORING NO. S-17
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1140°
LONGITUDE: -80.1270°
DATE: 09/18/2017
DRILLER: T. FICKLING
RIG: CME 45

LEGEND



1.5' GROUNDWATER DEPTH IN FEET
09-21-17 AND DRILLING DATE
N STANDARD PENETRATION RESISTANCE-
BLOWS PER FOOT USING AUTOMATIC HAMMER

SP, SP-SM, GP, PT UNIFIED SOIL CLASSIFICATION SYSTEM
GROUP SYMBOL (ASTM D 2488)

S-1 STANDARD PENETRATION TEST (SPT)
BORING AND NUMBER

MC MOISTURE CONTENT (%)

-200 AMOUNT PASSING US STANDARD # 200
SIEVE

OC ORGANIC CONTENTS (%)

LL LIQUID LIMIT (%)

PI PLASTICITY INDEX (%)

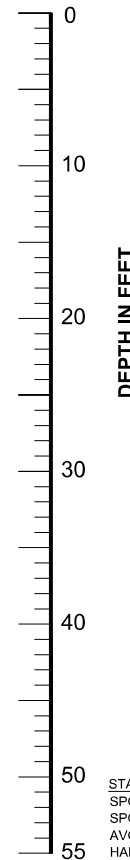
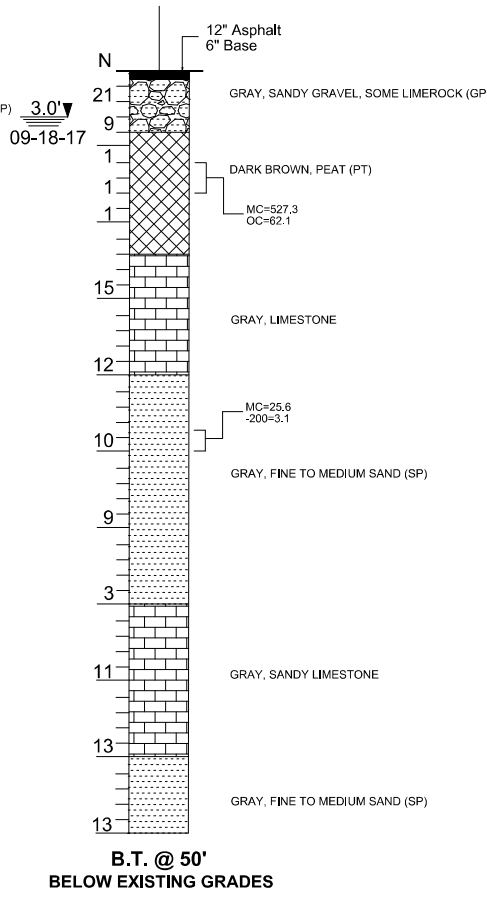
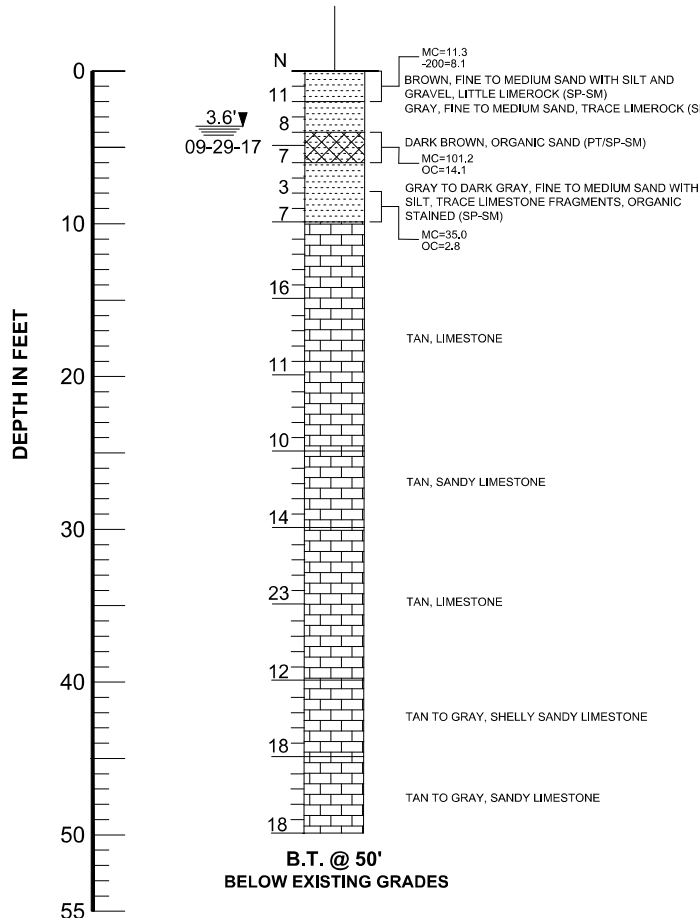
B.T. @ 50' BORING TERMINATED AT 50 FEET
BELOW THE EXISTING GROUND SURFACE

NOTES

- (1) BORINGS WERE DRILLED ON SEPTEMBER AND OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
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- (3) GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
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- (5) ELEVATIONS WERE NOT AVAILABLE
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GRANULAR MATERIALS

STANDARD PENETRATION TEST DATA		RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
SPOON INSIDE DIA.	1.375 INCH	VERY LOOSE	LESS THAN 3
SPOON OUTSIDE DIA.	2.0 INCHES	LOOSE	3 - 8
AVG. HAMMER DROP	30 INCHES	MEDIUM	8 - 24
HAMMER WEIGHT	140 POUNDS	DENSE	24 - 40
		VERY DENSE	GREATER THAN 40



REVISIONS

Date	By	Descriptions	Date	By	Descriptions

Names	Dates
Drawn by ML	10/13/17
Checked by AB	10/13/17
Designed by	
Checked by	
Approved by	



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CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT

COUNTY	CLIENT
BROWARD	HAZEN AND SAWYER

SCALE: VERTICAL N.T.S.	SCALE: HORIZONTAL N.T.S.
---------------------------	-----------------------------

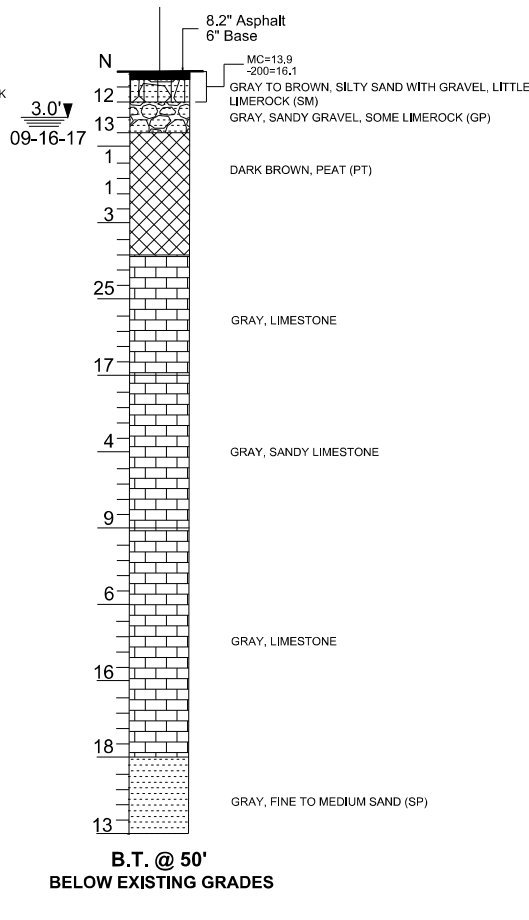
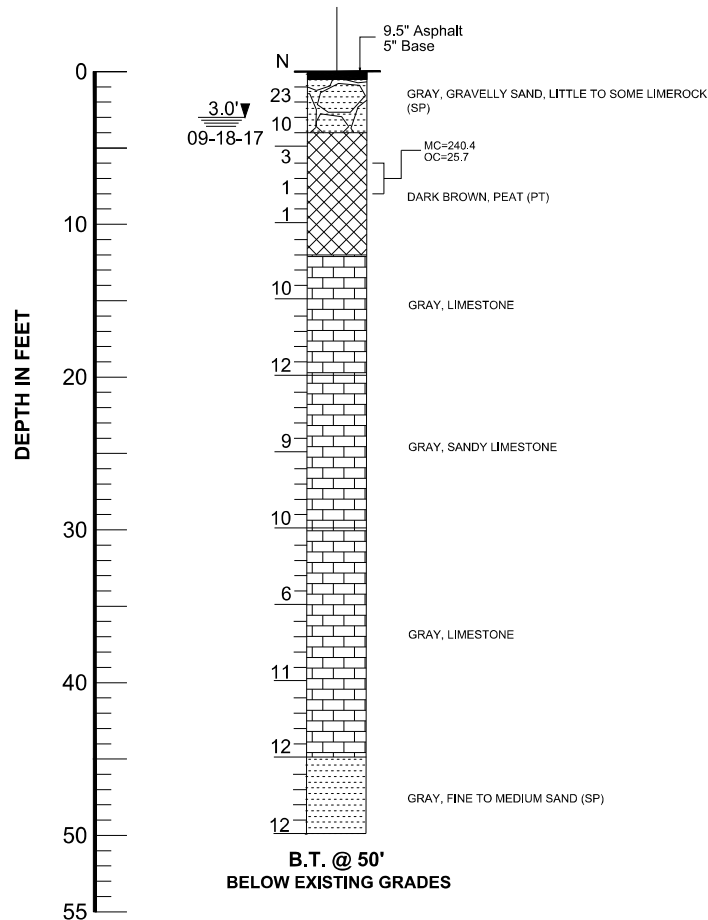
SHEET TITLE:	PROJECT NAME:
SUBSURFACE PROFILES (SEAWALLS)	STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION

SHEET NO.	RADISE PROJECT NO:
9E	170901

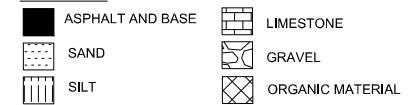
BORING NO.
ELEVATION (NAVD 88):
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

S-18
N/A
26.1129°
-80.1272°
09/18/2017
T. FICKLING
CME 45

S-19
N/A
26.1123°
-80.1274°
09/16/2017
T. FICKLING
CME 45



LEGEND



1.5'▼

09-21-17

AND DRILLING DATE

N

STANDARD PENETRATION RESISTANCE-
BLOWS PER FOOT USING AUTOMATIC HAMMER

SP, SP-SM, GP, PT

UNIFIED SOIL CLASSIFICATION SYSTEM
GROUP SYMBOL (ASTM D 2488)

S-1

STANDARD PENETRATION TEST (SPT)
BORING AND NUMBER

MC

MOISTURE CONTENT (%)

-200

AMOUNT PASSING US STANDARD # 200
SIEVE

OC

ORGANIC CONTENTS (%)

LL

LIQUID LIMIT (%)

PI

PLASTICITY INDEX (%)

B.T. @ 50'

BORING TERMINATED AT 50 FEET
BELOW THE EXISTING GROUND SURFACE

NOTES

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GRANULAR MATERIALS

STANDARD PENETRATION TEST DATA		RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
SPoon INSIDE DIA.	1.375 INCH	VERY LOOSE	BLOWS/FOOT
SPoon OUTSIDE DIA.	2.0 INCHES	LOOSE	LESS THAN 3
AVG. HAMMER DROP	30 INCHES	MEDIUM	3 - 8
HAMMER WEIGHT	140 POUNDS	DENSE	8 - 24
		VERY DENSE	24 - 40
			GREATER THAN 40

REVISIONS

Date	By	Descriptions	Date	By	Descriptions

Names	Dates
Drawn by ML	10/13/17
Checked by AB	10/13/17
Designed by	
Checked by	
Approved by	



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CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT

COUNTY CLIENT
BROWARD HAZEN AND SAWYER

SCALE: VERTICAL
N.T.S.

SCALE: HORIZONTAL
N.T.S.

SHEET TITLE:
SUBSURFACE PROFILES
(SEAWALLS)

PROJECT NAME:
STORMWATER MASTER PLAN MODELING
AND DESIGN IMPLEMENTATION

SHEET NO.
9F

RADISE PROJECT NO:
170901

BORING NO. S-20
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1117°
LONGITUDE: -80.1275°
DATE: 09/16/2017
DRILLER: T. FICKLING
RIG: CME 45

BORING NO. S-21
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1110°
LONGITUDE: -80.1280°
DATE: 09/15/2017
DRILLER: T. FICKLING
RIG: CME 45

LEGEND



1.5' GROUNDWATER DEPTH IN FEET
09-21-17 AND DRILLING DATE

N STANDARD PENETRATION RESISTANCE-
BLOWS PER FOOT USING AUTOMATIC HAMMER

SP, SP-SM, GP, PT UNIFIED SOIL CLASSIFICATION SYSTEM
GROUP SYMBOL (ASTM D 2488)

S-1 STANDARD PENETRATION TEST (SPT)
BORING AND NUMBER

MC MOISTURE CONTENT (%)

-200 AMOUNT PASSING US STANDARD # 200
SIEVE

OC ORGANIC CONTENTS (%)

LL LIQUID LIMIT (%)

PI PLASTICITY INDEX (%)

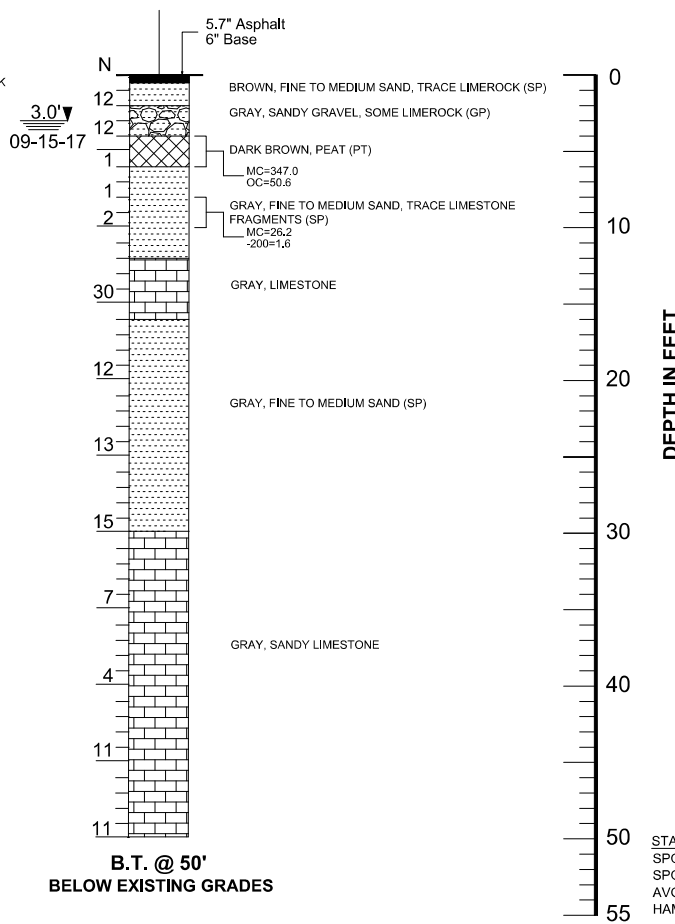
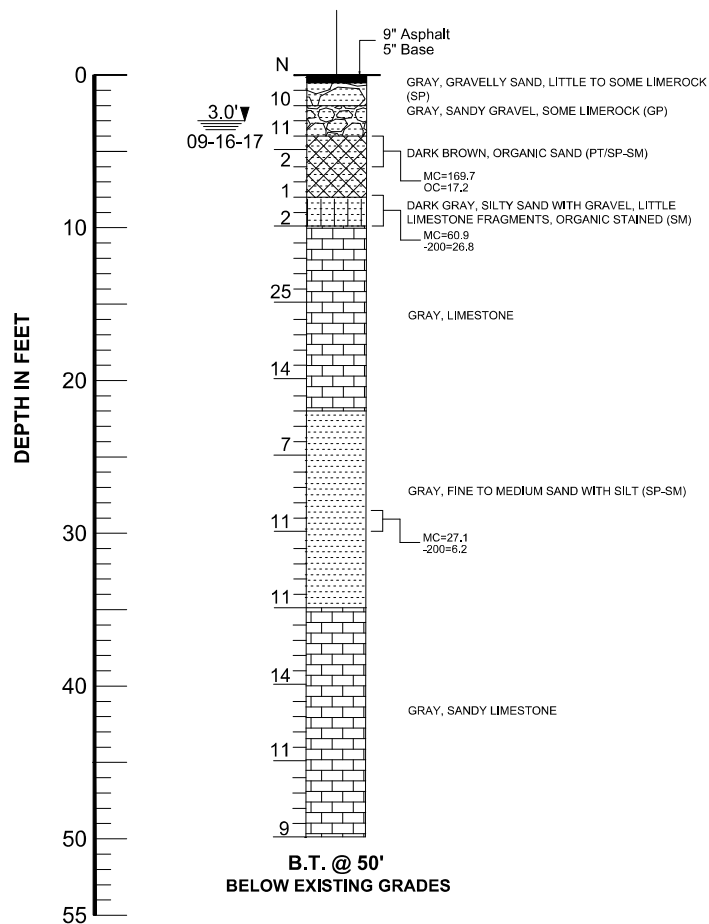
B.T. @ 50' BORING TERMINATED AT 50 FEET
BELOW THE EXISTING GROUND SURFACE

NOTES

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GRANULAR MATERIALS

STANDARD PENETRATION TEST DATA		RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
SPoon INSIDE DIA.	1.375 INCH	VERY LOOSE	BLOWS/FOOT LESS THAN 3
SPoon OUTSIDE DIA.	2.0 INCHES	LOOSE	3 - 8
AVG. HAMMER DROP	30 INCHES	MEDIUM	8 - 24
HAMMER WEIGHT	140 POUNDS	DENSE	24 - 40
		VERY DENSE	GREATER THAN 40



REVISIONS

Date	By	Descriptions	Date	By	Descriptions



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CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
COUNTY BROWARD
CLIENT HAZEN AND SAWYER

SCALE: VERTICAL
N.T.S.
SCALE: HORIZONTAL
N.T.S.

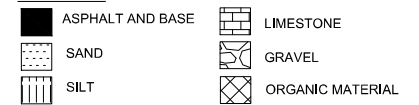
SHEET TITLE:
SUBSURFACE PROFILES
(SEAWALLS)
PROJECT NAME:
STORMWATER MASTER PLAN MODELING
AND DESIGN IMPLEMENTATION

SHEET NO.
9G
RADISE PROJECT NO:
170901

BORING NO. S-22
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1097°
LONGITUDE: -80.1282°
DATE: 09/16/2017
DRILLER: T. FICKLING
RIG: CME 45

BORING NO. S-23
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1086°
LONGITUDE: -80.1282°
DATE: 09/14/2017
DRILLER: T. FICKLING
RIG: CME 45

LEGEND



1.5' GROUNDWATER DEPTH IN FEET
09-21-17 AND DRILLING DATE
N STANDARD PENETRATION RESISTANCE-
BLOWS PER FOOT USING AUTOMATIC HAMMER

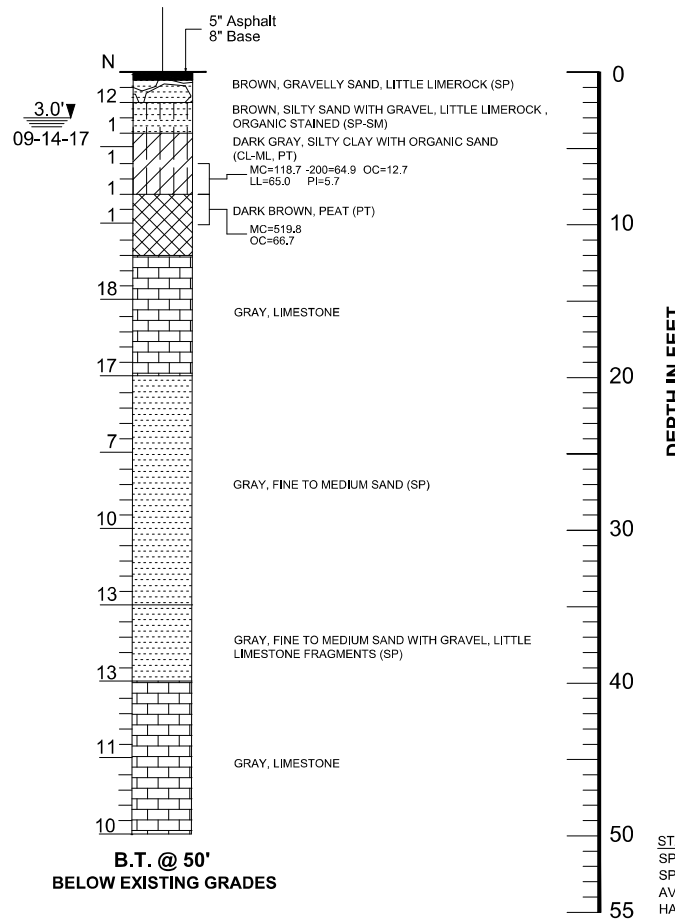
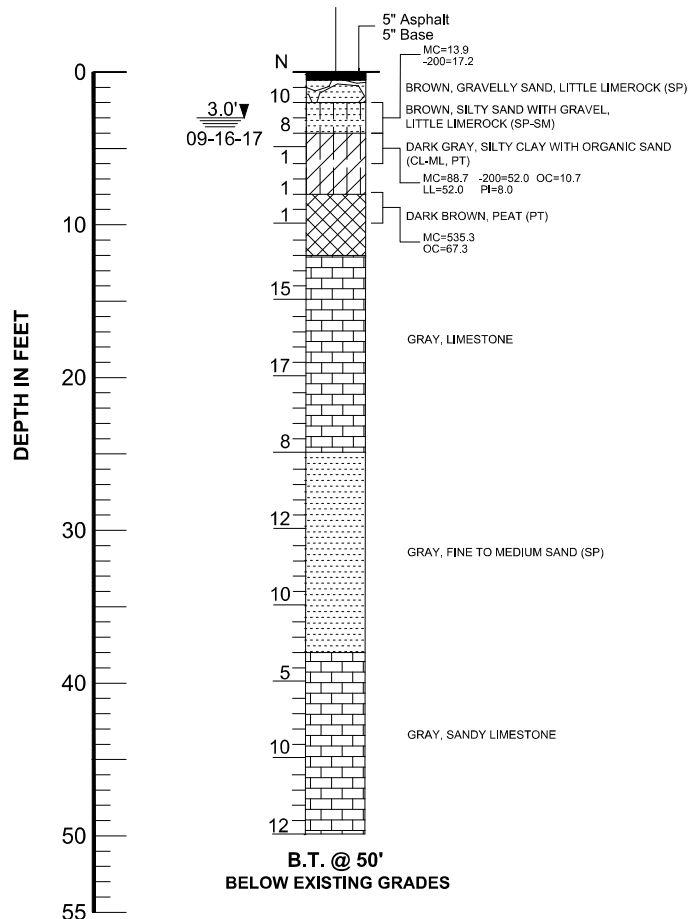
SP, SP-SM, GP, PT UNIFIED SOIL CLASSIFICATION SYSTEM
GROUP SYMBOL (ASTM D 2488)
S-1 STANDARD PENETRATION TEST (SPT)
BORING AND NUMBER
MC MOISTURE CONTENT (%)
-200 AMOUNT PASSING US STANDARD # 200
SIEVE
OC ORGANIC CONTENTS (%)
LL LIQUID LIMIT (%)
PI PLASTICITY INDEX (%)
B.T. @ 50' BORING TERMINATED AT 50 FEET
BELOW THE EXISTING GROUND SURFACE

NOTES

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GRANULAR MATERIALS

STANDARD PENETRATION TEST DATA	RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
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SPOON OUTSIDE DIA. 2.0 INCHES	LOOSE	3 - 8
AVG. HAMMER DROP 30 INCHES	MEDIUM	8 - 24
HAMMER WEIGHT 140 POUNDS	DENSE	24 - 40
	VERY DENSE	GREATER THAN 40



REVISIONS

Date	By	Descriptions	Date	By	Descriptions



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CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
COUNTY BROWARD
CLIENT HAZEN AND SAWYER

SCALE: VERTICAL
N.T.S.
SCALE: HORIZONTAL
N.T.S.

SHEET TITLE:
SUBSURFACE PROFILES
(SEAWALLS)
PROJECT NAME:
STORMWATER MASTER PLAN MODELING
AND DESIGN IMPLEMENTATION

SHEET NO.
9H
RADISE PROJECT NO:
170901

BORING NO. S-24
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1123°
LONGITUDE: -80.1243°
DATE: 09/22/2017
DRILLER: T. FICKLING
RIG: CME 45

BORING NO. S-25
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1123°
LONGITUDE: -80.1235°
DATE: 09/22/2017
DRILLER: T. FICKLING
RIG: CME 45

LEGEND



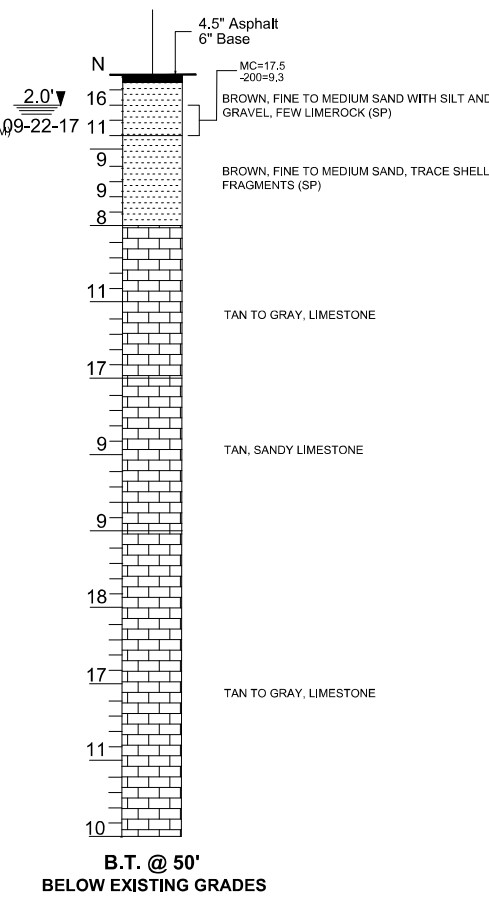
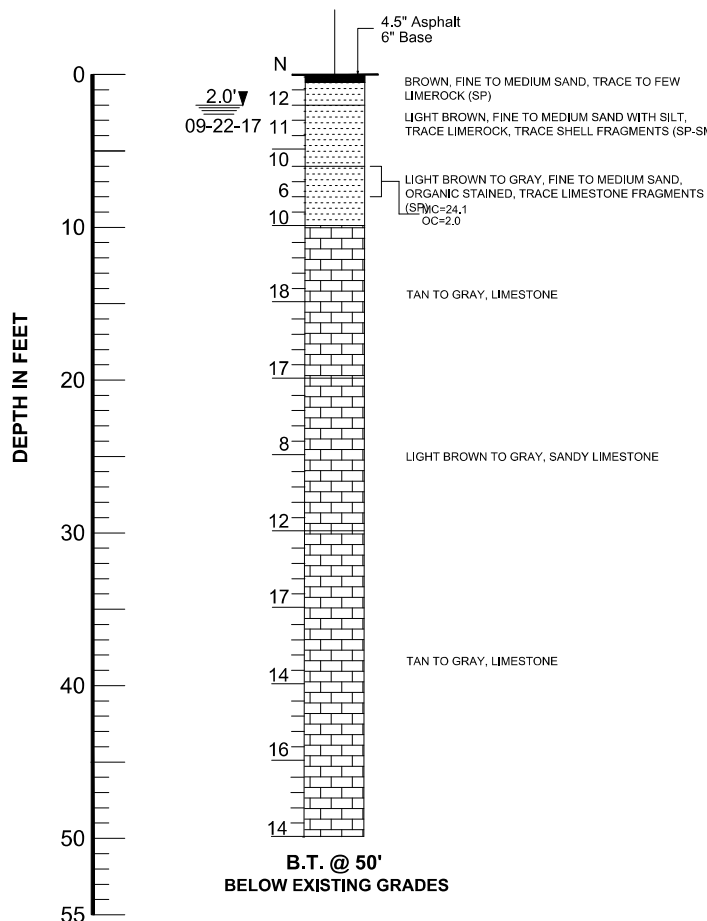
1.5' AND DRILLING DATE
09-21-17
N STANDARD PENETRATION RESISTANCE-
BLOWS PER FOOT USING AUTOMATIC HAMMER
SP, SP-SM, GP, PT UNIFIED SOIL CLASSIFICATION SYSTEM
GROUP SYMBOL (ASTM D 2488)
S-1 STANDARD PENETRATION TEST (SPT)
BORING AND NUMBER
MC MOISTURE CONTENT (%)
-200 AMOUNT PASSING US STANDARD # 200
SIEVE
OC ORGANIC CONTENTS (%)
LL LIQUID LIMIT (%)
PI PLASTICITY INDEX (%)
B.T. @ 50' BORING TERMINATED AT 50 FEET
BELOW THE EXISTING GROUND SURFACE

NOTES

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GRANULAR MATERIALS

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AVG. HAMMER DROP	30 INCHES	MEDIUM	8 - 24
HAMMER WEIGHT	140 POUNDS	DENSE	24 - 40
		VERY DENSE	GREATER THAN 40



REVISIONS

Date	By	Descriptions	Date	By	Descriptions

Names	Dates
Drawn by ML	10/13/17
Checked by AB	10/13/17
Designed by	
Checked by	
Approved by	



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PUBLIC WORKS DEPARTMENT

COUNTY	CLIENT
BROWARD	HAZEN AND SAWYER

SCALE: VERTICAL N.T.S.	SCALE: HORIZONTAL N.T.S.
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SHEET TITLE: SUBSURFACE PROFILES (SEAWALLS)	PROJECT NAME: STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION
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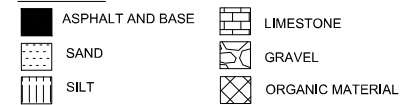
SHEET NO. 91	RADISE PROJECT NO: 170901
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BORING NO.
ELEVATION (NAVD 88):
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

S-26
N/A
26.1103°
-80.1221°
09/25/2017
T. FICKLING
CME 45

S-27
N/A
26.1103°
-80.1214°
09/25/2017
T. FICKLING
CME 45

LEGEND



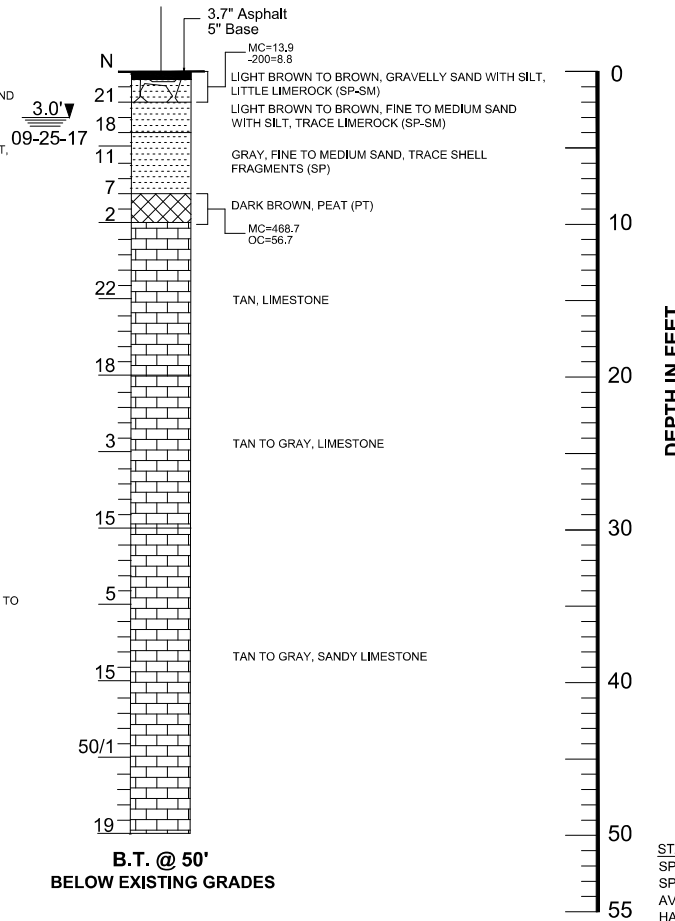
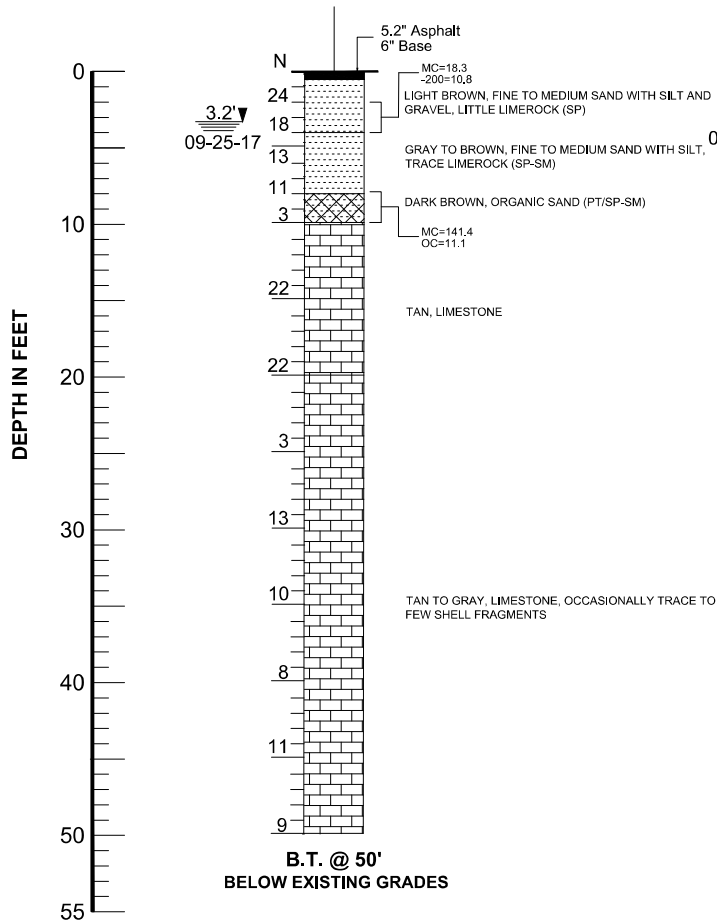
1.5' GROUNDWATER DEPTH IN FEET
09-21-17 AND DRILLING DATE
N STANDARD PENETRATION RESISTANCE-
BLOWS PER FOOT USING AUTOMATIC HAMMER
SP, SP-SM, GP, PT UNIFIED SOIL CLASSIFICATION SYSTEM
GROUP SYMBOL (ASTM D 2488)
S-1 STANDARD PENETRATION TEST (SPT)
BORING AND NUMBER
MC MOISTURE CONTENT (%)
-200 AMOUNT PASSING US STANDARD # 200
SIEVE
OC ORGANIC CONTENTS (%)
LL LIQUID LIMIT (%)
PI PLASTICITY INDEX (%)
B.T. @ 50' BORING TERMINATED AT 50 FEET
BELOW THE EXISTING GROUND SURFACE

NOTES

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GRANULAR MATERIALS

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SPOON INSIDE DIA. 1.375 INCH	VERY LOOSE	BLOWS/FOOT LESS THAN 3
SPOON OUTSIDE DIA. 2.0 INCHES	LOOSE	3 - 8
AVG. HAMMER DROP 30 INCHES	MEDIUM	8 - 24
HAMMER WEIGHT 140 POUNDS	DENSE	24 - 40
	VERY DENSE	GREATER THAN 40



REVISIONS

Date.	By	Descriptions	Date.	By	Descriptions



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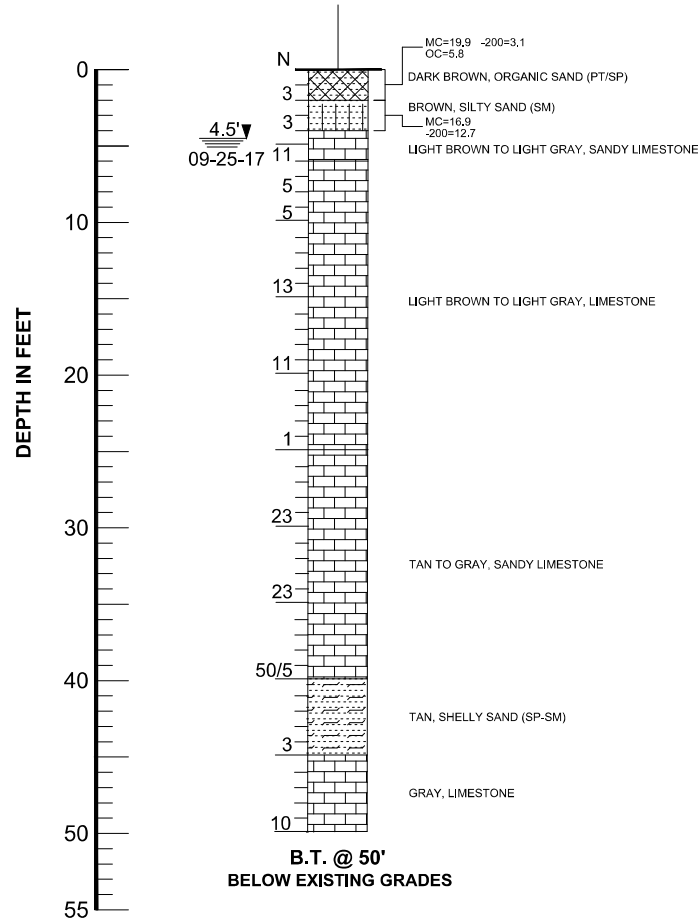
CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
COUNTY CLIENT
BROWARD HAZEN AND SAWYER

SCALE: VERTICAL
N.T.S.
SCALE: HORIZONTAL
N.T.S.

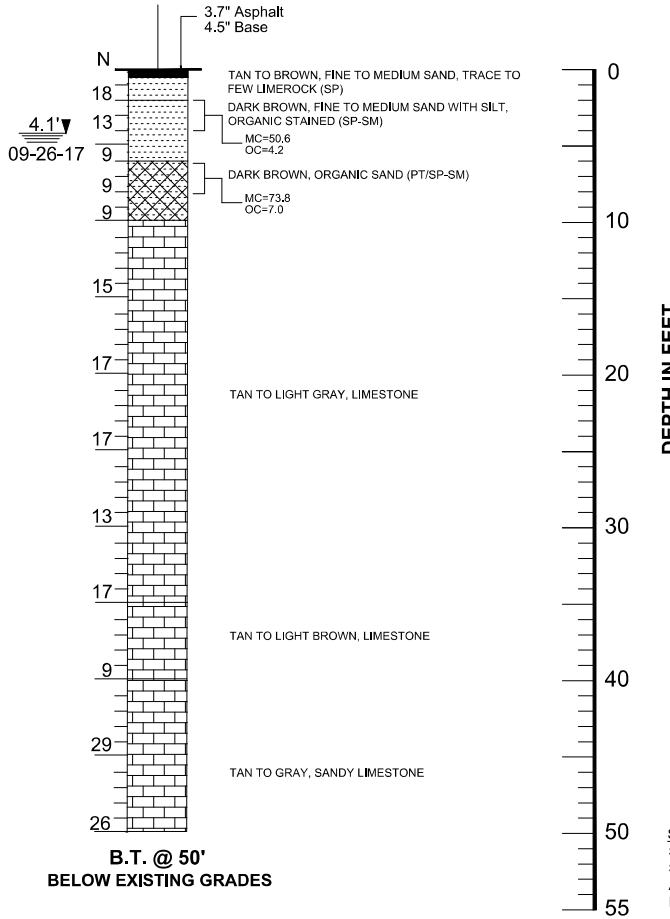
SHEET TITLE:
SUBSURFACE PROFILES
(SEAWALLS)
PROJECT NAME:
STORMWATER MASTER PLAN MODELING
AND DESIGN IMPLEMENTATION

SHEET NO.
9J
RADISE PROJECT NO:
170901

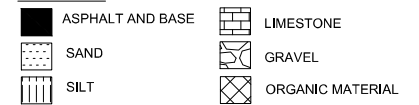
BORING NO. S-28
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1228°
LONGITUDE: -80.1242°
DATE: 09/25/2017
DRILLER: T. FICKLING
RIG: CME 45



BORING NO. S-29
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1213°
LONGITUDE: -80.1155°
DATE: 09/26/2017
DRILLER: T. FICKLING
RIG: CME 45



LEGEND



1.5'▼ GROUNDWATER DEPTH IN FEET
09-21-17 AND DRILLING DATE
N STANDARD PENETRATION RESISTANCE-
BLOWS PER FOOT USING AUTOMATIC HAMMER
SP, SP-SM, GP, PT UNIFIED SOIL CLASSIFICATION SYSTEM
GROUP SYMBOL (ASTM D 2488)
S-1 STANDARD PENETRATION TEST (SPT)
BORING AND NUMBER
MC MOISTURE CONTENT (%)
-200 AMOUNT PASSING US STANDARD # 200
SIEVE
OC ORGANIC CONTENTS (%)
LL LIQUID LIMIT (%)
PI PLASTICITY INDEX (%)
B.T. @ 50' BORING TERMINATED AT 50 FEET
BELOW THE EXISTING GROUND SURFACE

NOTES

- (1) BORINGS WERE DRILLED ON SEPTEMBER AND OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- (2) STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- (3) GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- (4) LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- (5) ELEVATIONS WERE NOT AVAILABLE
- (6) AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

STANDARD PENETRATION TEST DATA		RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
SPOON INSIDE DIA.	1.375 INCH	VERY LOOSE	BLOWS/FOOT LESS THAN 3
SPOON OUTSIDE DIA.	2.0 INCHES	LOOSE	3 - 8
AVG. HAMMER DROP	30 INCHES	MEDIUM	8 - 24
HAMMER WEIGHT	140 POUNDS	DENSE	24 - 40
		VERY DENSE	GREATER THAN 40

REVISIONS

Date.	By	Descriptions	Date.	By	Descriptions

Names	Dates
Drawn by ML	10/13/17
Checked by AB	10/13/17
Designed by	
Checked by	
Approved by	



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CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
COUNTY BROWARD
CLIENT HAZEN AND SAWYER

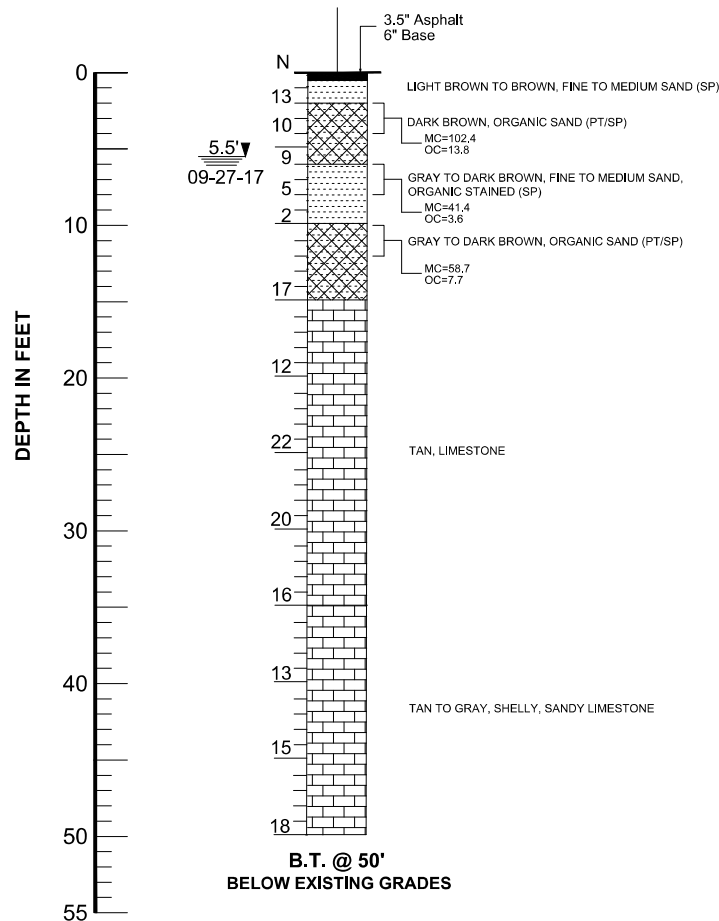
SCALE: VERTICAL
N.T.S.
SCALE: HORIZONTAL
N.T.S.

SHEET TITLE:
SUBSURFACE PROFILES (SEAWALLS)
PROJECT NAME:
STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION

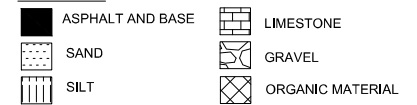
SHEET NO.
9K
RADISE PROJECT NO:
170901

BORING NO.
ELEVATION (NAVD 88):
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

S-30
N/A
26.1259°
-80.1097°
09/27/2017
T. FICKLING
CME 45



LEGEND



1.5'▼
09-21-17
AND DRILLING DATE
N STANDARD PENETRATION RESISTANCE-
BLOWS PER FOOT USING AUTOMATIC HAMMER

SP, SP-SM, GP, PT UNIFIED SOIL CLASSIFICATION SYSTEM
GROUP SYMBOL (ASTM D 2488)

S-1 STANDARD PENETRATION TEST (SPT)
BORING AND NUMBER

MC MOISTURE CONTENT (%)

-200 AMOUNT PASSING US STANDARD # 200
SIEVE

OC ORGANIC CONTENTS (%)

LL LIQUID LIMIT (%)

PI PLASTICITY INDEX (%)

B.T. @ 50' BORING TERMINATED AT 50 FEET
BELOW THE EXISTING GROUND SURFACE

NOTES

- BORINGS WERE DRILLED ON SEPTEMBER AND OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
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- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA. 1.375 INCH
SPOON OUTSIDE DIA. 2.0 INCHES
AVG. HAMMER DROP 30 INCHES
HAMMER WEIGHT 140 POUNDS

RELATIVE DENSITY
VERY LOOSE
LOOSE
MEDIUM
DENSE
VERY DENSE

AUTOMATIC HAMMER
SPT N-VALUE
BLOWS/FOOT
LESS THAN 3
3 - 8
8 - 24
24 - 40
GREATER THAN 40

REVISIONS

Date.	By	Descriptions	Date.	By	Descriptions

Names	Dates
Drawn by ML	10/13/17
Checked by AB	10/13/17
Designed by	
Checked by	
Approved by	



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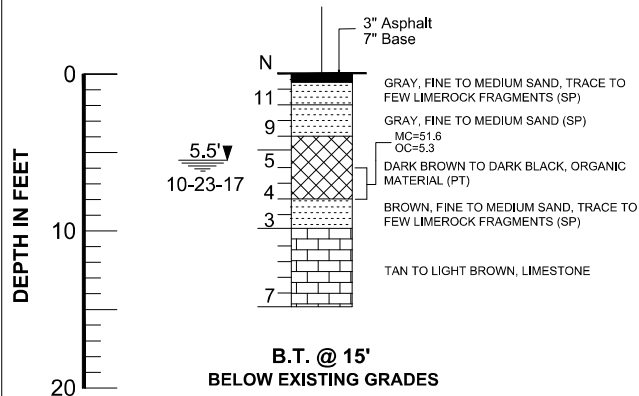
COUNTY	CLIENT
BROWARD	HAZEN AND SAWYER

SCALE: VERTICAL N.T.S.	SCALE: HORIZONTAL N.T.S.
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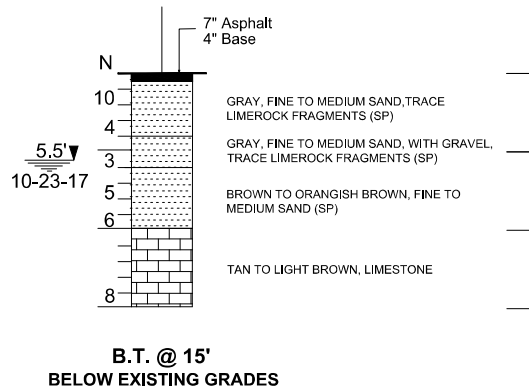
SHEET TITLE: SUBSURFACE PROFILES (SEAWALLS)	PROJECT NAME: STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION
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SHEET NO. 9L	RADISE PROJECT NO: 170901
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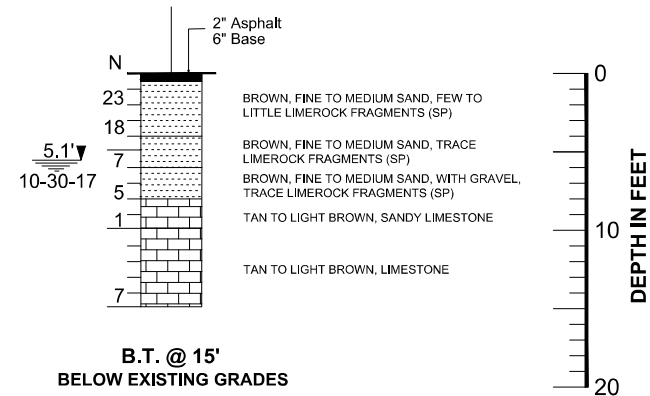
BORING NO. V-1
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1300°
LONGITUDE: -80.1335°
DATE: 10/23/2017
DRILLER: T. FICKLING
RIG: CME 45



BORING NO. V-2
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1301°
LONGITUDE: -80.1274°
DATE: 10/23/2017
DRILLER: T. FICKLING
RIG: CME 45



BORING NO. V-3
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1353°
LONGITUDE: -80.1286°
DATE: 10/30/2017
DRILLER: T. FICKLING
RIG: CME 45



LEGEND

	ASPHALT AND BASE		LIMESTONE
	SAND		GRAVEL
	SILTY SAND		ORGANIC MATERIAL
	GROUNDWATER DEPTH IN FEET AND DRILLING DATE		
	STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER		

SP, SP-SM, PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
V-1	STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
MC	MOISTURE CONTENT (%)
-200	AMOUNT PASSING US STANDARD # 200 SIEVE (%)
OC	ORGANIC CONTENTS (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
B.T. @ 15'	BORING TERMINATED AT 15 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- BORING WERE DRILLED ON SEPTEMBER AND OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
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- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
VERY LOOSE	BLOWS/FOOT LESS THAN 3
LOOSE	3 - 8
MEDIUM	8 - 24
DENSE	24 - 40
VERY DENSE	GREATER THAN 40

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

REVISIONS

Date	By	Descriptions	Date	By	Descriptions

Names	Dates
Drawn by KA	11/06/17
Checked by AB	11/06/17
Designed by	
Checked by	
Approved by	



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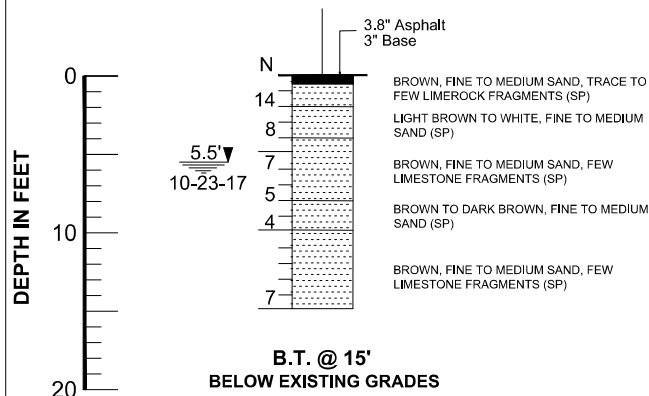
CITY OF FORT LAUDERDALE PUBLIC WORKS DEPARTMENT	
COUNTY	CLIENT
BROWARD	HAZEN AND SAWYER

SCALE: VERTICAL N.T.S.	SCALE: HORIZONTAL N.T.S.
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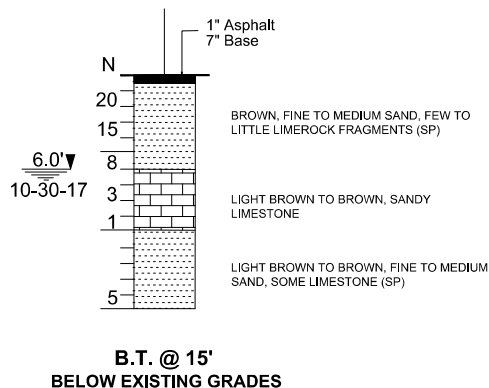
SHEET TITLE: SUBSURFACE PROFILES (VICTORIA PARK)	SHEET NO. 10A
PROJECT NAME: STORMWATER MASTERPLAN MODELING AND DESIGN IMPLEMENTATION	RADISE PROJECT NO: 170901

BORING NO.
ELEVATION (NAVD 88):
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

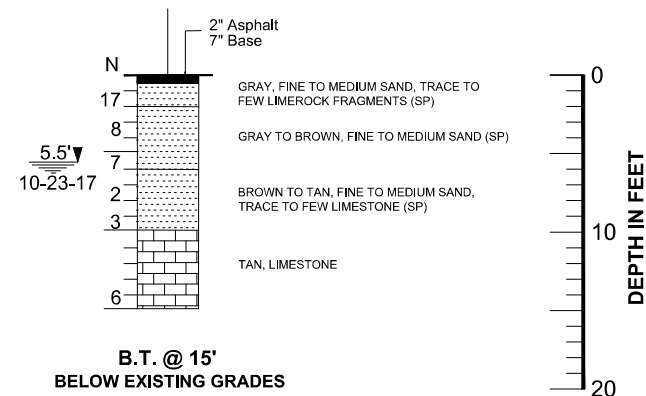
V-4
N/A
26.1338°
-80.1266°
10/23/2017
T. FICKLING
CME 45



V-5
N/A
26.1320°
-80.1234°
10/30/2017
T. FICKLING
CME 45



V-6
N/A
26.1289°
-80.1229°
10/23/2017
T. FICKLING
CME 45



LEGEND

	ASPHALT AND BASE		LIMESTONE
	SAND		GRAVEL
	SILTY SAND		ORGANIC MATERIAL
5.5'▼ 10-23-17	GROUNDWATER DEPTH IN FEET AND DRILLING DATE		
N	STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER		

SP, SP-SM, PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)		
V-1	STANDARD PENETRATION TEST (SPT) BORING AND NUMBER		
MC	MOISTURE CONTENT (%)		
-200	AMOUNT PASSING US STANDARD # 200 SIEVE (%)		
OC	ORGANIC CONTENTS (%)		
LL	LIQUID LIMIT (%)		
PI	PLASTICITY INDEX (%)		
B.T. @ 15'	BORING TERMINATED AT 15 FEET BELOW THE EXISTING GROUND SURFACE		

NOTES

- BORING WERE DRILLED ON SEPTEMBER AND OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN, GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER
VERY LOOSE	SPT N-VALUE
LOOSE	BLOWS/FOOT
MEDIUM	LESS THAN 3
DENSE	3 - 8
VERY DENSE	8 - 24
	24 - 40
	GREATER THAN 40

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

REVISIONS

Date	By	Descriptions	Date	By	Descriptions

Names	Dates
Drawn by KA	11/06/17
Checked by AB	11/06/17
Designed by	
Checked by	
Approved by	



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CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT

COUNTY CLIENT
BROWARD HAZEN AND SAWYER

SCALE: VERTICAL
N.T.S.
SCALE: HORIZONTAL
N.T.S.

SHEET TITLE:

SUBSURFACE PROFILES
(VICTORIA PARK)

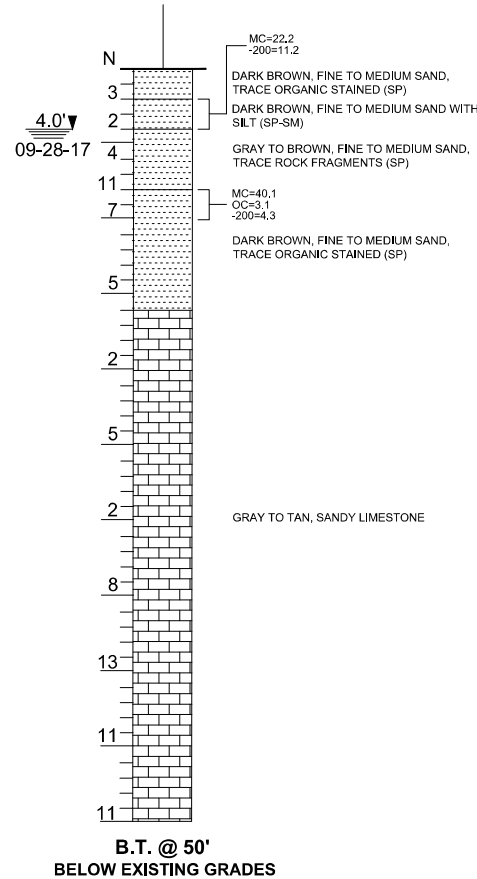
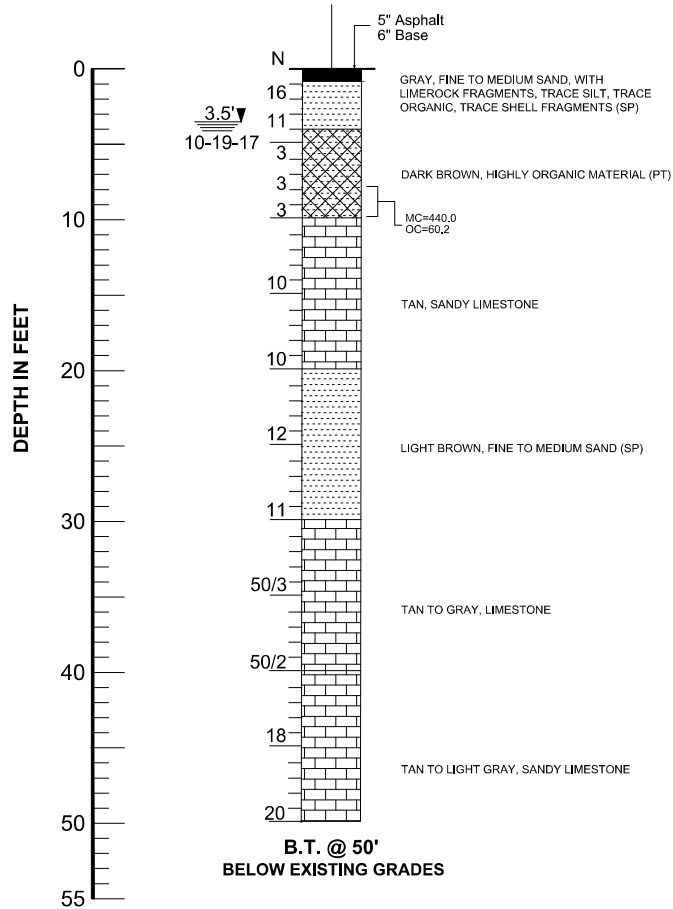
PROJECT NAME:
STORMWATER MASTER PLAN MODELING
AND DESIGN IMPLEMENTATION

SHEET NO.
10B

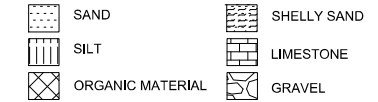
RADISE PROJECT NO:
170901

BORING NO. V-8
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1323°
LONGITUDE: -80.1194°
DATE: 10/19/2017
DRILLER: T. FICKLING
RIG: CME 45

BORING NO. V-9
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1321°
LONGITUDE: -80.1192°
DATE: 09/28/2017
DRILLER: T. FICKLING
RIG: CME 45



LEGEND



1.5'▼
09-21-17
AND DRILLING DATE

N
STANDARD PENETRATION RESISTANCE-
BLOWS PER FOOT USING AUTOMATIC HAMMER

SP
UNIFIED SOIL CLASSIFICATION SYSTEM
GROUP SYMBOL (ASTM D 2488)

V-9
STANDARD PENETRATION TEST (SPT)
BORING AND NUMBER

MC
MOISTURE CONTENT (%)

-200
AMOUNT PASSING US STANDARD # 200
SIEVE

OC
ORGANIC CONTENTS (%)

LL
LIQUID LIMIT (%)

PI
PLASTICITY INDEX (%)

B.T. @ 50'
BORING TERMINATED AT 50 FEET
BELOW THE EXISTING GROUND SURFACE

NOTES

- (1) BORINGS WERE DRILLED ON SEPTEMBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
- (2) STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- (3) GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVELS WILL FLUCTUATE THROUGHOUT THE YEAR.
- (4) LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- (5) ELEVATIONS WERE NOT AVAILABLE
- (6) AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA. 1.375 INCH

SPOON OUTSIDE DIA. 2.0 INCHES

AVG. HAMMER DROP 30 INCHES

HAMMER WEIGHT 140 POUNDS

RELATIVE DENSITY

VERY LOOSE

LOOSE

MEDIUM

DENSE

VERY DENSE

AUTOMATIC HAMMER
SPT N-VALUE
BLOWS/FOOT
LESS THAN 3
3 - 8
8 - 24
24 - 40
GREATER THAN 40

REVISIONS

Date	By	Descriptions	Date	By	Descriptions

Names	Dates
Drawn by ML	10/13/17
Checked by AB	10/13/17
Designed by	
Checked by	
Approved by	



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URL : http://www.radise.net

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT

COUNTY BROWARD

CLIENT HAZEN AND SAWYER

SCALE: VERTICAL
N.T.S.

SCALE: HORIZONTAL
N.T.S.

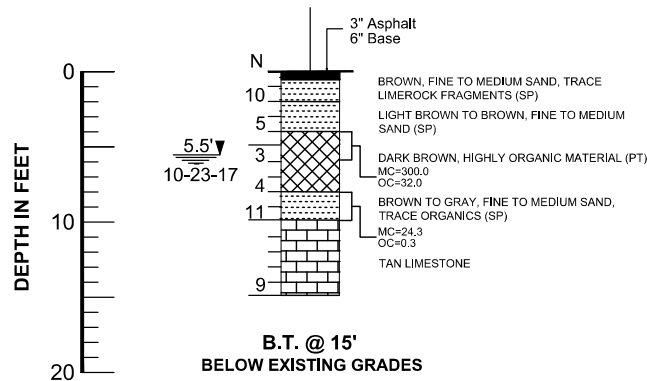
SHEET TITLE:
SUBSURFACE PROFILES
(VICTORIA PARK)

PROJECT NAME:
STORMWATER MASTER PLAN MODELING
AND DESIGN IMPLEMENTATION

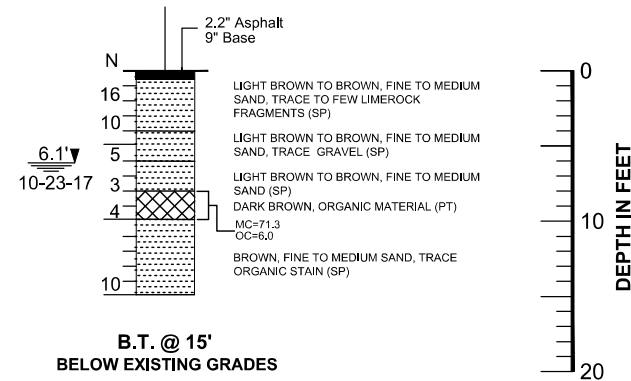
SHEET NO.
10C

RADISE PROJECT NO:
170901

BORING NO. V-7
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1321°
LONGITUDE: -80.1208°
DATE: 10/23/2017
DRILLER: T. FICKLING
RIG: CME 45



BORING NO. V-10
ELEVATION (NAVD 88): N/A
LATITUDE: 26.1345°
LONGITUDE: -80.1196°
DATE: 10/23/2017
DRILLER: T. FICKLING
RIG: CME 45



LEGEND

ASPHALT AND BASE	LIMESTONE
SAND	GRAVEL
SILTY SAND	ORGANIC MATERIAL
5.5'▼ 10-23-17	GROUNDWATER DEPTH IN FEET AND DRILLING DATE
N	STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER

SP, SP-SM, PT	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2488)
V-1	STANDARD PENETRATION TEST (SPT) BORING AND NUMBER
MC	MOISTURE CONTENT (%)
-200	AMOUNT PASSING US STANDARD # 200 SIEVE (%)
OC	ORGANIC CONTENTS (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
B.T. @ 15'	BORING TERMINATED AT 15 FEET BELOW THE EXISTING GROUND SURFACE

NOTES

- BORING WERE DRILLED ON SEPTEMBER AND OCTOBER, 2017 USING A CENTRAL MINING EQUIPMENT MODEL 45 (CME 45) AUTOMATIC HAMMER DRILL RIG.
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- LONGITUDE AND LATITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HAND HELD GPS UNIT.
- ELEVATIONS WERE NOT AVAILABLE
- AFTER COMPLETION OF DRILLING BOREHOLES WERE BACK FILLED WITH GROUT.

GRANULAR MATERIALS

RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE BLOWS/FOOT
VERY LOOSE	LESS THAN 3
LOOSE	3 - 8
MEDIUM	8 - 24
DENSE	24 - 40
VERY DENSE	GREATER THAN 40

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

REVISIONS

Date	By	Descriptions	Date	By	Descriptions	Names	Dates	SCALE: VERTICAL N.T.S.	SHEET TITLE: SUBSURFACE PROFILES (VICTORIA PARK)	SHEET NO. 10D
						Drawn by KA	11/06/17			
						Checked by AB	11/06/17			
						Designed by				
						Checked by				
						Approved by				

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LICENSE NO. - 8901

CITY OF FORT LAUDERDALE PUBLIC WORKS DEPARTMENT	COUNTY BROWARD	CLIENT HAZEN AND SAWYER
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SCALE: HORIZONTAL N.T.S.	PROJECT NAME: STORMWATER MASTER PLAN MODELING AND DESIGN IMPLEMENTATION	RADISE PROJECT NO: 170901
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APPENDIX A

TABLE A-1 – LABORATORY TEST RESULTS SUMMARY GRAIN SIZE DISTRIBUTION

Table A: Laboratory Test Results Summary

Project Name: City of Fort Lauderdale - Stormwater Master Plan Modeling and Design Implementation

Project ID: 170901

Boring No	Sample Depth	Soil Classification	Moisture Content (%)	Organic Content (%)	-200	ATTERBERG LIMITS			GRAIN SIZE ANALYSIS U.S STANDARD SIEVE SIZE (% Passing)													
						LL (%)	PL (%)	PI	3"	1.5"	1"	3/4"	3/8"	#4	#10	#20	#40	#50	#60	#100	#140	#200
DR-1	28.5' - 30'	SM	19.1	-	12.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DR-2	4' - 6'	SP	26.6	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DR-3	8' - 10'	SP	20.0	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DR-4	8' - 10'	SP	21.5	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DR-5	4' - 6'	SP	25.9	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D-1	6' - 8'	SP	22.8	-	1.7	-	-	-	100	100	-	100	100	100	100	100	86.2	64.0	49.5	11.5	2.6	1.7
D-1	8' -10'	SP	27.3	1.1	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D-2	6' - 8'	SP	32.9	3.2	3.7	-	-	-	100	100	-	100	100	100	98.9	98.1	88.7	64.4	48.3	8.8	4.2	3.7
D-2	8' - 10'	SP-SM	22.1	-	10.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D-3	0' - 2'	SP-SM	7.5	-	8.2	-	-	-	100	100	-	100	92.1	90.1	88.5	87.0	78.3	62.2	50.5	14.9	9.3	8.2
D-3	4' - 6'	SP	21.5	-	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D-5	8' - 10'	SP	27.8	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P-1	13.5' 15'	SP	20.8	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P-4	6' - 8'	SP	16.9	-	4.4	-	-	-	100	100	-	100	93.9	87.5	83.3	81.1	71.9	57.8	44.5	9.8	5.2	4.4
P-5	4' - 6'	SP	26.7	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P-6	28.5' - 30'	SP-SM	25.7	-	7.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V-1	6' - 8'	PT	51.6	5.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V-7	4' - 6'	PT	300.0	32.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V-7	8' - 10'	SP	24.3	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table A: Laboratory Test Results Summary

Project Name: City of Fort Lauderdale - Stormwater Master Plan Modeling and Design Implementation

Project ID: 170901

Boring No	Sample Depth	Soil Classification	Moisture Content (%)	Organic Content (%)	-200	ATTERBERG LIMITS			GRAIN SIZE ANALYSIS U.S STANDARD SIEVE SIZE (% Passing)													
						LL (%)	PL (%)	PI	3"	1.5"	1"	3/4"	3/8"	#4	#10	#20	#40	#50	#60	#100	#140	#200
V-8	8' - 10'	PT	440.5	60.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V-9	2' - 4'	SP-SM	22.2	-	11.2	-	-	-	100	100	-	100	92.3	90.1	88.7	87.5	79.6	67.1	56.9	21.2	12.5	11.2
V-9	8' - 10'	SP	40.1	3.1	4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V-10	8' - 10'	PT	71.3	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E-11	2' - 4'	SP	17.8	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-1	0' - 2'	SP-SM	8.1	-	8.3	-	-	-	100	100	-	95.1	80.3	75.2	72.1	70.3	62.8	52.1	43.5	15.6	9.7	8.3
R-2	2' - 4'	SP-SM	14.0	-	7.3	-	-	-	100	100	-	90.7	78.8	70.6	64.6	61.1	54.8	46.5	40.1	15.8	9.2	7.3
R-2	4' - 6'	SP	18.2	-	4.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-3	2' - 4'	SP	20.1	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-4	0' - 2'	SP	14.5	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-5	6' - 8'	SP	27.4	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-6	2' - 4'	SP-SM	16.8	-	8.1	-	-	-	100	100	-	93.0	87.2	82.5	80.4	78.5	72.6	62.3	52.7	17.5	10.3	8.1
R-6	6' - 8'	SP	24.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-9	4' - 6'	SP	56.3	10.2	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-9	13.5' - 15'	SP	26.5	-	1.2	-	-	-	100	100	100	100	100	100	100	100	95.4	79.9	64.3	8.8	1.6	1.2
R-10	2' - 4'	SP	51.4	18.4	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-10	28.5' - 30'	SP	25.6	-	2.7	-	-	-	100	100	100	100	100	100	100	99.1	77.8	55.0	43.5	13.8	3.5	2.7
R-11	4' - 6'	SP	27.0	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-11	8' - 10'	SP	24.8	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table A: Laboratory Test Results Summary

Project Name: City of Fort Lauderdale - Stormwater Master Plan Modeling and Design Implementation

Project ID: 170901

Boring No	Sample Depth	Soil Classification	Moisture Content (%)	Organic Content (%)	-200	ATTERBERG LIMITS			GRAIN SIZE ANALYSIS U.S STANDARD SIEVE SIZE (% Passing)													
						LL (%)	PL (%)	PI	3"	1.5"	1"	3/4"	3/8"	#4	#10	#20	#40	#50	#60	#100	#140	#200
R-11	38.5' - 40'	SP-SM	19.0	-	9.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-11	48.5' - 50'	SP-SM	26.2	-	8.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-12	0' - 2'	SP	20.2	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-12	4' - 6'	PT	107.6	9.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-12	38.5' - 40'	SP-SM	18.7	-	11.1	-	-	-	100	100	-	100	100	100	100	98.4	81.6	64.5	54.8	28.0	14.5	11.1
R-13	2' - 4'	SP	20.7	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-2	6' - 8'	PT	494.0	76.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-3	6' - 8'	SP	27.8	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-4	6' - 8'	PT	110.6	12.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-5	4' - 6'	PT	399.1	63.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-8	4' - 6'	PT/SP-SM	119.1	11.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-8	6' - 8'	SP-SM	33.4	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-8	13.5' - 15'	ML	27.6	-	69.3	NP	NP	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-9	0' - 2'	SP-SM	14.9	-	7.1	-	-	-	100	100	100	100	96.8	90.6	85.9	82.0	71.8	61.2	52.1	30.2	12.1	7.1
S-9	6' - 8'	SP	21.3	-	2.6	-	-	-	100	100	-	100	99.6	99.2	98.7	97.7	81.9	57.4	42.2	6.3	3.1	2.6
S-10	4' - 6'	SP	21.3	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-10	6' - 8'	SP	18.9	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-11	2' - 4'	SP-SM	18.9	-	11.3	-	-	-	100	100	-	92.5	81.2	77.9	74.8	71.7	62.0	49.1	39.5	15.1	11.7	11.3
S-11	4' - 6'	SP	19.9	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table A: Laboratory Test Results Summary

Project Name: City of Fort Lauderdale - Stormwater Master Plan Modeling and Design Implementation

Project ID: 170901

Boring No	Sample Depth	Soil Classification	Moisture Content (%)	Organic Content (%)	-200	ATTERBERG LIMITS			GRAIN SIZE ANALYSIS U.S STANDARD SIEVE SIZE (% Passing)													
						LL (%)	PL (%)	PI	3"	1.5"	1"	3/4"	3/8"	#4	#10	#20	#40	#50	#60	#100	#140	#200
S-12	0' - 2'	SM	16.6	-	18.4	-	-	-	100	100	100	94.0	80.9	72.3	65.9	61.4	54.3	46.0	40.0	23.8	19.9	18.4
S-12	4' - 6'	SP	23.0	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-13	0' - 2'	SP	24.9	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-13	4' - 6'	SP-SM	18.4	-	11.0	-	-	-	100	100	-	100	74.1	66.7	63.1	61.2	55.6	46.2	38.0	15.7	12.3	11.0
S-13	8' - 10'	SM	25.9	1.5	12.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-14	0' - 2'	SP	13.5	3.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-14	6' - 8'	PT	205.5	25.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-15	0' - 2'	SP	18.9	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-15	4' - 6'	PT	456.1	65.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-16	0' - 2'	SP-SM	11.3	-	8.1	-	-	-	100	100	-	95.0	85.1	79.2	74.7	72.1	62.7	50.6	42.4	17.8	9.7	8.1
S-16	4' - 6'	PT/SP-SM	101.2	14.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-16	8' - 10'	SP	35.0	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-17	6' - 8'	PT	527.3	62.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-17	23.5' - 25'	SP	25.6	-	3.1	-	-	-	100	100	-	100	100	100	100	99.4	92.4	82.3	76.5	24.6	5.4	3.1
S-18	6' - 8'	PT	240.4	25.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-19	0' - 2'	SM	13.9	-	16.1	-	-	-	100	100	-	96.3	81.0	69.0	61.8	57.4	48.7	39.9	34.8	21.1	17.6	16.1
S-20	4' - 6'	PT/SP-SM	169.7	17.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-20	8' - 10'	SM	60.9	-	26.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-20	28.5' - 30'	SP-SM	27.1	-	6.2	-	-	-	100	100	-	100	100	100	100	100	97.4	96.5	96.1	53.6	12.0	6.2

Table A: Laboratory Test Results Summary

Project Name: City of Fort Lauderdale - Stormwater Master Plan Modeling and Design Implementation

Project ID: 170901

Boring No	Sample Depth	Soil Classification	Moisture Content (%)	Organic Content (%)	-200	ATTERBERG LIMITS			GRAIN SIZE ANALYSIS U.S STANDARD SIEVE SIZE (% Passing)													
						LL (%)	PL (%)	PI	3"	1.5"	1"	3/4"	3/8"	#4	#10	#20	#40	#50	#60	#100	#140	#200
S-21	4' - 6'	PT	347.0	50.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-21	8' - 10'	SP	26.2	-	1.6	-	-	-	100	100	-	100	100	100	100	98.9	84.8	62.1	48.9	9.8	2.4	1.6
S-22	2' - 4'	SM	13.9	-	17.2	-	-	-	100	100	-	100	84.3	73.3	66.0	61.3	53.2	45.5	40.6	24.8	19.0	17.2
S-22	4' - 6'	CL-ML/PT	88.7	10.7	54.2	52	44	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-22	8' - 10'	PT	535.3	67.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-23	6' - 8'	CL-ML/PT	118.7	12.7	64.9	65	59.3	5.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-23	8' - 10'	PT	519.8	66.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-24	6' - 8'	SP	24.1	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-25	2' - 4'	SP-SM	17.5	-	9.3	-	-	-	100	100	100	100	87.7	80.8	75.9	73.0	62.6	49.5	41.7	14.1	10.3	9.3
S-26	2' - 4'	SP-SM	18.3	-	10.8	-	-	-	100	-	100	100	90.0	81.7	75.3	70.0	58.9	45.5	37.8	17.8	12.7	10.8
S-26	8' - 10'	PT/SP-SM	141.4	11.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-27	0' - 2'	SP-SM	13.9	-	8.8	-	-	-	100	-	89.6	89.6	68.6	59.5	53.3	49.3	41.7	33.7	28.2	13.6	9.8	8.8
S-27	8' - 10'	PT	468.7	56.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-28	0' - 2'	PT/SP	19.9	5.8	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-28	2' - 4'	SM	16.9	-	12.7	-	-	-	100	100	100	100	93.8	92.9	91.8	90.7	80.5	63.3	50.3	17.3	13.6	12.7
S-29	2' - 4'	SP	50.6	4.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-29	6' - 8'	PT/SP-SM	73.8	7.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-30	2' - 4'	PT/SP	102.4	13.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-30	6' - 8'	SP	41.4	3.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Table A: Laboratory Test Results Summary

Project Name: City of Fort Lauderdale - Stormwater Master Plan Modeling and Design Implementation

Project ID: 170901

						ATTERBERG LIMITS			GRAIN SIZE ANALYSIS U.S STANDARD SIEVE SIZE (% Passing)													
Boring No	Sample Depth	Soil Classification	Moisture Content (%)	Organic Content (%)	-200	LL (%)	PL (%)	PI	3"	1.5"	1"	3/4"	3/8"	#4	#10	#20	#40	#50	#60	#100	#140	#200
S-30	13.5' - 15'	PT/SP	58.7	7.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

Moisture Content tested in accordance ASTM-D2216,
 Organic Content tests are performed with furnace temperature @450 Celsius and tested accordance ASTM-D2974,
 Plasticity Index Properties tested with accordance to ASTM-D4318,. LL=Liquid Limit, PL=Plasticity Limit and PI=Plasticity Index and NP=Non-Pastic
 Soil Classification tested with accordance to ASTM D 2487,
 Grain Size Analysis was tested in general accordance with ASTM-D422

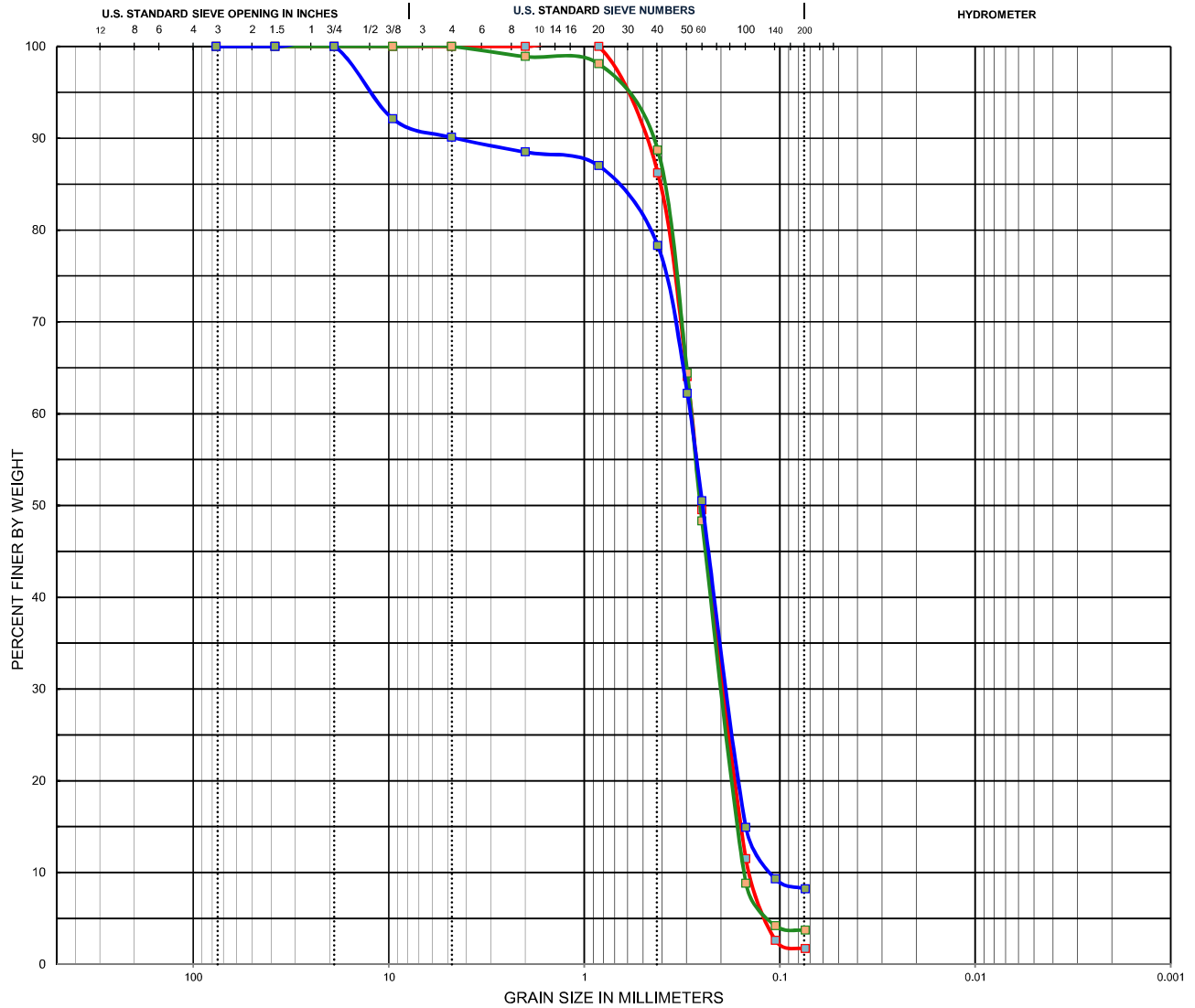


GRAIN SIZE DISTRIBUTION

CLIENT NAME Hazen and Sawyer, P.C.

PROJECT NAME City of Fort Lauderdale - Stormwater Master Modeling and Design Implementation

PROJECT NUMBER 170901



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

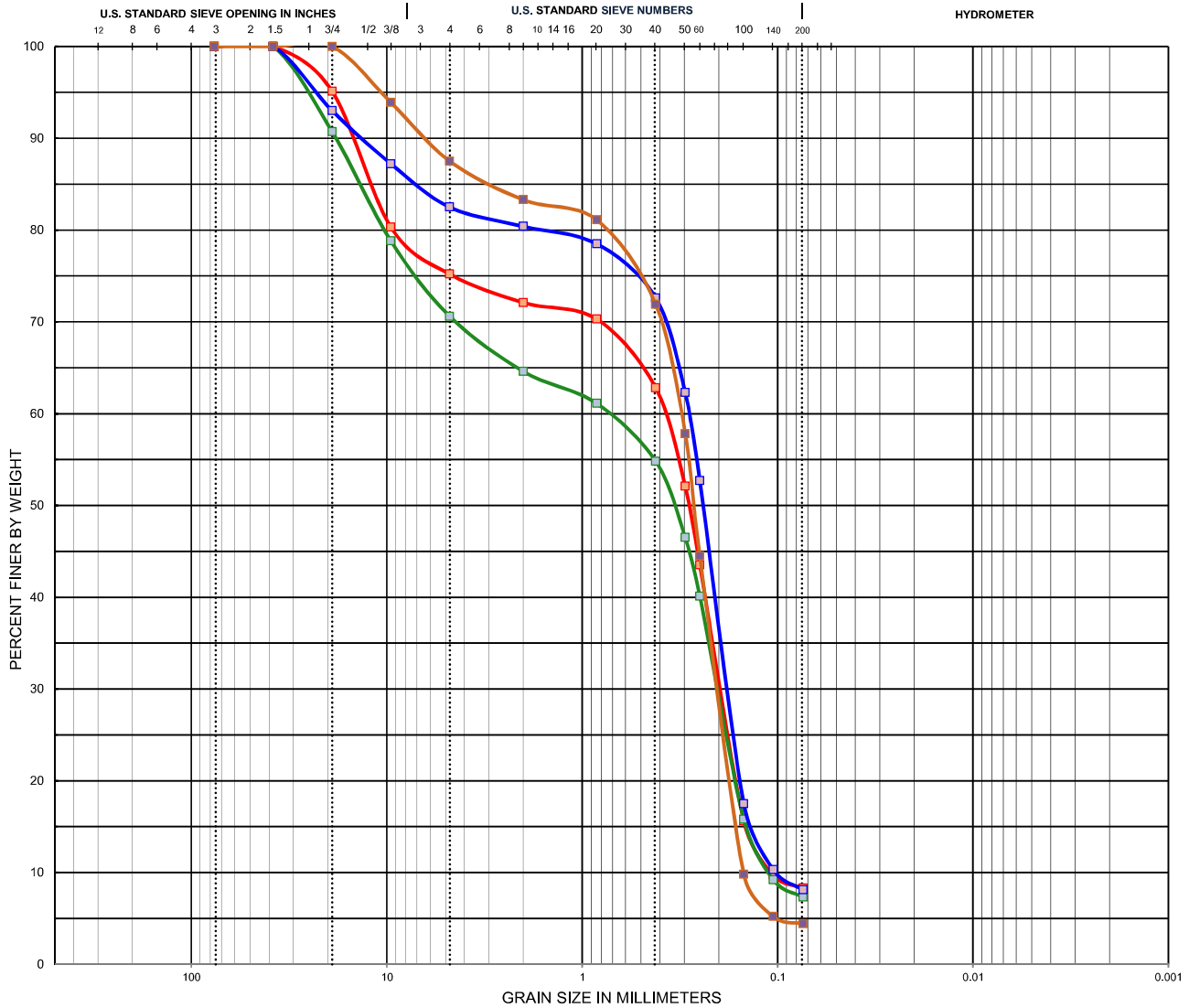
Boring No. Depth	Classification	LL	PL	PI	Cc	Cu
D-1, 6-8	Poorly-graded sand (SP)	NP	NP	NP	1.02	2
D-2, 6-8	Poorly-graded sand (SP)	NP	NP	NP	0.95	1.87
D-3, 0-2	Poorly-graded sand with silt (SP-SM)	NP	NP	NP	1.13	2.64

Boring No. Depth	D100	D60	D30	D10	% Cobble	%Gravel	%Sand	%Silt	%Clay
D-1, 6-8	0.84	0.28	0.2	0.14	0	0	98.3	1.7	
D-2, 6-8	4.76	0.28	0.2	0.15	0	0	96.3	3.7	
D-3, 0-2	19	0.29	0.19	0.11	0	9.9	81.9	8.2	

GRAIN SIZE DISTRIBUTION

CLIENT NAME Hazen and Sawyer, P.C.
PROJECT NUMBER 170901

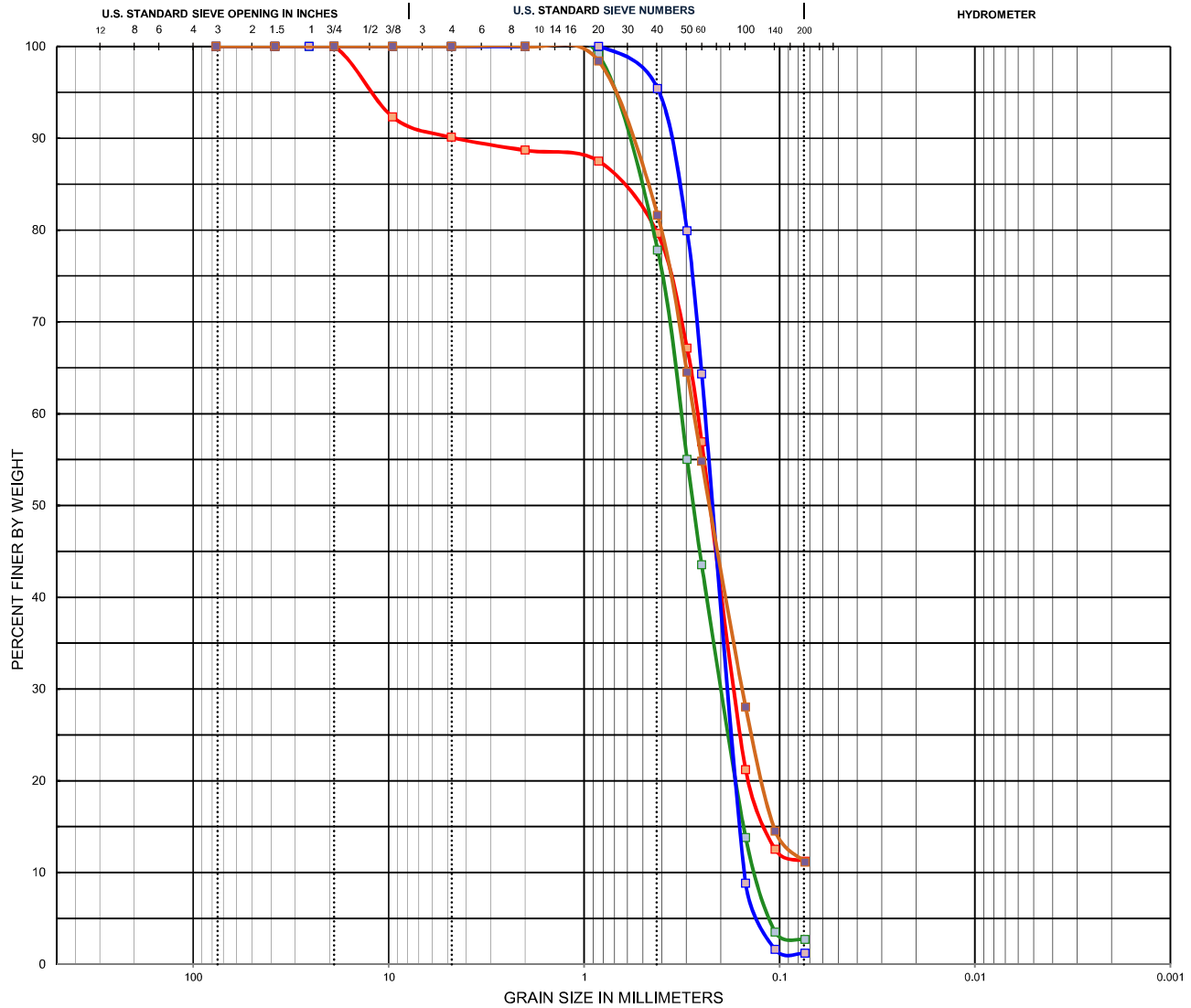
PROJECT NAME City of Fort Lauderdale - Stormwater Master Modeling and Design Implementation



GRAIN SIZE DISTRIBUTION

CLIENT NAME Hazen and Sawyer, P.C.
PROJECT NUMBER 170901

PROJECT NAME City of Fort Lauderdale - Stormwater Master Modeling and Design Implementation



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No. Depth	Classification	LL	PL	PI	Cc	Cu
V-9 , 2-4	Poorly-graded sand with silt (SP-SM)	NP	NP	NP	0	0
R-10 , 28.5-30	Poorly-graded sand (SP)	NP	NP	NP	0.96	2.46
R-9 , 13.5-15	Poorly-graded sand (SP)	NP	NP	NP	1	1.6
R-12 , 38.5' - 40'	Poorly-graded sand with silt (SP-SM)	NP	NP	NP	0	0

Boring No. Depth	D100	D60	D30	D10	% Cobble	%Gravel	%Sand	%Silt	%Clay
V-9 , 2-4	19	0.26	0.17	0	0	9.9	78.9	11.2	
R-10 , 28.5-30	2	0.32	0.2	0.13	0	0	97.3	2.7	
R-9 , 13.5-15	0.84	0.24	0.19	0.15	0	0	98.8	1.2	
R-12 , 38.5' - 40'	2	0.28	0.16	0	0	0	88.9	11.1	

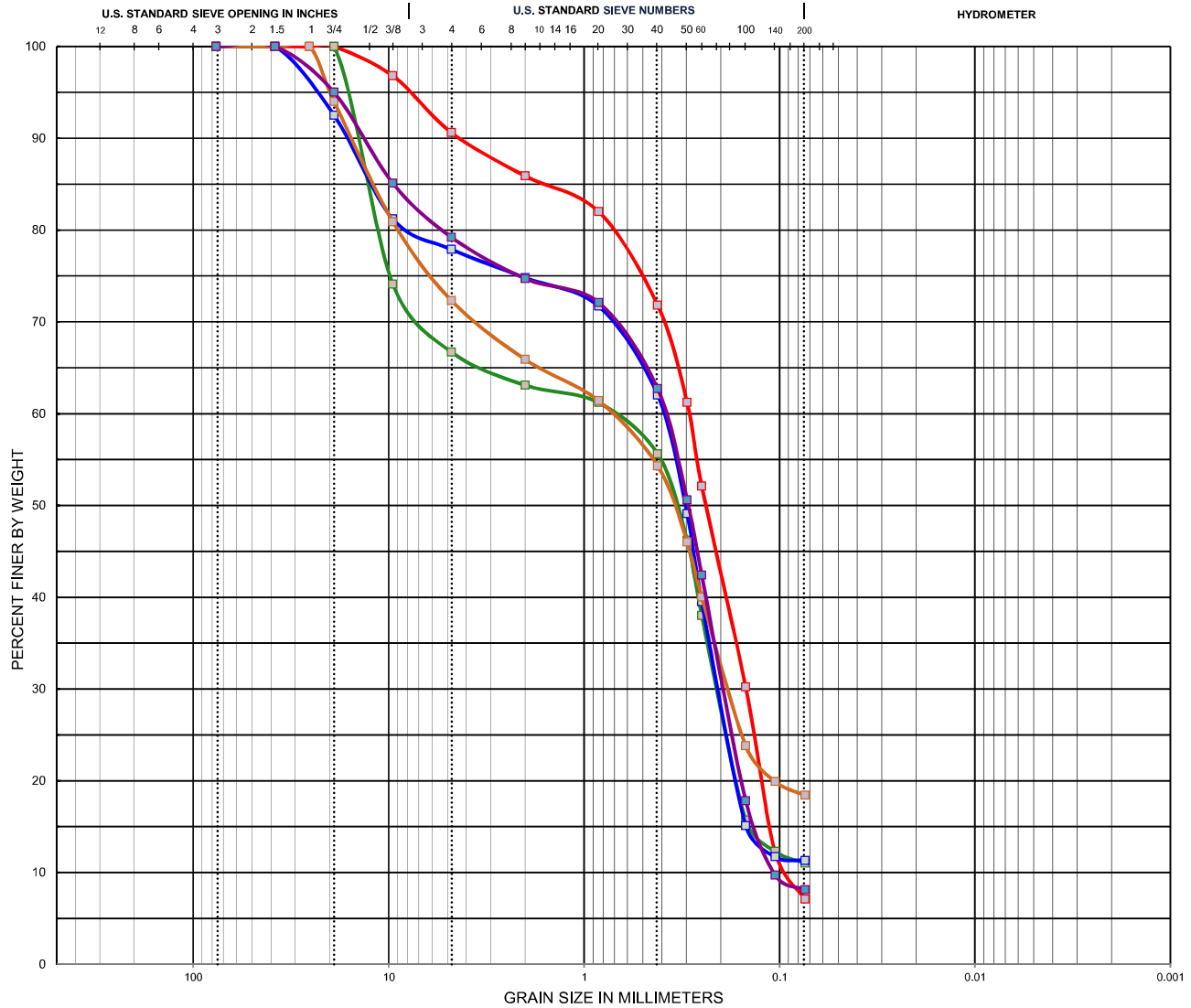


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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No. Depth	Classification	LL	PL	PI	Cc	Cu
S-9 , 0-2	Poorly-graded sand with silt (SP-SM)	NP	NP	NP	0.86	3.22
S-13 , 4-6	Poorly-graded sand with silt and gravel (SP-SM)	NP	NP	NP	0	0
S-11 , 2-4	Poorly-graded sand with silt and gravel (SP-SM)	NP	NP	NP	0	0
S-12 , 0-2	Silty sand with gravel (SM)	NP	NP	NP	0	0
S-16 , 0-2	Poorly-graded sand with silt and gravel (SP-SM)	NP	NP	NP	0.93	3.55

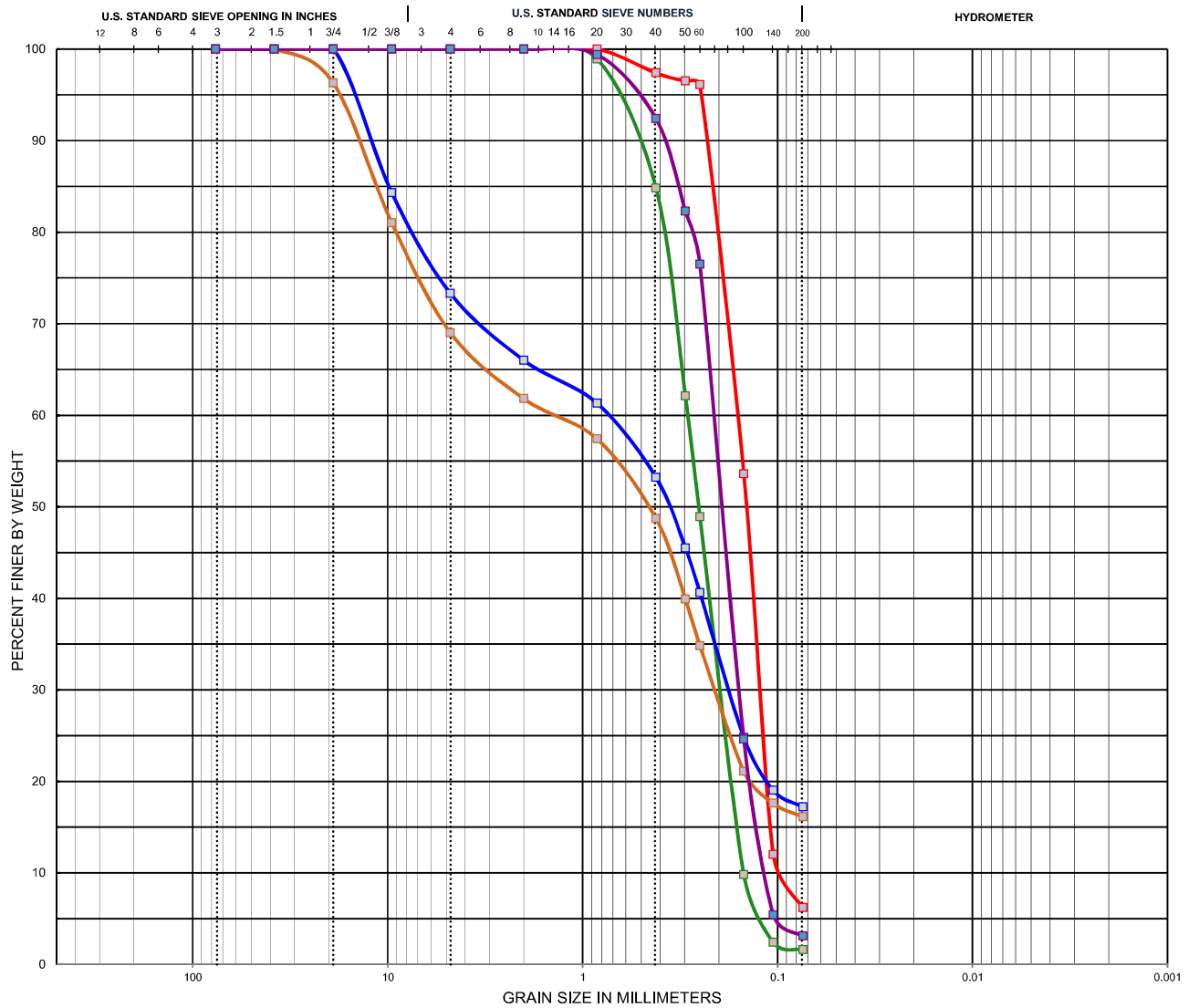
Boring No. Depth	D100	D60	D30	D10	% Cobble	%Gravel	%Sand	%Silt	%Clay
S-9 , 0-2	19	0.29	0.15	0.09	0	9.4	83.5	7.1	
S-13 , 4-6	19	0.75	0.21	0	0	33.3	55.7	11	
S-11 , 2-4	38.1	0.4	0.21	0	0	22.1	66.6	11.3	
S-12 , 0-2	25.4	0.76	0.19	0	0	27.7	53.9	18.4	
S-16 , 0-2	38.1	0.39	0.2	0.11	0	20.8	71.1	8.1	

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COBBLES	GRAVEL		SAND			SILT OR CLAY				
	coarse	fine	coarse	medium	fine					

Boring No. Depth	Classification	LL	PL	PI	Cc	Cu
S-20 , 28.5-30	Poorly-graded sand with silt (SP-SM)	NP	NP	NP	1	1.78
S-21 , 8-10	Poorly-graded sand (SP)	NP	NP	NP	0.92	1.93
S-22 , 2-4	Silty sand with gravel (SM)	NP	NP	NP	0	0
S-19 , 0-2	Silty sand with gravel (SM)	NP	NP	NP	0	0
S-17 , 23.5-25	Poorly-graded sand (SP)	NP	NP	NP	0.97	1.83

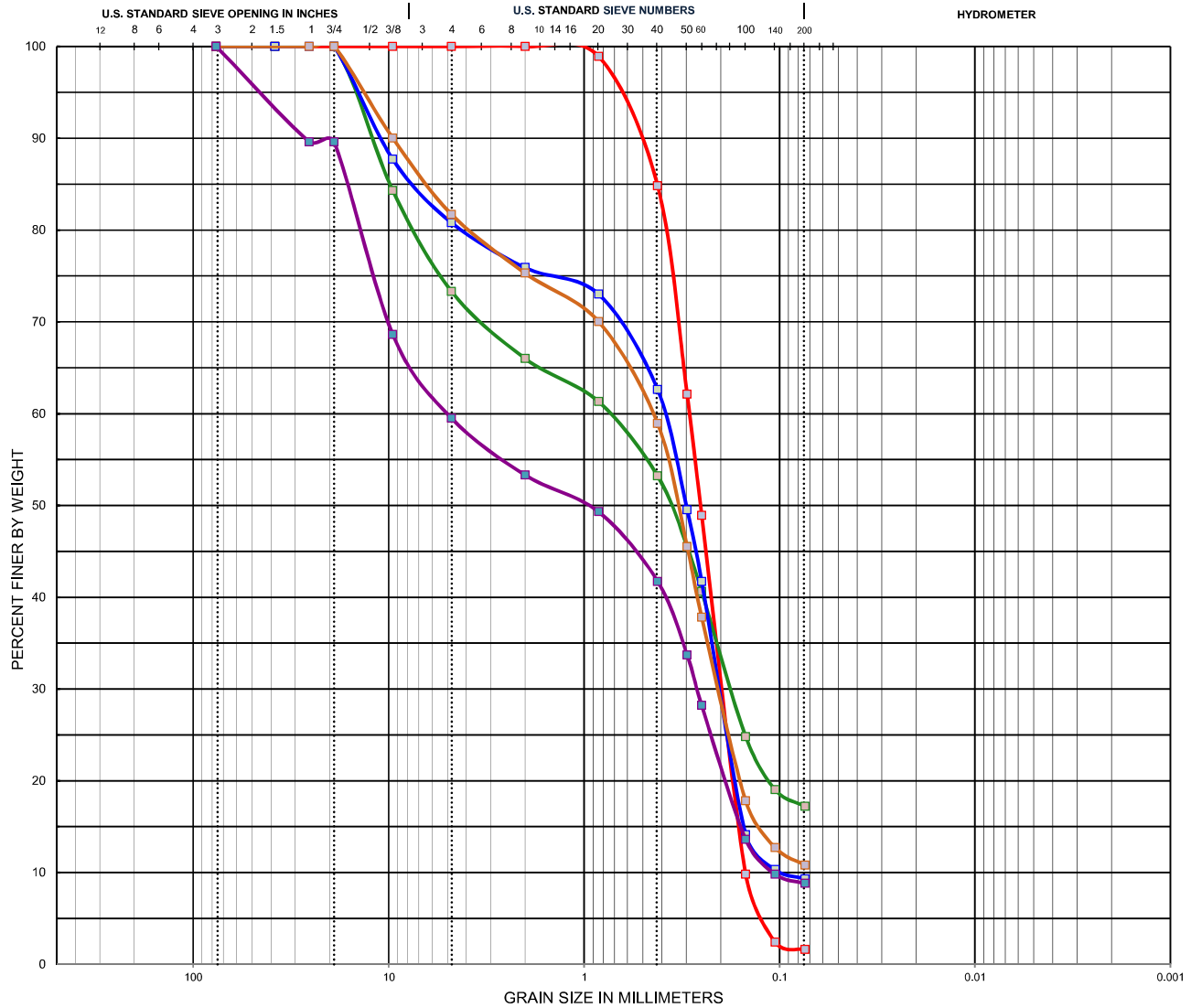
Boring No. Depth	D100	D60	D30	D10	% Cobble	%Gravel	%Sand	%Silt	%Clay
S-20 , 28.5-30	0.84	0.16	0.12	0.09	0	0	93.8	6.2	
S-21 , 8-10	2	0.29	0.2	0.15	0	0	98.4	1.6	
S-22 , 2-4	19	0.77	0.18	0	0	26.7	56.1	17.2	
S-19 , 0-2	38.1	1.53	0.21	0	0	31	52.9	16.1	
S-17 , 23.5-25	2	0.22	0.16	0.12	0	0	96.9	3.1	

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No. Depth	Classification	LL	PL	PI	Cc	Cu
S-21, 8-10	Poorly-graded sand (SP)	NP	NP	NP	0.92	1.93
S-22, 2-4	Silty sand with gravel (SM)	NP	NP	NP	0	0
S-25, 2-4	Poorly-graded sand with silt and gravel (SP-SM)	NP	NP	NP	1.1	4
S-26, 2-4	Poorly-graded sand with silt and gravel (SP-SM)	NP	NP	NP	0	0
S-27, 0-2	Poorly-graded sand with silt and gravel (SP-SM)	NP	NP	NP	0.13	45.64

Boring No. Depth	D100	D60	D30	D10	% Cobble	%Gravel	%Sand	%Silt	%Clay
S-21, 8-10	2	0.29	0.2	0.15	0	0	98.4	1.6	
S-22, 2-4	19	0.77	0.18	0	0	26.7	56.1	17.2	
S-25, 2-4	19	0.4	0.21	0.1	0	19.2	71.5	9.3	
S-26, 2-4	19	0.46	0.21	0	0	18.3	70.9	10.8	
S-27, 0-2	76.2	5.02	0.27	0.11	0	40.5	50.7	8.8	

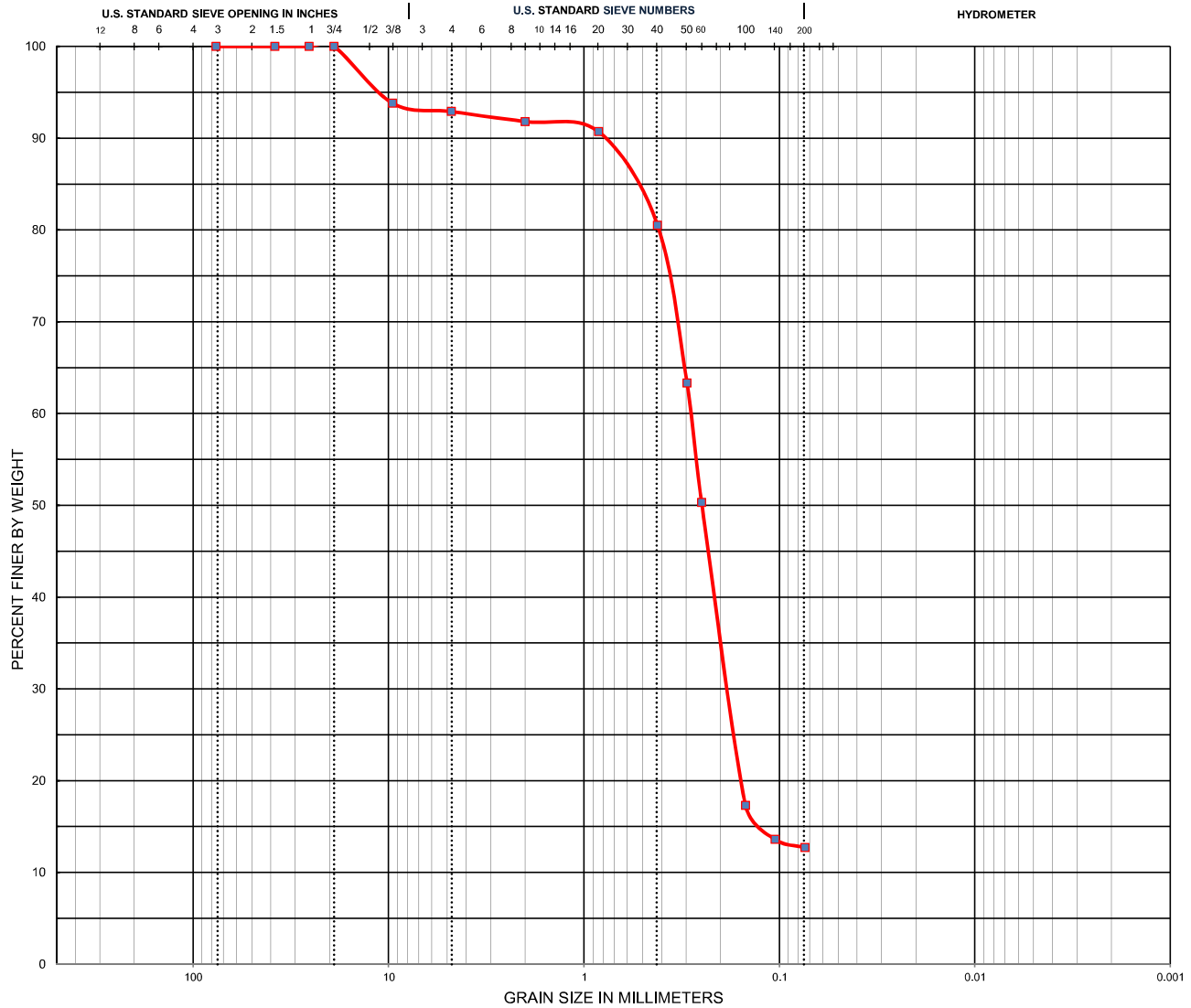


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PROJECT NUMBER 170901



APPENDIX B

PRELIMINARY DESIGN GEOTECHNICAL SERVICES REPORT



January 31, 2017

Hazen and Sawyer

4000 Hollywood Blvd., Suite 750N
Hollywood, Florida 33201

Attn: Mr. Robert B. Taylor, Jr., P.E.

Office: (954) 987- 0066

Cell: (772) 595- 2535

Email: rbtaylor@hazenandsawyer.com

RE: Geotechnical Services Report

City of Fort Lauderdale - 7 Neighborhoods Improvement Projects

Broward County, Florida

RADISE Project No: 160605

Dear Mr. Taylor,

RADISE International, LC (RADISE) is pleased to submit this *Geotechnical Services Report* for the above-referenced project. The purpose of this report is to provide geotechnical information and recommendations to aid in the design and construction of this project. This report describes the field exploration and laboratory testing performed, presents the data obtained, and provides our recommendation regarding geotechnical aspect of the of the proposed project.

The study was performed in general accordance with our agreement executed on October 11, 2016, our scope of work for geotechnical services, and the Florida Department of Transportation (FDOT) Soils and Foundations Handbook.

We appreciate the opportunity to work with Hazen and Sawyer on this project, and trust that the information presented is clear. Should you have any questions with this report, or if we can be of additional assistance as this project develops, please contact us at (561) 841-0103.

Sincerely,

RADISE International

Infrastructure Engineers & Software Developers

Khaled Abdelli
Staff Engineer

Akash Bissoon, P.E.
Project Engineer
Florida Registration
No. 74582



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ATTACHMENTS

Sheet 1 – Vicinity Map

Sheets 2A through 2G – Test Location Plan

Sheet 3A through 3E – SPT Boring Subsurface Profiles

Table A-1 – Laboratory Test Results Summary

Grain Size Distribution

Table A-2 – Open-Hole Exfiltration Test Results

1.0 INTRODUCTION

RADISE understands that the City of Fort Lauderdale is performing a study for Stormwater master plan modeling and design implementation in the City of Fort Lauderdale. To aid in the evaluation and design of the project, RADISE was requested to provide subsoil investigation and evaluation services that included drilling of exploratory borings and exfiltration testing to determine the subsurface stratigraphy, groundwater levels and physical properties of the soils underlying the site.

The information presented in this report is based upon our interpretation of the subsurface information revealed by the test borings. The report does not reflect variations in subsurface conditions that may exist between or beyond these borings. Variations in soil and groundwater conditions should be expected, the nature and extent of which might not become evident until construction is undertaken. If variations are encountered, and/or the scope of the project altered, we should be consulted for additional recommendations.

2.0 PROJECT DESCRIPTION

The project is located in the City of Fort Lauderdale, Florida and includes seven (7) neighborhoods located east of the interstate (I-95) and between Port Everglades Expressway and Sunrise Boulevard. The approximate limits of the neighborhood projects are shown on the attached *Vicinity Map*, Sheet 1.

3.0 PURPOSE AND SCOPE OF WORK

The purpose of this study was to perform a limited exploration of the subsurface conditions within the project proposed areas, to aid in the planning and design of the overall neighborhood site drainage infrastructure.

More specifically, the purpose of the work included the following:

- Development of the anticipated soil profiles and the subsurface conditions within the depth of influence of the needed and anticipated improvements.
- Identification of critical geotechnical design or construction considerations based on the soil and groundwater conditions encountered in the borings.

RADISE performed the following services in accordance with the proposed scope of work:

1. Performed a site visit to field mark (paint or/and stake) the planned soil boring and percolation test locations and observe existing site conditions.
2. Contacted Sunshine One-Call to request the field location and clearance of underground utilities in the areas of the proposed borings, as per Florida Statutes.
3. Set up basic Maintenance of Traffic (MOT) safety controls prior to and during the field

drilling and testing operations.

4. Mobilized drilling equipment to the site to perform thirty-five (35) Standard Penetration Test (SPT) soil borings to depths of twelve (12) to fourteen (14) feet below the existing ground surface within the various seven (7) neighborhoods. Samples of the subsurface soils encountered were obtained and the depth to the groundwater level was measured in each of the borings. Following completion of the testing, the boreholes were backfilled with neat cement grout.
5. Performed twenty-eight (28) open-hole Exfiltration tests to a depth of fifteen (15) feet below the existing ground surface. Tests were performed along the edge of the streets in the green space adjacent to the SPT borings. Tests were performed in accordance with the South Florida Water Management District (SFWMD) test procedures. Following completion of the testing, the boreholes were backfilled with neat cement grout.
6. Visually classified the SPT soil samples retrieved from the soil borings in accordance with the Unified Soil Classification System (USCS) using the Visual-Manual Procedure in general accordance with the American Society of Testing and Materials (ASTM) test method D 2488, *Description and Identification of Soils*.
7. Performed a limited laboratory testing program for soil index property determinations on selected SPT samples to aid in the classification process in general accordance with the ASTM test method D 2487, *Classification of Soils for Engineering Purposes*.
8. Prepared this geotechnical report which includes, but not necessarily be limited to:
 - Detailed graphical logs of the soil borings showing the groundwater level and subsurface soil stratigraphy and classification.
 - Presentation of the results of the field permeability exfiltration tests.
 - Geotechnical design and construction recommendations for the proposed improvements.

4.0 FIELD EXPLORATION

During this work phase, MOT was used to protect our field personnel, crew, equipment, and the public. The MOT was designed and set up in accordance with the FDOT Design Standards.

4.1 SOIL BORINGS

The field exploration program to evaluate the existing subsurface conditions consisted of drilling thirty-five (35) SPT borings. The SPT borings were drilled to depths of twelve (12) to fourteen (14) feet below the existing ground surface. The approximate locations of the SPT borings are depicted on the attached *Test Location Plan*, Sheets 2A through 2G. Latitude and Longitude coordinates of the test locations were obtained by the field crew using hand-held GPS equipment and are listed on the attached *Subsurface Profiles*, Sheets 3A through 3E. The SPT borings were

performed in general accordance with ASTM D 1586, “*Standard Test Method for the Standard Penetration Test and Split-Barrel Sampling*”. Upon retrieval, the split-spoon soil samples were visually classified and placed in moisture proof containers for transportation to our laboratory. Each borehole was backfilled with neat cement grout to the ground surface after the completion of drilling operations.

4.2 PERMEABILITY TEST

To evaluate the hydraulic conductivity of the subsurface soils, twenty-eight (28) Exfiltration Tests were performed along the edge of the streets in the green space adjacent to most of the SPT borings. Exfiltration tests were performed in general accordance with the South Florida Water Management District (SFWMD) procedures in 6-inch diameter by fifteen (15) feet deep auger boreholes. The approximate location of the tests are shown on the attached *Test Location Plan*, Sheets 2A through 2G.

4.3 GROUNDWATER LEVEL MEASUREMENTS

After completion of the borings and after a short stabilization period, the depth to the groundwater was measured from the existing ground surface in each boring. The measured groundwater depth/elevation is plotted adjacent to the soil profiles shown on the attached *Subsurface Profiles*, Sheets 3A through 3E.

5.0 LABORATORY TESTING

5.1 GENERAL

Representative soils samples collected from the borings were visually reviewed in the laboratory by a RADISE Geotechnical Engineer to confirm field classifications. The samples were classified in general accordance with the Unified Soil Classification System (USCS). The classifications were based on visual observations supplemented by laboratory test results performed on selected representative SPT samples. Laboratory index tests consisting of Full Sieve Analysis, Percent Passing No. 200 Sieve, Moisture and Organics Content tests were performed on selected samples.

5.2 LABORATORY TEST RESULTS

The following list summarizes the types and numbers of laboratory tests performed.

- Fifty (50), Moisture Content Tests (ASTM D 2216).
- Nineteen (19), Organics Content Tests (ASTM 2216 D).
- Eighteen (18), Full Sieve Analysis Test (ASTM D422).
- Fourteen (14), Percent Passing No. 200 Sieve Tests (ASTM D 1140).

Test assignments were provided by a geotechnical engineer during the laboratory review of secured soil samples. Laboratory assignments were made to supplement and confirm soil

classification at each general boring location.

All of the laboratory test results are presented on the attached *Subsurface Profiles*, Sheet 3A through 3E, and in the attached Table A-1 - *Laboratory Test Results Summary*.

6.0 SURFACE AND SUBSURFACE EXPLORATION

6.1 STRATIGRAPHY

Stratification of the explored soils is based on visual examination of the recovered soil samples, laboratory classification and index testing, and interpretation of the field boring logs by a geotechnical engineer in accordance with the Unified Soil Classification System (USCS). Subsurface profiles showing the soil stratification at the boring locations were developed and are presented on the attached *Subsurface Profiles*, Sheets 3A through 3E. Stratification lines represent approximate boundaries between soil types, but the actual transition between layers may be gradual or abrupt. Additionally, soil and groundwater conditions will vary between boring locations.

The soils encountered in all thirty-five (35) of the soil borings generally consist of sand with varying amounts of silt and limestone fragments occasionally underlain by limestone. Some of the borings encountered a layer of soil containing appreciable amounts of organic matter. Generalized descriptions of the soil stratigraphy are provided in the following Table 1:

TABLE 1 - STRATIGRAPHY

Stratum No.	Description	USCS Class.
1	Gray, tan, brown to dark brown, fine to medium SAND, trace Organics, trace Limestone, trace Silt	SP
2	Gray, tan, brown to dark brown, fine to medium SAND, trace to few Shell fragments	SP
3	Gray, tan, brown to dark brown Silty SAND, with Limestone Fragments	SM
4	Gray, tan, brown to dark brown SAND, with Silt, trace Limestone fragments	SP, SP-SM
5	Tan LIMESTONE	-
6	Dark Brown PEAT	PT

It is noted that the Layer 6 Dark Brown Peats were primarily encountered in the borings performed in the Seven Isles area of the project. Review of the boring logs indicates there appear to be layers of fill soils which were placed over remnant buried mangrove preserve areas along the Intracoastal

waterway. This land reclamation occurred during early development periods in the history of the coastal Ft. Lauderdale area.

The following Table 2 summarizes the borings, depths and thickness of the Stratum 6 soils that contain 14.7 to 62.5 percent organics encountered:

TABLE 2 – STRATUM 6 SOILS (PEAT)

Boring No.	Depth from (feet)	Depth to (feet)	Organic layer thickness (feet)
B-32	8	10	2
B-33	6	8	2
B-34	4	8	4
B-35	6	8	2

6.2 EXFILTRATION TESTING

The Exfiltration permeability tests were completed in an 8-inch diameter by 15-foot deep auger borehole in general accordance with the SFWMD procedures. The borehole sidewall was stabilized with a 6-inch diameter perforated section of No. 10 slot screen. The annulus space was backfilled with clean 6/20 silica sand. The results of the permeability tests are presented on Table A-2 - *Open-hole Exfiltration Test Results* included in the Attachments.

6.3 GROUNDWATER LEVELS

Groundwater was encountered in each of the auger borings and exfiltration test boreholes. The groundwater level varied between 3.5 to 7 feet below the existing ground surface. However, the groundwater levels will fluctuate with the seasons and variations of precipitation. It is our recommendation that the seasonal high groundwater table levels along the various project infrastructure alignments, be based on the normal high tide water levels of the adjacent waterways existing near the various neighborhood project areas and with additional geotechnical explorations. In inland areas not directly influenced by the water levels in the adjacent waterways and canals, normal high groundwater levels can be expected to be on the order of 2 to 3 feet above currently measured and reported levels herein.

7.0 DISCUSSIONS AND RECOMMENDATIONS

Generally speaking, the soils encountered in the majority of the borings performed for this study will be suitable for the proposed construction. However, it was previously noted that the Seven Isles area is likely a historical land reclamation area. This area as well as several others in the surrounding region, were infilled sometime in the historical past to facilitate the construction of the present residential communities. While no organics were encountered in the limited number of borings performed for the Victoria Park area, it is noted that the eastern area of this development

borders what appears to be the old Intracoastal Waterway footprint. Hence it might be expected that some buried organics may exist in the eastern areas/edges of this development.

The presence of the buried organics will be problematic to the installation of underground utilities especially when the inverts of such systems are founded in the organic layers. Such organics have very low shear strengths and will not support significant excavations made within or through them. As such, it is anticipated that significant shoring/sheet piling will be required to install infrastructure systems in this area.

7.1 CLEARING AND GRUBBING

Clearing and grubbing may be required in some of the proposed construction areas. Clearing and grubbing should include the complete removal and disposal of surficial grasses, associated root systems, topsoil, rubbish, debris, any demolition material/pavement and all other obstructions resting on or protruding through the surface of the existing ground and the surface of excavated areas.

7.2 UNDERGROUND UTILITIES

Existing underground utilities and structures are likely to be present in the proposed construction areas. These utilities need to be properly identified, and located and/or relocated as necessary to construct the new components of the project. The excavation bottoms of any relocated or replacement utilities should be cleaned of any undesirable materials prior to placing any engineered backfill.

Site preparation, excavation, and backfilling for new utilities or re-aligned utilities should follow all of the applicable recommendations of this report.

7.3 EXCAVATIONS

The project construction Contractor is solely responsible for making any utility or other excavations in a safe manner and to provide appropriate measures to retain side slopes to ensure that persons working in or near the excavation are protected.

Excavations shall comply with Occupational Health and Safety Administration (OHSA) stipulations for Trench Excavation Safety including all temporary design and safety requirements. The soils encountered in the majority borings outside of the Seven Isles area, generally consist of relatively clean sands. OSHA 29 CFR part 1926 (Subpart P, Excavations) defines such soils as Type C soils. As such, the granular deposits encountered in the borings are readily capable of being excavated to a depth of several feet with standard backhoe construction equipment. As such, temporary side slopes in fully dewatered excavations could be made at a 1½H:1V inclination or flatter. Adjustment to this inclination and/or the use of sheeting, shoring or sliding trench boxes should be evaluated by the Contractor if other soil strata are encountered. Any structural retaining walls shall be designed and sealed by a structural engineer registered in the State of Florida.

It is noted that in the Seven Isles area, that significant Muck deposits were encountered in the borings. Utilities installed in this area are likely to encounter organic Muck deposits during the utility excavation and installation process.

7.4 DEWATERING

At the time of the field exploration (October, 2016), the groundwater encountered varied between 3.5 to 7 feet below the existing ground surface. In-the-dry construction of the underground utilities may require groundwater lowering and control of groundwater seepage depending on the design installation depths. Dewatering of the excavations may necessitate the use of sumps, wells, wellpoints or combinations thereof. Control of groundwater should be accomplished in a manner that preserves the integrity of the in-situ soils and limestones and does not cause instability of the excavation sidewalls. The dewatering system employed should be capable of maintaining a pre-drained surface a minimum of 24 inches below the excavation bottoms.

7.5 PIPE BEDDING

Most of the sands encountered in the borings are expected to provide good support for utility pipelines without the need for bedding when the invert elevations are at least 24 inches above the groundwater level (natural or pre-drained by dewatering). Should or where organics or other deleterious materials be encountered at or within 2 feet below the pipe invert, such soils shall be considered compressible and unsuitable for pipe support. These soils should be over-excavated and replaced with compacted clean sand or FDOT No. 57 coarse aggregate or an approved equivalent. If FDOT No. 57 stone or an approved equivalent is utilized, such stone material will need to be encapsulated and/or covered with a geosynthetic fabric especially beneath pavement areas. Such fabric material is needed to prevent granular excavation soils and trench backfill from penetrating/settling into the void volumes of the open stone resulting in loss of ground and eventual settlement of the ground surface above the piping.

The bedding surface should be uniformly compacted to a density of not less than 95 percent of the maximum dry density in accordance with ASTM D 1557, the Modified Proctor Method.

7.6 TRENCH BACKFILL AND COMPACTION

Soils used to backfill utility excavations should consist of clean sands having no materials larger than one inch in size, not more than ten (10) percent passing the U.S. Standard No. 200 sieve, and not more than three (3) percent organics or other deleterious materials by weight. Some of the subsurface soils encountered at these neighborhood sites appear to meet these criteria and are suitable for reuse as backfill once inspected, tested and approved.

Granular backfill should be placed at a moisture content within three (3) percent of its ASTM D 1557 determined optimum moisture and in level lifts whose thickness does not exceed eight (8) inches. Each fill lift should be stable, unyielding and uniformly compacted to at least 95 percent of the maximum dry density in accordance with ASTM D 1557, the Modified Proctor Method. We recommend the use of only relatively light, hand-held compaction equipment in the

densification operations around utilities to limit the potential damage to the pipelines and buried structures.

7.7 SITE PREPARATION

The site preparation for any roadway modifications should consist of necessary clearing and grubbing in general accordance with Section 110 of the FDOT Standard Specifications for Road and Bridge Construction or any similar City/County standard design criteria applicable to the project. Any topsoil or other deleterious material encountered in proposed pavement areas, will need to be stripped, removed and replaced with embankment or roadway fill. If buried organic soils, debris or other unsuitable materials are encountered during the construction, which are or are not disclosed by the borings, they should be removed and replaced with a backfill material as described in following sections.

The Strata 1, 2, and 4 soils are select granular soils and are satisfactory to use in the subgrade and embankment when utilized in general accordance with FDOT Standard Index 505 or any similar City/County standard design criteria applicable to the project. Soils exposed at the stripped grades will require moisture conditioning to near the optimum moisture content prior to initiating the densification operations. The densification should normally be accomplished using a self-propelled vibratory compactor which imparts a dynamic drum force of not less than 44,000 pounds however, in residential areas, the use of such heavy vibratory compaction equipment may prove problematic and disruptive or even damaging to existing/adjacent home owner's properties. In such cases, the compaction will need to be performed and achieved with lighter weight, less vibration generation capable equipment such as walk behind (e.g. Whacker) ground pounder or small vibratory rolling equipment.

Each section of the stripped grade should be subjected to multiple, overlapping (minimum of 10 percent overlap) coverages of the compactor as it operates at a travel speed of no more than 1.5 miles per hour (normal walking speed). Compaction should be continued until no further settlement can be visually discerned at the ground surface. The densified areas should include a 3-foot perimeter along proposed new pavement areas.

Density control should be exercised for the exposed subgrade for any roadway repairs. Soils in this interval should be compacted to not less than 95 percent of the maximum dry density in accordance with ASTM D 1557, the Modified Proctor Method. Subgrade soils that noticeably pump or deflect under the weight of the passing compaction equipment, could indicate the presence of soft, weak, overly saturated soils or compressible and loose soil zones existing in the near surface subgrade within the depth of influence of the roller. In such cases, those areas should be remedied by appropriate means to be determined by the inspecting field representative in consultation with representatives of the design team.

7.8 SELECT FILL COMPOSITION, PLACEMENT AND COMPACTION

Site structural and pavement embankment fill and backfill required for construction should consist of clean, granular materials that are free of debris, cinders, combustibles and organic matter. The fines content (i.e., material passing U.S. Standard No. 200 sieve) should not be more than ten (10)

percent by weight, no particle sizes larger than one (1) inches in any direction and the organic content should not exceed three (3) percent by dry weight. The on-site sand soils appear to meet the above criteria and are suitable for use as structural fill and backfill material. Organic laden soils encountered in several of the borings soils beneath the upper sand layer such as those encountered in the Seven Isles area, will not be suitable for use of Select Fill.

The granular fill should be placed at a moisture content within three (3) percent of its Modified Proctor (ASTM D 1557) determined optimum in level lifts whose loose thickness does not exceed twelve (12) inches. In areas where heavy equipment cannot be operated for compaction, the fill should be placed in six (6) inch thick level lifts. Each fill lift should be stable, unyielding and uniformly compacted to 95 percent of the ASTM D 1557 maximum dry density, as verified by the designated site construction inspecting representative.

Select fill soils will require moisture conditioning to near the optimum moisture content prior to initiating the densification operations. Similar to the subgrade preparation, the fill densification should normally be accomplished using a self-propelled vibratory compactor which imparts a dynamic drum force of not less than 44,000 pounds. However, in residential areas, the use of such heavy vibratory compaction equipment may prove problematic and disruptive or even damaging to existing/adjacent home owner's properties. In such cases, the compaction will need to be performed and achieved with lighter weight, less vibration generation capable equipment such as walk behind (e.g. Whacker) ground pounder or small vibratory rolling equipment.

7.9 PAVEMENT DESIGN CONSIDERATIONS

The following information is intended as a guideline only, as the roadway or any repairs thereof, should be designed specifically for the vehicle load intensities and frequencies anticipated during the life of the project. Flexible pavement systems in this geographic area, typically consist of an asphaltic concrete wearing course, limerock base course and a stabilized pavement subgrade. Based on our preliminary analysis and experience in the area, the typical pavement section thicknesses shown in the following Table 3, are commonly used by local pavement design engineers.

TABLE 3 - TYPICAL FLEXIBLE AND RIGID PAVEMENT DESIGN

TYPE OF PAVEMENT	LAYER	MATERIAL DESCRIPTION	LAYER THICKNESS	
			LIGHT DUTY	HEAVY DUTY
Flexible	Asphaltic concrete	Florida DOT Asphalt Type S	1.5	2.0
	Base course	Crushed limerock with minimum LBR of 100, compacted to 98% of the Modified Proctor maximum dry density	6.0	8.0
	Stabilized subbase	Stabilized sub-base fill with a minimum LBR of 40 compacted to 95% of the Modified Proctor maximum dry density	12.0	12.0
Rigid	Concrete	Florida DOT Portland Cement Concrete	6.0	8.0
	Compacted subgrade	Natural in place soils compacted to at least 95 percent of the materials Modified Proctor maximum dry density	12.0	12.0

The base course material should consist of crushed limestone having a minimum Limerock Bearing Ratio (LBR) of 100. Base materials should meet the requirements presented in the latest revisions of the Florida Department of Transportation "Specifications for Road and Bridge Construction", Section 911 (limestone). The base course should be compacted to at least ninety-eight (98) percent of its maximum dry modified proctor density (AASHTO T 180).

We recommend that the pavement subgrade be stabilized to a depth of twelve (12) inches to achieve a minimum LBR of 40. This LBR can be achieved by blending base material (limerock) with the existing sandy subgrade soils. The required mixing ratio should be determined by laboratory testing. The stabilized subgrade should be compacted to at least ninety-eight (98) percent of its maximum dry as per ASTM D 1557, the Modified Proctor Method.

If it is not feasible to stabilize the subgrade, we recommend that the base course be thickened by an amount equivalent to the structural number of twelve (12) inches of stabilized subgrade.

A Portland concrete pavement thickness in the range of eight (8) inches is recommended for the project if a rigid pavement is to be employed (the thickness would depend on specific pavement use). The concrete should be reinforced to withstand the anticipated traffic loadings and jointed to reduce the chances for rigid pavement crack development. The minimum rigid pavement thickness recommended above is based upon concrete with an unconfined compressive strength of at least 3,000 psi and a modulus of rupture of at least 450 psi.

Actual pavement section thickness should be determined by the Design Civil Engineer based on traffic loads, volume, and the owner's design life requirements. The above sections represent minimum thickness representative of typical local construction practices and, as such, periodic

maintenance should be anticipated. All pavement materials and construction procedures should conform to FDOT, American Concrete Institute (ACI), or appropriate City and County requirements.

7.10 OBSERVATION AND TESTING

It is recommended that a geotechnical engineer be retained to provide soil engineering inspection services during the construction excavation phase of the project. This is to observe compliance with the design concept, specifications and recommendations, and to allow design changes in the event subsurface conditions differ from those anticipated. In addition, an inspection and testing representative of a geotechnical engineer should be present to provide monitoring and testing of both fill and concrete placement during the construction phase of the project.

8.0 PROTECTION OF EXISTING STRUCTURES

Ground vibrations induced upon adjacent structures, primarily by soil compaction equipment or any other construction activities such as pile driving, should be monitored to assure that they do not reach levels which prove damaging to any adjacent/nearby structures. Vibration Monitoring should be performed in general accordance with “Section 108, Protection of Existing Structures” of the current FDOT Standard Specifications for Road and Bridge Construction or other similar local City/County regulations or ordinances.

Vibration levels on adjacent facilities should generally be maintained below a 0.25 ips peak particle velocity level however, more restrictive/lessor levels may be specified for highly sensitive residential or commercial areas. The construction Contractor will need to inventory and provide a pre-construction inspection of adjacent structures and determine suitable vibration monitoring programs and impact limits for their construction activities. Such monitoring will be particularly important for the Seven Isles area as the ground conditions will have a higher tendency and capability to transmit vibrations horizontally from the construction activities. It is noted that the residential homes in this area are all likely founded on short driven piles installed to sound bearing conditions beneath the buried organics. Vibrations in the lower soil/rock layers beneath the organics, from construction activities such as sheet piling installation, will have the potential to be transmitted into the residences via the piling foundations installed for the structures.

9.0 LIMITATIONS

This report is intended for geotechnical purposes only, and not to document or detect the presence, or absence of any environmental conditions at the site, or to perform an environmental assessment of the site.

The analysis and recommendations presented in this report are based upon our interpretation of the subsurface information revealed by the test borings. The report does not reflect variations in subsurface conditions that may exist between or beyond these borings. Variations in soil and groundwater conditions should be expected, the nature and extent of which might not become

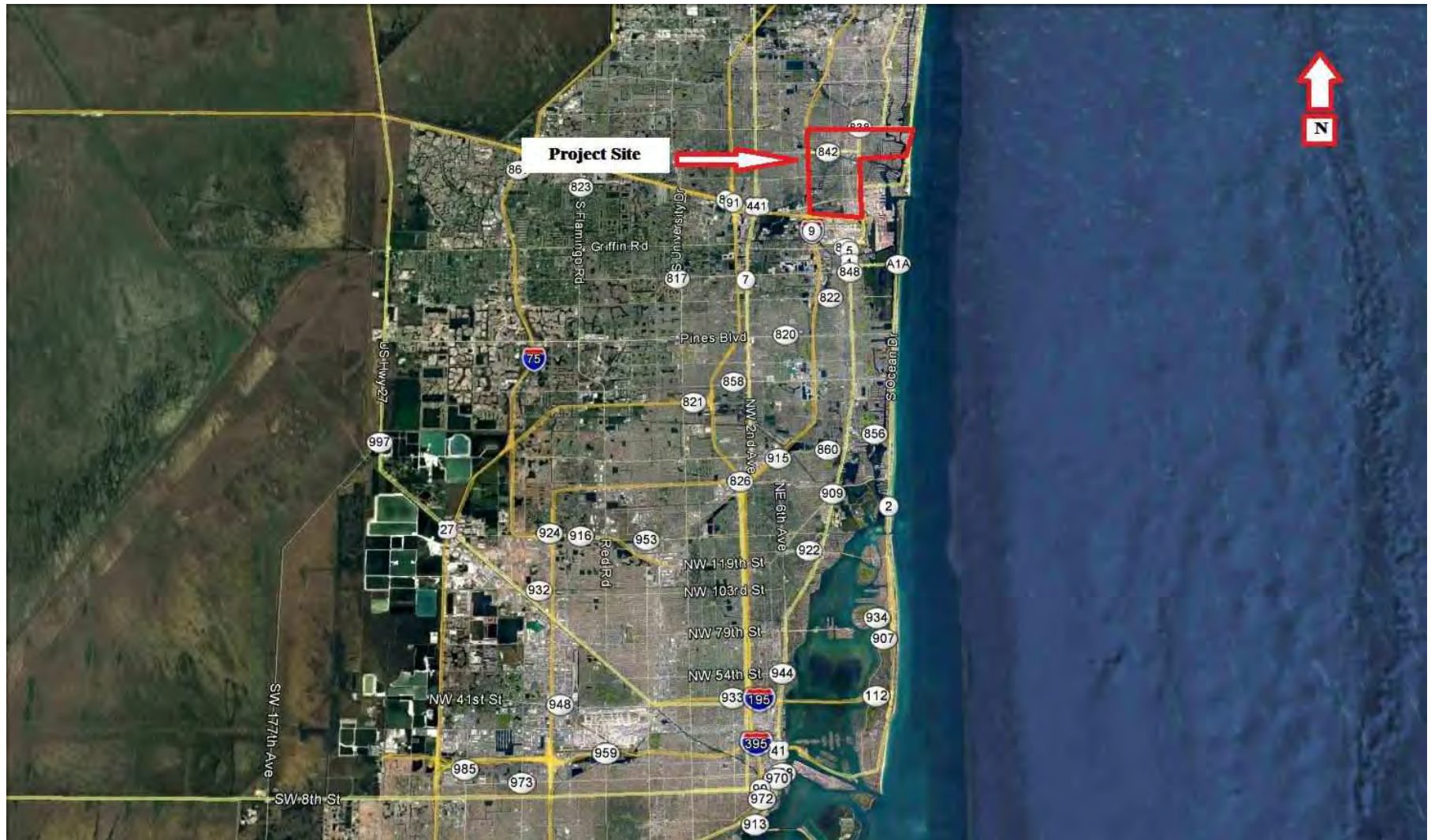
evident until construction is undertaken. If variations are encountered, and/or the scope of the project altered, we should be consulted for additional recommendations.

RADISE International warrants that the professional services performed and presented in this report are prepared for Hazen and Sawyer, and are based upon typical standard of care recognized principles and practices in the discipline of geotechnical engineering and hydrogeology at this place and point in time, for this project site. No other warranties are expressed or implied.

-oOo-

RADISE appreciates the opportunity to be of service to you. Please feel free to contact us at 561-841-0103 if you have any questions or comments regarding this report.

**Respectfully submitted
RADISE INTERNATIONAL, L.C.**



REVISIONS						Names		Dates		 ENGINEER OF RECORD THOMAS F. MULLIN (P.E.No. 43366) RADISE International 4152 West Blue Heron Boulevard, Suite # 1114 Riviera Beach, Florida 33404 TEL 561-841-0103 FAX 561-841-0104 URL : http://www.radise.net LICENSE NO. - 8901	THE CITY OF FORT LAUDERDALE		SCALE: VERTICAL	SHEET TITLE:	SHEET NO.
Date.	By	Descriptions	Date.	By	Descriptions	Drawn by	KA	11/9/2016			N.T.S.	VICINITY MAP	1		
						Checked by	TM <th>11/9/2016</th> <th colspan="2"></th> <th></th> <th></th> <th></th>	11/9/2016							
						Designed by									
						Checked by									
						Approved by									
											COUNTY	CLIENT	SCALE: HORIZONTAL	PROJECT NAME:	RADISE PROJECT NO:
											BROWARD	HAZEN AND SAWYER	N.T.S.	FORT LAUDERDALE - 7 NEIGHBORHOODS IMPROVEMENT	160605



LEGEND

● TEST NUMBER AND APPROXIMATE LOCATION

REVISIONS

Date	By	Descriptions	Date	By	Descriptions	Drawn by	Names	Dates	 ENGINEER OF RECORD RADISE International 4152 West Blue Heron Boulevard, Suite 1114 Riviera Beach, Florida 33404 TEL 561-841-0103 FAX 561-841-0104 URL : http://www.radise.net		THE CITY OF FORT LAUDERDALE COUNTY CLIENT BROWARD HAZEN AND SAWYER		SCALE: VERTICAL	SHEET TITLE: TEST LOCATION PLAN		SHEET NO.
						Checked by	KA	11/9/2016					N.T.S.			2D
						Designed by							N.T.S.			RADISE PROJECT NO:
						Checked by										160605
						Approved by			LICENSE NO. - 8901				PROJECT NAME: FORT LAUDERDALE - 7 NEIGHBORHOODS IMPROVEMENT			



LEGEND

● TEST NUMBER AND APPROXIMATE LOCATION

REVISIONS

Date	By	Descriptions	Date	By	Descriptions

Names	Dates
Drawn by KA	11/9/2016
Checked by AB	11/9/2016
Designed by	
Checked by	
Approved by	



ENGINEER OF RECORD
RADISE International
4152 West Blue Heron Boulevard, Suite 1114
Riviera Beach, Florida, 33404
TEL 561-841-0103 FAX 561-841-0104
URL : <http://www.radise.net>

THE CITY OF FORT LAUDERDALE	
COUNTY	CLIENT
BROWARD	HAZEN AND SAWYER

SCALE: VERTICAL N.T.S.
SCALE: HORIZONTAL N.T.S.

SHEET TITLE: TEST LOCATION PLAN
PROJECT NAME: FORT LAUDERDALE - 7 NEIGHBORHOODS IMPROVEMENT

SHEET NO. 2F
RADISE PROJECT NO: 160605



LEGEND

● TEST NUMBER AND APPROXIMATE LOCATION

REVISIONS

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						Checked by	KA	11/9/2016	RADISE International	BROWARD	HAZEN AND SAWYER	N.T.S.	TEST LOCATION PLAN	2G
						Designed by	AB	11/9/2016	4152 West Blue Heron Boulevard, Suite 1114			SCALE: HORIZONTAL	PROJECT NAME:	RADISE PROJECT NO:
						Checked by			Riviera Beach, Florida, 33404			N.T.S.	FORT LAUDERDALE - 7 NEIGHBORHOODS IMPROVEMENT	160605
						Approved by			TEL 561-841-0103 FAX 561-841-0104					
									URL : http://www.radise.net					

BORING NO:
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

B-1
26°08'07.1"N
80°09'58.8"W
10-14-16
TIM FLICKING
CME 45

B-2
26°08'05.1"N
80°09'36.1"W
10-14-16
TIM FLICKING
CME 45

B-3
26°07'51.6"N
80°09'51.2"W
10-14-16
TIM FLICKING
CME 45

B-4
26°07'51.6"N
80°09'36.2"W
10-14-16
TIM FLICKING
CME 45

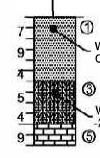
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80°09'57.5"W
10-14-16
TIM FLICKING
CME 45

B-6
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80°08'37.7"W
10-14-16
TIM FLICKING
CME 45

B-7
26°07'32.7"N
80°09'25.5"W
10-14-16
TIM FLICKING
CME 45

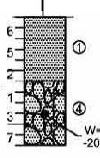
DEPTH IN FEET
0
5
10
15

5.2'
10-14-16



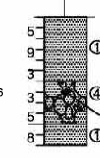
B.T. @ 12'

5.2'
10-14-16



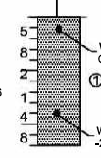
B.T. @ 12'

5.6'
10-14-16



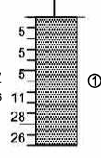
B.T. @ 12'

5.6'
10-14-16



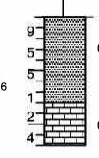
B.T. @ 12'

6.0'
10-14-16



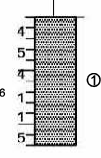
B.T. @ 12'

5.0'
10-14-16



B.T. @ 12'

5.6'
10-14-16



B.T. @ 12'

DEPTH IN FEET
0
5
10
15

LEGEND

- ① GRAY, TAN, BROWN TO DARK BROWN, FINE TO MEDIUM SAND, TRACE ORGANIC, TRACE LIMESTONE FRAGMENTS, TRACE SILT (SP)
- ② GRAY, TAN, BROWN FINE TO MEDIUM SAND, TRACE TO FEW SHELL FRAGMENTS (SP)
- ③ GRAY, TAN, BROWN TO DARK BROWN SILTY SAND, WITH LIMESTONE FRAGMENTS (SM)
- ④ GRAY, TAN, BROWN TO DARK BROWN SAND, WITH SILT, TRACE LIMESTONE FRAGMENTS (SP, SP-SM)
- ⑤ TAN LIMESTONE
- ⑥ DARK BROWN PEAT (PT)

- B.T. @ 12' BORING TERMINATED AT 12' BELOW THE EXISTING GROUND SURFACE
- PT-SP-SM UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2487)
- N STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER
- W MOISTURE CONTENT (%)
- OC ORGANIC CONTENT (%)
- 200 AMOUNT PASSING US STANDARD 200 SIEVE (%)

NOTES

- BORINGS WERE DRILLED IN OCTOBER OF 2016. SPT BORINGS WERE PERFORMED USING A CME-45C AUTOMATIC HAMMER DRILLING RIG (ASTM D1586).
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVEL FLUCTUATIONS SHOULD BE ANTICIPATED THROUGHOUT THE YEAR.
- LATITUDE AND LONGITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HELD HAND GPS.
- AFTER COMPLETION OF DRILLING, BOREHOLES WERE BACKFILLED WITH GROUT.

STANDARD PENETRATION TEST DATA
SPOON INSIDE DIA. 1.375 INCH
SPOON OUTSIDE DIA. 2.0 INCHES
AVG. HAMMER DROP 30 INCHES
HAMMER WEIGHT 140 POUNDS

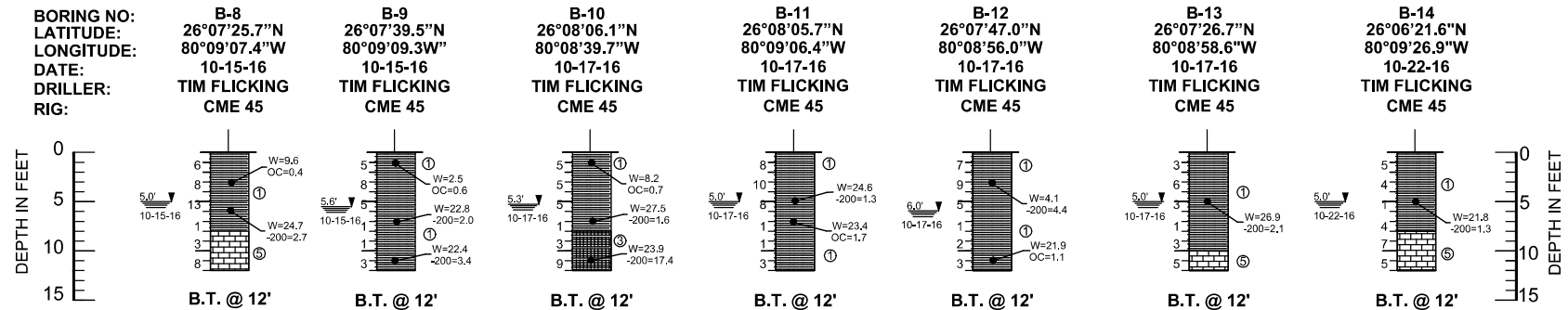
GRANULAR MATERIALS
RELATIVE DENSITY
VERY LOOSE
LOOSE
MEDIUM
DENSE
VERY DENSE
AUTOMATIC HAMMER SPT N-VALUE
BLOWS/FOOT
LESS THAN 3
3 - 8
8 - 24
24 - 40
GREATER THAN 40

SILTS AND CLAYS
CONSISTENCY
VERY SOFT
SOFT
FIRM
STIFF
VERY STIFF
HARD
AUTOMATIC HAMMER SPT N-VALUE
BLOWS/FOOT
LESS THAN 1
1 - 3
3 - 8
8 - 12
12 - 24
GREATER THAN 24

REVISIONS

Date	By	Descriptions	Date	By	Descriptions	Drawn by	Names	Dates	ENGINEER OF RECORD	CITY OF FORT LAUDERDALE	SCALE: VERTICAL	SHEET TITLE:	SHEET NO.
						K.A.		01/03/2017	RADISE International		N.T.S.	SPT BORING SUBSURFACE PROFILES	3A
						A.B.		01/03/2017	4152 West Blue Heron Boulevard, Suite 228	COUNTY			
									Riviera Beach, Florida, 33404	CLIENT			
									TEL 561-241-0103 FAX 561-241-0104	BROWARD	SCALE: HORIZONTAL	PROJECT NAME:	RADISE PROJECT NO:
									URL : http://www.radise.net	HAZEN AND SAWYER	N.T.S.	FORT LAUDERDALE - 7 NEIGHBORHOODS IMPROVEMENT	160605

BORING NO:
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:



LEGEND

	①	GRAY, TAN, BROWN TO DARK BROWN, FINE TO MEDIUM SAND, TRACE ORGANIC, TRACE LIMESTONE FRAGMENTS, TRACE SILT (SP)	B.T. @ 12'	BORING TERMINATED AT 12' BELOW THE EXISTING GROUND SURFACE
	②	GRAY, TAN, BROWN FINE TO MEDIUM SAND, TRACE TO FEW SHELL FRAGMENTS (SP)	PT-SP-SM	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2487)
	③	GRAY, TAN, BROWN TO DARK BROWN SILTY SAND, WITH LIMESTONE FRAGMENTS (SM)	N	STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER
	④	GRAY, TAN, BROWN TO DARK BROWN SAND, WITH SILT, TRACE LIMESTONE FRAGMENTS (SP, SP-SM)	W	MOISTURE CONTENT (%)
	⑤	TAN LIMESTONE	OC	ORGANIC CONTENT (%)
	⑥	DARK BROWN PEAT (PT)	-200	AMOUNT PASSING US STANDARD 200 SIEVE (%)

NOTES

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STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

GRANULAR MATERIALS

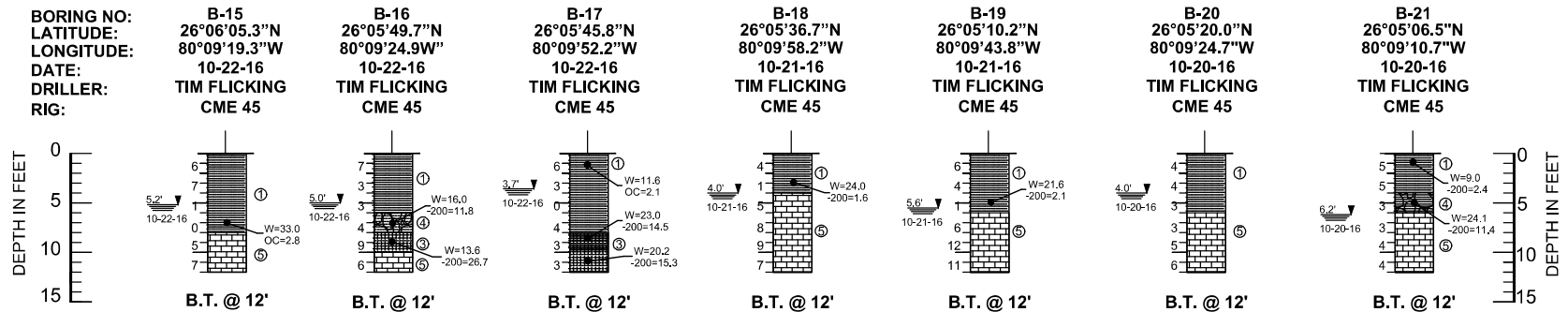
RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
VERY LOOSE	BLOWS/FOOT
LOOSE	LESS THAN 3
MEDIUM	3 - 8
DENSE	8 - 24
VERY DENSE	24 - 40
	GREATER THAN 40

SILTS AND CLAYS

CONSISTENCY	AUTOMATIC HAMMER SPT N-VALUE
VERY SOFT	BLOWS/FOOT
SOFT	LESS THAN 1
FIRM	1 - 3
STIFF	3 - 6
VERY STIFF	6 - 12
HARD	12 - 24
	GREATER THAN 24

REVISIONS

Date	By	Descriptions	Date	By	Descriptions	Names	Dates	ENGINEER OF RECORD	CITY OF FORT LAUDERDALE	SCALE: VERTICAL	SHEET TITLE:	SHEET NO.
						Drawn by	K.A.	01/03/2017	RADISE International	N.T.S.	SPT BORING SUBSURFACE PROFILES	3B
						Checked by	A.B.	01/03/2017	4152 West Blue Heron Boulevard, Suite 228			
						Designed by			Riviera Beach, Florida, 33404			
						Checked by			TEL 561-341-0103 FAX 561-341-0104	SCALE: HORIZONTAL	FORT LAUDERDALE - 7 NEIGHBORHOODS IMPROVEMENT	RADISE PROJECT NO:
						Approved by			URL : http://www.radise.net	N.T.S.		160605
								LICENSE NO. - 8901	BROWARD	HAZEN AND SAWYER		



LEGEND

	①	GRAY, TAN, BROWN TO DARK BROWN, FINE TO MEDIUM SAND, TRACE ORGANIC, TRACE LIMESTONE FRAGMENTS, TRACE SILT (SP)	B.T. @ 12'	BORING TERMINATED AT 12' BELOW THE EXISTING GROUND SURFACE
	②	GRAY, TAN, BROWN FINE TO MEDIUM SAND, TRACE TO FEW SHELL FRAGMENTS (SP)	PT-SP-SM	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2487)
	③	GRAY, TAN, BROWN TO DARK BROWN SILTY SAND, WITH LIMESTONE FRAGMENTS (SM)	N	STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER
	④	GRAY, TAN, BROWN TO DARK BROWN SAND, WITH SILT, TRACE LIMESTONE FRAGMENTS (SP, SP-SM)	W	MOISTURE CONTENT (%)
	⑤	TAN LIMESTONE	OC	ORGANIC CONTENT (%)
	⑥	DARK BROWN PEAT (PT)	-200	AMOUNT PASSING US STANDARD 200 SIEVE (%)

NOTES

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- AFTER COMPLETION OF DRILLING, BOREHOLES WERE BACKFILLED WITH GROUT.

STANDARD PENETRATION TEST DATA	
SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

GRANULAR MATERIALS	
RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE BLOWS/FOOT
VERY LOOSE	LESS THAN 3
LOOSE	3 - 8
MEDIUM	8 - 24
DENSE	24 - 40
VERY DENSE	GREATER THAN 40

SILTS AND CLAYS	
CONSISTENCY	AUTOMATIC HAMMER SPT N-VALUE BLOWS/FOOT
VERY SOFT	LESS THAN 1
SOFT	1 - 3
FIRM	3 - 6
STIFF	6 - 12
VERY STIFF	12 - 24
HARD	GREATER THAN 24

REVISIONS

Date	By	Descriptions	Date	By	Descriptions	Names	Dates	ENGINEER OF RECORD	CITY OF FORT LAUDERDALE	SCALE: VERTICAL	SHEET TITLE:	SHEET NO.
						Drawn by	K.A.	01/03/2017	RADISE International	N.T.S.	SPT BORING SUBSURFACE PROFILES	3C
						Checked by	A.B.	01/03/2017	4152 West Blue Heron Boulevard, Suite 228			
						Designed by			Riviera Beach, Florida, 33404	SCALE: HORIZONTAL	FORT LAUDERDALE - 7 NEIGHBORHOODS IMPROVEMENT	RADISE PROJECT NO:
						Checked by			TEL 561-341-0103 FAX 561-341-0104	BROWARD	HAZEN AND SAWYER	160605
						Approved by			URL : http://www.radise.net			

BORING NO:
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

B-22
26°05'24.2"N
80°08'40.8"W
10-20-16
TIM FLICKING
CME 45

B-23
26°04'59.9"N
80°08'28.3"W
10-20-16
TIM FLICKING
CME 45

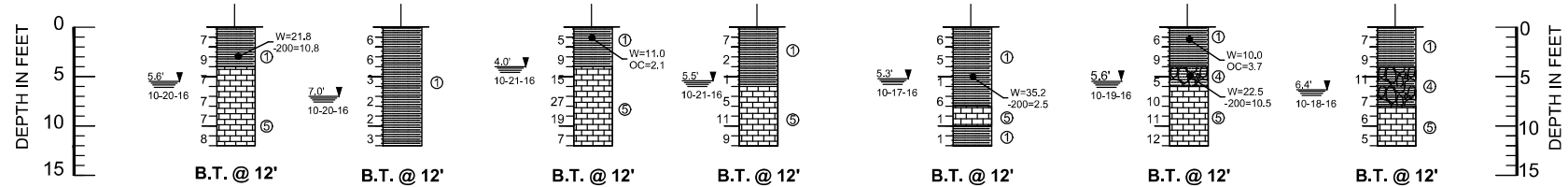
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26°04'58.9"N
80°09'38.8"W
10-21-16
TIM FLICKING
CME 45

B-25
26°05'27.0"N
80°08'18.8"W
10-21-16
TIM FLICKING
CME 45

B-26
26°07'53.9"N
80°08'06.7"W
10-17-16
TIM FLICKING
CME 45

B-27
26°07'34.9"N
80°07'56.6"W
10-19-16
TIM FLICKING
CME 45

B-28
26°07'24.9"N
80°07'35.9"W
10-18-16
TIM FLICKING
CME 45



LEGEND

	①	GRAY, TAN, BROWN TO DARK BROWN, FINE TO MEDIUM SAND, TRACE ORGANIC, TRACE LIMESTONE FRAGMENTS, TRACE SILT (SP)	B.T. @ 12'	BORING TERMINATED AT 12' BELOW THE EXISTING GROUND SURFACE
	②	GRAY, TAN, BROWN FINE TO MEDIUM SAND, TRACE TO FEW SHELL FRAGMENTS (SP)	PT-SP-SM	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2487)
	③	GRAY, TAN, BROWN TO DARK BROWN SILTY SAND, WITH LIMESTONE FRAGMENTS (SM)	N	STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER
	④	GRAY, TAN, BROWN TO DARK BROWN SAND, WITH SILT, TRACE LIMESTONE FRAGMENTS (SP, SP-SM)	W	MOISTURE CONTENT (%)
	⑤	TAN LIMESTONE	OC	ORGANIC CONTENT (%)
	⑥	DARK BROWN PEAT (PT)	-200	AMOUNT PASSING US STANDARD 200 SIEVE (%)

NOTES

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- LATITUDE AND LONGITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HELD HAND GPS.
- AFTER COMPLETION OF DRILLING, BOREHOLES WERE BACKFILLED WITH GROUT.

STANDARD PENETRATION TEST DATA	
SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

GRANULAR MATERIALS	
RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
VERY LOOSE	LESS THAN 3
LOOSE	3 - 8
MEDIUM	8 - 24
DENSE	24 - 40
VERY DENSE	GREATER THAN 40

SILTS AND CLAYS	
CONSISTENCY	AUTOMATIC HAMMER SPT N-VALUE
VERY SOFT	LESS THAN 1
SOFT	1 - 3
FIRM	3 - 6
STIFF	6 - 12
VERY STIFF	12 - 24
HARD	GREATER THAN 24

REVISIONS

Date	By	Descriptions	Date	By	Descriptions	Names	Dates	ENGINEER OF RECORD	CITY OF FORT LAUDERDALE	SCALE: VERTICAL	SHEET TITLE:	SHEET NO.
						Drawn by K.A.	01/03/2017	RADISE International		N.T.S.	SPT BORING SUBSURFACE PROFILES	3D
						Checked by A.B.	01/03/2017	4152 West Blue Heron Boulevard, Suite 228	COUNTY			
						Designed by		Riviera Beach, Florida, 33404	CLIENT	SCALE: HORIZONTAL	FORT LAUDERDALE - 7 NEIGHBORHOODS IMPROVEMENT	RADISE PROJECT NO:
						Checked by		TEL 561-341-0103 FAX 561-341-0104	BROWARD	N.T.S.		160605
						Approved by		URL : http://www.radise.net	HAZEN AND SAWYER			

BORING NO:
LATITUDE:
LONGITUDE:
DATE:
DRILLER:
RIG:

B-29
26°07'45.6"N
80°07'38.8"W
10-18-16
TIM FLICKING
CME 45

B-30
26°08'02.0"N
80°07'28.7"W
10-18-16
TIM FLICKING
CME 45

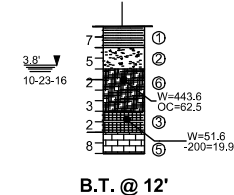
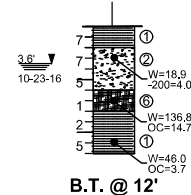
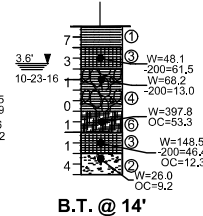
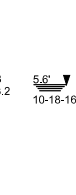
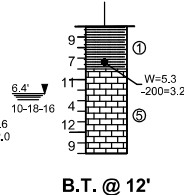
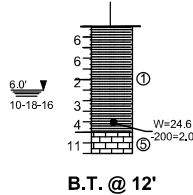
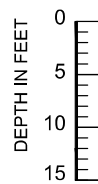
B-31
26°08'08.4"N
80°08'00.4"W
10-18-16
TIM FLICKING
CME 45

B-32
26°07'19.7"N
80°07'09.6"W
10-23-16
TIM FLICKING
CME 45

B-33
26°07'28.7"N
80°06'45.1"W
10-23-16
TIM FLICKING
CME 45

B-34
26°07'16.8"N
80°06'57.7"W
10-23-16
TIM FLICKING
CME 45

B-35
26°07'35.5"N
80°06'30.9"W
10-23-16
TIM FLICKING
CME 45



LEGEND

	①	GRAY, TAN, BROWN TO DARK BROWN, FINE TO MEDIUM SAND, TRACE ORGANIC, TRACE LIMESTONE FRAGMENTS, TRACE SILT (SP)	B.T. @ 12'	BORING TERMINATED AT 12' BELOW THE EXISTING GROUND SURFACE
	②	GRAY, TAN, BROWN FINE TO MEDIUM SAND, TRACE TO FEW SHELL FRAGMENTS (SP)	PT-SP-SM	UNIFIED SOIL CLASSIFICATION SYSTEM GROUP SYMBOL (ASTM D 2487)
	③	GRAY, TAN, BROWN TO DARK BROWN SILTY SAND, WITH LIMESTONE FRAGMENTS (SM)	N	STANDARD PENETRATION RESISTANCE- BLOWS PER FOOT USING AUTOMATIC HAMMER
	④	GRAY, TAN, BROWN TO DARK BROWN SAND, WITH SILT, TRACE LIMESTONE FRAGMENTS (SP, SP-SM)	W	MOISTURE CONTENT (%)
	⑤	TAN LIMESTONE	OC	ORGANIC CONTENT (%)
	⑥	DARK BROWN PEAT (PT)	-200	AMOUNT PASSING US STANDARD 200 SIEVE (%)

NOTES

- BORINGS WERE DRILLED IN OCTOBER OF 2016. SPT BORINGS WERE PERFORMED USING A CME-45C AUTOMATIC HAMMER DRILLING RIG (ASTM D1586).
- STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. SOIL TRANSITIONS MAY BE MORE GRADUAL THAN IMPLIED.
- GROUNDWATER LEVELS SHOWN ON THE SUBSURFACE PROFILES REPRESENT GROUNDWATER SURFACES ON THE DATES SHOWN. GROUNDWATER LEVEL FLUCTUATIONS SHOULD BE ANTICIPATED THROUGHOUT THE YEAR.
- LATITUDE AND LONGITUDE COORDINATES WERE MEASURED IN THE FIELD USING A HELD HAND GPS.
- AFTER COMPLETION OF DRILLING, BOREHOLES WERE BACKFILLED WITH GROUT.

STANDARD PENETRATION TEST DATA	
SPOON INSIDE DIA.	1.375 INCH
SPOON OUTSIDE DIA.	2.0 INCHES
AVG. HAMMER DROP	30 INCHES
HAMMER WEIGHT	140 POUNDS

GRANULAR MATERIALS	
RELATIVE DENSITY	AUTOMATIC HAMMER SPT N-VALUE
VERY LOOSE	LESS THAN 3
LOOSE	3 - 8
MEDIUM	8 - 24
DENSE	24 - 40
VERY DENSE	GREATER THAN 40

SILTS AND CLAYS	
CONSISTENCY	AUTOMATIC HAMMER SPT N-VALUE
VERY SOFT	LESS THAN 1
SOFT	1 - 3
FIRM	3 - 6
STIFF	6 - 12
VERY STIFF	12 - 24
HARD	GREATER THAN 24

REVISIONS

Date	By	Descriptions	Date	By	Descriptions	Names	Dates	ENGINEER OF RECORD	CITY OF FORT LAUDERDALE	SCALE: VERTICAL	SHEET TITLE:	SHEET NO.
						Drawn by	K.A.	01/03/2017	RADISE International	N.T.S.	SPT BORING SUBSURFACE PROFILES	3E
						Checked by	A.B.	01/03/2017	4152 West Blue Heron Boulevard, Suite 228			
						Designed by			Riviera Beach, Florida, 33404	SCALE: HORIZONTAL	FORT LAUDERDALE - 7 NEIGHBORHOODS IMPROVEMENT	RADISE PROJECT NO:
						Checked by			TEL 561-341-0103 FAX 561-341-0104	COUNTY	HAZEN AND SAWYER	160605
						Approved by			URL : http://www.radise.net			
									LICENSE NO. - 8901			

Table A-1 - Laboratory Test Results Summary

Project Name: Fort Lauderdale-7 Neighborhoods

Project ID: 160605

						GRAIN SIZE ANALYSIS U.S STANDARD SIEVE SIZE (% Passing)														
Boring No	Sample Depth	Soil Classification	Moisture Content (%)	Organic Content (%)	-200	3"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#50	#60	#100	#140	#200
B-1	0-2	SP	4.2	2.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-1	6-8	SP-SM	22.7	-	13.7	100	100	-	95.3	-	65.1	55.5	49.7	45.3	38.3	29.7	25.5	17.2	15.0	13.7
B-2	8-10	SP-SM	17.5	-	11.1	100	100	-	100	-	90.4	82.4	77.8	76.5	72.3	57.2	41.9	16.3	13.0	11.1
B-3	6-8	SP-SM	19.4	-	7.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-4	0-2	SP	1.2	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-4	8-10	SP	20.5	-	3.2	100	100	-	100	-	96.7	94.1	93.1	92.4	81.7	56.9	42.9	10.7	3.9	3.2
B-8	2-4	SP	9.6	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-8	6-8	SP	24.7	-	2.7	100	100	-	100	-	100	100	100	99.5	87.1	72.4	61.2	22.4	4.7	2.7
B-9	0-2	SP	2.5	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-9	10-12	SP	22.4	-	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-9	6-8	SP	22.8	-	2.0	100	100	-	100	-	100	100	100	99.7	88.4	67.3	49.0	9.0	2.8	2.0
B-10	0-2	SP	8.2	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-10	10-12	SM	23.9	-	17.4	100	100	-	99.0	-	94.2	87.4	84.9	83.6	65.7	45.7	38.5	26.6	21.9	17.4
B-10	6-8	SP	27.5	-	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-11	4-6	SP	24.6	-	1.3	100	100	-	100	100	100	100	100	99.4	87.2	70.4	57.8	16.2	2.4	1.3
B-11	6-8	SP	23.4	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-12	10-12	SP	21.9	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-12	2-4	SP	4.1	-	4.4	100	100	-	100	-	100	96.9	95.6	94.6	84.9	66.9	53.1	12.6	5.8	4.4
B-13	4-6	SP	26.9	-	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-14	6-8	SP	21.8	-	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-15	6-8	SP	33	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-16	6-8	SP-SM	16	-	11.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-16	8-10	SM	13.6	-	26.7	100	100	-	97.7	-	88.6	75.6	68.1	64.6	58.0	51.1	47.2	34.3	30.9	26.7

B-17	0-2	SP	11.6	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-17	10-12	SM	20.2	-	15.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-17	8-10	SM	23	-	14.5	100	100	-	95.2	-	94.3	88.5	86.3	84.7	78.7	69.1	59.7	22.8	15.5	14.5
B-18	2-4	SP	24	-	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-19	4-6	SP	21.6	-	2.1	100	100	-	100	-	100	100	100	99.1	80.5	57.9	42.8	6.3	2.4	2.1
B-21	0-2	SP	9	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-21	4-6	SP-SM	24.1	-	11.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-22	2-4	SP-SM	21.8	-	10.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-24	0-2	SP	11	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-26	4-6	SP	35.2	-	2.5	100	100	-	100	-	100	100	100	98.7	83.6	63.4	45.2	6.0	2.9	2.5
B-27	0-2	SP	10	3.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-27	4-6	SP-SM	22.5	-	10.5	100	100	-	76.1	-	72.2	69.6	67.6	66.2	59.3	51.6	45.1	16.4	11.9	10.5
B-29	8-10	SP	24.6	-	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-30	2-4	SP	5.3	-	3.2	100	100	-	98.1	-	96.7	95.4	94.2	92.7	79.4	61.5	48.3	9.4	3.9	3.2
B-31	10-12	SP	23.6	-	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-31	8-10	SP	25.5	1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-32	10-12	SM	148.5	12.3	46.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-32	12-14	SP-SM	26	-	9.2	100	-	98.1	92.8	-	91.1	85.9	81.0	75.0	65.4	54.5	47.2	21.2	11.9	9.2
B-32	2-4	SM	48.1	-	61.5	100	100	-	93.0	-	90.2	85.1	82.6	81.3	79.3	77.3	75.9	69.5	64.9	61.5
B-32	4-6	SM	68.2	-	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-32	8-10	PT	397.8	53.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-33	10-12	SP	46	3.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-33	2-4	SP	18.9	-	4.0	100	100	-	100	-	100	98.7	94.4	78.4	46.5	30.5	23.6	8.5	4.9	4.0
B-33	6-8	PT	136.8	14.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-34	4-6	PT	443.6	62.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B-34	8-10	SM	51.6	-	19.9	100	100	-	100	-	100	98.1	95.2	92.9	86.7	78.3	72.6	43.0	24.8	19.9
B-35	6-8	PT	170.1	23.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

Moisture Content tested in accordance ASTM-D2216,
Organic Content tests are performed with furnace temperature @450 Celsius and tested accordance ASTM-D2974,
Soil Classification tested with accordance to ASTM D 2487,
Grain Size Analysis was tested in general accordance with ASTM-D422.

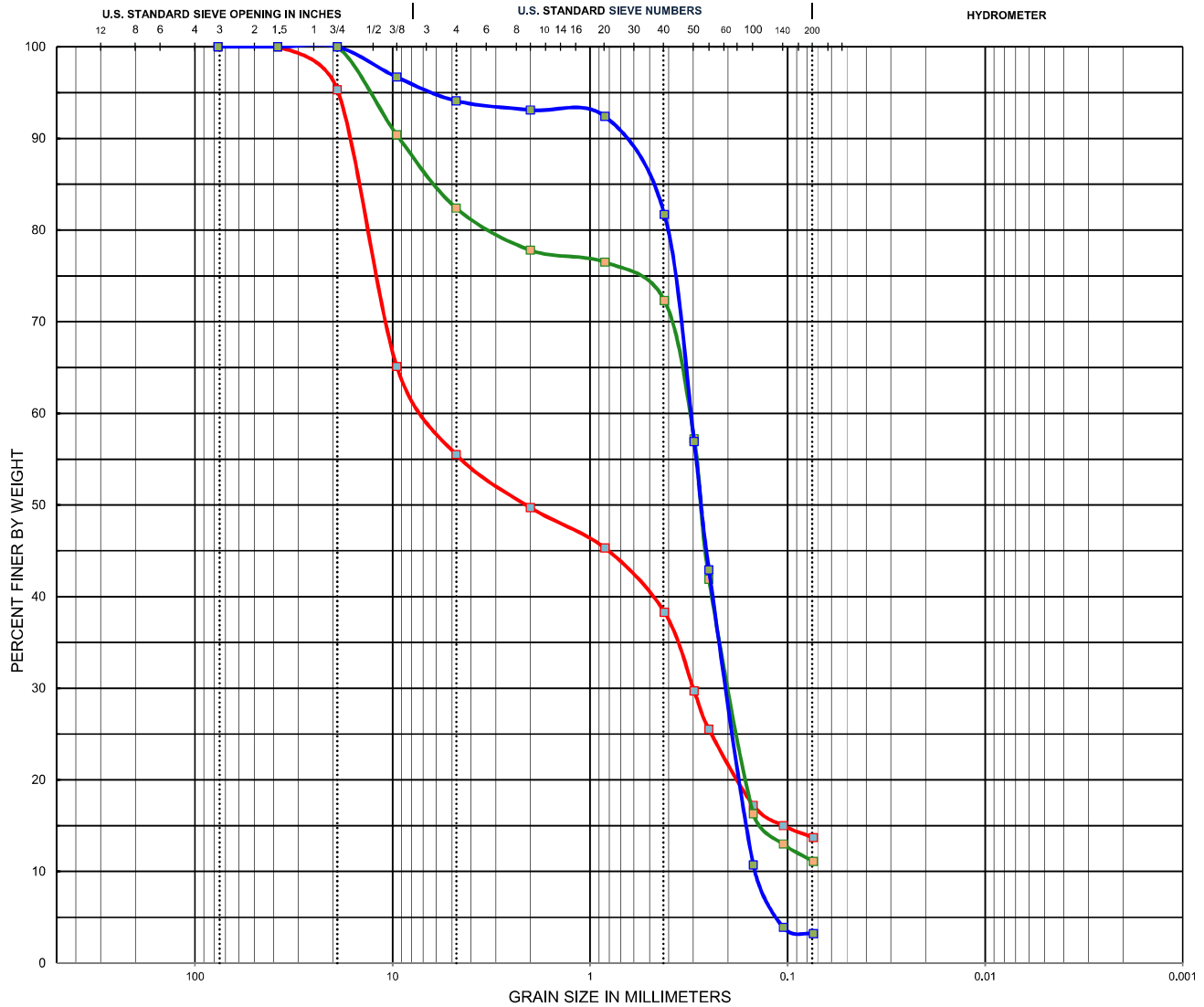


GRAIN SIZE DISTRIBUTION

CLIENT NAME Hazen and Sawyer, P.C.

PROJECT NAME Fort Lauderdale-7 Neighborhoods - Hazen and Sawyer

PROJECT NUMBER 160605



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No. Depth	Classification	LL	PL	PI	Cc	Cu
B-1 , 6-8	SP-SM	NP	NP	NP	0	0
B-2 , 8-10	SP-SM	NP	NP	NP	0	0
B-4 , 8-10	SP	NP	NP	NP	1.02	2.21

Boring No. Depth	D100	D60	D30	D10	% Cobble	%Gravel	%Sand	%Silt	%Clay
B-1 , 6-8	38.1	6.99	0.3	0	0	44.5	41.8	13.7	
B-2 , 8-10	19	0.32	0.2	0	0	17.6	71.3	11.1	
B-4 , 8-10	19	0.31	0.21	0.14	0	5.9	90.9	3.2	

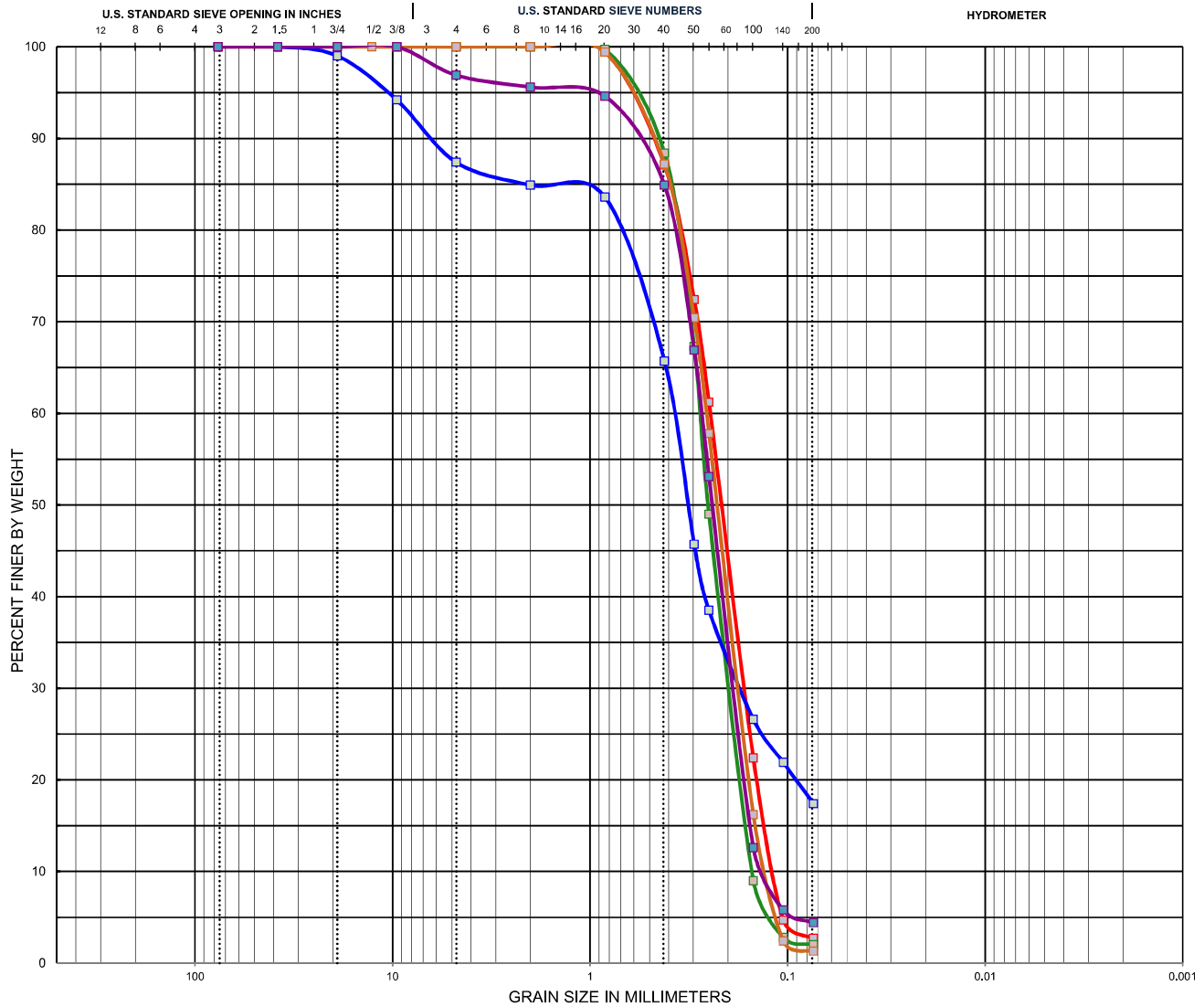


GRAIN SIZE DISTRIBUTION

CLIENT NAME Hazen and Sawyer, P.C.

PROJECT NAME Fort Lauderdale-7 Neighborhoods - Hazen and Sawyer

PROJECT NUMBER 160605



COBBLES	GRAVEL		SAND			SILT OR CLAY				
	coarse	fine	coarse	medium	fine					

Boring No. Depth	Classification	LL	PL	PI	Cc	Cu
B-8 , 6-8	SP	NP	NP	NP	0.96	2.08
B-9 , 6-8	SP	NP	NP	NP	0.95	1.87
B-10 , 10-12	SM	NP	NP	NP	0	0
B-11 , 4-6	SP	NP	NP	NP	0.96	2
B-12 , 2-4	SP	NP	NP	NP	1.03	2.08

Boring No. Depth	D100	D60	D30	D10	% Cobble	%Gravel	%Sand	%Silt	%Clay
B-8 , 6-8	2	0.25	0.17	0.12	0	0	97.3	2.7	
B-9 , 6-8	2	0.28	0.2	0.15	0	0	98	2	
B-10 , 10-12	38.1	0.38	0.18	0	0	12.6	70	17.4	
B-11 , 4-6	2	0.26	0.18	0.13	0	0	98.7	1.3	
B-12 , 2-4	9.51	0.27	0.19	0.13	0	3.1	92.5	4.4	

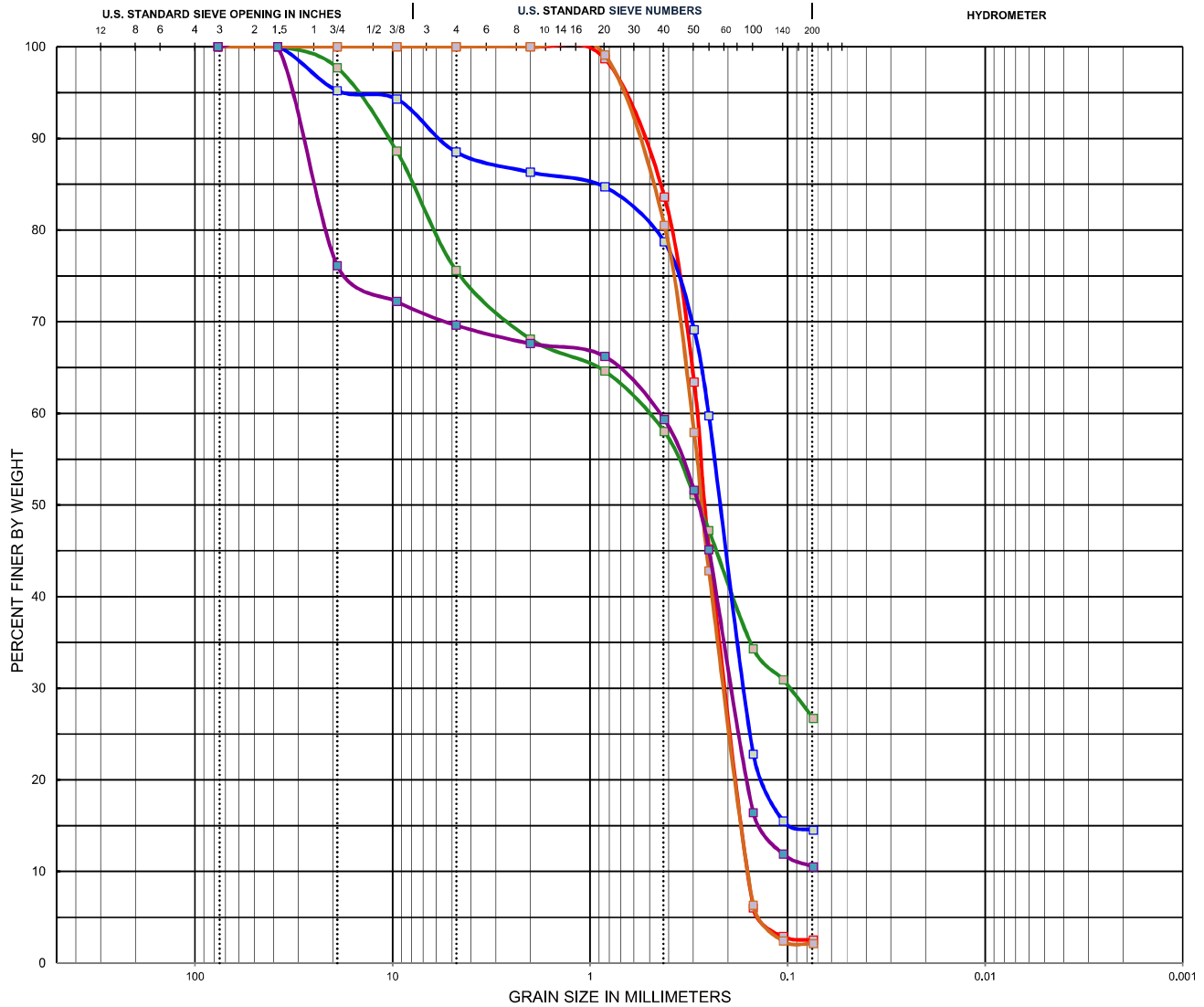


GRAIN SIZE DISTRIBUTION

CLIENT NAME Hazen and Sawyer, P.C.

PROJECT NAME Fort Lauderdale-7 Neighborhoods - Hazen and Sawyer

PROJECT NUMBER 160605



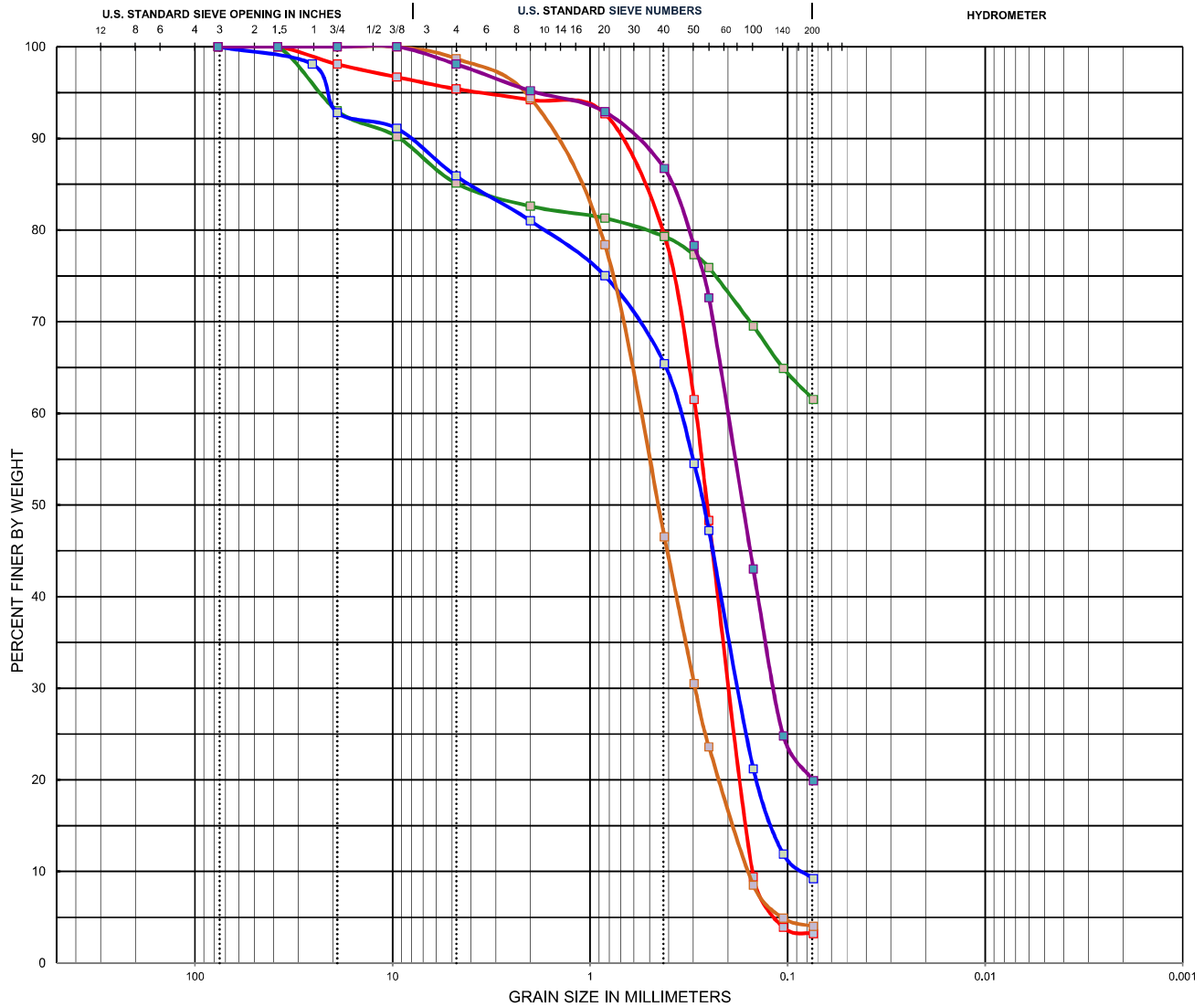


GRAIN SIZE DISTRIBUTION

CLIENT NAME Hazen and Sawyer, P.C.

PROJECT NAME Fort Lauderdale-7 Neighborhoods - Hazen and Sawyer

PROJECT NUMBER 160605



COBBLES	GRAVEL		SAND			SILT OR CLAY				
	coarse	fine	coarse	medium	fine					

Boring No. Depth	Classification	LL	PL	PI	Cc	Cu
B-30 , 2-4	SP	NP	NP	NP	0.92	1.93
B-32 , 2-4	SM	NP	NP	NP	0	0
B-32 , 12-14	SP-SM	NP	NP	NP	1.12	4.5
B-33 , 2-4	SP	NP	NP	NP	0.88	3.75
B-34 , 8-10	SM	NP	NP	NP	0	0

Boring No. Depth	D100	D60	D30	D10	% Cobble	%Gravel	%Sand	%Silt	%Clay
B-30 , 2-4	38.1	0.29	0.2	0.15	0	4.6	92.2	3.2	
B-32 , 2-4	38.1	0	0	0	0	14.9	23.6	61.5	
B-32 , 12-14	76.2	0.36	0.18	0.08	0	14.1	76.7	9.2	
B-33 , 2-4	9.51	0.6	0.29	0.16	0	1.3	94.7	4	
B-34 , 8-10	9.51	0.21	0.12	0	0	1.9	78.2	19.9	

TABLE A-2 - OPEN-HOLE EXFILTRATION TEST RESULTS
City of Ft. Lauderdale - 7 Neighborhoods Improvement
Broward County, Florida

Boring No.	Test Depth (ft.)	Diameter of the test hole (in.)	Diameter of the test hole, d (ft.)	Length of the exposed soil, L (ft.)	Depth to water table, H ₂ (ft.)	Volume of Water (gal.)	Time (sec)	Stabilized flow rate, Q (cfs)	Saturated Hole Depth, Ds (ft)	Hydraulic Conductivity, K (cfs/ft ² - ft head)
E-1	0 - 15	8	0.67	15	5.50	109.0	600	0.024	9.5	1.70E-04
E-2	0 - 15	8	0.67	15	5.50	53.4	600	0.012	9.5	8.32E-05
E-3	0 - 15	8	0.67	15	5.50	19.1	600	0.004	9.5	2.98E-05
E-4	0 - 15	8	0.67	15	6.00	64.0	600	0.014	9.0	9.33E-05
E-5	0 - 15	8	0.67	15	5.00	80.2	600	0.018	10.0	1.35E-04
E-6	0 - 15	8	0.67	15	5.00	39.7	600	0.009	10.0	6.67E-05
E-7	0 - 15	8	0.67	15	5.50	36.3	600	0.008	9.5	5.65E-05
E-8	0 - 15	8	0.67	15	5.25	93.6	600	0.021	9.8	1.51E-04
E-9	0 - 15	8	0.67	15	6.00	19.0	600	0.004	9.0	2.77E-05
E-10	0 - 15	8	0.67	15	5.00	48.7	600	0.011	10.0	8.18E-05
E-11	0 - 15	8	0.67	15	5.16	167.2	600	0.037	9.8	2.74E-04
E-12	0 - 15	8	0.67	15	3.58	54.1	600	0.012	11.4	1.20E-04
E-13	0 - 15	8	0.67	15	5.00	113.5	600	0.025	10.0	1.91E-04
E-14	0 - 15	8	0.67	15	4.00	126.5	600	0.028	11.0	2.56E-04
E-15	0 - 15	8	0.67	15	4.00	46.3	600	0.010	11.0	9.35E-05
E-16	0 - 15	8	0.67	15	7.00	50.8	600	0.011	8.0	6.62E-05
E-17	0 - 15	8	0.67	15	5.50	116.3	600	0.026	9.5	1.81E-04
E-18	0 - 15	8	0.67	15	4.00	168.9	600	0.038	11.0	3.41E-04
E-19	0 - 15	8	0.67	15	5.50	117.2	600	0.026	9.5	1.83E-04
E-20	0 - 15	8	0.67	15	5.41	254.8	600	0.057	9.6	4.02E-04
E-21	0 - 15	8	0.67	15	5.50	87.0	600	0.019	9.5	1.36E-04
E-22	0 - 15	8	0.67	15	6.33	134.8	600	0.030	8.7	1.89E-04
E-23	0 - 15	8	0.67	15	5.50	51.6	600	0.011	9.5	8.04E-05
E-24	0 - 15	8	0.67	15	6.00	110.3	600	0.025	9.0	1.61E-04
E-25	0 - 15	8	0.67	15	6.33	153.7	600	0.034	8.7	2.15E-04
E-26	0 - 15	8	0.67	15	3.50	16.9	600	0.004	11.5	3.83E-05
E-27	0 - 15	8	0.67	15	3.66	37.8	600	0.008	11.3	8.24E-05
E-28	0 - 15	8	0.67	15	3.50	21.2	600	0.005	11.5	4.80E-05

Notes:

* Equation from
SFWMD Manual

K =

$$K = \frac{4 * Q}{\pi * d * (2 * H_2^2 + 4 * H_2 * D_s + H_2 * d)}$$



APPENDIX B – BENTHIC SURVEY

**BENTHIC RESOURCE SURVEY
SUMMARY REPORT**



**VICTORIA PARK STORMWATER IMPROVEMENT
TCG PROJECT NO. 24-0019**

AUGUST 2024

**PREPARED FOR:
HAZEN & SAWYER
4000 HOLLYWOOD BLVD # 750N,
HOLLYWOOD, FL 33021**

Table of Contents

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II. Purpose.....	2
III. Method	2
IV. Findings	3
V. Conclusions.....	3

List of Figures & Appendices

FIGURE 1	Location Map
FIGURE 2	Survey Aerial
APPENDIX A	Site Photographs

I. Introduction

The proposed project site consists of a right-of-way owned by the City of Fort Lauderdale located at NE 7 Place Fort Lauderdale, FL 33304 in Section 01, Township 50, Range 42, in the City of Fort Lauderdale, Broward County, Florida (Figure 1). The project site is located along the Middle River.

These waters are tidal waters with the nearest direct connection to the Atlantic Ocean approximately 2.75 miles to the north of the Port Everglades Inlet. As the project site is located on the Middle River, the incoming tidal waters (flood) at the site move to the north, and the outgoing waters move to the south (ebb).

The property site contains an existing concrete panel seawall. The proposed project consists of the installation of a new seawall. As such, due to environmental permitting regulations related to the modification of the shoreline, the investigation of the presence and location of marine seagrass and other benthic resources within the submerged bottoms is warranted.

II. Purpose

The purpose of this benthic resource study is to identify and locate any seagrass species (*Halophila decipiens*, *Halophila johnsonii*, *Thalassia testudinum*, *Halodule wrightii*, *Ruppia maritima*, etc.) or other benthic resources that may be present within the property boundaries of the subject site. Environmental regulatory agencies require representative data to be acquired from any site that has potential seagrass habitat.

III. Method

The field work for the benthic resource survey was conducted on August 19th, 2024, by two (2) qualified biologists from The Chappell Group, Inc. This work was performed at high tide (incoming). Line transects were conducted parallel to the existing shoreline and within the proposed project footprint. The survey area was approximately $\pm 40'$ along the existing shoreline, extended $\pm 50'$ waterward and encompassed a 50-foot radius around the proposed project. Each diver conducted five (5) line transects within the canal to ensure complete coverage of the survey area (Figure 2). The biologists traversed each line to determine the presence of any seagrass species and/or other submerged benthic resources. In addition to the line transects, each diver conducted a meandering transect to ensure complete visual coverage and that no additional benthic resources were present adjacent to the subject site. Due to visibility ($<10'$), spacing between

transects was approximately 7'-10' to ensure complete coverage of the survey area.

IV. Findings

The benthic community of the subject site consisted of sand, oyster, and rock rubble substrate (Appendix A). Depths within the survey area varied from 1'-6', with depths increasing towards the center of the canal. No species of seagrass were observed.

Species of fish observed during the survey were limited to checkered puffer (*Sphoeroides testudineus*) and gray snapper (*Lutjanus griseus*). A complete listing of species observed is included in Table 1 below:

Table 1. Species Observed

Common Name	Scientific Name
Fish	
Checkered puffer	<i>Sphoeroides testudineus</i>
Gray snapper	<i>Lutjanus griseus</i>

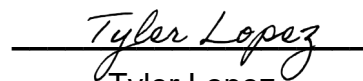
V. Conclusions

As seagrass is a protected natural resource, potential impacts to seagrass will need to be eliminated and/or minimized to the greatest extent possible. Due to the absence of seagrass within the survey area, no modifications to the proposed project may be necessary. Permit issuance may entail a similar investigation by the Broward County Resilient Environmental Department (BCRED), the Florida Department of Environmental Protection (FDEP), and the United States Army Corps of Engineers (USACOE).

This report is submitted in partial completion of the regulatory requirements anticipated to be required in the processing of the applicable environmental permits for the proposed project. This report and the information contained herein is based on the existing site conditions observed at the time of the survey inspection. Please note that while not anticipated, site conditions, including the presence, absence, location and/or coverage of seagrass or other benthic resources within the project vicinity is subject to change based on varying environmental conditions. Should you have any questions or comments regarding the report, or the information contained herein, please do not hesitate to contact the undersigned at your convenience.

Sincerely,

THE CHAPPELL GROUP INC.


Tyler Lopez
Project Biologist


Sarah Chappell
President

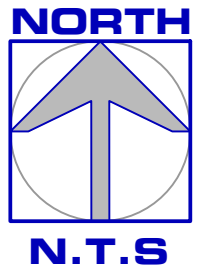


FIGURE 2
SURVEY AERIAL EXHIBIT



 SUBJECT SITE

 SURVEY TRANSECT

APPENDIX A

SITE PHOTOGRAPHS



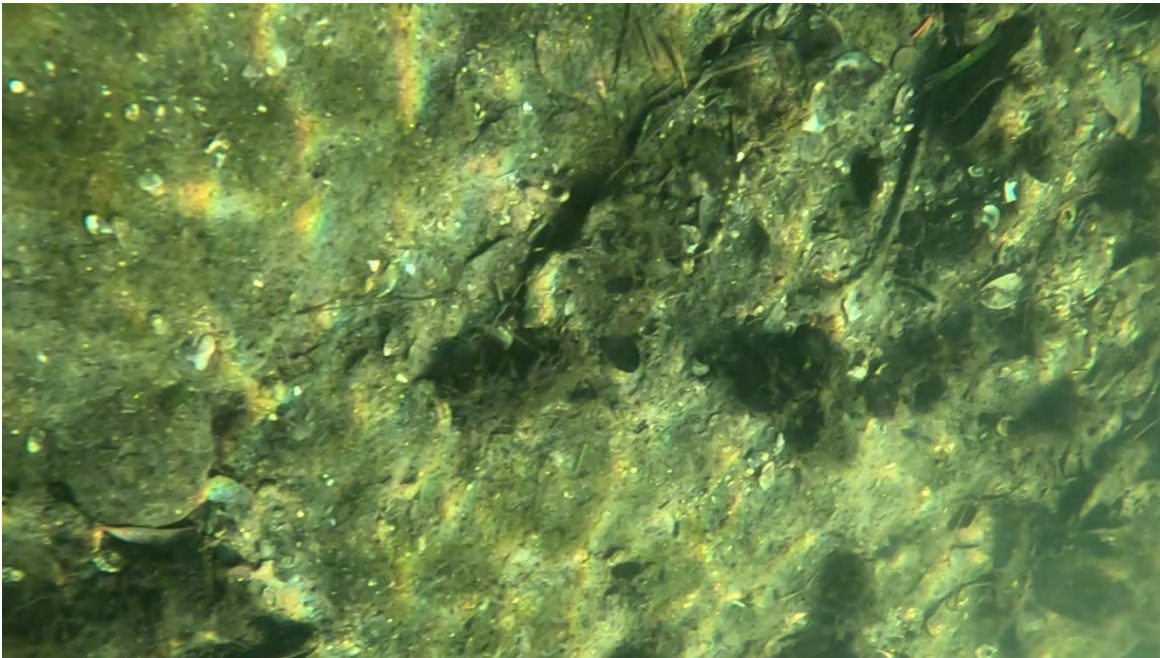
1. North corner of the property, facing south.



2. South corner of the property, facing north.



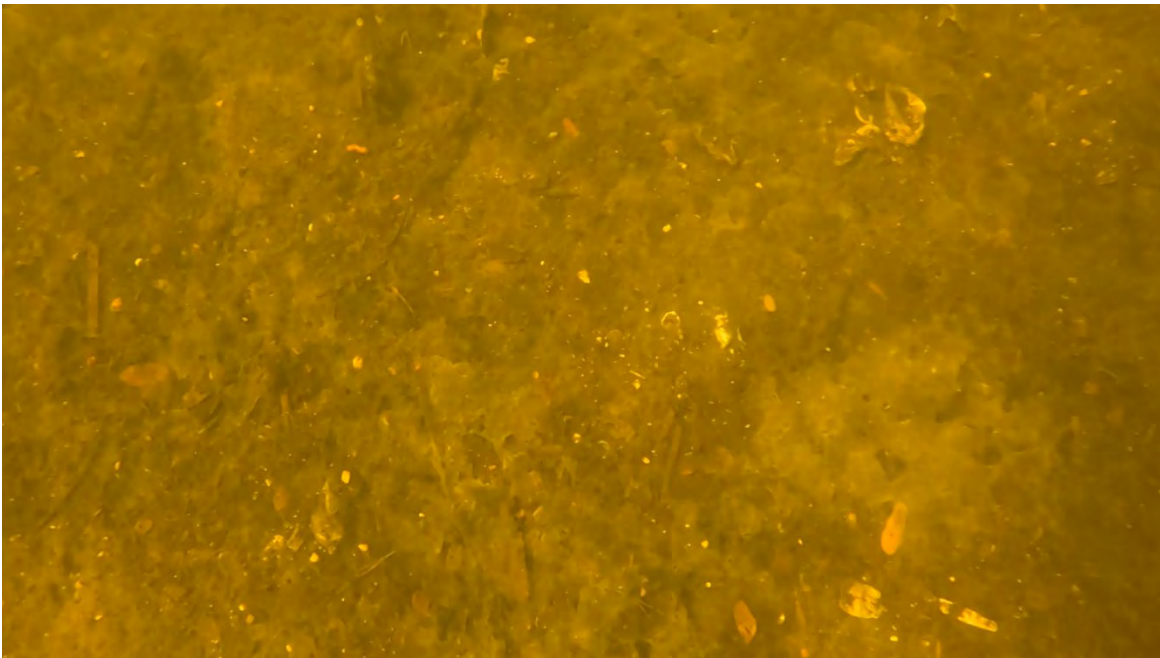
3. Northern portion of the property, $\pm 5'$ waterward of the seawall. Note sand and leaf substrate.



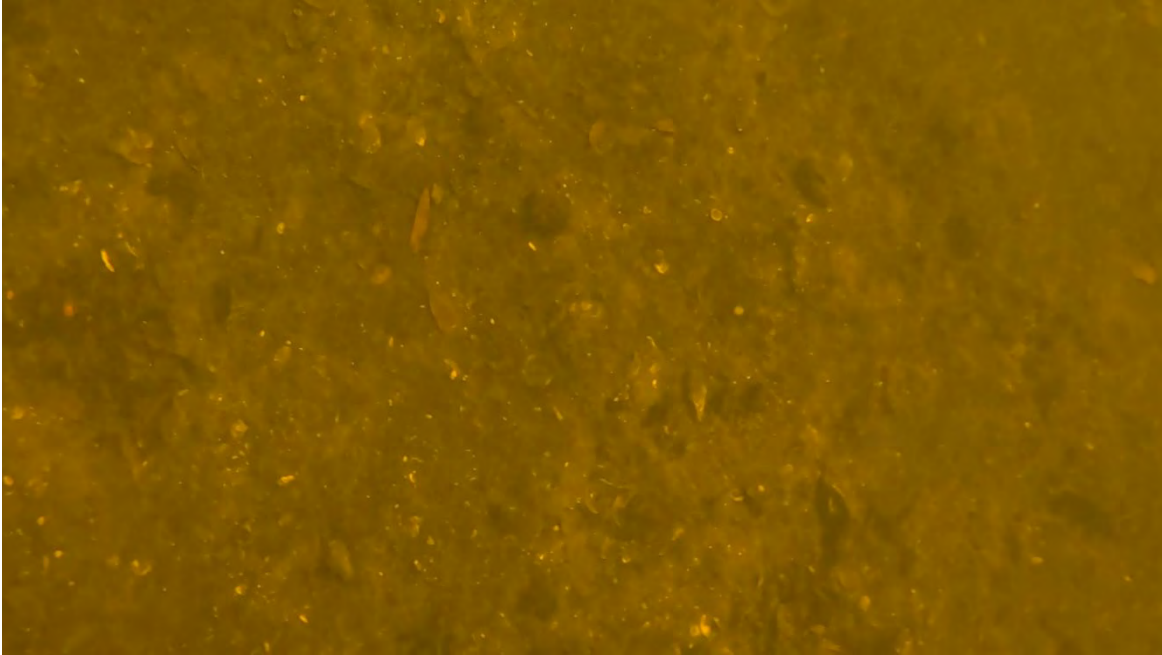
4. Central portion of the survey area, $\pm 10'$ waterward of the seawall. Note rock, sand, and oyster substrate.



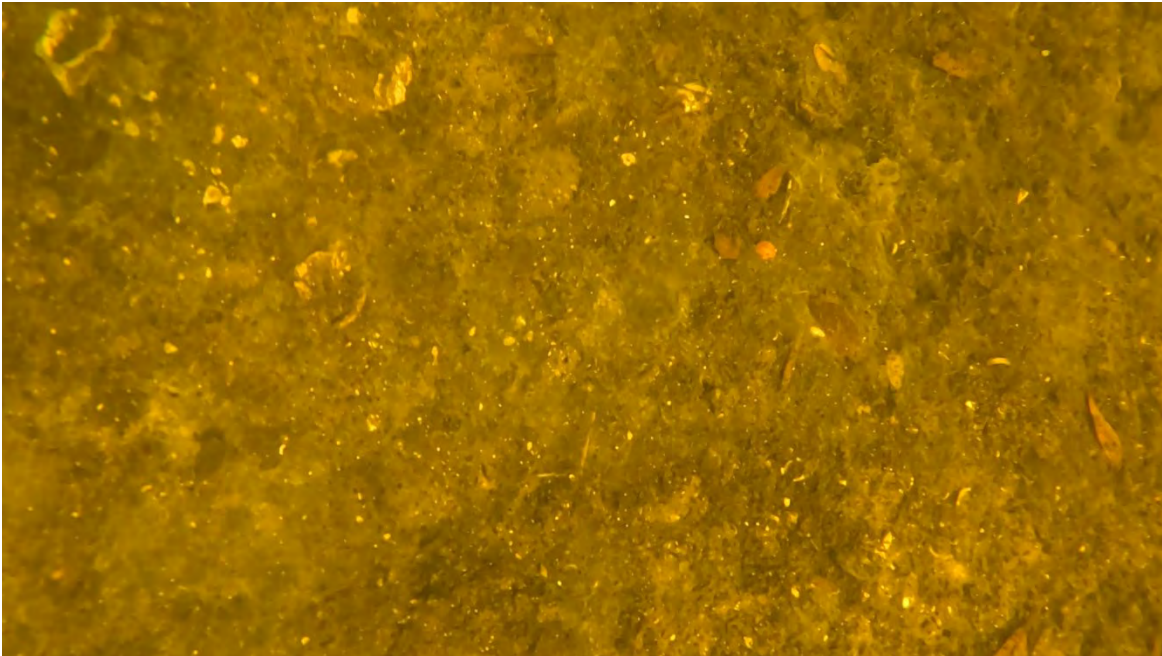
5. Northern portion of the survey area, $\pm 20'$ waterward of the seawall. Note sand and leaf substrate.



6. Southern portion of the survey area, $\pm 30'$ waterward of the seawall. Note sand and leaf substrate.



7. Northern portion of the survey area, $\pm 40'$ waterward of the seawall. Note sand and leaf substrate.



8. Southern portion of the survey area, $\pm 50'$ waterward of the seawall. Note sand substrate.

APPENDIX C – TOPOGRAPHIC SURVEY

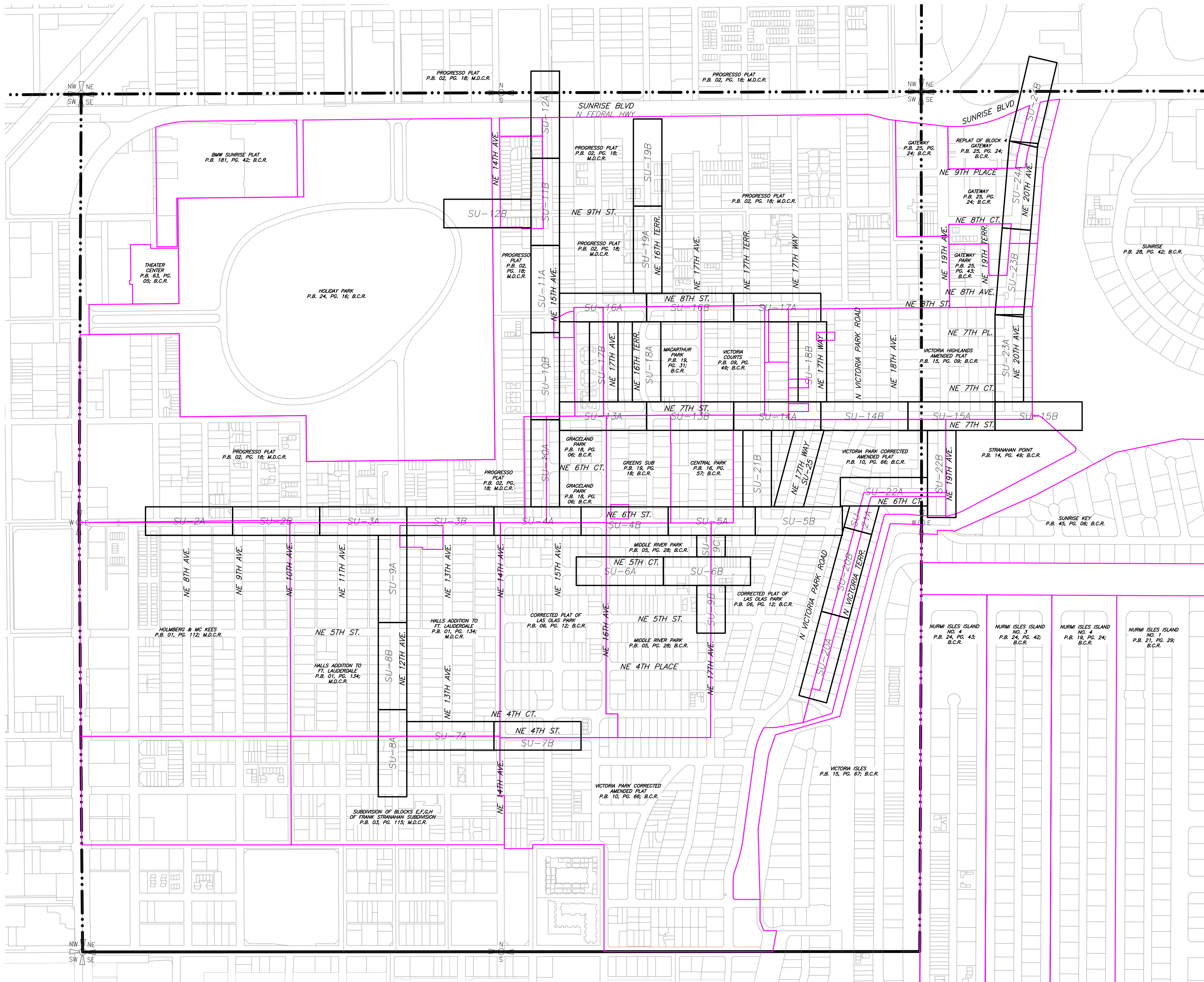
A PORTION OF THE VICTORIA PARK NEIGHBORHOOD LYING WITHIN SECTION 1 & 2, TOWNSHIP 50 SOUTH, RANGE 42 EAST, IN THE CITY OF FORT LAUDERDALE, BROWARD COUNTY, FLORIDA.

A PORTION OF THE VICTORIA PARK NEIGHBORHOOD LYING WITHIN SECTION 1 & 2, TOWNSHIP 50 SOUTH, RANGE 42 EAST, IN THE CITY OF FORT LAUDERDALE, BROWARD COUNTY, FLORIDA.

BH	BUD HEIGHT
BM	BENCHMARK
BOTT	BOTTOM OF STRUCTURE
C&G	CURB AND GUTTER
CALC	CALCULATED
CB	CATCH BASIN
CI	CURB INLET
CONC	CONCRETE
CMF	CORRUGATE METAL PIPE
DIP	DUCTILE IRON PIPE
EL	ELEVATION
ELLIP	ELLIPTICAL
FND	FOUND
FM	FORCE MAIN
INV	INVERT ELEVATION
LB	LICENSED BUSINESS
MEAS	MEASURED
MH	MANHOLE
NTS	NOT TO SCALE
ORB	OFFICIAL RECORDS BOOK
PB.	PLAT BOOK
PG.	PAGE
PRM	PERMANENT REFERENCE MONUMENT
Pt	POINT
PVC	POLYVINYL CHLORIDE
RCP	REINFORCED CONCRETE PIPE
R.E.	RIM ELEVATION
R/W	RIGHT OF WAY
SAN	SANITARY
SEC	SECTION
C.L.L.F.	CHAIN LINK FENCE
V.F.	VINYL FENCE
W.I.F.	WROUGHT IRON FENCE
W.F.	WOOD FENCE

	AIR RELEASE VALVE MANHOLE
	ANCHOR
	BACK FLOW PREVENTER
	BOLLARD
	CABLE / FIBER OPTIC PEDESTAL
	CACTUS
	CATCH BASIN
	CITRUS TREE
	CLEAN OUT
	CONCRETE LIGHT POLE
	CONCRETE POST
	CONCRETE POWER POLE
	CONCRETE TELEPHONE POLE
	CURB INLET
	DECORATIVE LIGHT POLE
	DETECTOR CHECK VALVE
	DOUBLE DETECTOR CHECK VALVE
	ELECTRICAL / CABLE PULL BOX
	ELECTRICAL MANHOLE
	ELECTRICAL METER
	ELECTRICAL OUTLET
	FIBER OPTIC PEDESTAL / PULLBOX
	FIRE HYDRANT
	HANDICAP SPOT
	KEYPAD
	MAILBOX
	MAIL DROP BOX
	METAL LIGHT POLE
	METAL POST / PIPE
	METAL POWER / TELEPHONE POLE
	PALM TREE
	PARK BENCH
	PARKING LIGHT SQUARE BULB
	PEDESTRIAN SIGNAL
	PINE TREE
	PIPE PLUG / STORM OUTFALL
	SANITARY MANHOLE
	SHADE TREE
	SIAMESE VALVE
	SIGN (DOUBLE POST)
	SIGN (SINGLE POST)
	SPOT / FLOOD LIGHT
	SQUARE COLUMN
	STORM MANHOLE
	TELEPHONE MANHOLE
	TRAFFIC POLE
	TRAFFIC PULL BOX
	TRANSFORMER PAD
	UTILITY VAULT
	WATER METER
	WATER WELL
	WOOD LIGHT POLE
	WOOD POST
	WOOD POWER / TELEPHONE POLE
	YARD DRAIN

	IRON PIPE
	IRON ROD
	MAG NAIL & DISC
	PERMANENT REFERENCE MONUMENT NAIL & DISC
	QUARTER SECTION CORNER
	SECTION CORNER



1. THIS TOPOGRAPHIC SURVEY DRAWING OF A PORTION OF THE VICTORIA PARK NEIGHBORHOOD WAS PREPARED FOR THE EXCLUSIVE USE OF THE CITY OF FORT LAUDERDALE, CRAVEN THOMPSON & ASSOCIATES, INC., AND HAZEN AND SAWYER, INC. FOR THE EXPRESS PURPOSE STATED HEREON AS RELATED TO OUR SUB AGREEMENT CONTRACT WITH HAZEN & SAWYER, INC.
2. THE PURPOSE OF THIS TOPOGRAPHIC SURVEY WAS TO ESTABLISH HORIZONTAL AND VERTICAL CONTROL AND COLLECT ABOVE GROUND AND VISIBLE IMPROVEMENTS WITHIN AND ALONG THE RIGHTS-OF-WAYS DELINEATED HEREIN WITHIN THE PROJECT LIMITS. THE IMPROVEMENTS ALSO INCLUDED INFORMATION INSIDE OF THE STORM WATER AND SANITARY SEWER STRUCTURES, IF ACCESSIBLE, SUCH AS, INVERTS, WEIRS, PIPE SIZES AND MATERIALS, AND BOTTOM OF STRUCTURES.
3. THE EXPECTED USE OF THIS SURVEY AND MAP IS FOR COMMERCIAL/HIGH RISK, THEREFORE THIS SURVEY IS CLASSIFIED AS COMMERCIAL/HIGH RISK LINEAR AND EXCEEDS THE MINIMUM RELATIVE DISTANCE ACCURACY OF 1 FOOT IN 10,000 FEET AS REQUIRED BY THE FLORIDA STANDARDS OF PRACTICE (5J-17, F.A.C.).
4. THE ELEVATIONS SHOWN HEREON ARE RELATIVE TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVOD88) AND ARE BASED ON THE FOLLOWING BENCHMARKS:
 - A. NATIONAL GEODETIC SURVEY MARKER
DESIGNATION P 235, PID A02566
BENCHMARK DISK SET ON TOP OF CONCRETE MONUMENT
STAMPED P 235 1965, ELEVATION = 6.01 (NAVOD88)
 - B. NATIONAL GEODETIC SURVEY MARKER
DESIGNATION 872 2937 F, PID A05867
BENCHMARK DISK SET ON TOP OF RETAINING WALL
STAMPED 2937 F 1981, ELEVATION = 3.45 (NAVOD88)
5. THE MEAN-HIGH-WATER ELEVATION OF 0.33 FEET, NORTH AMERICAN DATUM OF 1988 (NAVOD88) WAS PROVIDED BY THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION FOR SEAWALL SITE LOCATED AT LAT26°07'55"N, LONG80°07'09"W. SEE SHEET 5U-15 FOR SITE LOCATION.
6. THIS PROJECT WAS PERFORMED IN THE FIELD DURING THE MONTHS OF MARCH THROUGH JULY, 2024
7. THE COORDINATES SHOWN HEREON ARE RELATIVE TO STATE PLANE, FLORIDA EAST ZONE, NAD83 (2011), UNITS U.S. SURVEY FEET, AND BASED ON REAL TIME KINEMATIC (RTK) GPS SURVEY UTILIZING THE TRIMBLE STATE-WIDE VRS NETWORK.
8. SECTIONAL INFORMATION AND RIGHT-OF-WAY LINES SHOWN HEREON ARE BASED ON THE RECORDED PLATS WITHIN THE PROJECT AREA AND FLORIDA DEPARTMENT OF TRANSPORTATION RIGHT-OF-WAY MAPS AND PROJECT CONTROL NETWORKS. THE RESIDENTIAL RIGHTS-OF-WAY HAVE BEEN ADJUSTED TO MATCH A BEST FIT SCENARIO OF THE FOUND OCCUPATION SURVEY MONUMENTATION ALONG EACH ROADWAY IN RELATION TO THE RECORDED DOCUMENT.
9. THIS SURVEY WAS PERFORMED BY CRAVEN THOMPSON & ASSOCIATES UNDER CTA PROJECT NO. 16-0042-001-02 WITH THE FOLLOWING REFERENCED FIELD BOOKS:
 - 3243, PAGES 77-79
 - 3243, PAGES 43-44
 - 3244, PAGES 1-38
 - 3245, PAGES 1-52
 - 3246, PAGES 1-76
 - 3246, PAGES 1-38
10. ALL PLATS SHOWN HEREON REFER TO RECORDED PLATS IN BROWARD COUNTY PUBLIC RECORDS THAT WERE READILY AVAILABLE THROUGH <https://officialrecords.broward.org/AccessionWeb>
11. NO TITLE DOCUMENTS WERE SUPPLIED TO THE SURVEYOR FOR REVIEW.

I HEREBY CERTIFY THAT THIS TOPOGRAPHIC SURVEY AND OTHER PERTINENT DATA SHOWN HEREON, CONFORMS TO THE STANDARDS OF PRACTICE FOR LAND SURVEYING IN THE STATE OF FLORIDA, AS OUTLINED IN RULES 5J-17, (FLORIDA ADMINISTRATIVE CODE) AS ADOPTED BY THE DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES, BOARD OF PROFESSIONAL SURVEYORS AND MAPPERS IN SEPTEMBER, 1981, AS AMENDED, PURSUANT TO CHAPTER 472.027, FLORIDA STATUTES AND THAT SAID SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF AS PREPARED UNDER MY DIRECTION.

LAST DATE OF FIELD WORK: 7/25/2024

RICHARD D. PRYCE., FOR THE FIRM
FLORIDA PROFESSIONAL SURVEYOR MAPPER NO 4038
CRAVEN THOMPSON & ASSOCIATES, INC.
LICENSED BUSINESS NUMBER NO. 271

THIS SURVEY MAP AND REPORT OR COPIES THEREOF ARE NOT VALID WITHOUT THE SIGNATURE AND ORIGINAL RAISED SEAL OR A UNIQUE ELECTRONIC SIGNATURE OF A FLORIDA LICENSED PROFESSIONAL SURVEYOR AND MAPPER UNDER CHAPTER RULES 5J-17 FLORIDA ADMINISTRATIVE CODE.

SURVEYOR
RICHARD PRYCE
FL PSM NO: 4038
DATE: 8/6/2024

TEL: 954-739-6400
FAX: 954-739-6409

DRAWN BY: JP, TS, JE	DATE: 7/30/24
DESIGNED BY:	SCALE:

DESIGNED BY:	SCALE:
XX	1"=400'

CHECKED BY:

JDR	FIELD BOOK.
-----	-------------

SEE SURVEY NOTE #8

CITY of FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE

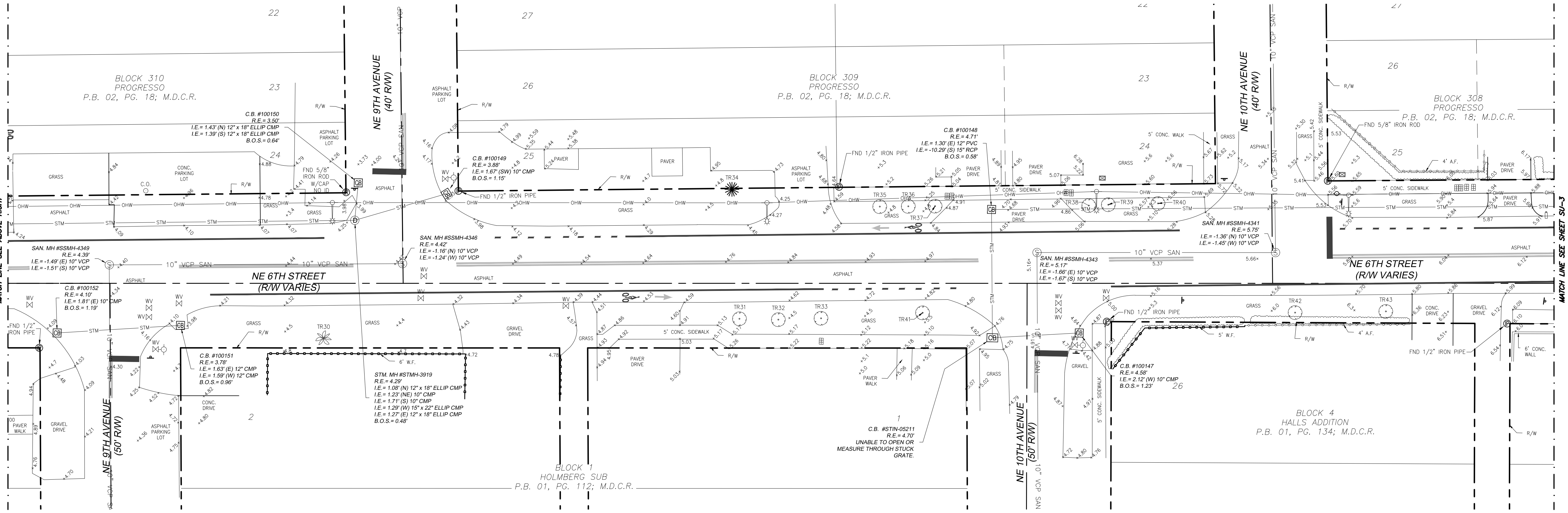
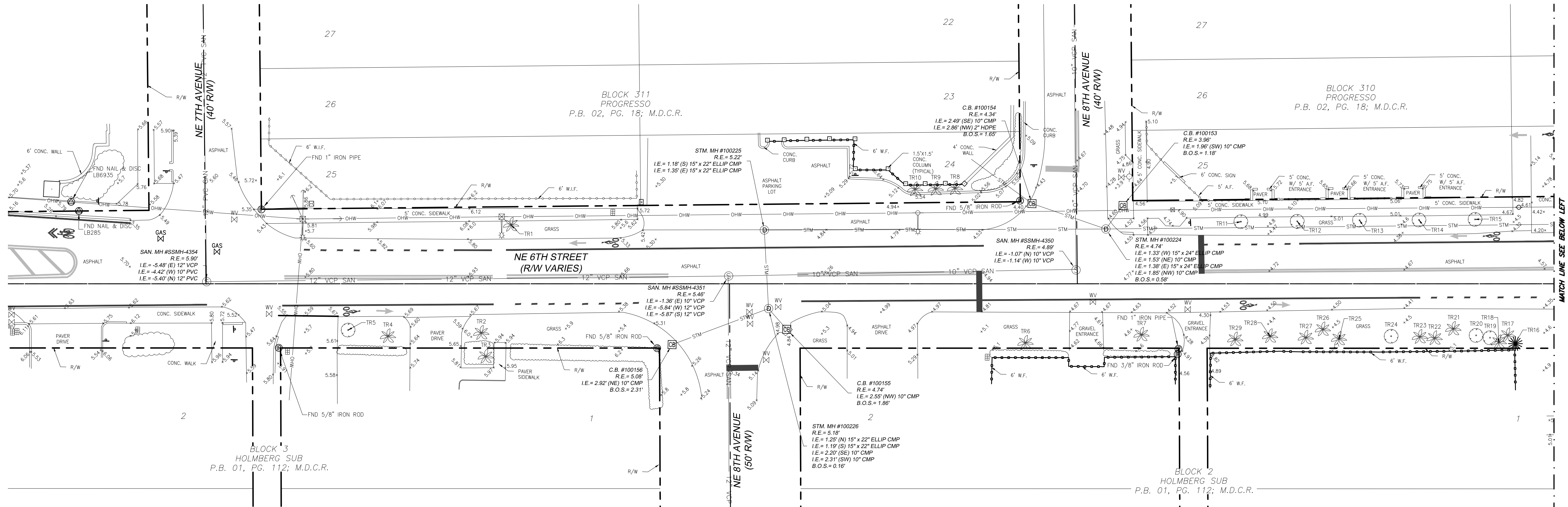


100 North Andrews Avenue, Fort Lauderdale, Florida 33301

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STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY KEY PLAN

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TOTAL:	26
CAD FILE: CTA_12082SURV	
DRAWING FILE NO.	



MATCH LINE SEE ABOVE RIGHT

MATCH LINE SEE SHEET SU-3

PROJECT # 12082
STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

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REVISONS			DESCRIPTION
NO.	DATE	BY	



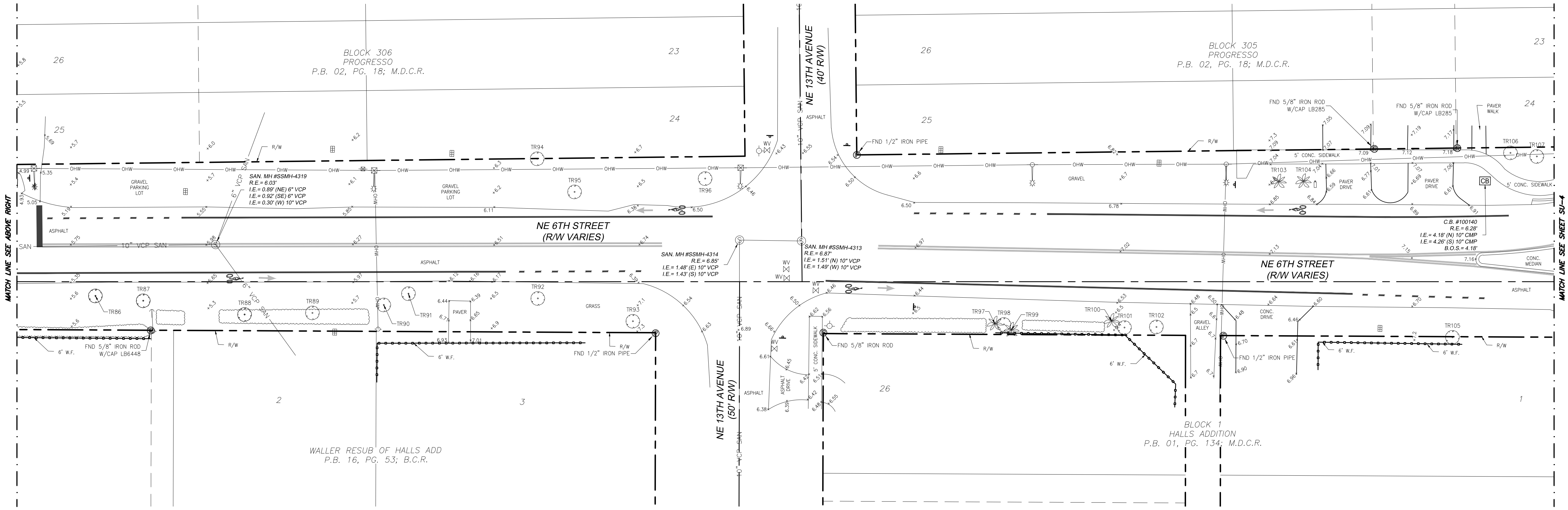
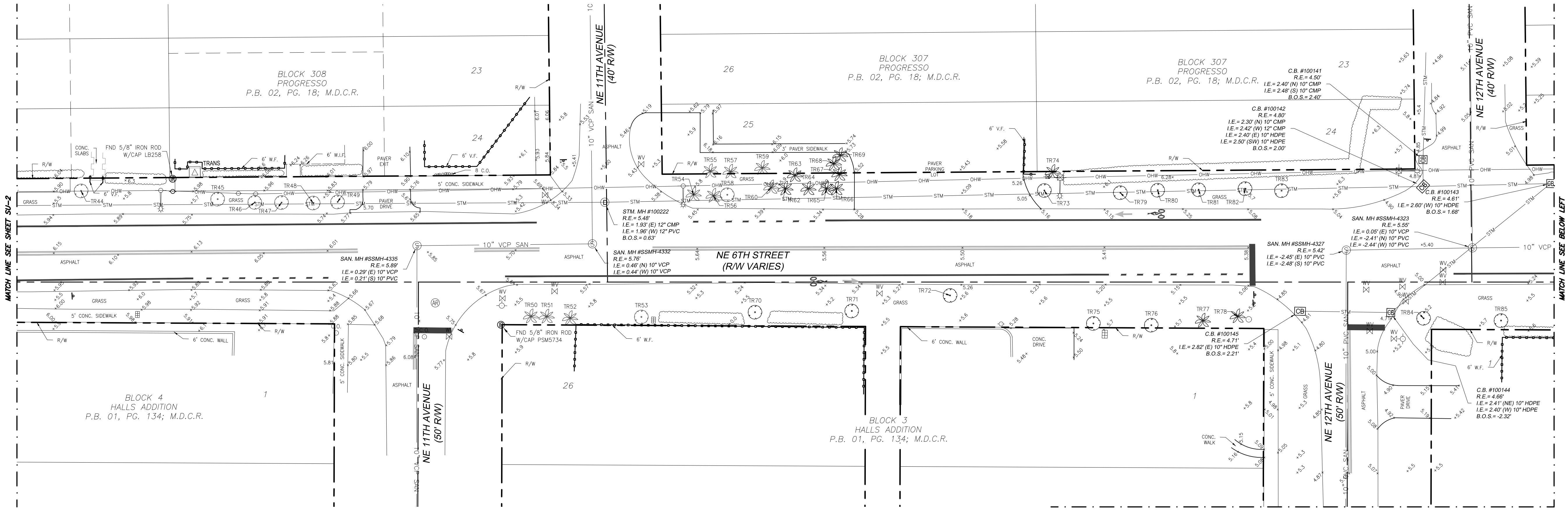
CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE

100 North Andrews Avenue, Fort Lauderdale, Florida 33301

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J.P., TS, JE	7/30/24
DESIGNED BY:	SCALE:
XX	1"=20'
CHECKED BY:	JDR
FIELD BOOK:	SEE SURVEY NOTE #5

SURVEYOR
RICHARD PRYCE
FL PSM NO. 4038
DATE: 6/6/2024

TBL: 954-739-6400
FAX: 954-739-6409



CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE



100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISONS		DESCRIPTION	
NO.	DATE	BY	CHK'D

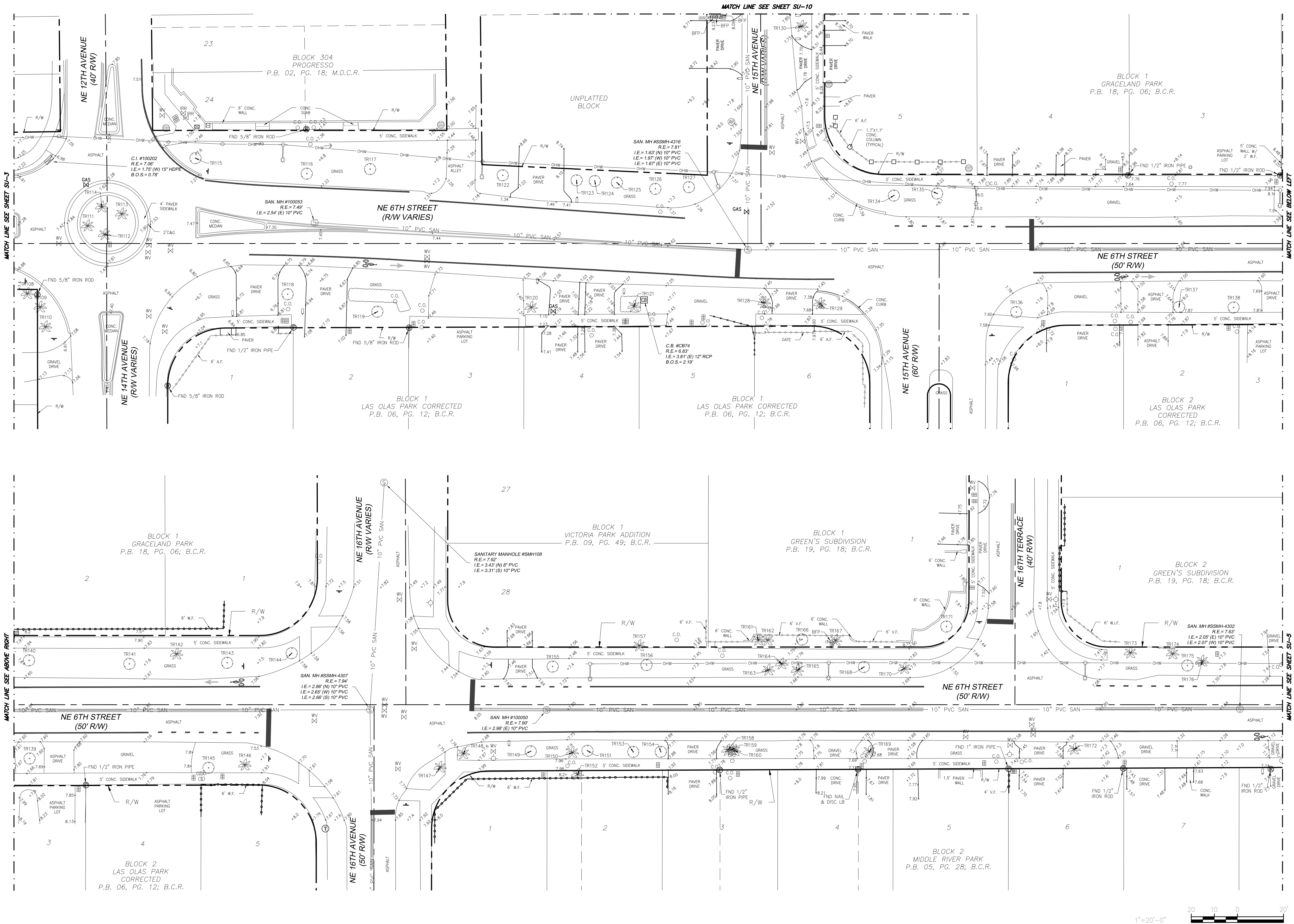
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VICTORIA PARK NEIGHBORHOOD
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SURVEYOR
RICHARD PRYCE
FL PSM NO. 4038
DATE: 6/6/2024

DRAWN BY: DATE: 7/30/24
DESIGNED BY: SCALE: 1"=20'
CHECKED BY: JDR
FIELD BOOK: SEE SURVEY NOTE #5

TBL 954-739-6400
FAX: 954-739-6409



CITY OF FORT LAUDERDALE

PUBLIC WORKS DEPARTMENT

ENGINEERING & ARCHITECTURE

100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISIONS		DESCRIPTION	
NO.	DATE	BY	CHK'D

PROJECT # 12082

STORMWATER IMPROVEMENTS

VICTORIA PARK NEIGHBORHOOD

SURVEY PLAN

SHEET NO. SU-4

OF 26

TOTAL: 26

CAD FILE: CTA_12082SURV

DRAWING FILE NO.

SURVEYOR

RICHARD PRYCE

FL PSM NO. 4038

DATE: 6/6/2024

DRAWN BY:

JP, TS, JE

DATE:

7/30/24

DESIGNED BY:

XX

SCALE:

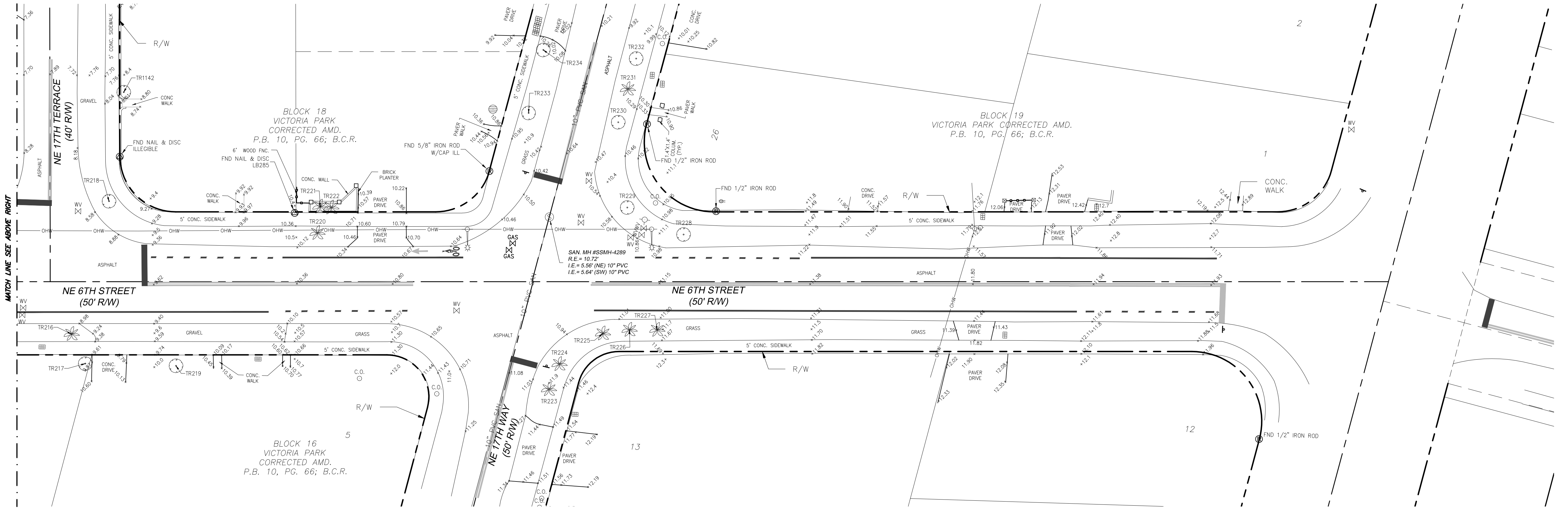
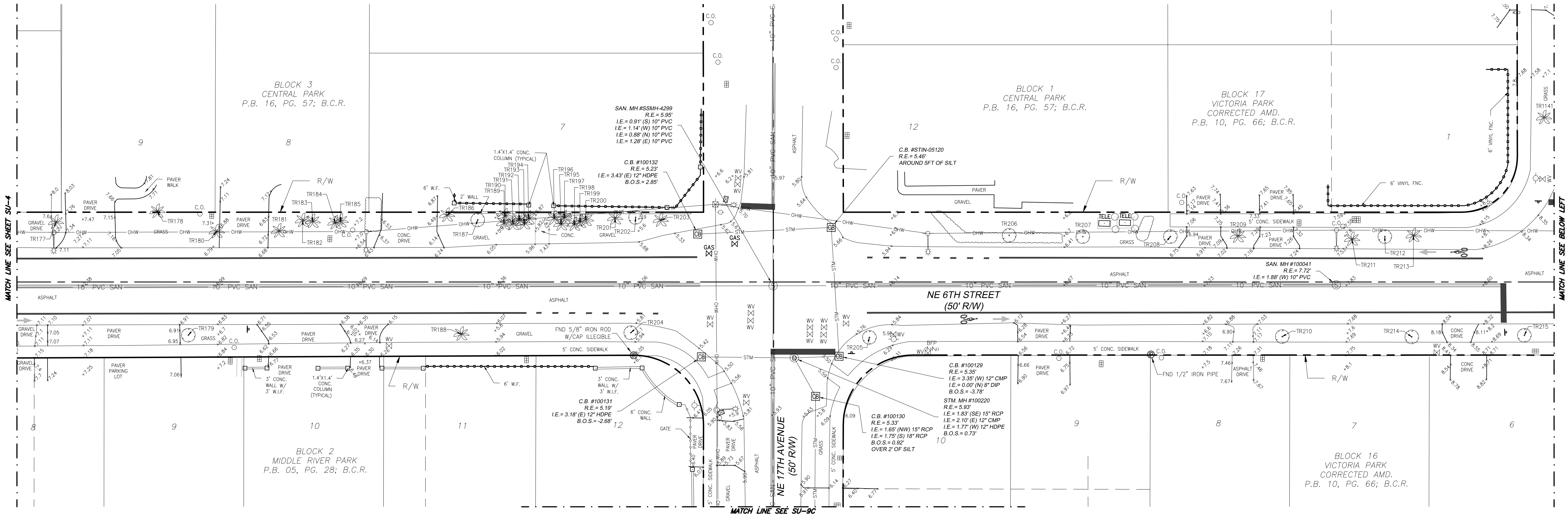
1"=20'

CHECKED BY:

JDR

FIELD BOOK:

SEE SURVEY NOTE #5



SURVEYOR
RICHARD PRYCE
FL PSM NO. 4038
DATE: 8/6/24

DRAWN BY: DATE: 7/30/24
JP, TS, JE
DESIGNED BY: SCALE: 1"=20'
XX
CHECKED BY: JDR
FIELD BOOK: SEE SURVEY NOTE #5

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE

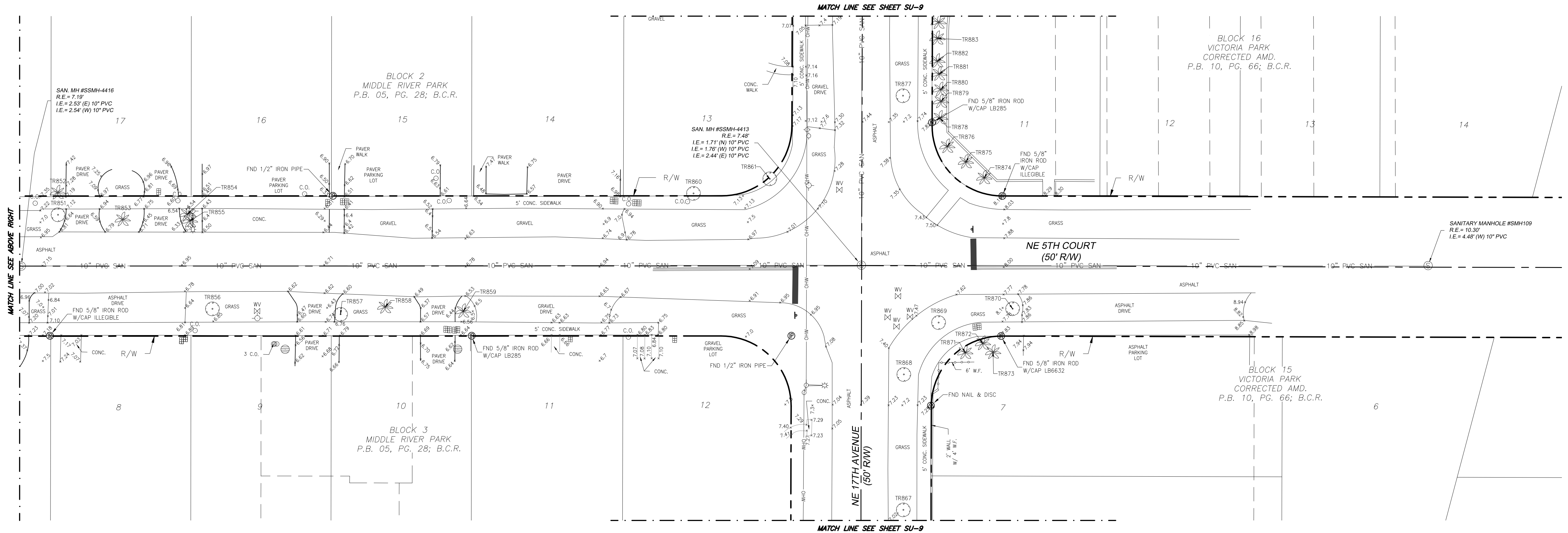
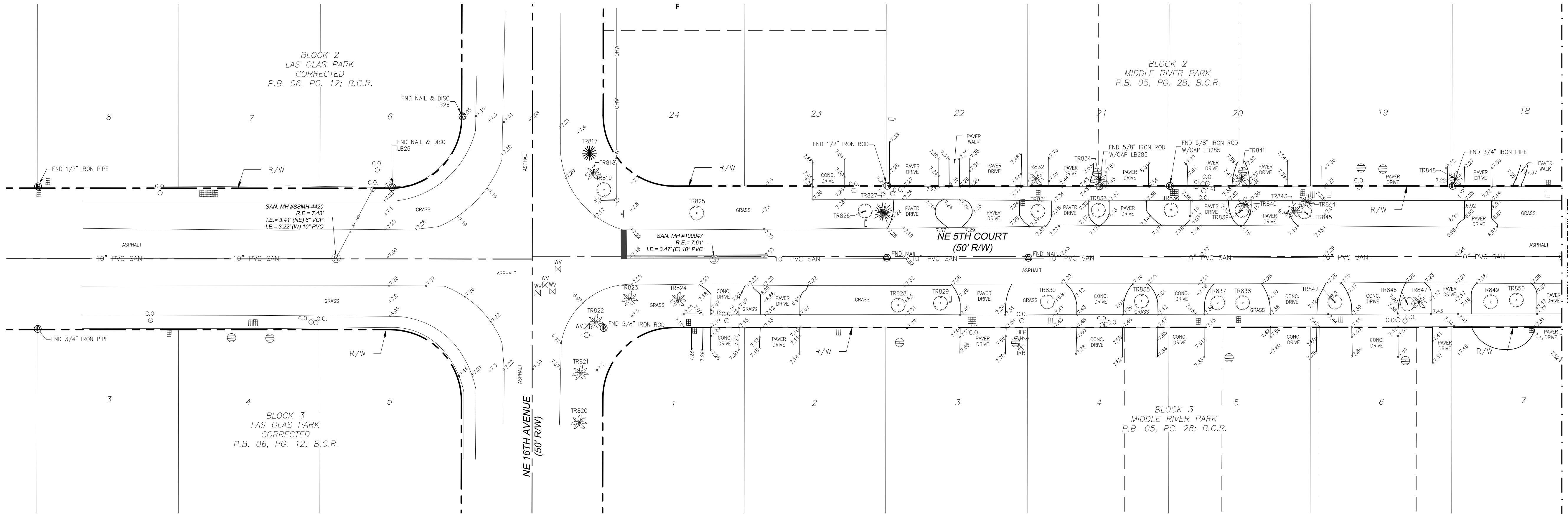


100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISONS			DESCRIPTION
NO.	DATE	BY	

PROJECT # 12082
STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

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TOTAL:	26
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DRAWING FILE NO.	



SURVEYOR
RICHARD PRYCE
FL PSM NO. 4038
DATE: 6/6/2024

DRAWN BY: DATE: 7/30/24
JP, TS, JE
DESIGNED BY: SCALE: 1"=20'
XX
CHECKED BY: JDR
FIELD BOOK: SEE SURVEY NOTE #5

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE

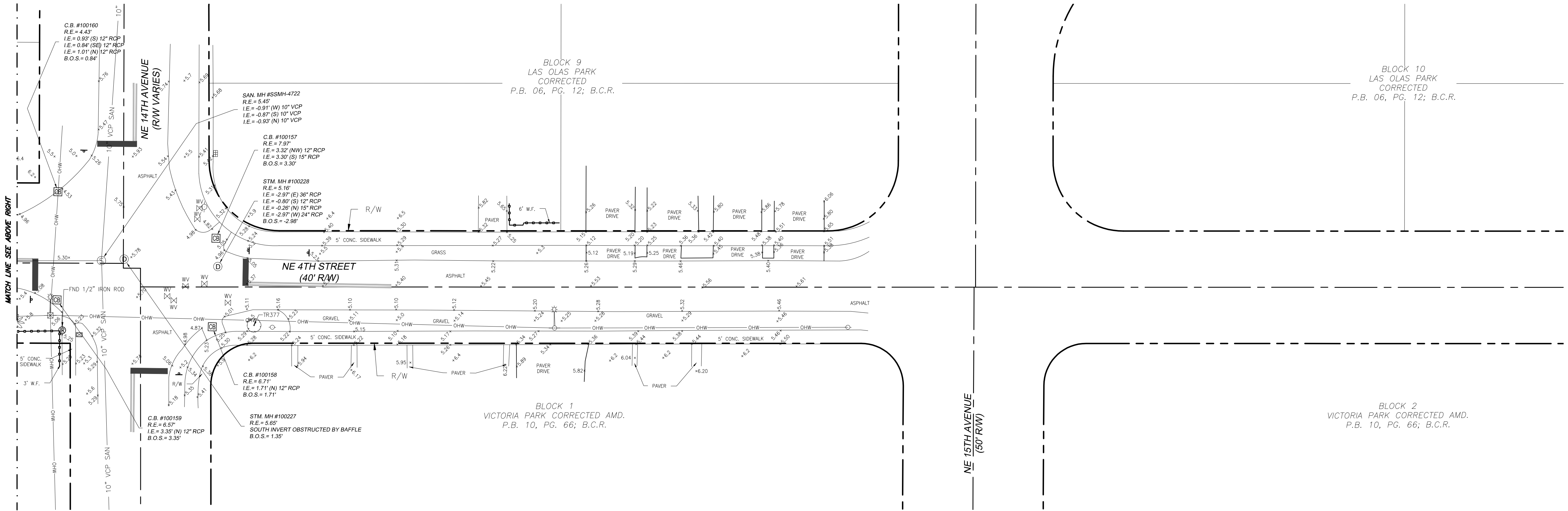
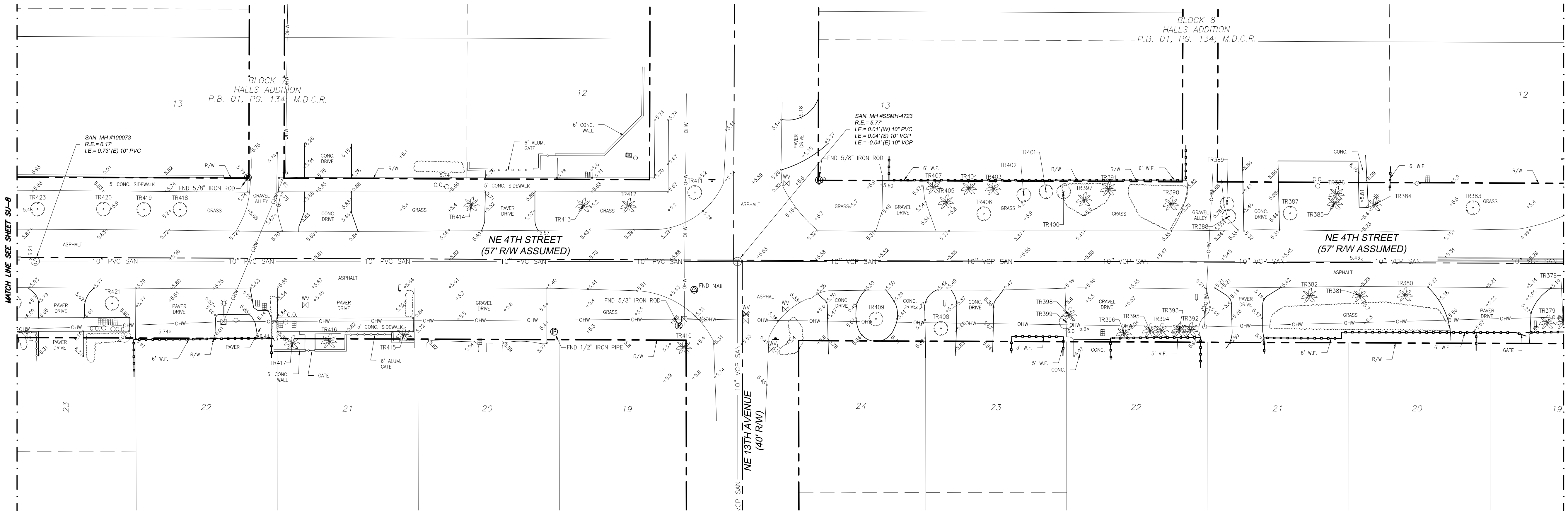


100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISONS		DESCRIPTION	
NO.	DATE	BY	CHK'D

PROJECT # 12082
STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

SHEET NO.	OF
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TOTAL:	26
CAD FILE:	CTA_12082SURV
DRAWING FILE NO.	



CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE



100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISIONS		DESCRIPTION	
NO.	DATE	BY	CHK'D

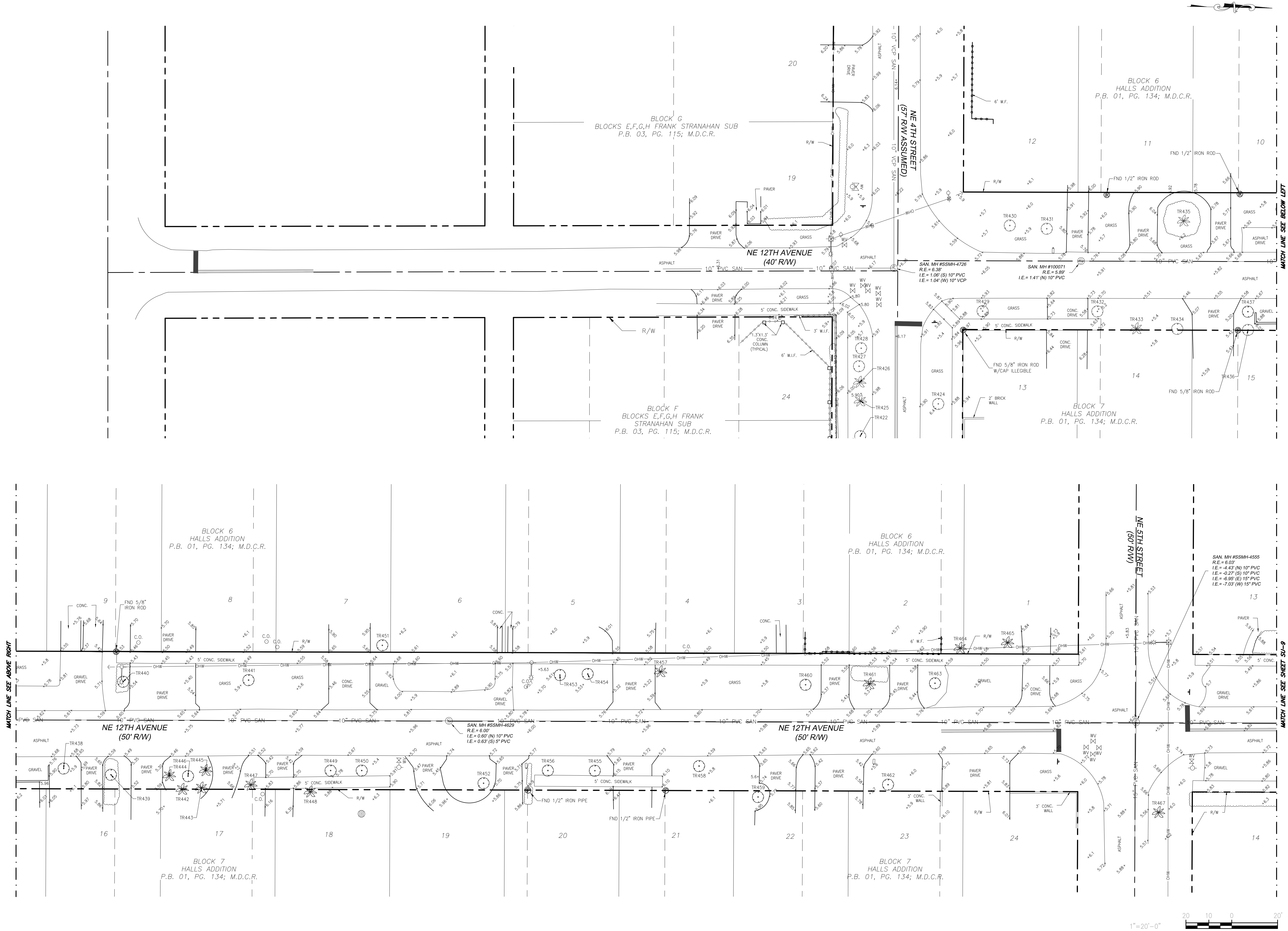
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STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

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DRAWING FILE NO.	

SURVEYOR
RICHARD PRYCE
FL PSM NO. 4038
DATE: 8/6/2024

TEL: 954-739-6400
FAX: 954-739-6409

DRAWN BY: DATE: 7/30/24
J.P., T.S., J.E.
DESIGNED BY: SCALE: 1"=20'
XX
CHECKED BY: JDR
FIELD BOOK: SEE SURVEY NOTE #5



SURVEYOR
RICHARD PRYCE
FL PSM NO. 4038
DATE: 6/6/2024

DRAWN BY: DATE: 7/30/24
JF, TS, JE
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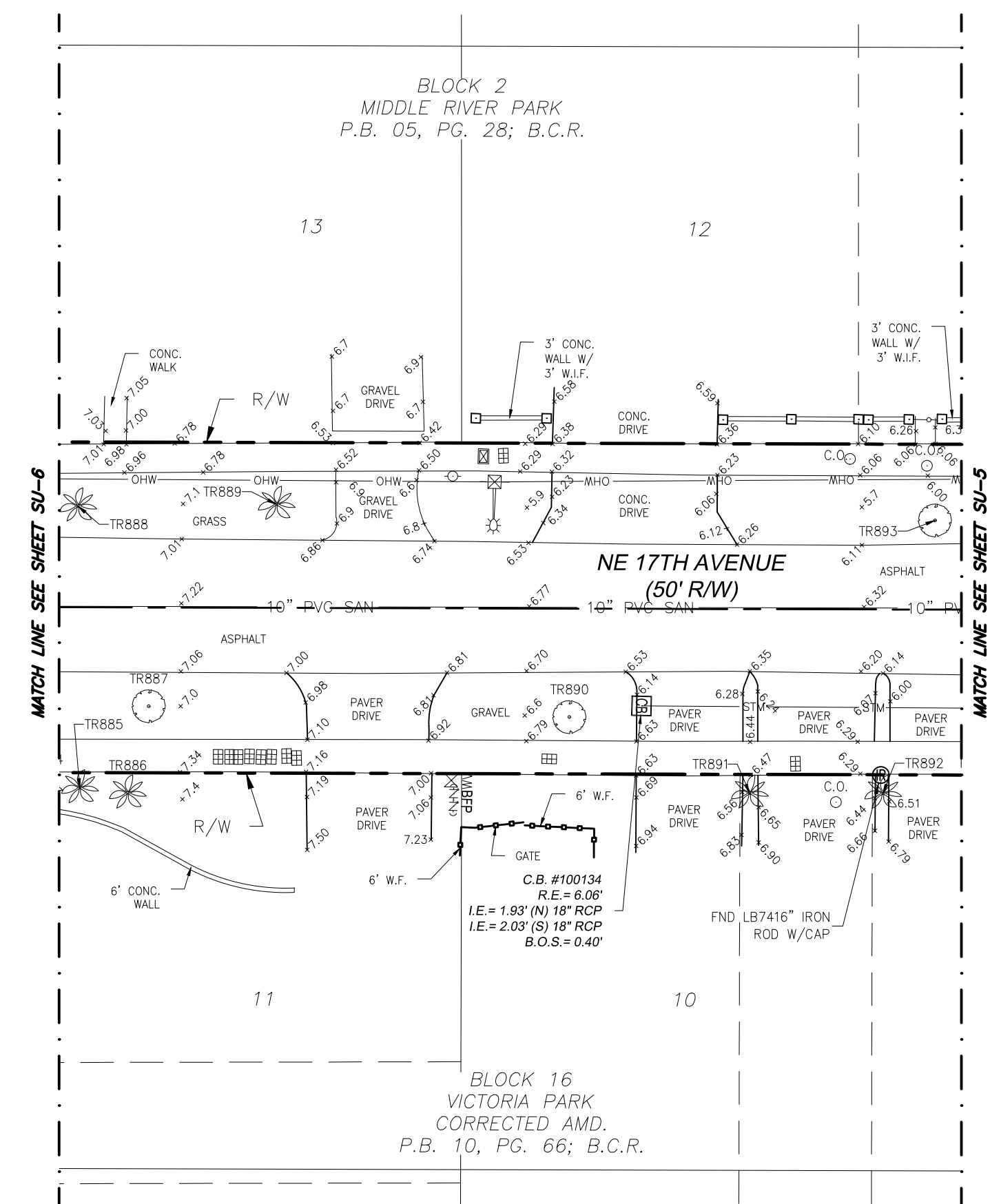
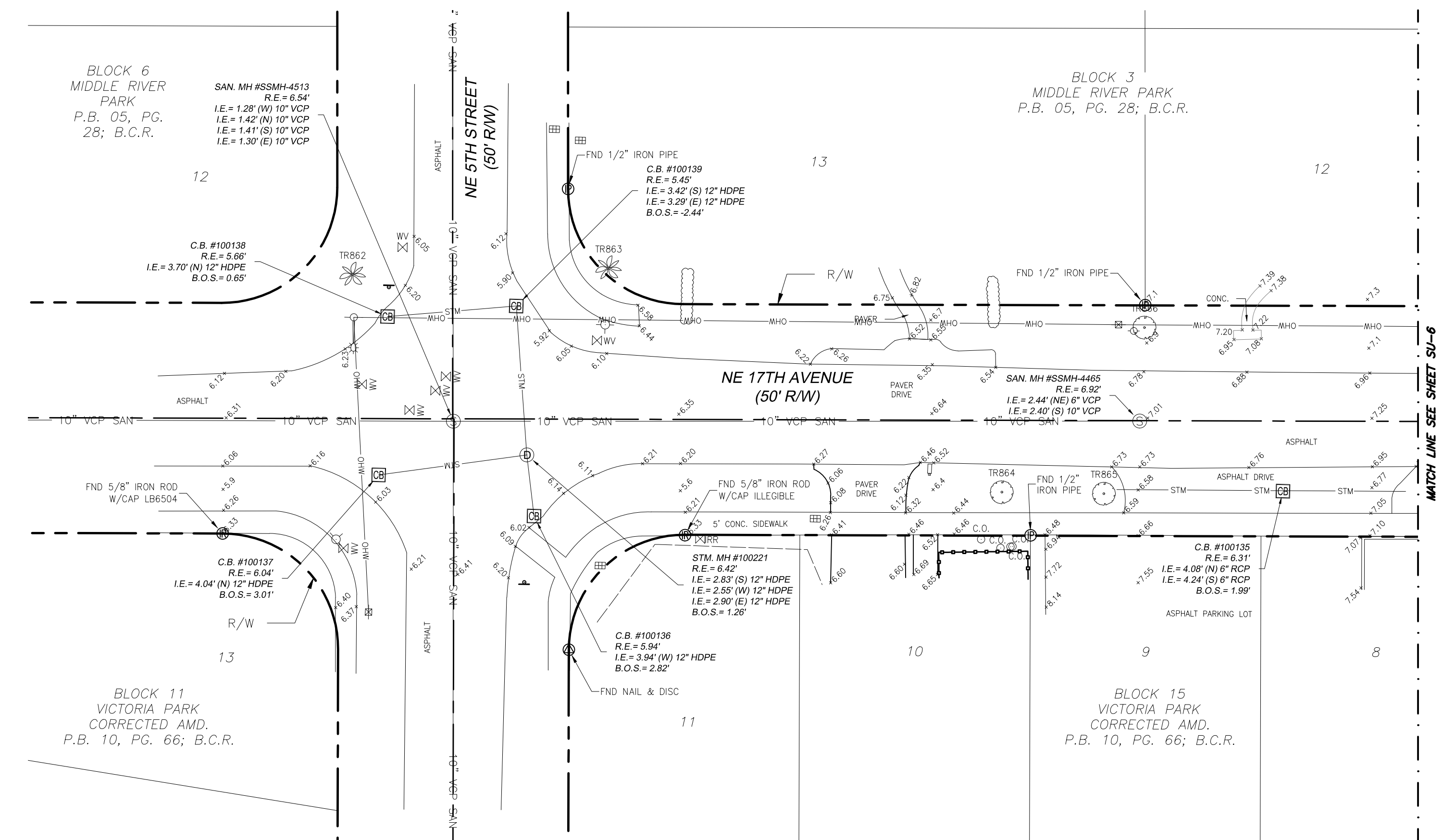
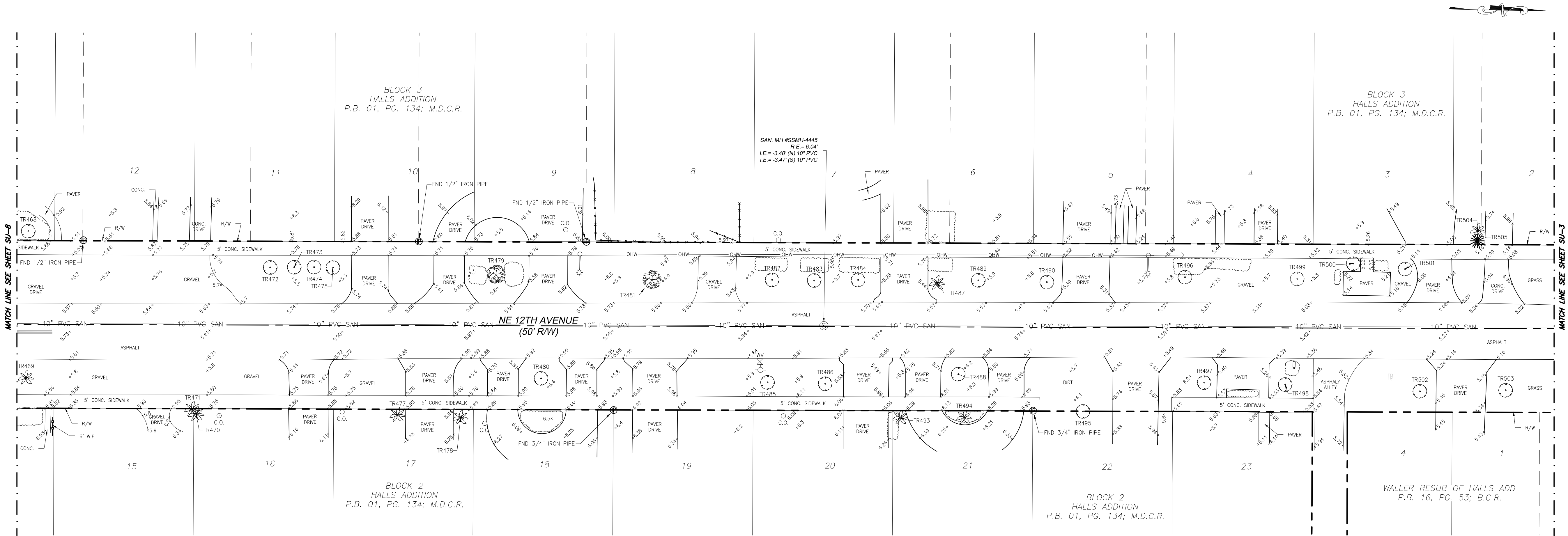
CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE

100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISITONS			DESCRIPTION
NO.	DATE	BY	CHK'D

PROJECT # 12082
STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

SHEET NO.	OF
SU-8	26
TOTAL:	26
CAD FILE:	CTA_12082SURV
DRAWING FILE NO.	



SURVEYOR
RICHARD PRYCE
FL PSM NO. 4038
DATE: 6/2024

DRAWN BY: DATE: 7/30/24
DESIGNED BY: SCALE: 1"=20'
CHECKED BY: JDR
FIELD BOOK: SEE SURVEY NOTE #5

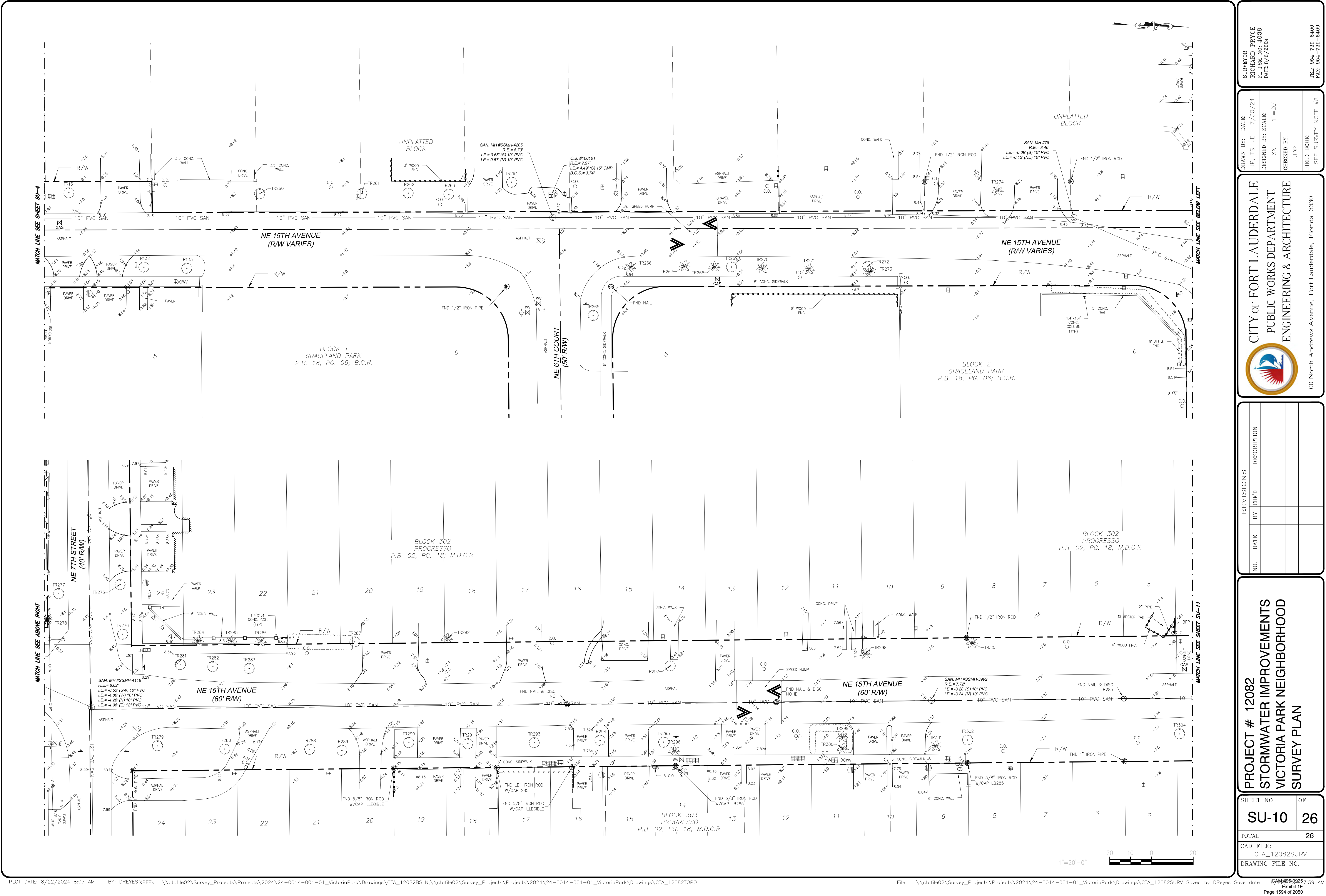
CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE

100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISIONS			DESCRIPTION
NO.	DATE	BY	CHK'D

PROJECT # 12082
STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

SHEET NO.	OF
SU-9	26
TOTAL:	26
CAD FILE:	CTA_12082SURV
DRAWING FILE NO.	



SURVEYOR
RICHARD PRYCE
FL PSM NO. 4038
DATE: 8/6/2024

DRAWN BY: DATE: 7/30/24
DESIGNED BY: SCALE: 1"=20'
CHECKED BY: JDR
FIELD BOOK: SEE SURVEY NOTE #5

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE

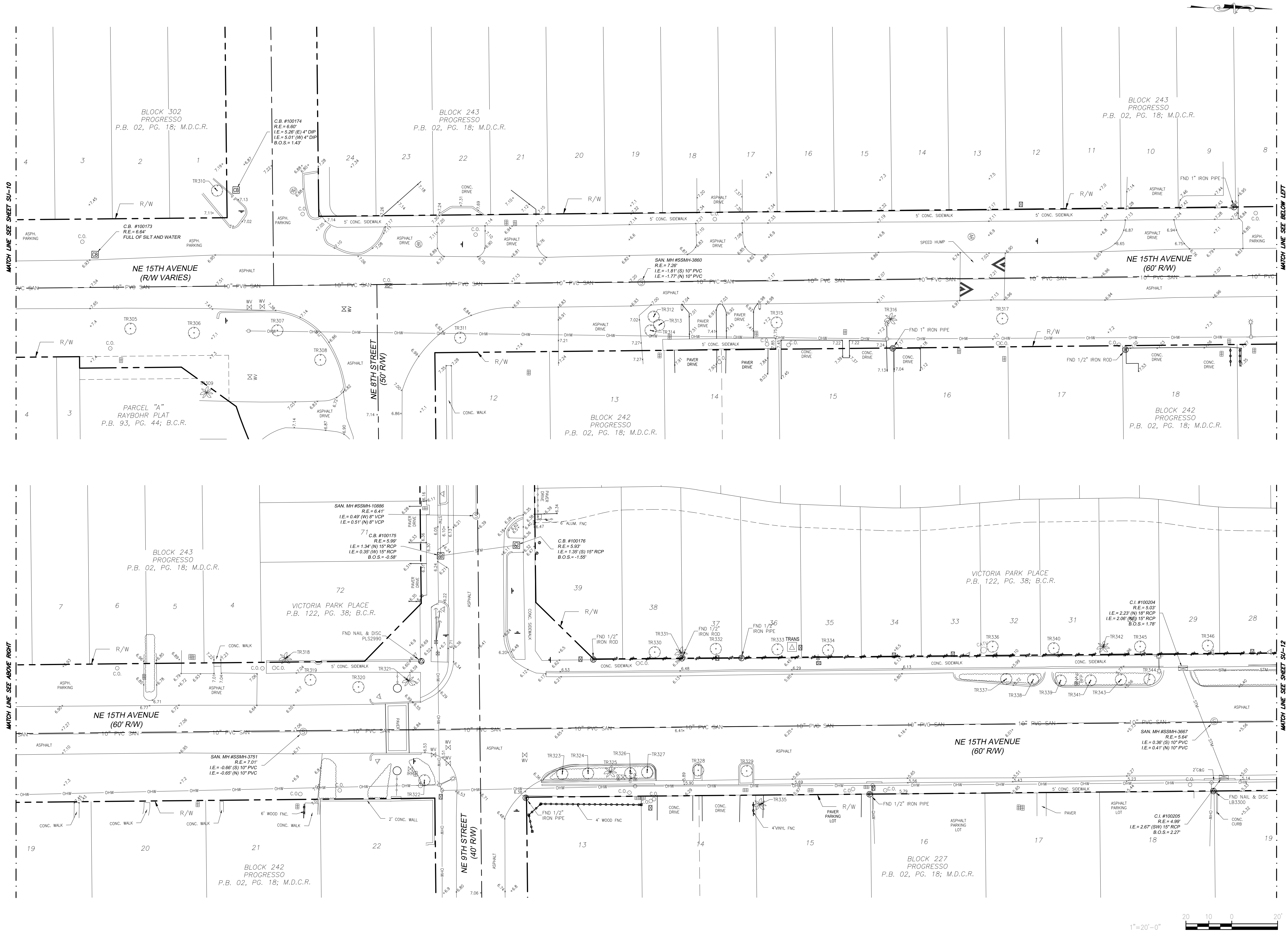


100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISIONS		DESCRIPTION	
NO.	DATE	BY	CHK'D

PROJECT # 12082
STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

SHEET NO.	OF
SU-10	26
TOTAL:	26
CAD FILE:	CTA_12082SURV
DRAWING FILE NO.	



SURVEYOR
RICHARD PRYCE
FL PSM NO. 4038
DATE: 6/6/2024

DRAWN BY: DATE: 7/30/24
J.P., TS., JE
DESIGNED BY: SCALE: 1"=20'
XX
CHECKED BY: JDR
FIELD BOOK: SEE SURVEY NOTE #5

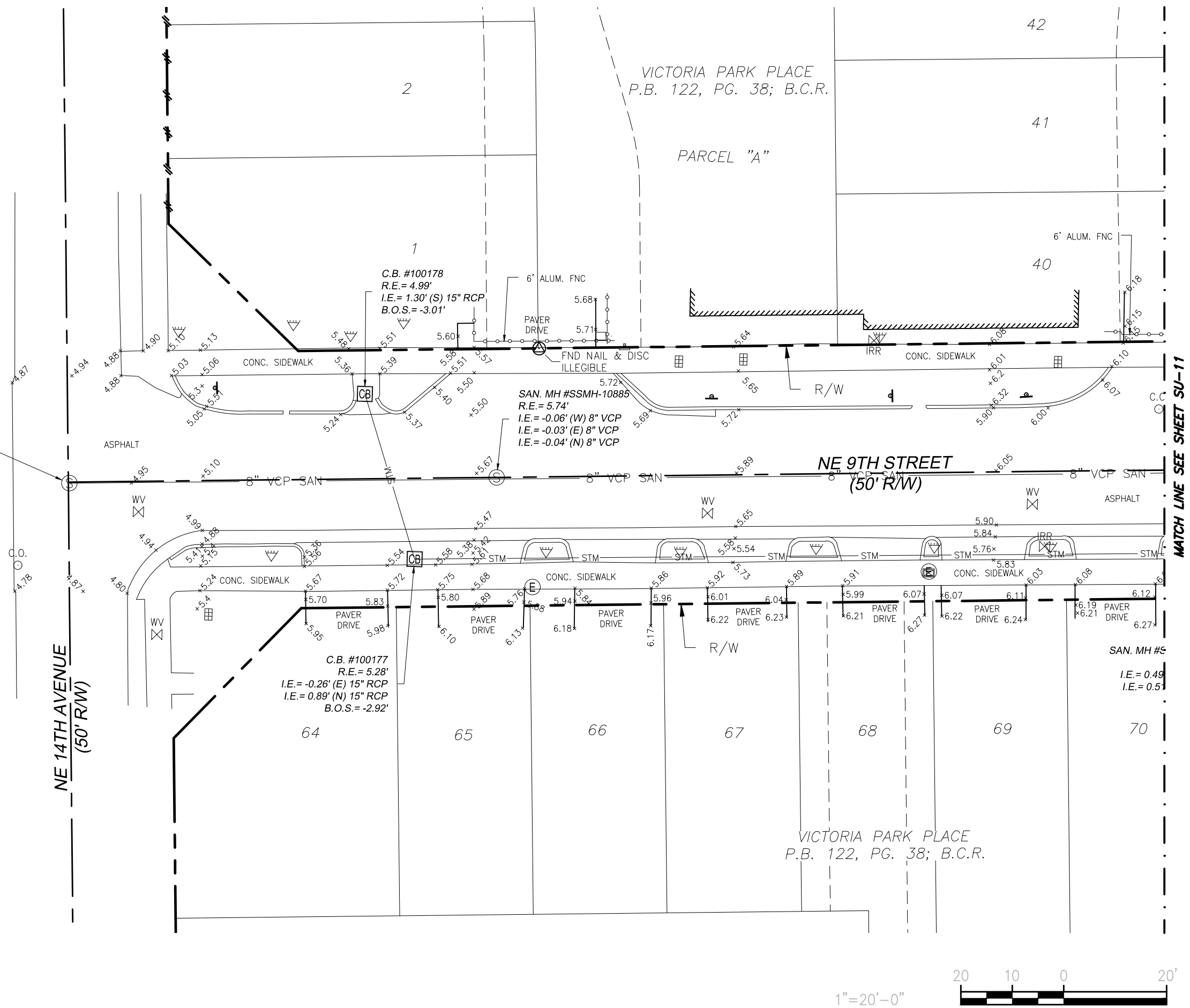
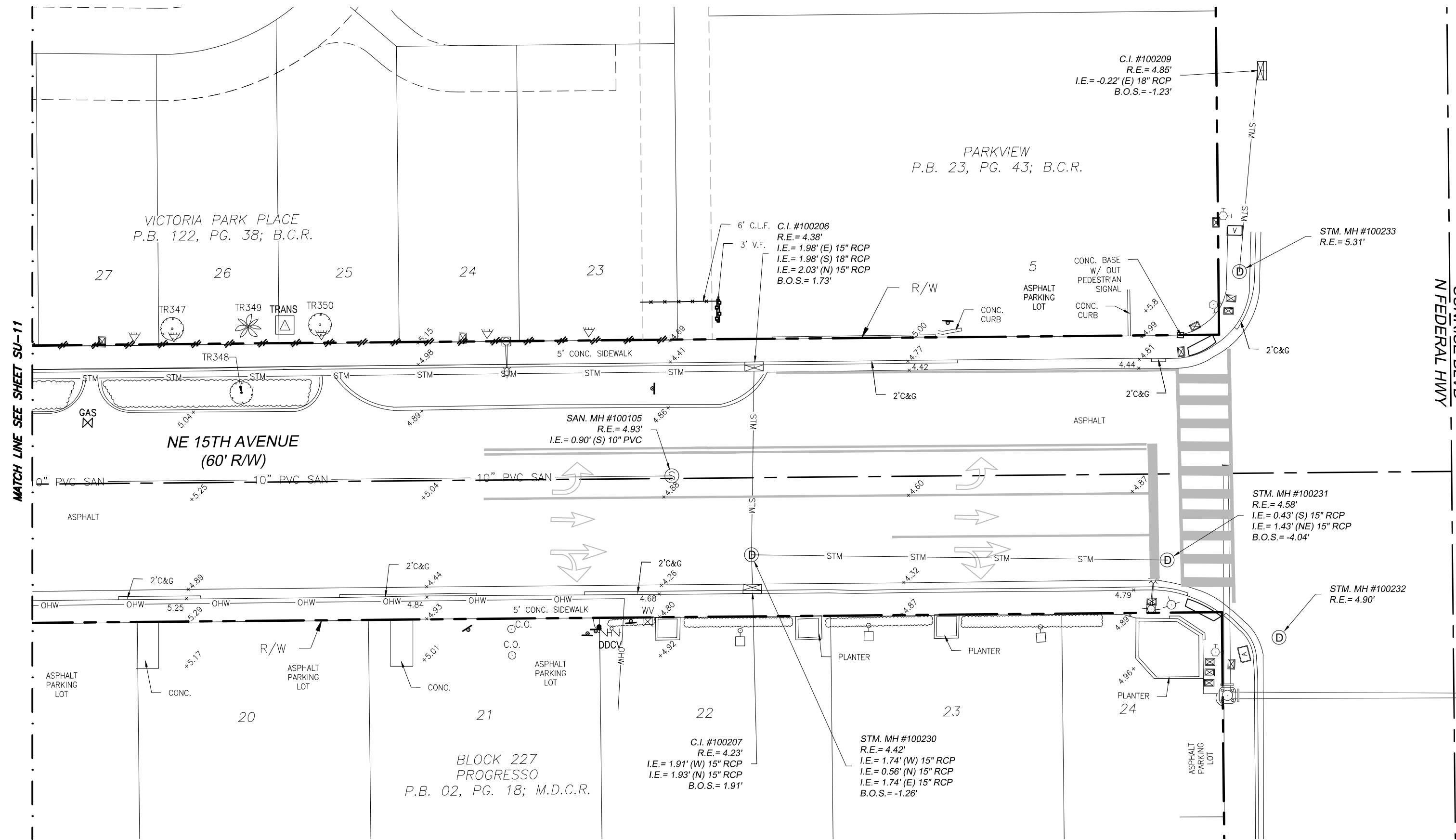
CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE

100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISITONS		DESCRIPTION	
NO.	DATE	BY	CHK'D

PROJECT # 12082
STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

SHEET NO.	OF
SU-11	26
TOTAL:	26
CAD FILE:	CTA_12082SURV
DRAWING FILE NO.	



CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE

100 North Andrews Avenue, Fort Lauderdale, Florida 33301

NO.	DATE	BY	CHK'D	DESCRIPTION

PROJECT # 12082
STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

SHEET NO.	OF
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TOTAL:	26
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DRAWING FILE NO.	

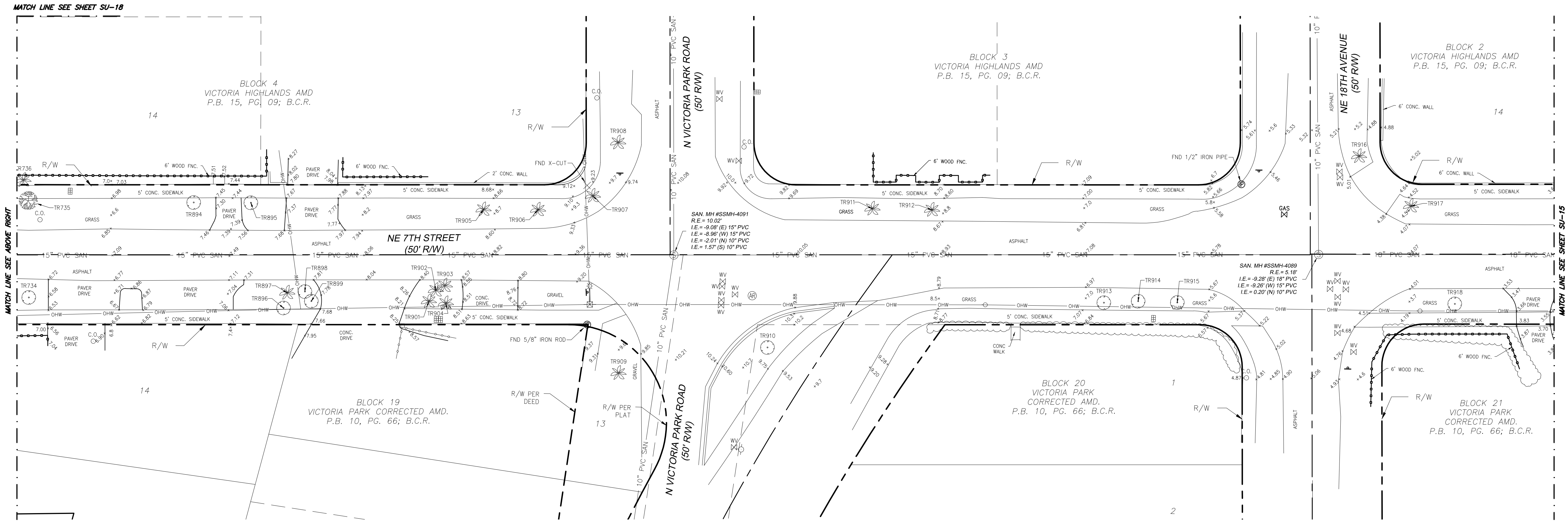
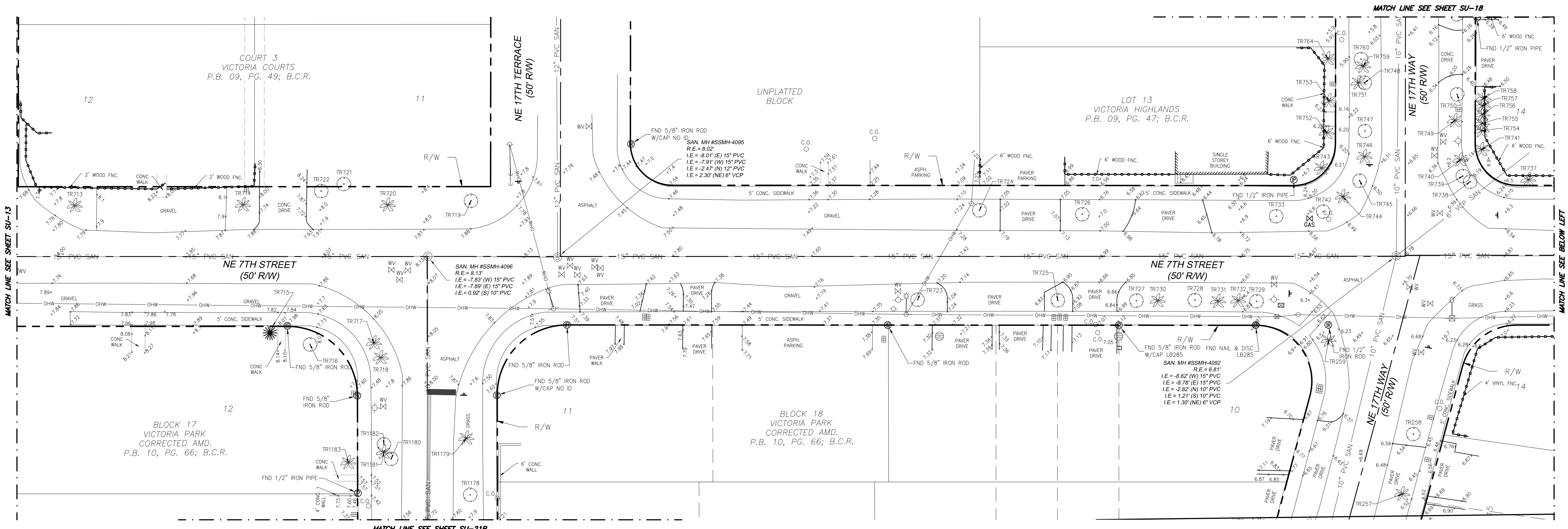
SURVEYOR
RICHARD PRYCE
FL PSM NO. 4038
DATE: 8/6/2024

DRAWN BY: J.P., TS., JE
DATE: 7/30/24

DESIGNED BY: XX
SCALE: 1"=20'

CHECKED BY: JDR
FIELD BOOK: SEE SURVEY NOTE #5

TEL: 954-739-6400
FAX: 954-739-6409



CITY OF FORT LAUDERDALE

PUBLIC WORKS DEPARTMENT

ENGINEERING & ARCHITECTURE

100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISIONS		DESCRIPTION	
NO.	DATE	BY	CHK'D

PROJECT # 12082

STORMWATER IMPROVEMENTS

VICTORIA PARK NEIGHBORHOOD

SURVEY PLAN

SHEET NO. OF

SU-14 26

TOTAL:

26

CAD FILE:

CTA_12082SURV

DRAWING FILE NO.

SURVEYOR

RICHARD PRYCE

FL PSM NO. 4038

DATE: 8/6/2024

DRAWN BY:

DATE:

DESIGNED BY:

SCALE:

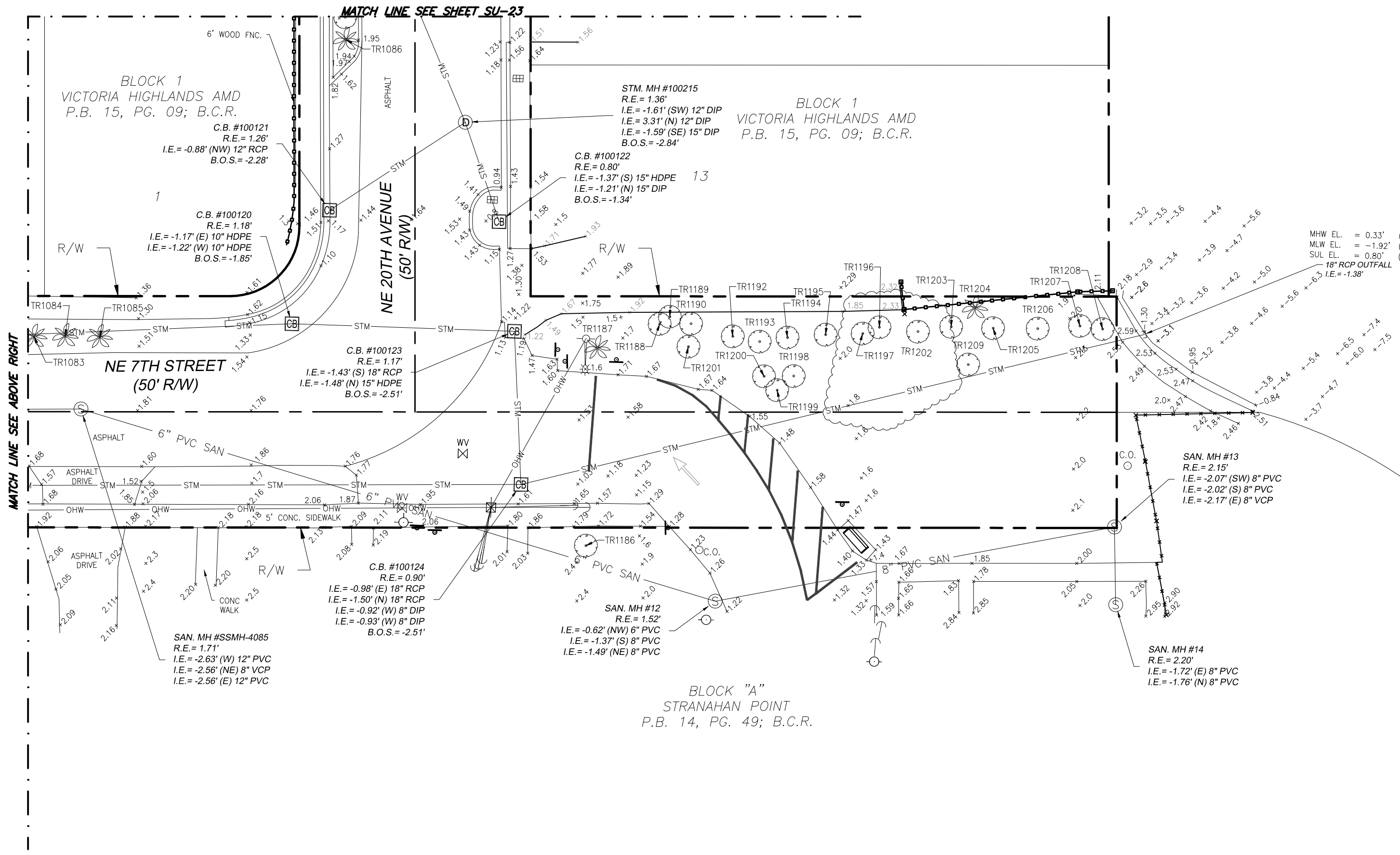
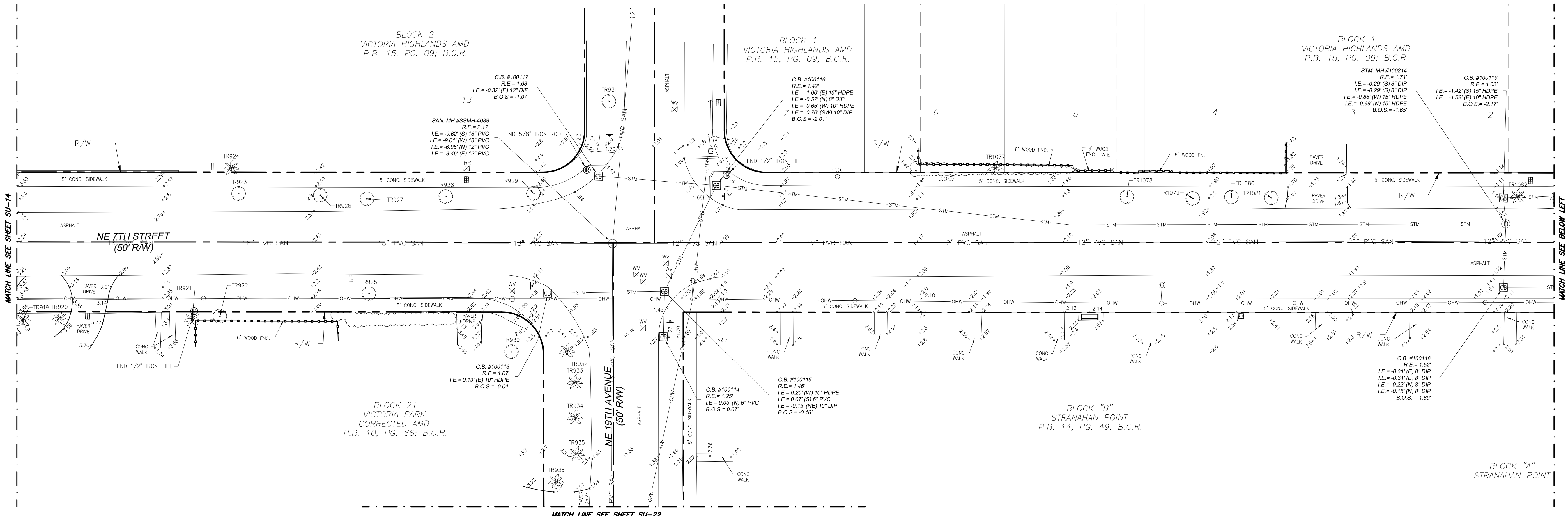
CHECKED BY:

1"=20'

FIELD BOOK:

JDR

SEE SURVEY NOTE #5



SURVEYOR
RICHARD PRYCE
FL PSM NO. 4038
DATE: 8/6/2024

DRAWN BY: DATE: 7/30/24
JP, TS, JE
DESIGNED BY: SCALE: 1"=20'
XX
CHECKED BY: JDR
FIELD BOOK: SEE SURVEY NOTE #5

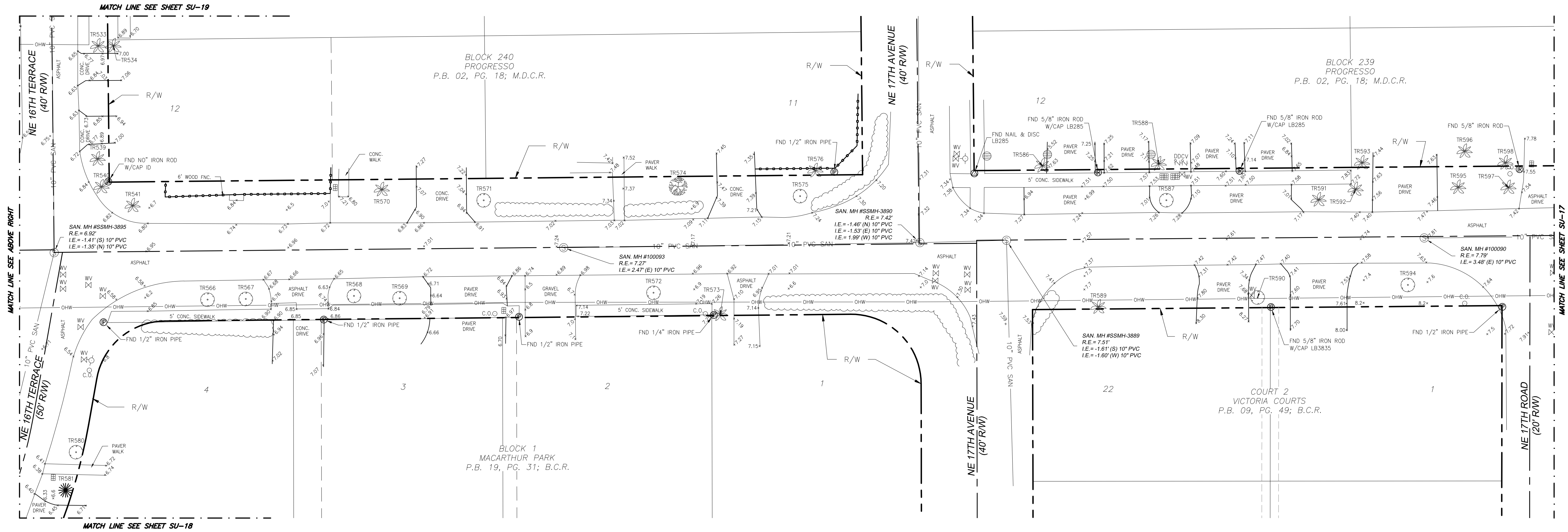
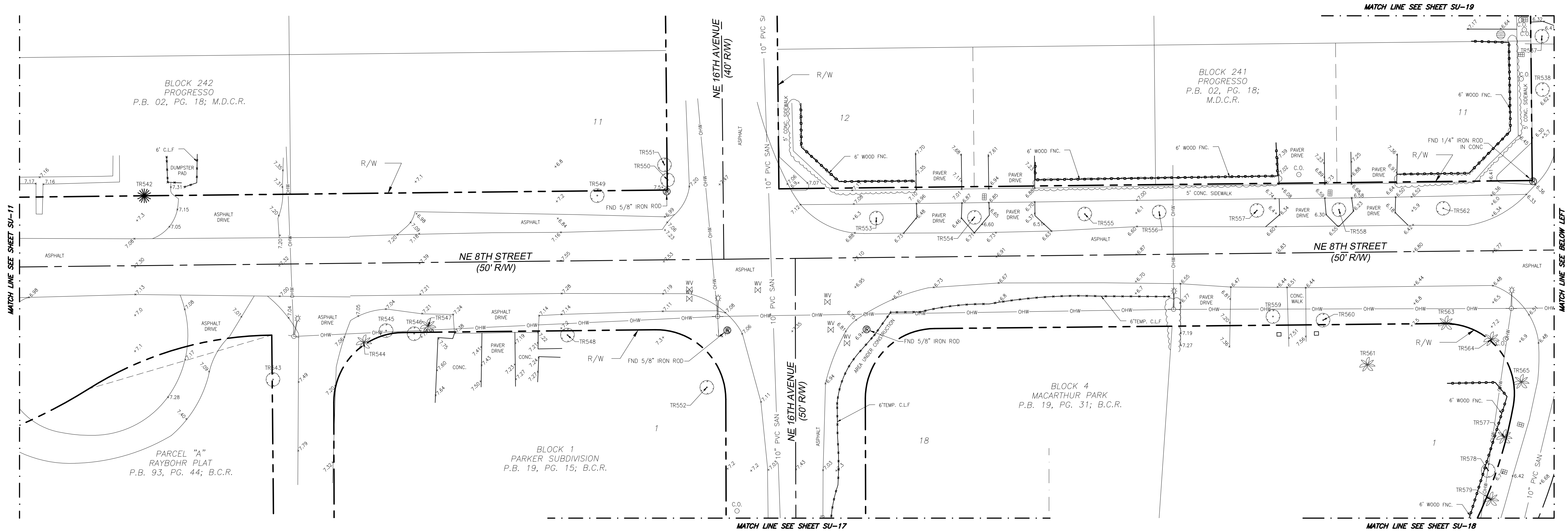
CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE

100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISIONS		DESCRIPTION	
NO.	DATE	BY	CHK'D

PROJECT # 12082
STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

SHEET NO.	OF
SU-15	26
TOTAL:	26
CAD FILE:	CTA_12082SURV
DRAWING FILE NO.	



SURVEYOR
RICHARD PRYCE
FL PSM NO. 4038
DATE: 8/6/2024

DRAWN BY: DATE: 7/30/24
DESIGNED BY: SCALE: 1"=20'
CHECKED BY: JDR
FIELD BOOK: JDR
SEE SURVEY NOTE #5

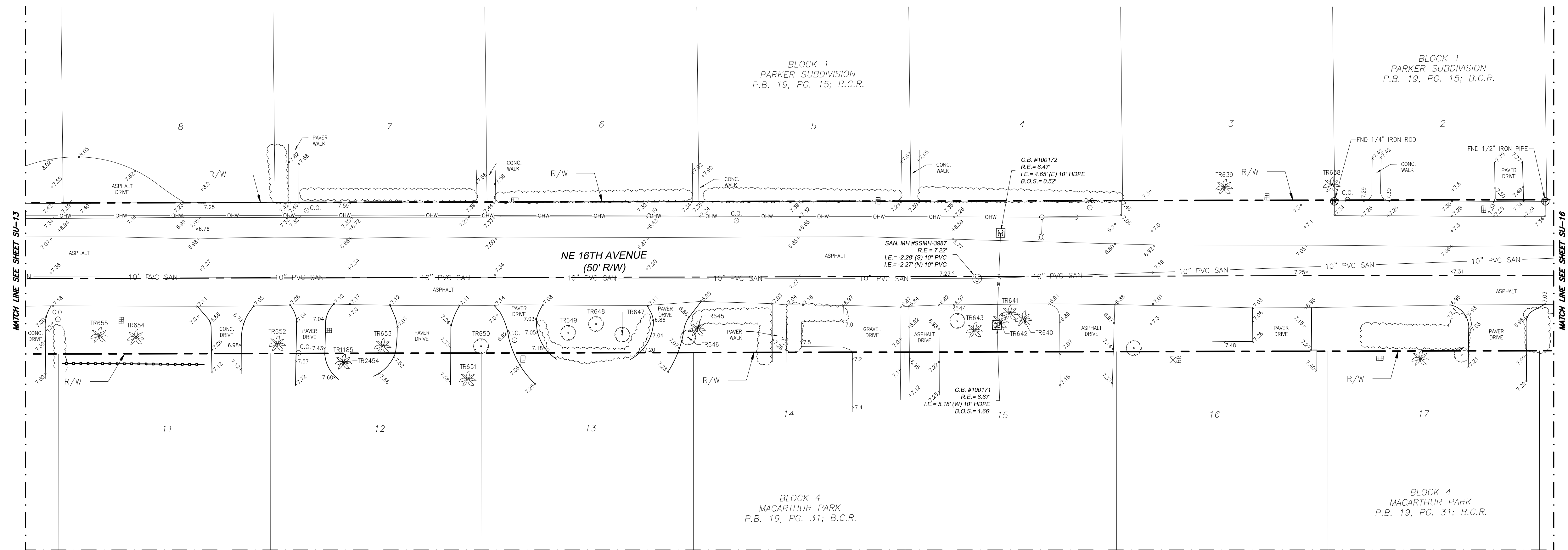
CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE

100 North Andrews Avenue, Fort Lauderdale, Florida 33301

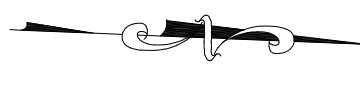
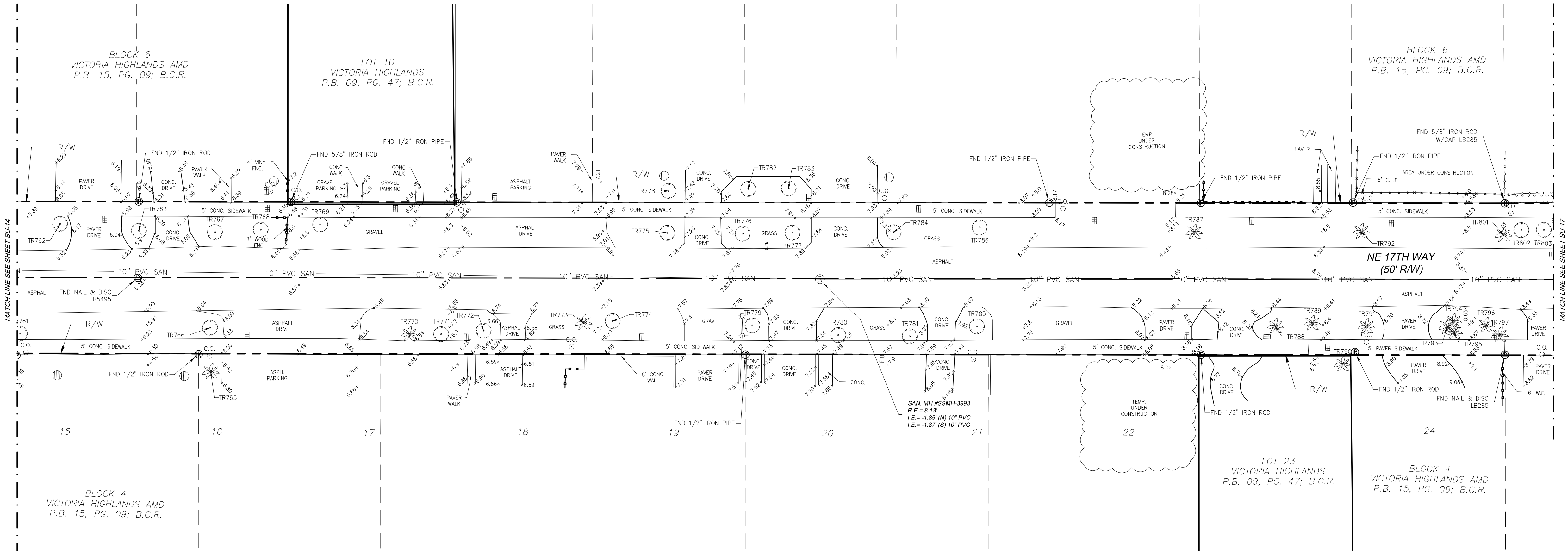
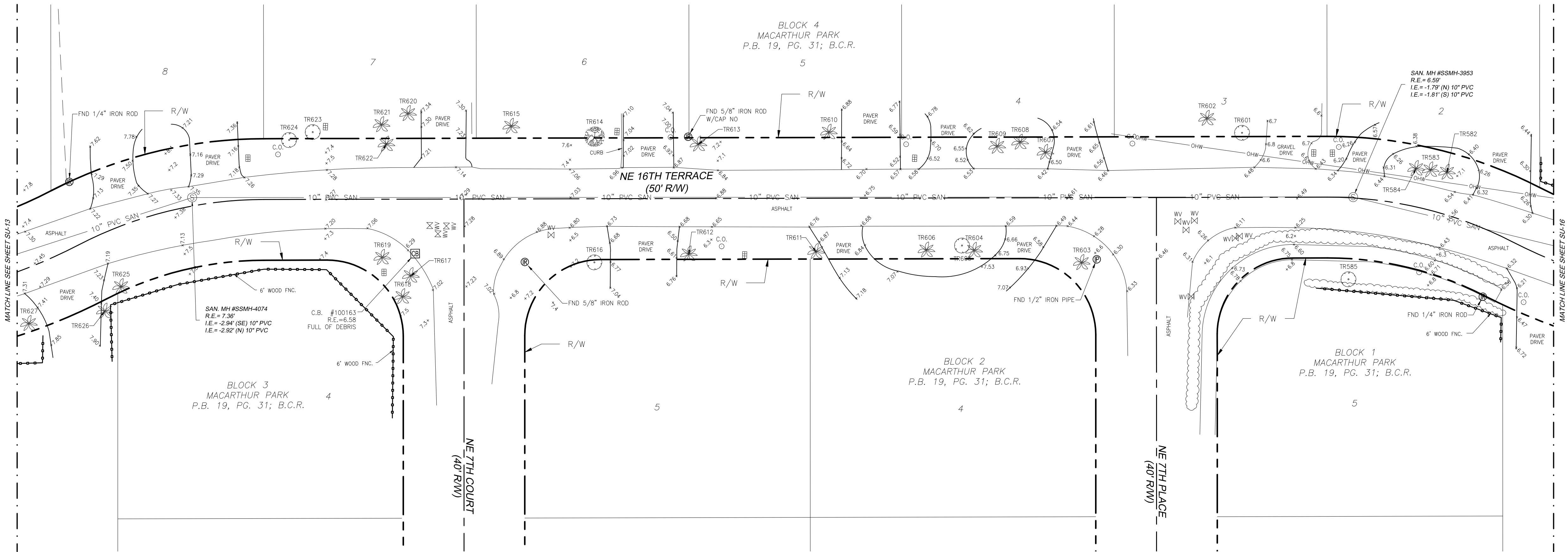
REVISIONS		DESCRIPTION	
NO.	DATE	BY	CHK'D

PROJECT # 12082
STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

SHEET NO.	OF
SU-16	26
TOTAL:	26
CAD FILE:	CTA_12082SURV
DRAWING FILE NO.	



SHEET NO.	OF
SU-17	26
TOTAL: 26	
CAD FILE: CTA_12082SURV	
DRAWING FILE NO.	



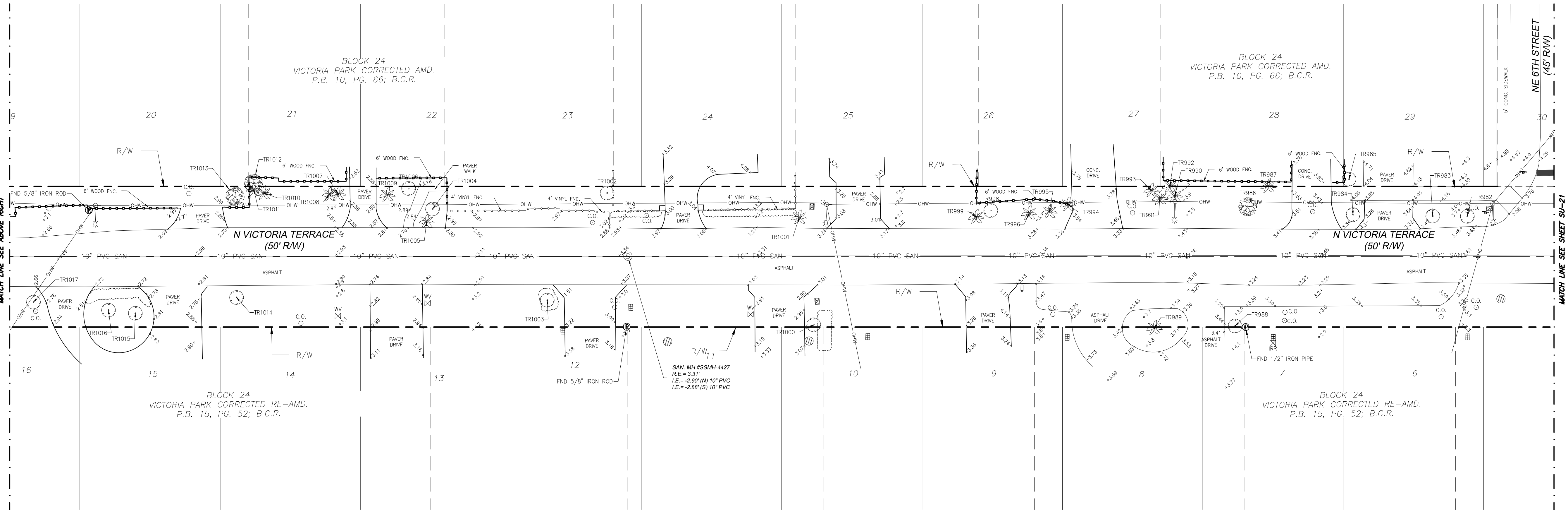
CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE

100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISITONS		DESCRIPTION	
NO.	DATE	BY	CHK'D

PROJECT # 12082
STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

SHEET NO.	OF
SU-18	26
TOTAL:	26
CAD FILE:	CTA_12082SURV
DRAWING FILE NO.	

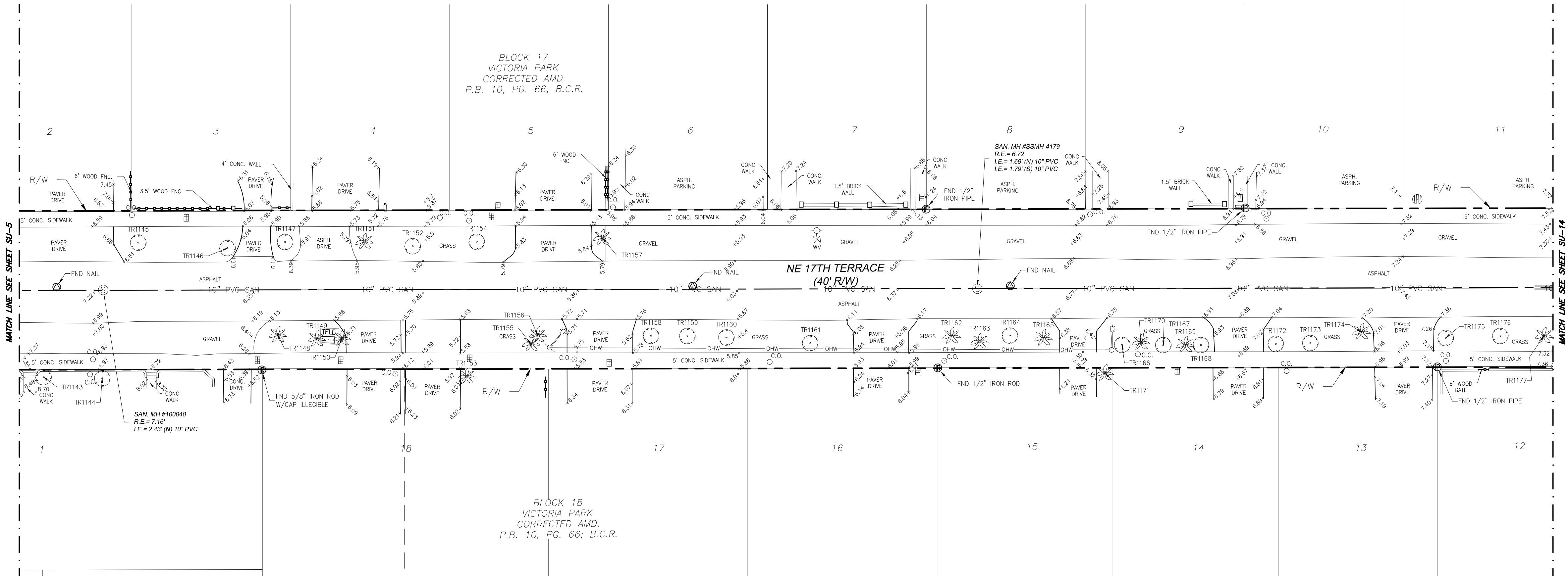
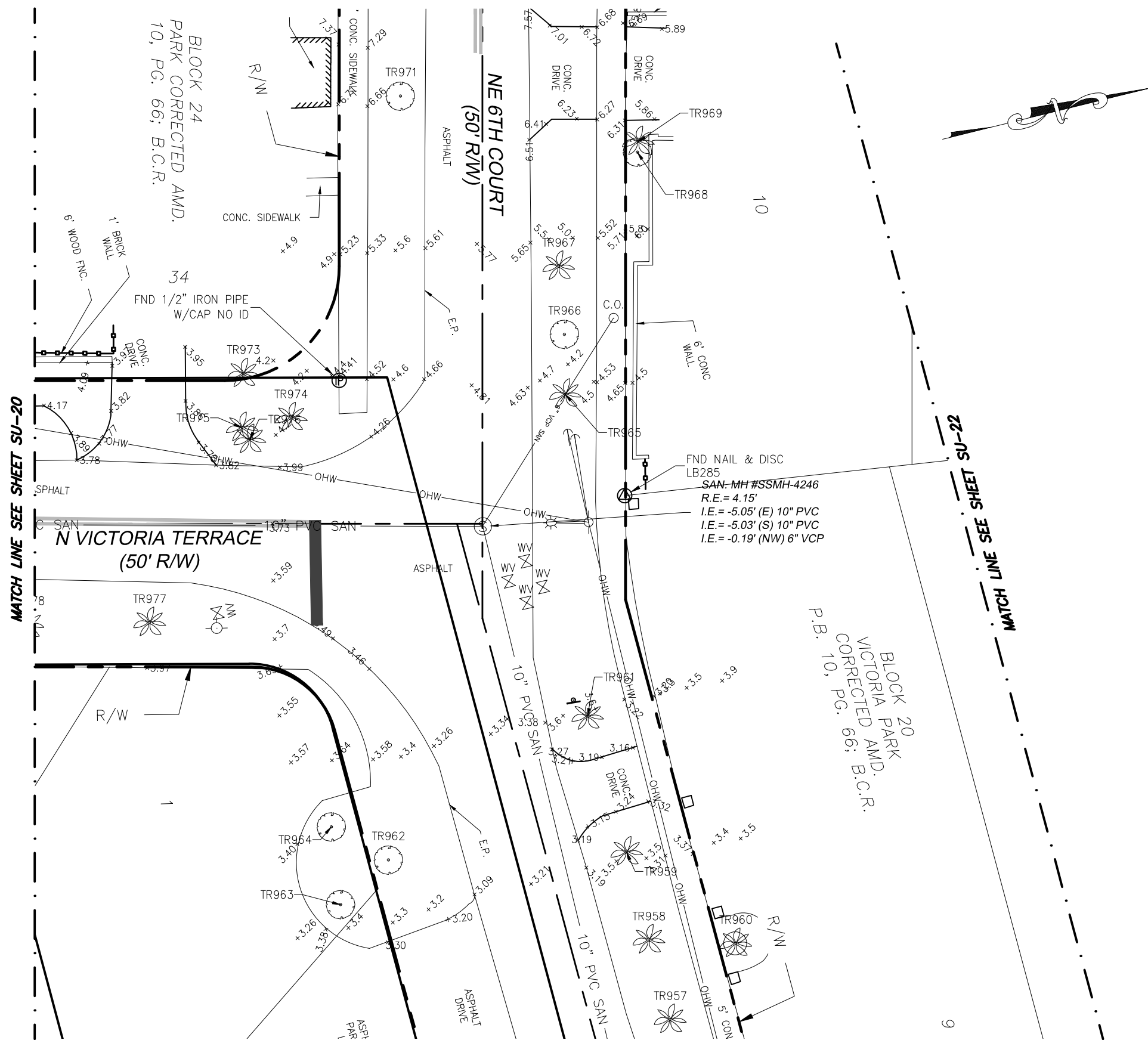


CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE

100 North Andrews Avenue, Fort Lauderdale, Florida 33301

PROJECT # 12082
STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

SHEET NO.	OF
SU-20	26
TOTAL:	26
CAD FILE: CTA_12082SURV	
DRAWING FILE NO.	



SURVEYOR
RICHARD PRYCE
FL PSM NO. 4038
DATE: 8/6/2024

DRAWN BY: JF, TS, JE
DATE: 7/30/24
DESIGNED BY: XX
SCALE: 1"=20'
CHECKED BY: JDR
FIELD BOOK: SEE SURVEY NOTE #5

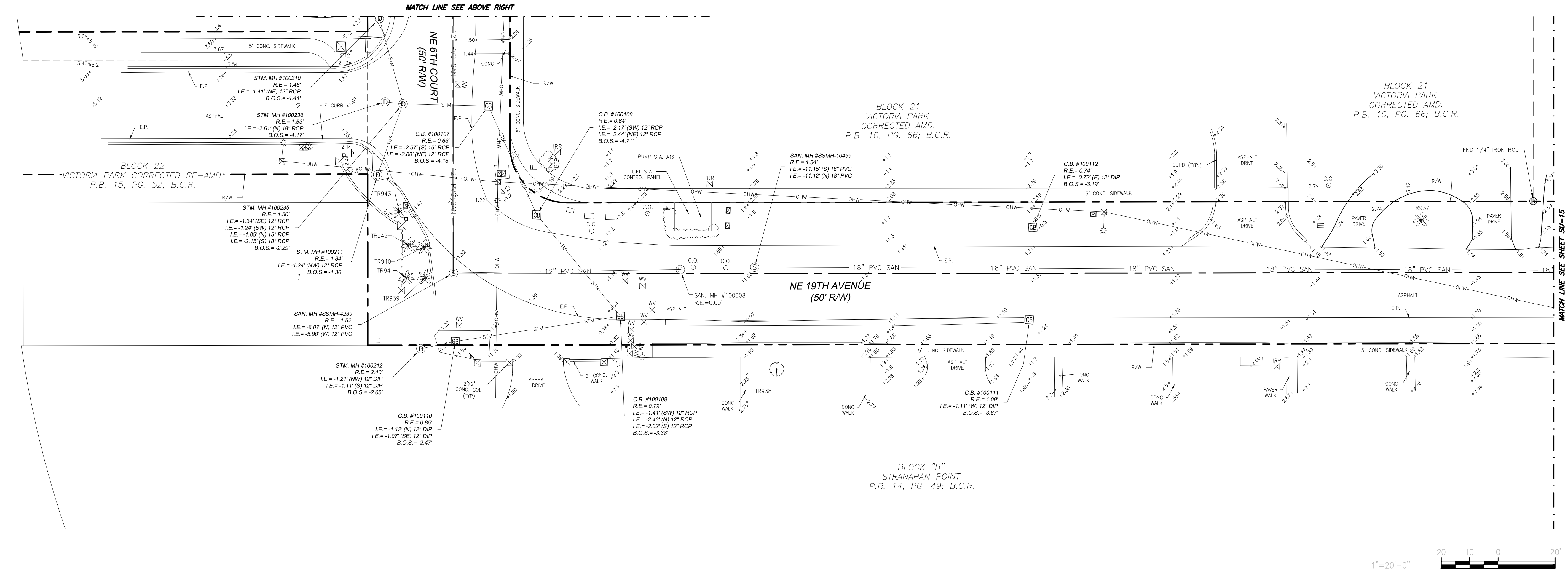
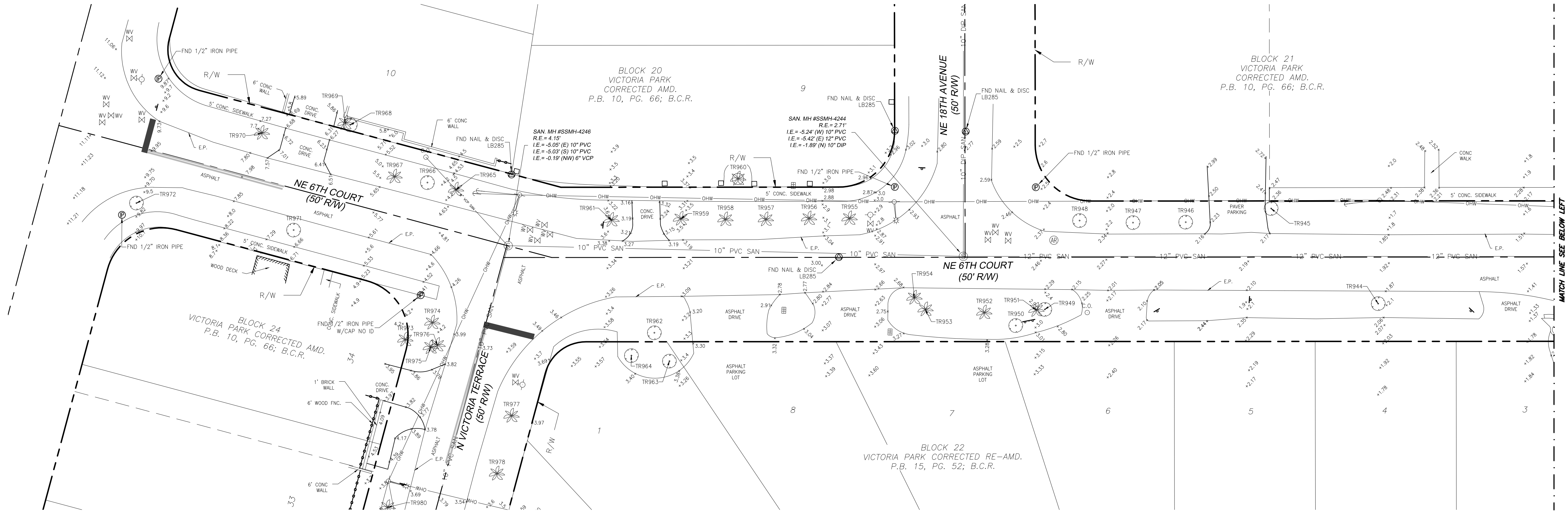
CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE

100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISITONS			DESCRIPTION
NO.	DATE	BY	CHK'D

PROJECT # 12082
STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

SHEET NO.	OF
SU-21	26
TOTAL:	26
CAD FILE:	CTA_12082SURV
DRAWING FILE NO.	



SURVEYOR
RICHARD PRYCE
FL PSM NO. 438
DATE: 6/2024

DRAWN BY: DATE: 7/30/24
DESIGNED BY: SCALE: 1"=20'
CHECKED BY: JDR
FIELD BOOK: SEE SURVEY NOTE #5

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE

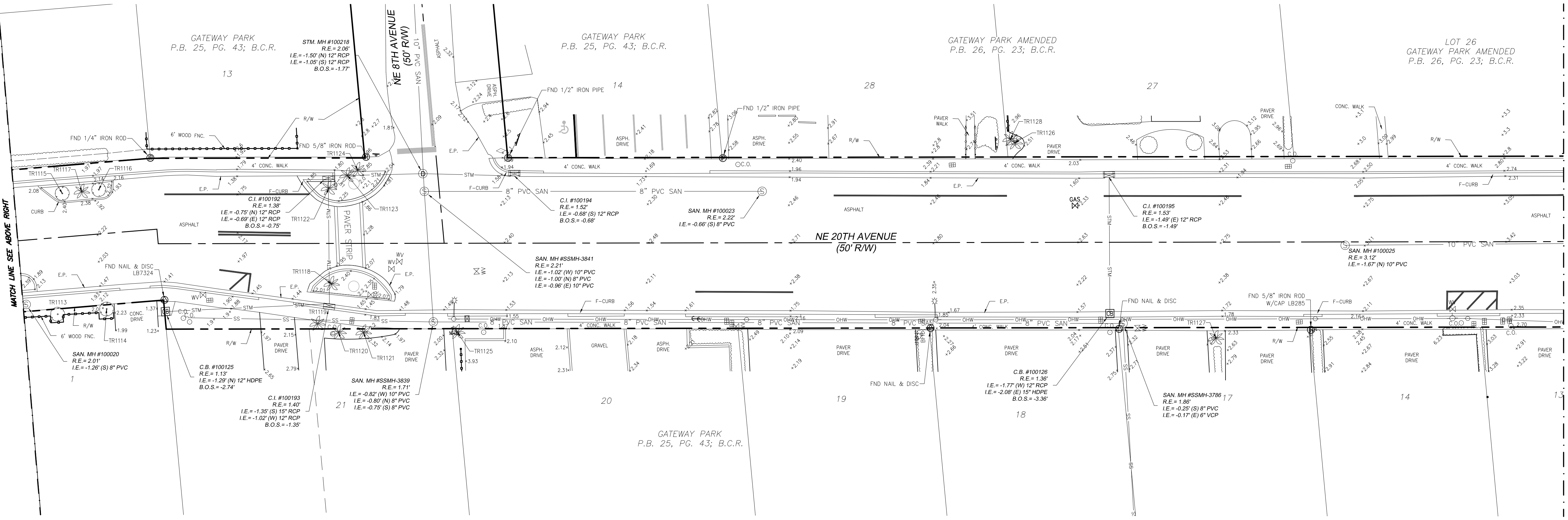
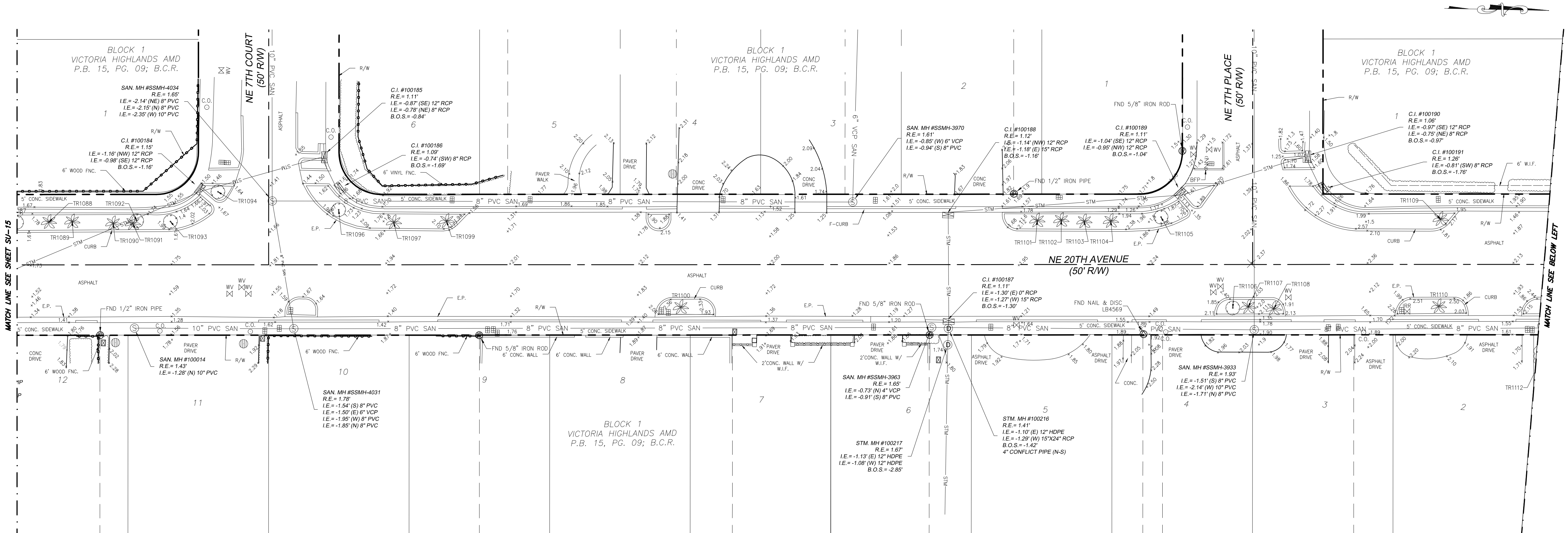


100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISIONS		DESCRIPTION
NO.	DATE	BY

PROJECT # 12082
STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

SHEET NO.	OF
SU-22	26
TOTAL:	26
CAD FILE:	CTA_12082SURV
DRAWING FILE NO.	



SURVEYOR
RICHARD PRYCE
FL PSM NO. 4038
DATE: 8/6/2024

DRAWN BY: J.P., Y.S., J.E.
DATE: 7/30/24
DESIGNED BY: XX
SCALE: 1"=20'
CHECKED BY: JDR
FIELD BOOK: JDR
SEE SURVEY NOTE #5

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE

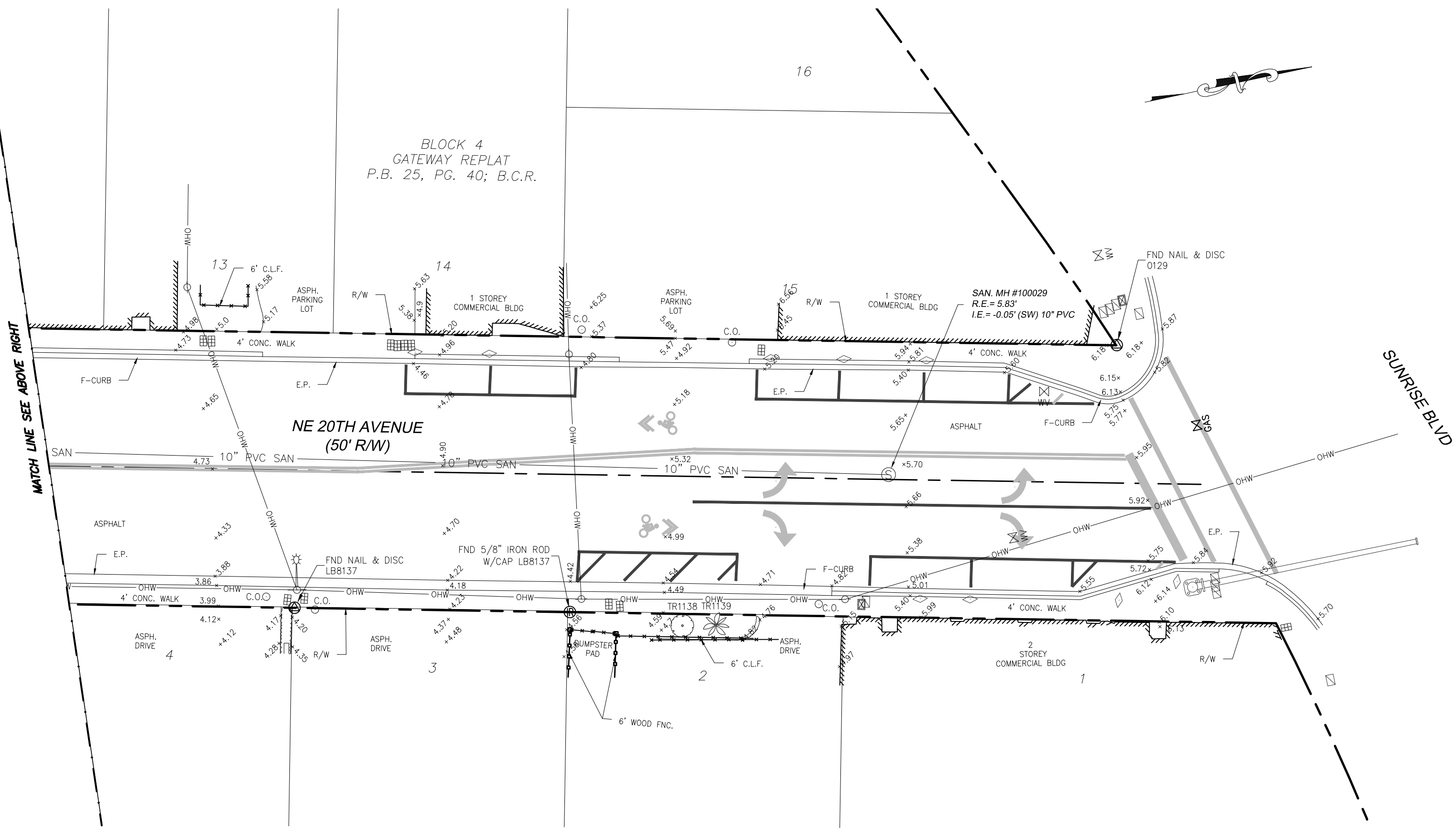
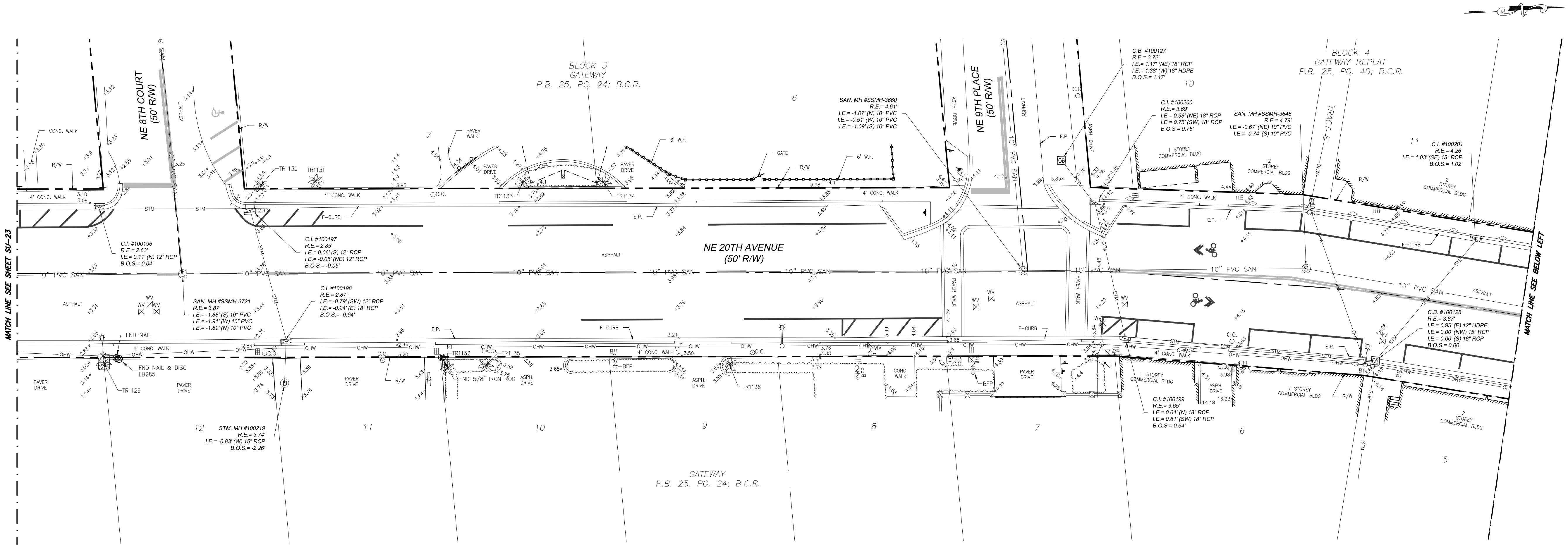


100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISONS		DESCRIPTION	
NO.	DATE	BY	CHK'D

PROJECT # 12082
STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

SHEET NO.	OF
SU-23	26
TOTAL:	26
CAD FILE:	CTA_12082SURV
DRAWING FILE NO.	



SURVEYOR
RICHARD PRYCE
FL PSM NO. 4038
DATE: 8/6/2024

DRAWN BY: DATE: 7/30/24
DESIGNED BY: SCALE: 1"=20'
CHECKED BY: JDR
FIELD BOOK: SEE SURVEY NOTE #5

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE



100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISITONS		DESCRIPTION	
NO.	DATE	BY	CHK'D

PROJECT # 12082
STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

SHEET NO.	OF
SU-24	26
TOTAL:	###
CAD FILE:	CTA_12082SURV
DRAWING FILE NO.	



PROJECT # 12082
STORMWATER IMPROVEMENTS
VICTORIA PARK NEIGHBORHOOD
SURVEY PLAN

SHEET NO.	OF
SU-25	26
TOTAL: 26	
CAD FILE: CTA_12082SURV	
DRAWING FILE NO.	

100 North Andrews Avenue, Fort Lauderdale, Florida 33301

DRAWN BY: JP, TY, JE	DATE: 7/30/24
DESIGNED BY: XX	SCALE: 1"=20'
CHECKED BY: JDR	
FIELD BOOK: SEE SURVEY NOTE #8	

SURVEYOR
RICHARD PRYCE
FL PSM NO: 4038
DATE: 8/6/2024

TEL: 954-739-6400
FAX: 954-739-6409

[illegible]

APPENDIX D – SUE TEST HOLE REPORT



TEST HOLE INVENTORY
 PROJECT: VICTORIA PARK
 PROJECT NO.: PF23119
 PROJECT MANAGER: ANDRES GARCIA
 CLIENT: HAZEN & SAWYER
 DATE: 10/29/24

TH#	REQUESTED UTILITY	UTILITY FOUND	REMARKS
1	6" WATER	6" WATER PVC (BLUE)	
2	10" WATER	SEE NOTE	SEE TEST HOLE FORM
3	WATER	10" STORM CORRUGATED METAL PIPE	SEE TEST HOLE FORM
4	10" WATER	10" WATER STEEL	
5	WATER	6" WATER PVC (BLACK/BLUE STRIPE)	
6	6" WATER	STORM	SEE TEST HOLE FORM
7	6" WATER	6" WATER WRAPPED STEEL	
8	FORCE MAIN	UNKNOWN STEEL	SEE TEST HOLE FORM
9	6" WATER	WATER	SEE TEST HOLE FORM
10	6" WATER	WATER	SEE TEST HOLE FORM
11	10" WATER	10" WATER DUCTILE IRON	
12	6" WATER	6" WATER DUCTILE IRON	
14	6" WATER	6" WATER DUCTILE IRON	
15	10" WATER	10" WATER DUCTILE IRON	
16	8" WATER	8" WATER DUCTILE IRON	
17	10" WATER	10" WATER DUCTILE IRON	
18	6" WATER	6" WATER DUCTILE IRON	
19	10" WATER	10" WATER DUCTILE IRON	
20	10" WATER	10" WATER CAST IRON	
21	12" WATER	12" WATER CAST IRON	
22	6" WATER	6" WATER CAST IRON	
23	6" WATER	6" WATER CAST IRON	
24	WATER	WATER	SEE TEST HOLE FORM
25	6" WATER	8" WATER DUCTILE IRON	
26	8" WATER	8" WATER WRAPPED STEEL	
27	48" FORCE MAIN	FORCE MAIN	SEE TEST HOLE FORM
28	10" SANITARY FORCE MAIN	SANITARY FORCE MAIN	SEE TEST HOLE FORM
29	6" WATER	2" WATER STEEL	
30	16" SANITARY FORCE MAIN	SANITARY FORCE MAIN DUCTILE IRON	SEE TEST HOLE FORM
31	16" SANITARY FORCE MAIN	SANITARY FORCE MAIN DUCTILE IRON	SEE TEST HOLE FORM
32	6" WATER	6" WATER HDPE	
33	16" SANITARY FORCE MAIN	SANITARY FORCE MAIN	SEE TEST HOLE FORM
34	18" SANITARY FORCE MAIN	SANITARY FORCE MAIN	SEE TEST HOLE FORM
35	WATER	SEE NOTE	SEE TEST HOLE FORM
36	WATER	WATER	SEE TEST HOLE FORM
37	6" WATER	WATER	SEE TEST HOLE FORM
38	36" WATER	WATER	SEE TEST HOLE FORM
39	6" WATER DUCTILE IRON	6" WATER DUCTILE IRON	
40	48" SANITARY FORCE MAIN	48" SANITARY FORCE MAIN HDPE	



41	12" WATER	WATER	SEE TEST HOLE FORM
42	36" SANITARY FORCE MAIN	SANITARY FORCE MAIN	SEE TEST HOLE FORM
43	48" SANITARY FORCE MAIN	SANITARY FORCE MAIN HDPE	SEE TEST HOLE FORM
44	6" WATER	WATER	SEE TEST HOLE FORM
45	48" SANITARY FORCE MAIN	SANITARY FORCE MAIN	SEE TEST HOLE FORM
46	48" FORCE MAIN	SANITARY FORCE MAIN	SEE TEST HOLE FORM
47	12" WATER DUCTILE IRON	WATER DUCTILE IRON	SEE TEST HOLE FORM
48	6" WATER	8" WATER DUCTILE IRON	
49	12" WATER	12" WATER DUCTILE IRON	
50	36" WATER	36" WATER DUCTILE IRON	
51	6" WATER	2" UNKNOWN	SEE TEST HOLE FORM
52	36" WATER	36" WATER DUCTILE IRON	
53	48" FORCE MAIN	FORCE MAIN	SEE TEST HOLE FORM
54	16" FORCE MAIN	FORCE MAIN	SEE TEST HOLE FORM
55	6" WATER	UNKNOWN	SEE TEST HOLE FORM
56	12" WATER	12" WATER CAST IRON	
57	48" FORCE MAIN	FORCE MAIN	SEE TEST HOLE FORM
58	6" WATER	6" WATER CAST IRON	
59	48" FORCE MAIN	FORCE MAIN	SEE TEST HOLE FORM
60	36" WATER	WATER	SEE TEST HOLE FORM

PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 6" WATER

SHEET #: SD OF 01

PROPOSED: UTILITY WORK

UTILITY FOUND: WATER

FORM BY: SD

ASSISTED BY: DC VT

OF HOLES: 1

MATERIAL AS FOUND: PVC (BLUE)

PAVING CONDITION: GOOD

DATE DUG: 09/09/24

SIZE AS FOUND: 6"

SOIL CONDITIONS: HARD SOFT DRY SAND ROCKY

UTILITY CONDITION: GOOD

ELEV SURVEY PIN

5.21

INSTALLED: PK

AT: CROWN OF UTILITY

MARKING TAPE: BLUE

EXIST. GRADE

0.30 ASPHALT
N/A

COVER (TOP)

2.90

2.31

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

FACING

NORTH

WIDTH

7"±

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

653850.28

939824.59

5.21

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:

NOT TO SCALE



NE 6TH ST.

EOP

EOP



28.5

12.9

12.2

6" W



NE 8TH AVE.

EOP

CAM #25-0925

"LOCATING A BETTER WAY"
UNDER IT

PN: PF23119

VACUUM TEST HOLE REPORT NO.: 2

PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 10" WATER UTILITY FOUND: SEE NOTE MATERIAL AS FOUND: CAST IN PLACE CONCRETE SIZE AS FOUND: SEE NOTE	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 01 PROPOSED: UTILITY WORK FORM BY: SD ASSISTED BY: DC VT # OF HOLES: 1 PAVING CONDITION: GOOD DATE DUG: 09/09/24 SOIL CONDITIONS: HARD SOFT DRY SAND ROCKY UTILITY CONDITION: SEE NOTE
---	---

ELEV SURVEY PIN

5.21

COVER (TOP)

0.55

ELEV. (TOP)

4.66

COVER (BOTTOM)

N/A

ELEV. (BOTTOM)

N/A

WIDTH

SEE NOTE

FACING

EAST

AT: **TOP** OF UTILITY MARKING TAPE: **WHITE**

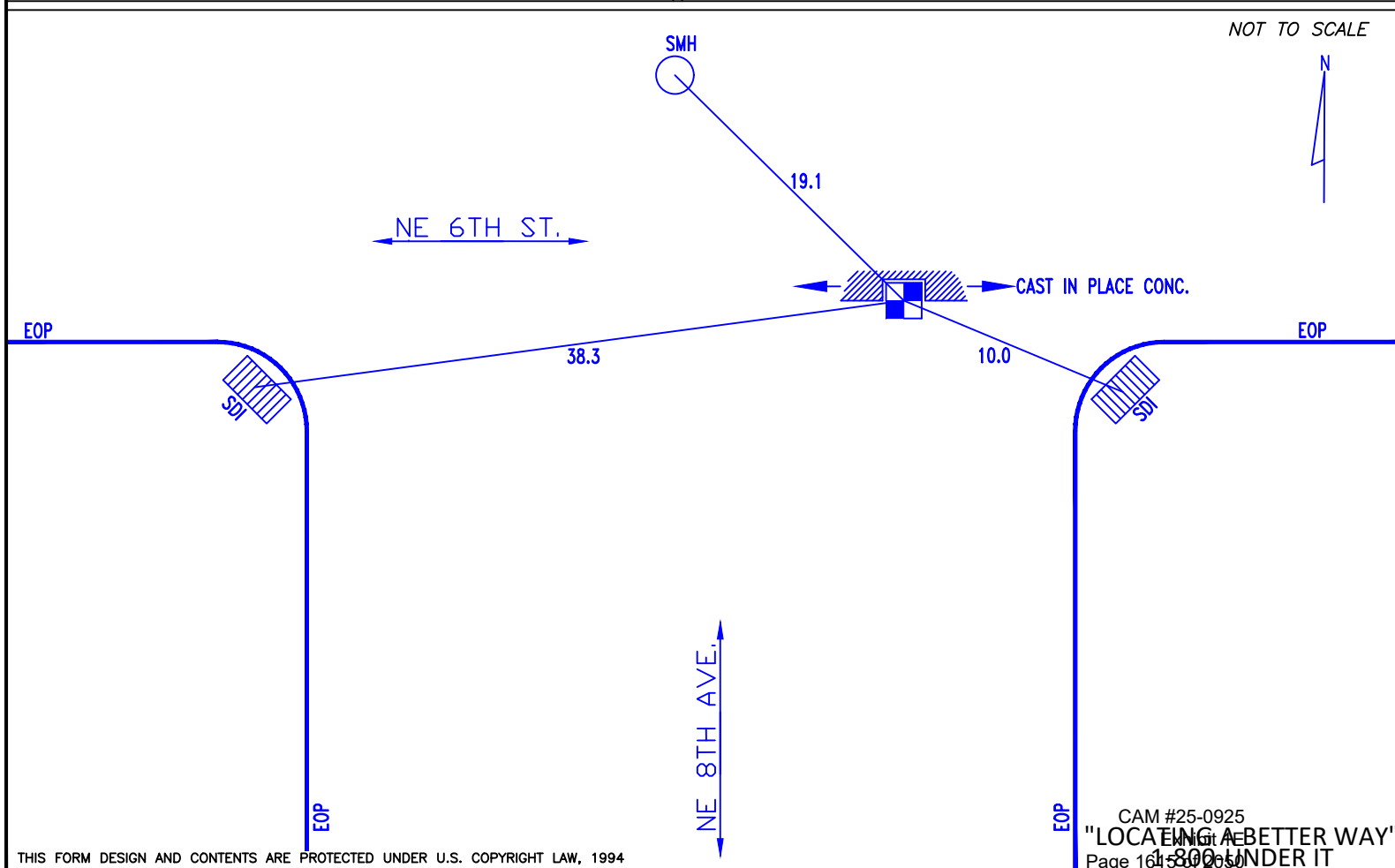
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
653860.34	939831.84	5.21

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: **TEST HOLE REVEALED CONCRETE OVER TOP OF UTILITY. UNABLE TO CONTINUE EXCAVATION DUE TO POSSIBLE DAMAGE. COVER TAKEN TO TOP OF SLAB.**



PN: PF23119

VACUUM TEST HOLE REPORT NO.: 3

PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: WATER UTILITY FOUND: STORM MATERIAL AS FOUND: CORRUGATED METAL PIPE SIZE AS FOUND: 10"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 01 PROPOSED: UTILITY WORK FORM BY: SD ASSISTED BY: DC VT # OF HOLES: 1 PAVING CONDITION: GOOD DATE DUG: 09/09/24 SOIL CONDITIONS: HARD SOFT WET DRY SAND ROCKY UTILITY CONDITION: SEE NOTE
--	---

ELEV SURVEY PIN

4.14

COVER (TOP)

1.75

2.39

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

WIDTH

10"±

FACING

NORTH

AT: **CROWN OF UTILITY** MARKING TAPE: **GREEN**

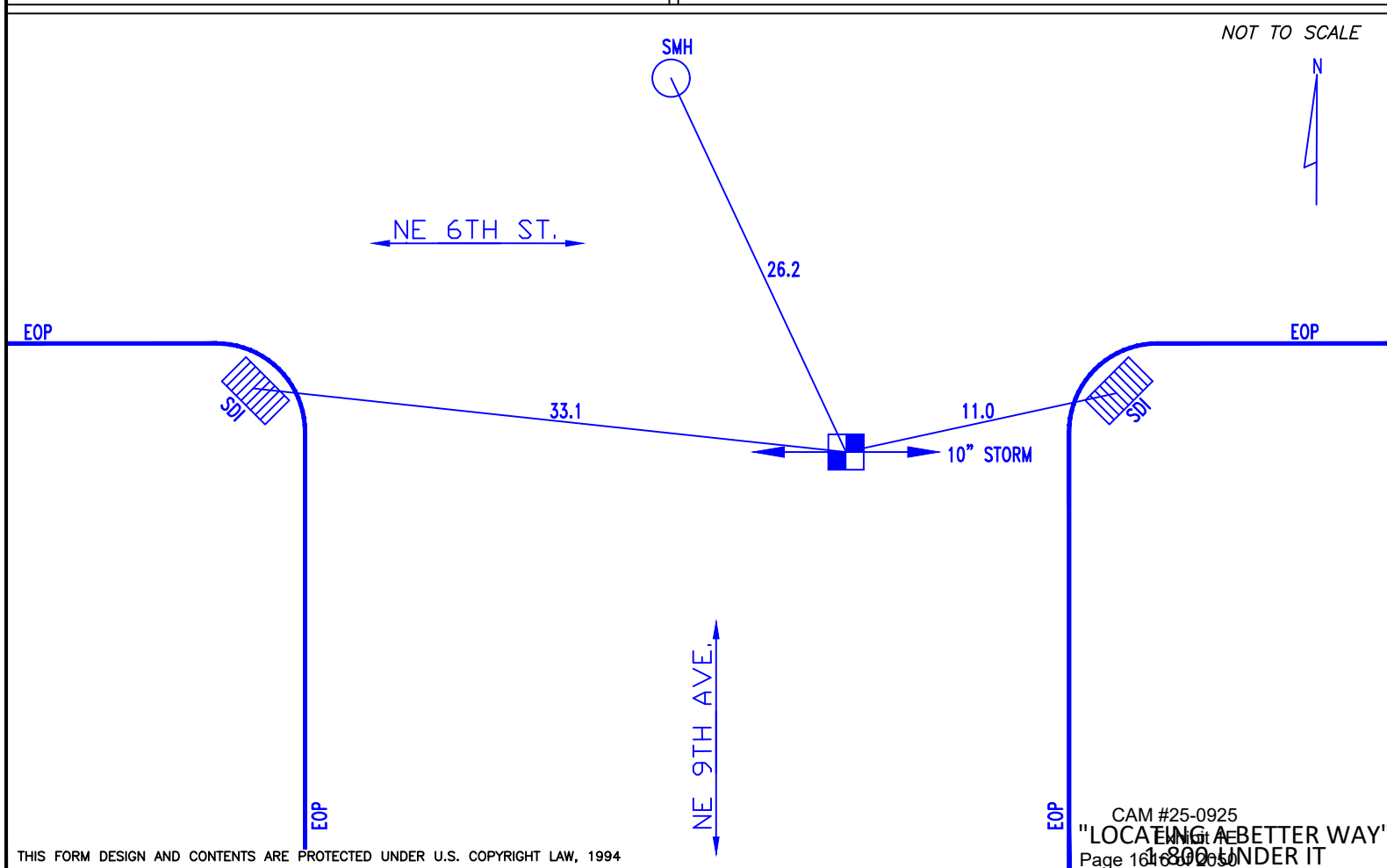
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
653861.80	940160.52	4.14

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: **WATER REQUESTED, TEST HOLE REVEALED STORM LINE. DUG TO A DEPTH OF 6.3' AND PROBED TO 10' ON SOUTH SIDE OF STORM LINE. NO WATER MAIN FOUND.**



PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 10" WATER UTILITY FOUND: WATER MATERIAL AS FOUND: STEEL SIZE AS FOUND: 10"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 02 PROPOSED: UTILITY WORK FORM BY: SD ASSISTED BY: VT # OF HOLES: 1 PAVING CONDITION: GOOD DATE DUG: 09/11/24 SOIL CONDITIONS: HARD SOFT MOIST SAND ROCKY UTILITY CONDITION: GOOD
--	--

ELEV SURVEY PIN

4.97

COVER (TOP)

3.23

1.74

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

WIDTH

11"±

FACING

WEST

INSTALLED: **PK** AT: **CROWN OF UTILITY** MARKING TAPE: **BLUE**

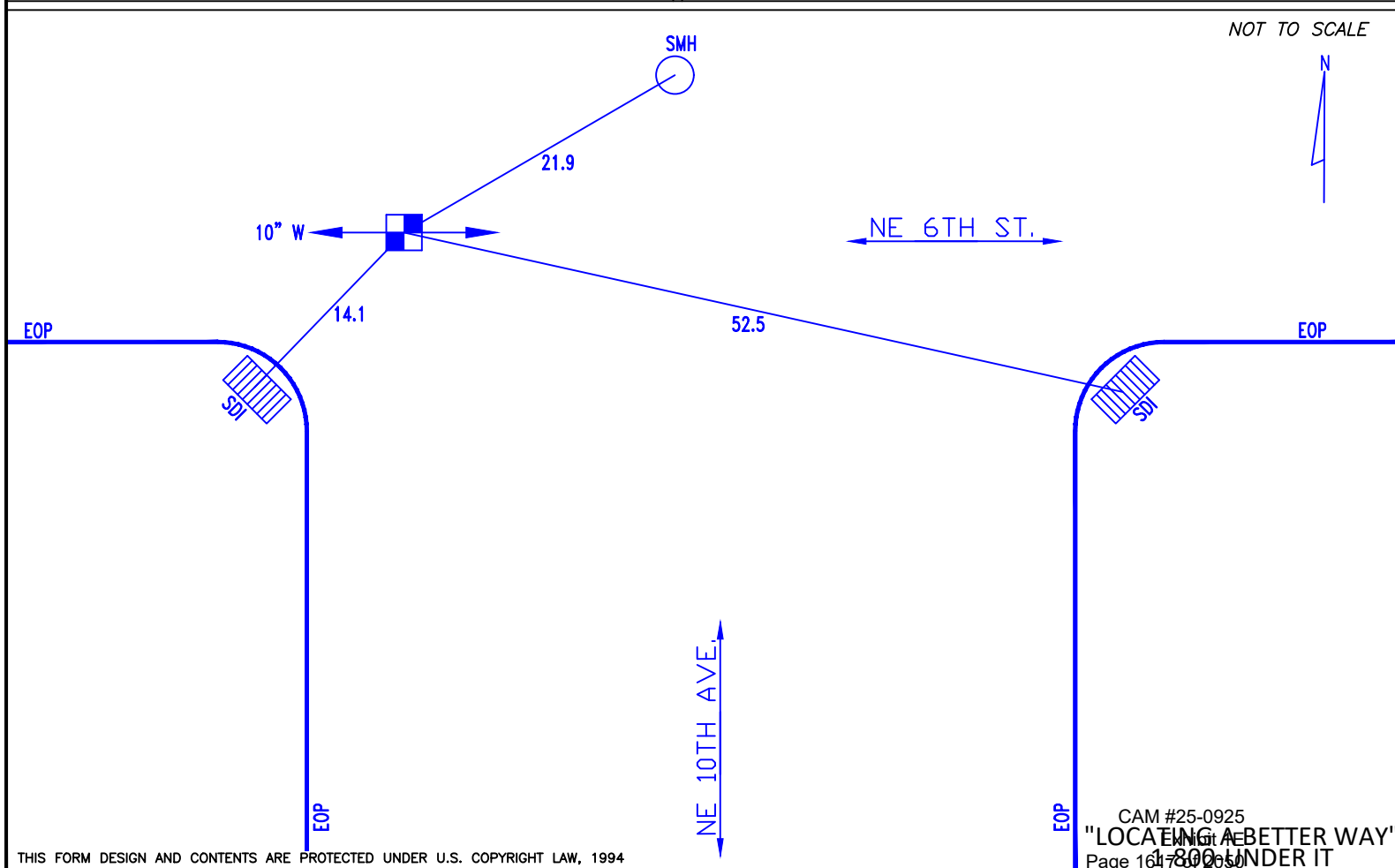
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
653879.62	940460.66	4.97

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:



PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: WATER UTILITY FOUND: WATER MATERIAL AS FOUND: PVC (BLACK/BLUE STRIPED) SIZE AS FOUND: 6"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 02 PROPOSED: UTILITY WORK FORM BY: SD ASSISTED BY: DC VT # OF HOLES: 1 PAVING CONDITION: GOOD DATE DUG: 09/09/24 SOIL CONDITIONS: HARD SOFT DRY SAND ROCKY UTILITY CONDITION: GOOD
--	--

ELEV SURVEY PIN

4.82

EXIST. GRADE

COVER (TOP)

3.05

COVER (BOTTOM)

N/A

ELEV. (TOP)

1.77

ELEV. (BOTTOM)

N/A

INSTALLED: **PK** AT: **CROWN OF UTILITY** MARKING TAPE: **BLUE**

0.30 ASPHALT
N/A

WIDTH
7"±

FACING
NORTH

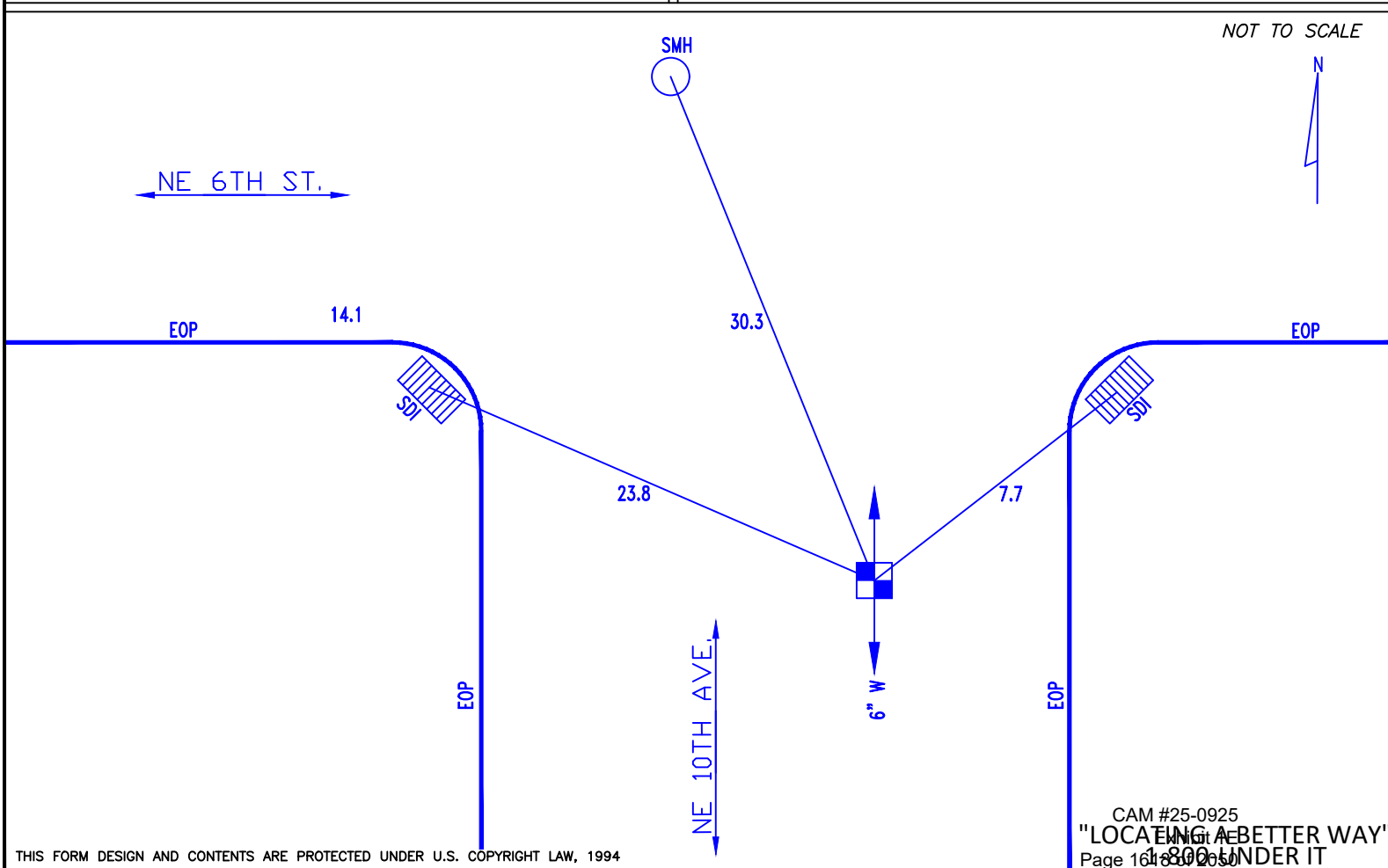
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
653866.44	940483.80	4.82

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:



PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 6" WATER UTILITY FOUND: STORM MATERIAL AS FOUND: SEE NOTE SIZE AS FOUND: SEE NOTE	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 02 PROPOSED: UTILITY WORK FORM BY: SD ASSISTED BY: VT # OF HOLES: 1 PAVING CONDITION: GOOD DATE DUG: 09/11/24 SOIL CONDITIONS: HARD SOFT MOIST SAND ROCKY UTILITY CONDITION: SEE NOTE
---	---

ELEV SURVEY PIN

5.49

EXIST. GRADE

COVER (TOP)

2.80

COVER (BOTTOM)

N/A

ELEV. (TOP)

2.69

ELEV. (BOTTOM)

N/A

INSTALLED: **PK** AT: **TOP** OF UTILITY MARKING TAPE: **GREEN**

0.30 ASPHALT
N/A

WIDTH
SEE NOTE

FACING
EAST

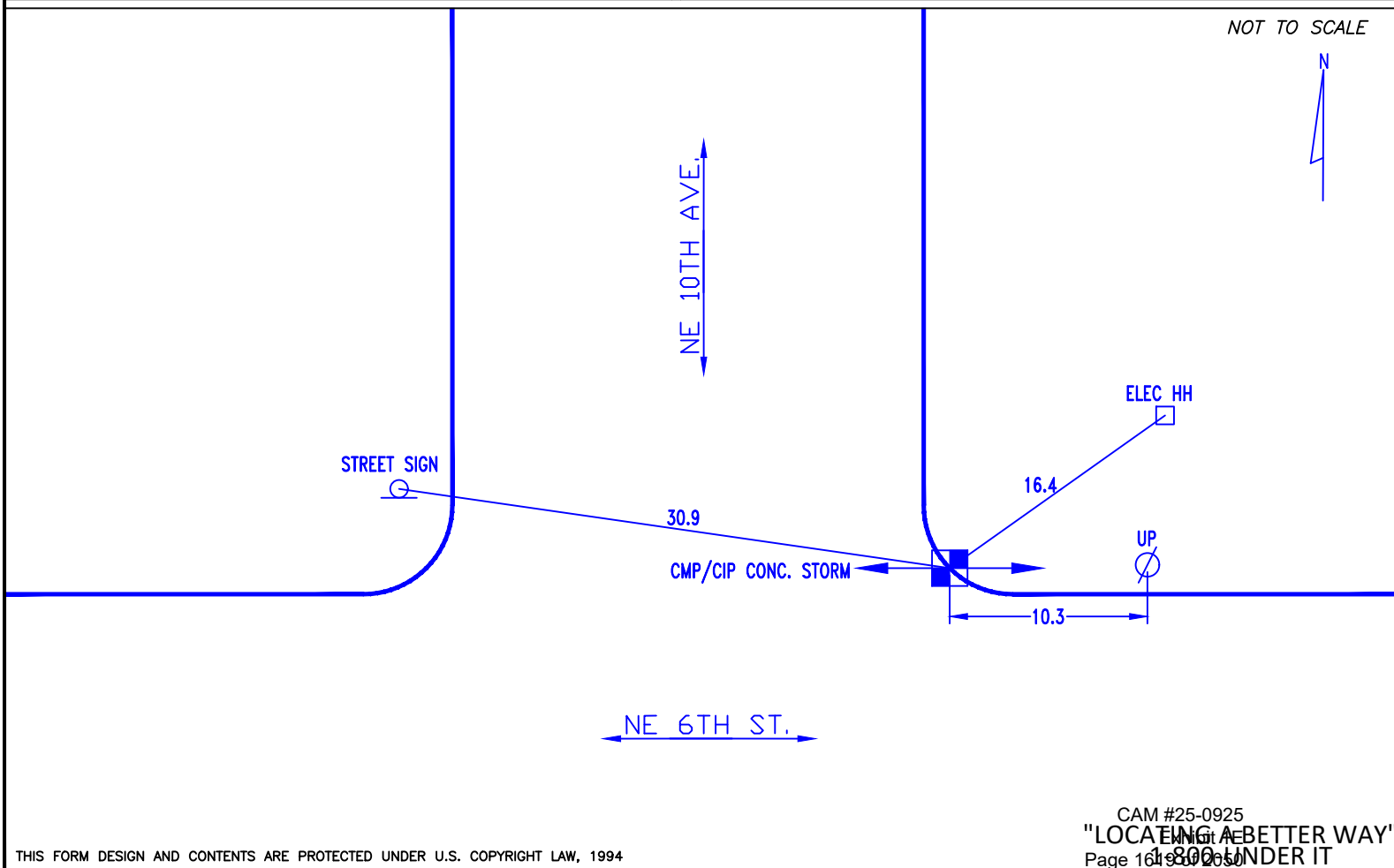
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
653915.72	940571.59	5.49

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: TEST HOLE DUG ON ELECTRONIC SIGNAL AT REQUESTED LOCATION. TEST HOLE REVEALED CORRUGATED METAL PIPE WITH CAST IN PLACE CONCRETE DIRECTLY ON TOP OF IT. UNABLE TO DETERMINE WIDTH.



PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 6" WATER

SHEET #: SD OF 03

PROPOSED: UTILITY WORK

UTILITY FOUND: WATER

FORM BY: SD

ASSISTED BY: VT

OF HOLES: 1

MATERIAL AS FOUND: WRAPPED STEEL

PAVING CONDITION: N/A

DATE DUG: 09/12/24

SIZE AS FOUND: 6"

SOIL CONDITIONS: HARD MOIST SAND ROCKY

UTILITY CONDITION: GOOD

ELEV SURVEY PIN

5.38

INSTALLED: PK

AT: CROWN OF UTILITY

MARKING TAPE: BLUE

EXIST. GRADE

COVER (TOP)

3.44

ELEV. (TOP)

COVER (BOTTOM)

N/A

ELEV. (BOTTOM)

FACING

NORTH

WIDTH

7"±

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

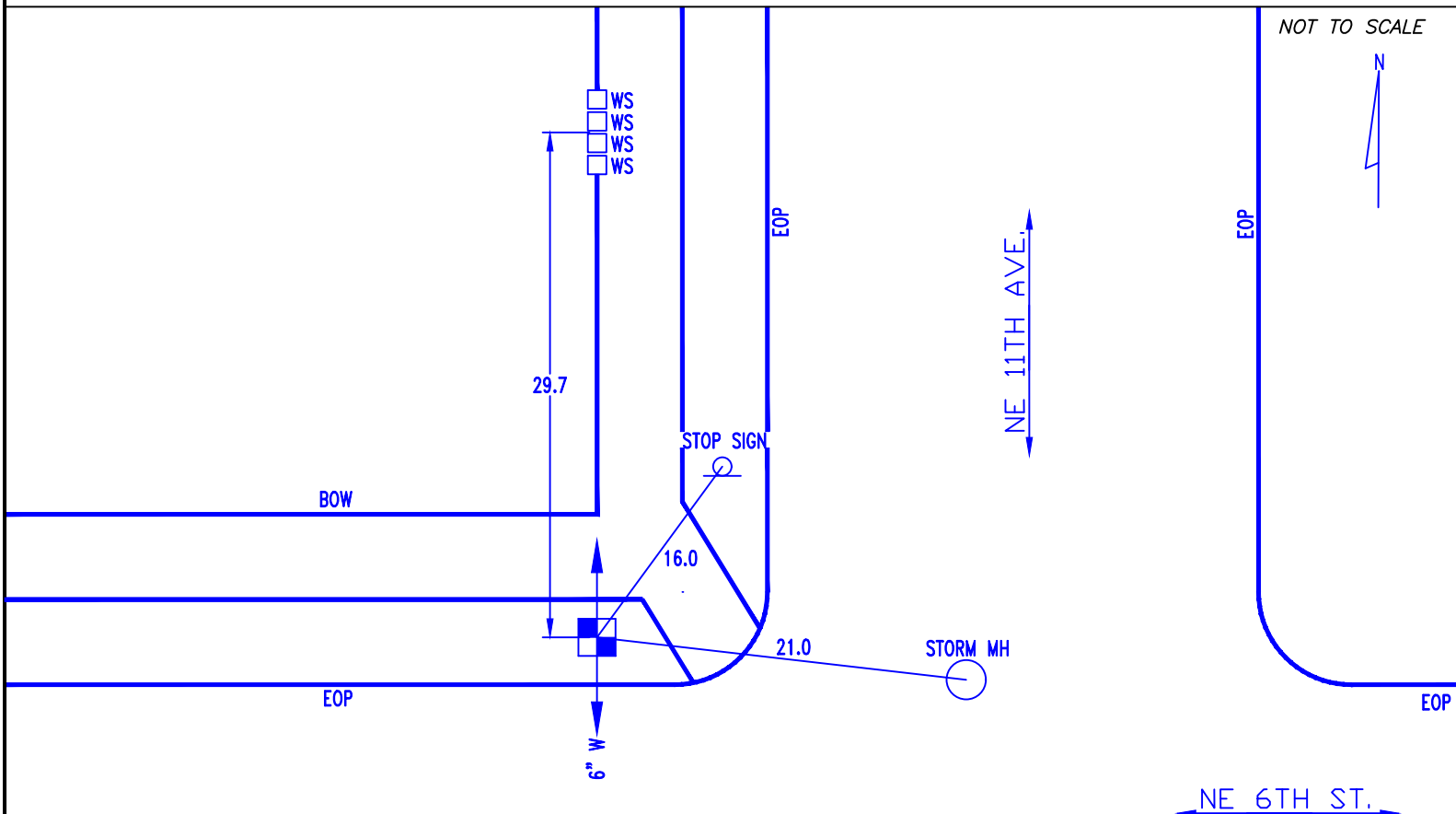
653923.88

940848.03

5.38

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:



NOT TO SCALE



PN: PF23119

VACUUM TEST HOLE REPORT NO.: 8

PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: N/A UTILITY FOUND: UNKNOWN MATERIAL AS FOUND: STEEL SIZE AS FOUND: SEE NOTE	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 03 PROPOSED: UTILITY WORK FORM BY: SD ASSISTED BY: VT # OF HOLES: 1 PAVING CONDITION: GOOD DATE DUG: 09/12/24 SOIL CONDITIONS: HARD WET MOIST SAND ROCKY UTILITY CONDITION: SEE NOTE
---	---

ELEV SURVEY PIN

5.15

COVER (TOP)

6.46

-1.31

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

WIDTH

SEE NOTE

FACING
EAST

AT: **EDGE** OF UTILITY MARKING TAPE: **PINK**

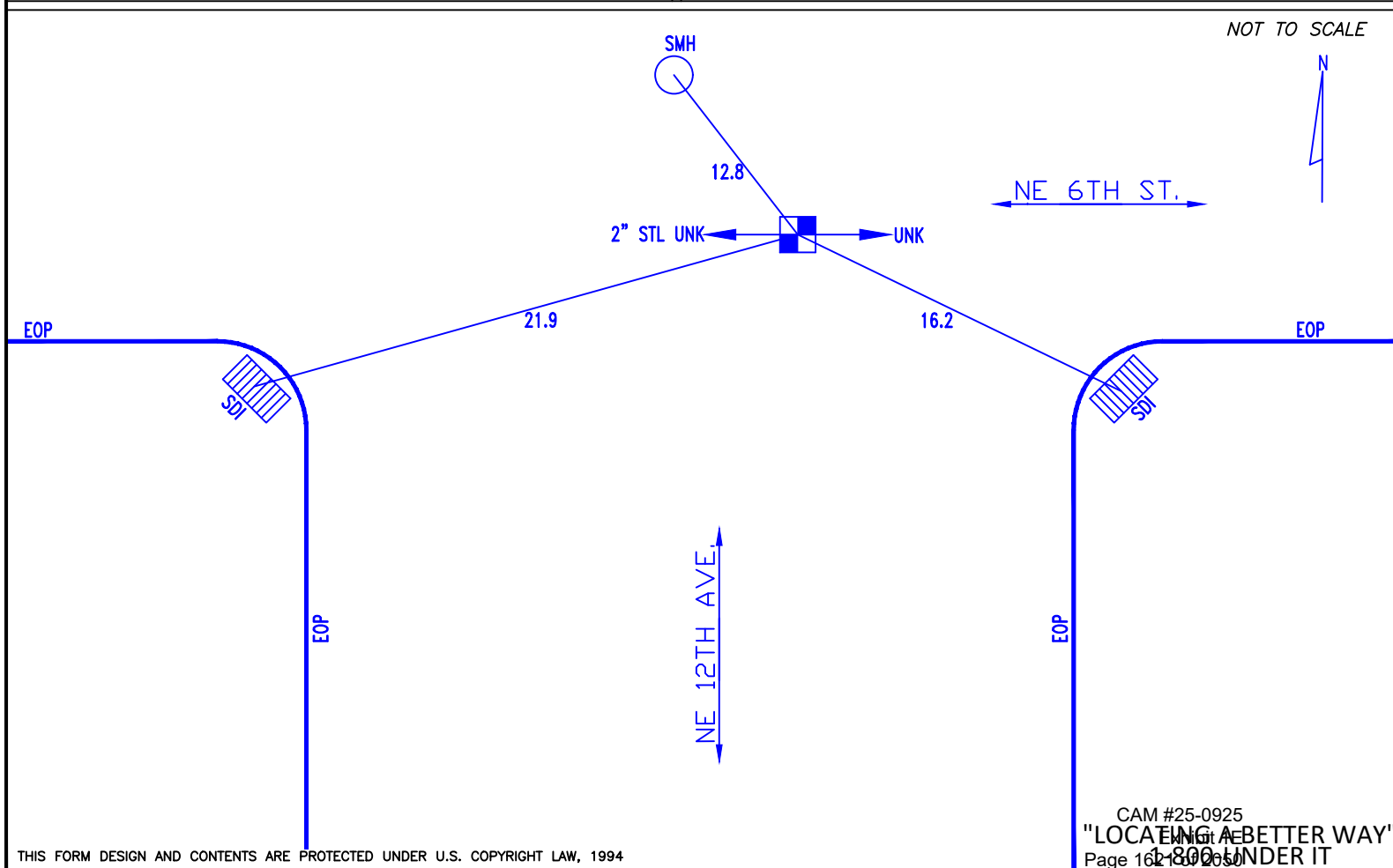
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
653902.62	941138.09	5.15

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: UNABLE TO OBTAIN CROWN OF UTILITY, ADDITIONAL TEST HOLE NEEDED. UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER. TEST HOLE REVEALED 2" STEEL UNKNOWN UTILITY RUNNING EAST–WEST, OFFSET 1.95'± NORTH OF PK. PK SET ON NORTHERNMOST EDGE OF UTILITY FOUND.



PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 6" WATER

SHEET #: SD OF 03

PROPOSED: UTILITY WORK

UTILITY FOUND: WATER

FORM BY: SD

ASSISTED BY: VT

OF HOLES: 1

MATERIAL AS FOUND: SEE NOTE

PAVING CONDITION: GOOD

DATE DUG: 09/12/24

SIZE AS FOUND: SEE NOTE

SOIL CONDITIONS: HARD

UTILITY CONDITION: SEE NOTE

ELEV SURVEY PIN

4.96

INSTALLED: PK

AT: CROWN OF UTILITY

MARKING TAPE: BLUE

EXIST. GRADE

0.40 ASPHALT
N/A

COVER (TOP)

3.05

1.91

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

FACING

NORTH

WIDTH

SEE NOTE

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

653892.53

941142.90

4.96

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER. PLANS INDICATE 6" WATER MAIN.

NOT TO SCALE

NE 6TH ST.

SMH

23.9

24.2

8.2

EOP

EOP

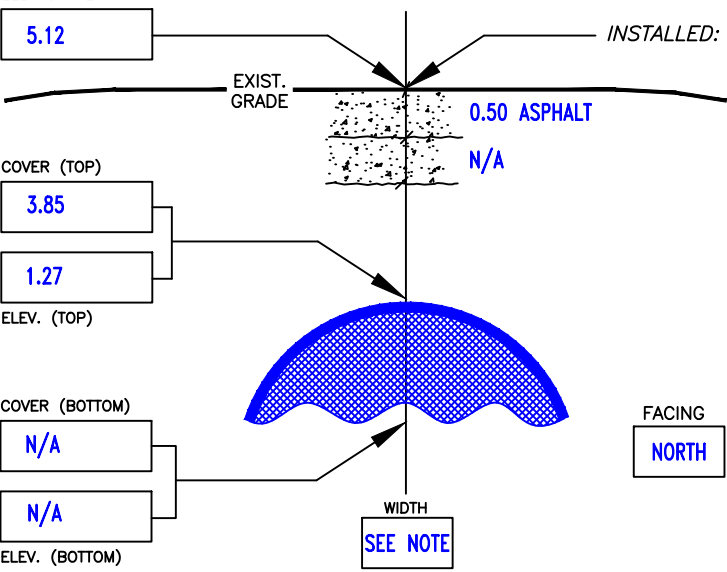
EOP

EOP

NE 12TH AVE.

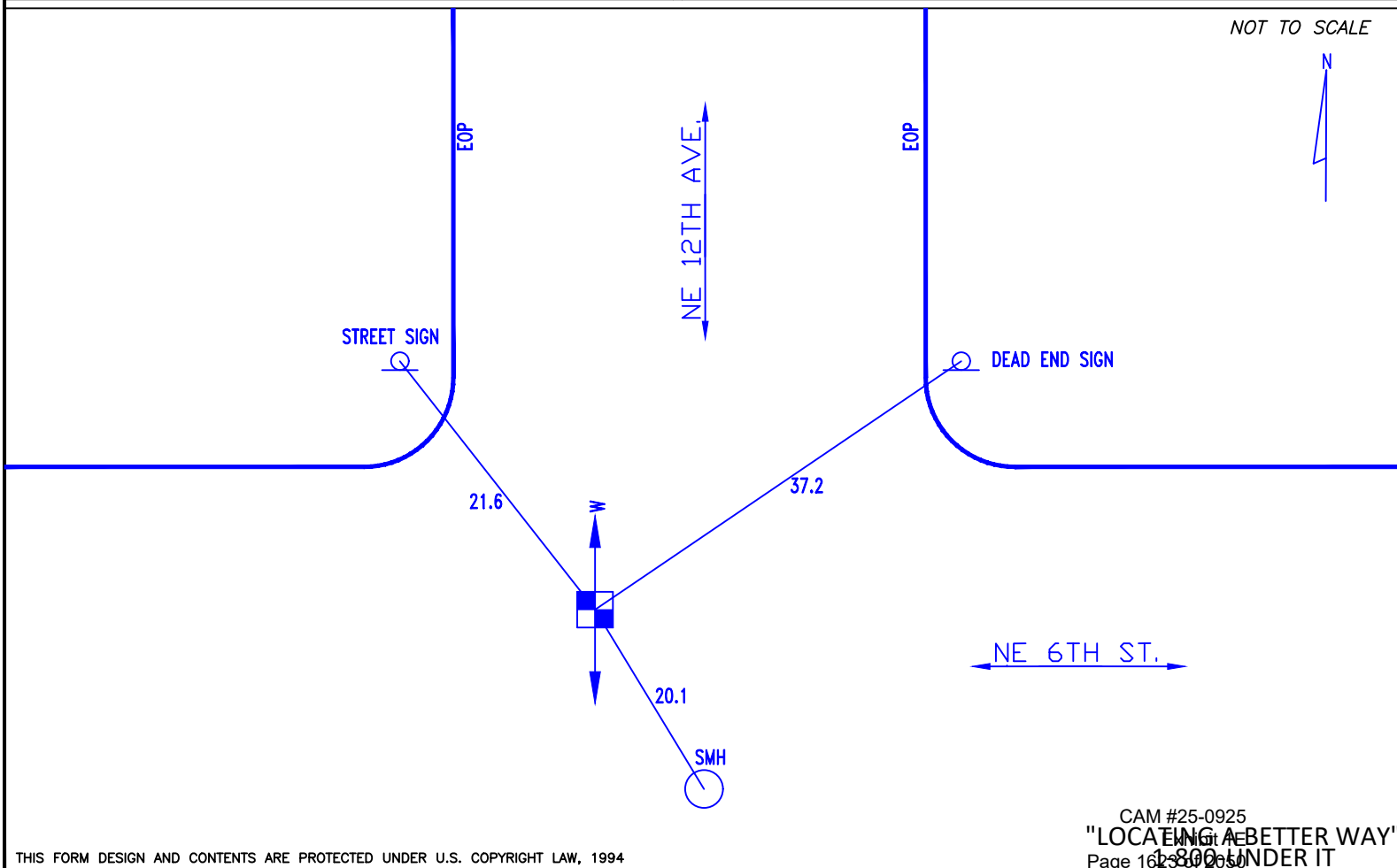
PROJECT NAME: VICTORIA PARK – TEST HOLES	CLIENT JOB# N/A	WORK ORDER # N/A
LOCATE REQUESTED BY: HAZEN & SAWYER	PROJECT LOCATION: FT. LAUDERDALE, FL	
UTILITY REQUESTED: 6" WATER	SHEET #: SD OF 03	PROPOSED: UTILITY WORK
UTILITY FOUND: WATER	FORM BY: SD	ASSISTED BY: A DC VT # OF HOLES: 1
MATERIAL AS FOUND: SEE NOTE	PAVING CONDITION: GOOD	DATE DUG: 09/12/24
SIZE AS FOUND: SEE NOTE	SOIL CONDITIONS: HARD WET MOIST DRY SAND ROCKY	
UTILITY CONDITION: SEE NOTE		

ELEV SURVEY PIN 5.12	INSTALLED: PK	AT: CROWN OF UTILITY	MARKING TAPE: BLUE
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COVER (TOP) 3.85	ELEV. (TOP) 1.27	COVER (BOTTOM) N/A	ELEV. (BOTTOM) N/A	WIDTH SEE NOTE	FACING NORTH

SURVEY PIN LOCATED BY: IMC		
SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).		
NORTH 653933.63	EAST 941168.70	GRADE ELEV. 5.12
HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.		
NOTES: UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER. PLANS INDICATE 6" WATER MAIN.		



PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 10" WATER UTILITY FOUND: WATER MATERIAL AS FOUND: DUCTILE IRON SIZE AS FOUND: 10"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 04 PROPOSED: UTILITY WORK FORM BY: SD ASSISTED BY: DC VT # OF HOLES: 1 PAVING CONDITION: GOOD DATE DUG: 09/13/24 SOIL CONDITIONS: HARD SOFT DRY SAND ROCKY UTILITY CONDITION: GOOD
---	---

ELEV SURVEY PIN

6.12

COVER (TOP)

3.30

2.82

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

WIDTH

11"±

FACING

EAST

AT: **CROWN OF UTILITY** MARKING TAPE: **BLUE**

SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
653911.87	941454.90	6.12

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:

PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 6" WATER UTILITY FOUND: WATER MATERIAL AS FOUND: DUCTILE IRON SIZE AS FOUND: 6"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 04 PROPOSED: UTILITY WORK FORM BY: SD ASSISTED BY: DC VT # OF HOLES: 1 PAVING CONDITION: GOOD DATE DUG: 09/13/24 SOIL CONDITIONS: HARD DRY SAND ROCKY UTILITY CONDITION: GOOD
---	---

ELEV SURVEY PIN

6.76

EXIST. GRADE

COVER (TOP)

3.33

3.43

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

INSTALLED: **PK** AT: **CROWN OF UTILITY** MARKING TAPE: **BLUE**

0.50 ASPHALT
N/A

WIDHTH
7"±

FACING
NORTH

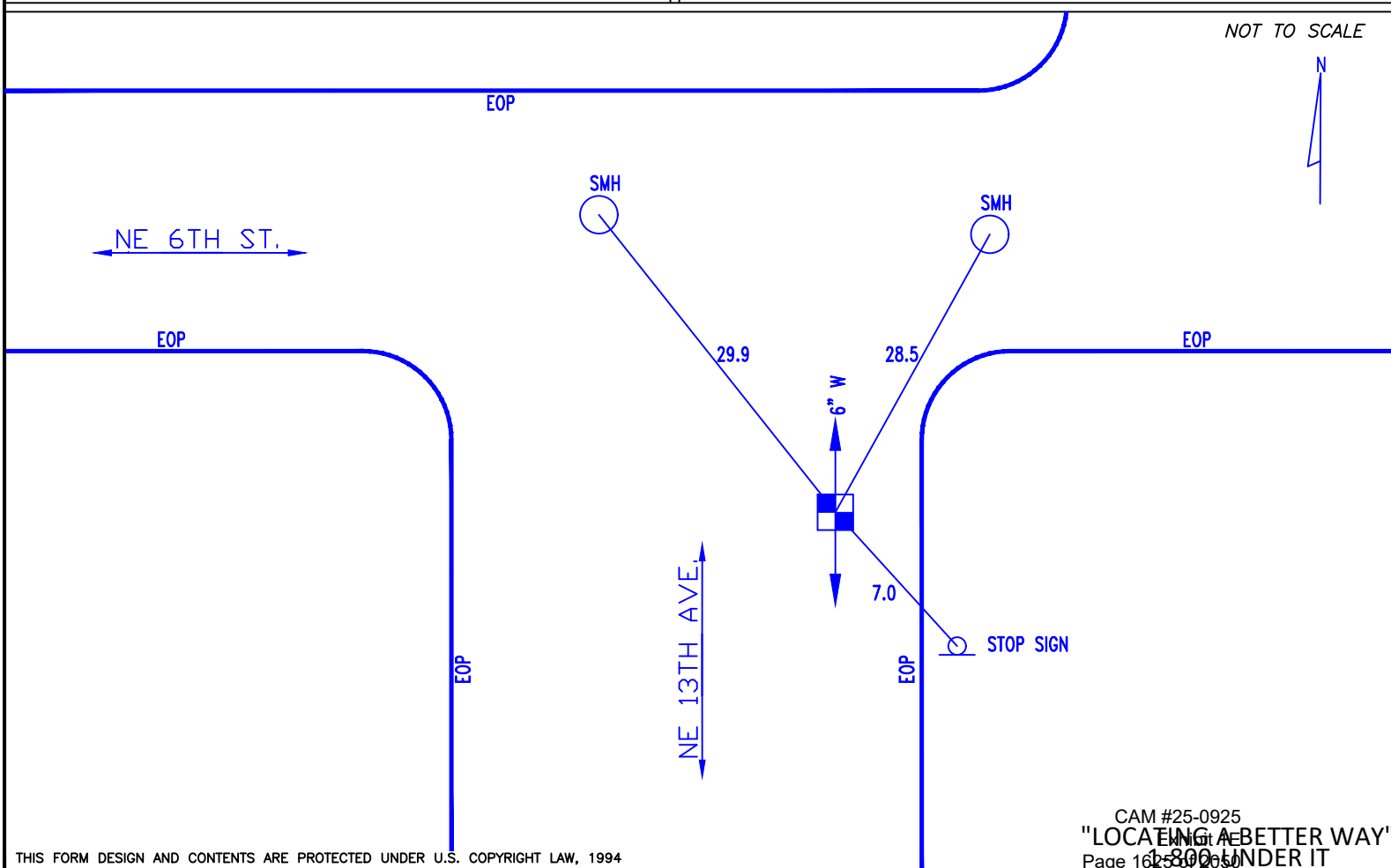
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
653900.52	941480.51	6.76

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:



PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 10" WATER UTILITY FOUND: WATER MATERIAL AS FOUND: DUCTILE IRON SIZE AS FOUND: 10"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 05 PROPOSED: UTILITY WORK FORM BY: DL ASSISTED BY: JA # OF HOLES: DC PAVING CONDITION: GOOD DATE DUG: 09/13/24 SOIL CONDITIONS: HARD SOFT MOIST SAND ROCKY UTILITY CONDITION: GOOD
---	--

ELEV SURVEY PIN

7.44

EXIST. GRADE

COVER (TOP)

3.14

COVER (BOTTOM)

N/A

ELEV. (TOP)

4.30

ELEV. (BOTTOM)

N/A

INSTALLED: **PK**

AT: **CROWN OF UTILITY**

MARKING TAPE: **BLUE**

SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
653920.89	941780.94	7.44

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:

0.40 ASPHALT

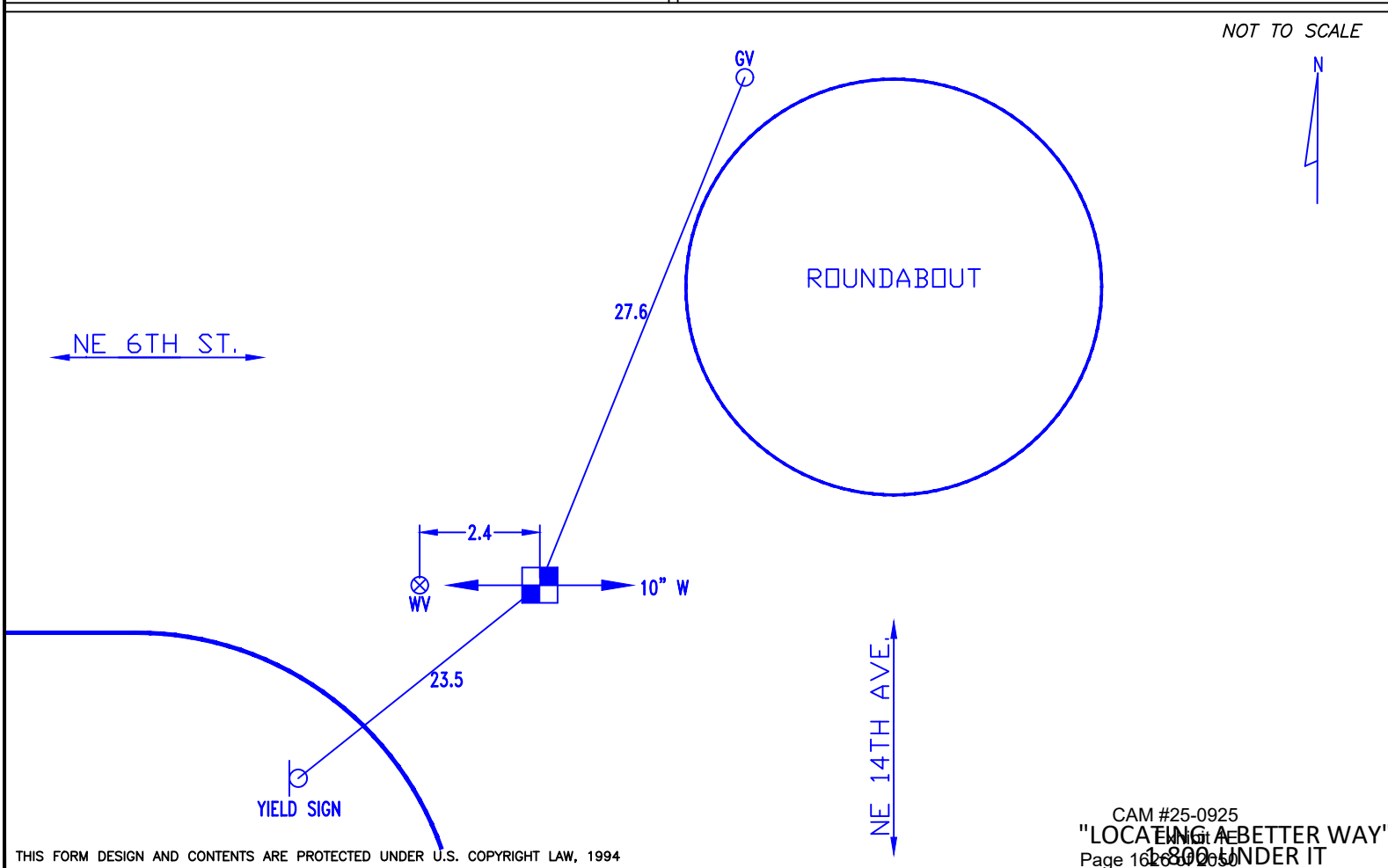
N/A

WIDTH

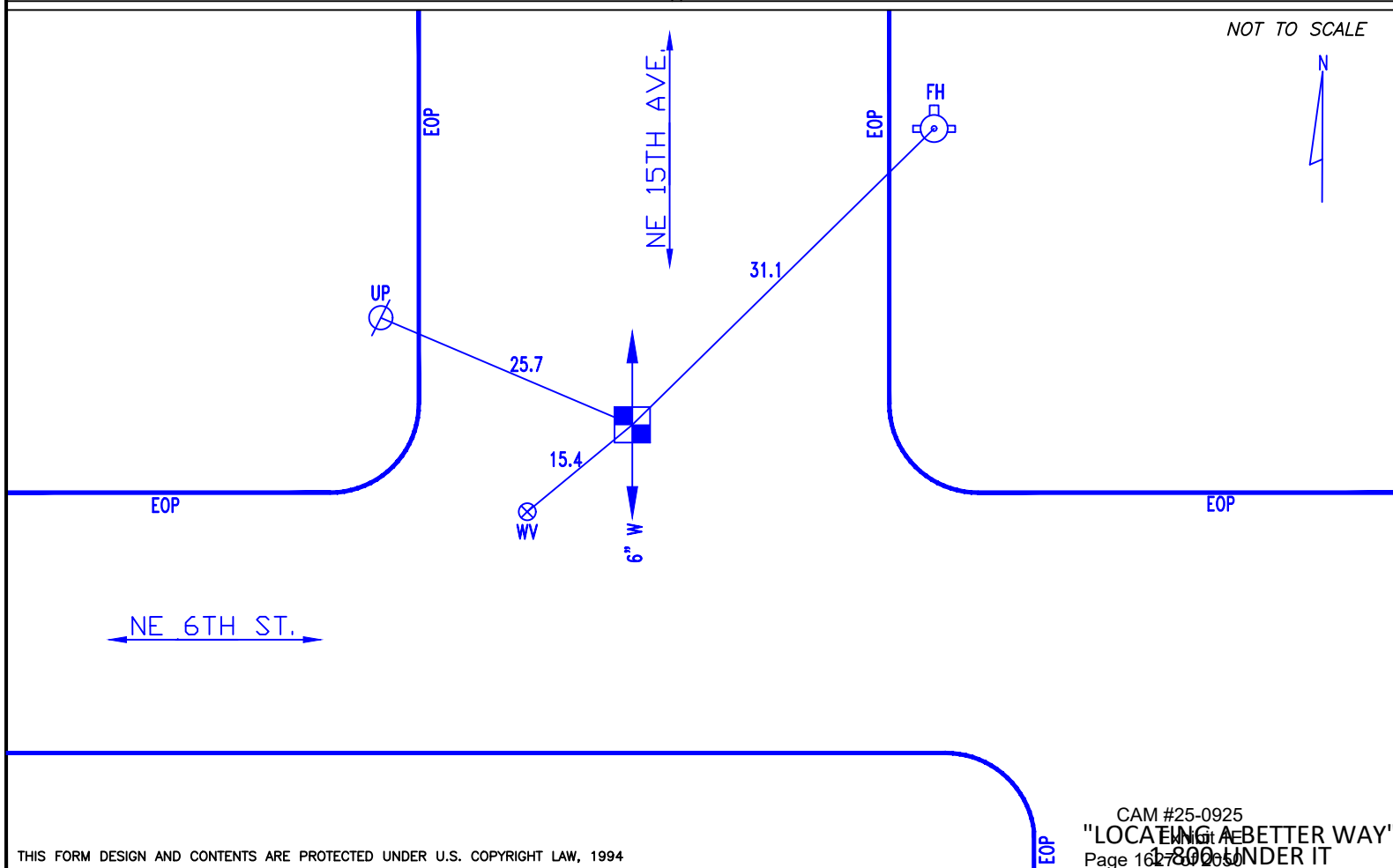
11"±

FACING

EAST



PROJECT NAME: VICTORIA PARK – TEST HOLES	CLIENT JOB# N/A	WORK ORDER # N/A						
LOCATE REQUESTED BY: HAZEN & SAWYER	PROJECT LOCATION: FT. LAUDERDALE, FL							
UTILITY REQUESTED: 6" WATER	SHEET #: SD OF 05	PROPOSED: UTILITY WORK						
UTILITY FOUND: WATER	FORM BY: SD	ASSISTED BY: DC VT # OF HOLES: 1						
MATERIAL AS FOUND: DUCTILE IRON	PAVING CONDITION: GOOD	DATE DUG: 09/13/24						
SIZE AS FOUND: 6"	SOIL CONDITIONS: HARD DRY SAND ROCKY							
	UTILITY CONDITION: GOOD							
ELEV SURVEY PIN 7.50 EXIST. GRADE 0.60 ASPHALT N/A COVER (TOP) 2.10 5.40 ELEV. (TOP) COVER (BOTTOM) N/A N/A ELEV. (BOTTOM) WIDTH 7"± FACING NORTH INSTALLLED: PK AT: CROWN OF UTILITY MARKING TAPE: BLUE	SURVEY PIN LOCATED BY: IMC SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET). <table> <tr> <td>NORTH</td> <td>EAST</td> <td>GRADE ELEV.</td> </tr> <tr> <td>653953.64</td> <td>942086.88</td> <td>7.50</td> </tr> </table> HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT. NOTES:		NORTH	EAST	GRADE ELEV.	653953.64	942086.88	7.50
NORTH	EAST	GRADE ELEV.						
653953.64	942086.88	7.50						



PROJECT NAME: VICTORIA PARK – TEST HOLES – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 10" WATER

SHEET #: SD OF 05

PROPOSED: UTILITY WORK

UTILITY FOUND: WATER

FORM BY: SD

ASSISTED BY: DC VT

OF HOLES: 1

MATERIAL AS FOUND: DUCTILE IRON

PAVING CONDITION: GOOD

DATE DUG: 09/13/24

SIZE AS FOUND: 10"

SOIL CONDITIONS: HARD DRY SAND ROCKY

UTILITY CONDITION: GOOD

ELEV SURVEY PIN

7.83

INSTALLED: PK

AT: CROWN OF UTILITY

MARKING TAPE: BLUE

EXIST. GRADE

0.50 ASPHALT
N/A

COVER (TOP)

2.98

4.85

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

FACING

EAST

WIDTH

11"±

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

653919.52

942136.09

7.83

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:

NOT TO SCALE

EOP

23.8

NE 6TH ST.

10" WM

EOP

59.6

54.3

EOP

STOP SIGN

STOP SIGN

EOP

EOP

NE 15TH AVE.

PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 8" WATER UTILITY FOUND: WATER MATERIAL AS FOUND: DUCTILE IRON SIZE AS FOUND: 8"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 06 PROPOSED: UTILITY WORK FORM BY: SD ASSISTED BY: DC VT # OF HOLES: 1 PAVING CONDITION: GOOD DATE DUG: 09/16/24 SOIL CONDITIONS: HARD DRY SAND ROCKY UTILITY CONDITION: GOOD
---	--

ELEV SURVEY PIN

7.67

COVER (TOP)

COVER (BOTTOM)

ELEV. (TOP)

ELEV. (BOTTOM)

WIDTH

FACING

INSTALLED: **PK** AT: **CROWN OF UTILITY** MARKING TAPE: **BLUE**

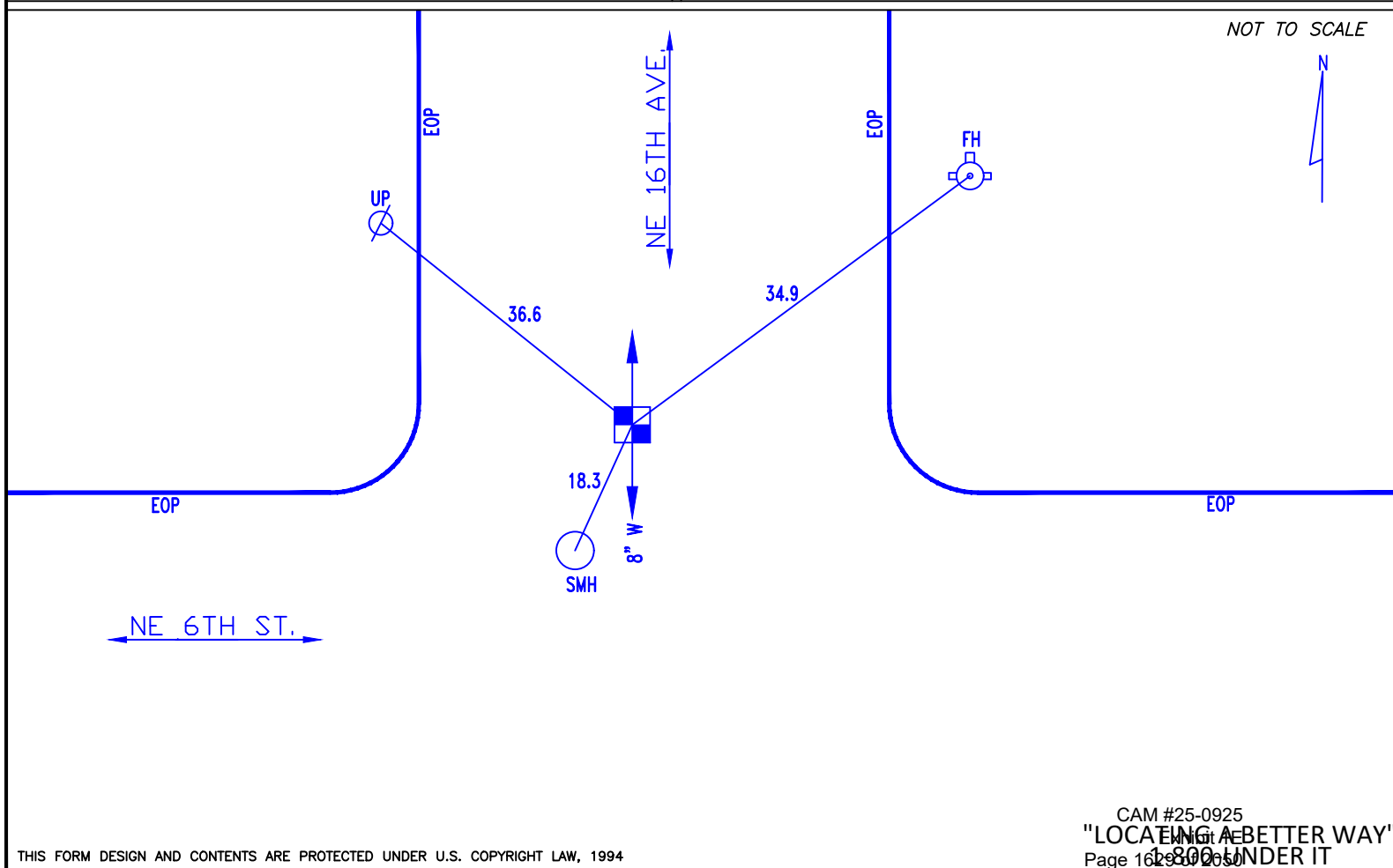
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
653953.80	942470.47	7.67

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:



PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 10" WATER UTILITY FOUND: WATER MATERIAL AS FOUND: DUCTILE IRON SIZE AS FOUND: 10"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 07 PROPOSED: UTILITY WORK FORM BY: SD ASSISTED BY: DC VT # OF HOLES: 1 PAVING CONDITION: GOOD DATE DUG: 09/16/24 SOIL CONDITIONS: HARD SOFT DRY SAND ROCKY UTILITY CONDITION: GOOD
---	--

ELEV SURVEY PIN

7.67

EXIST. GRADE

COVER (TOP)

2.82

4.85

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

INSTALLED: **PK** AT: **CROWN OF UTILITY** MARKING TAPE: **BLUE**

0.30 ASPHALT
N/A

WIDTH
11"±

FACING
EAST

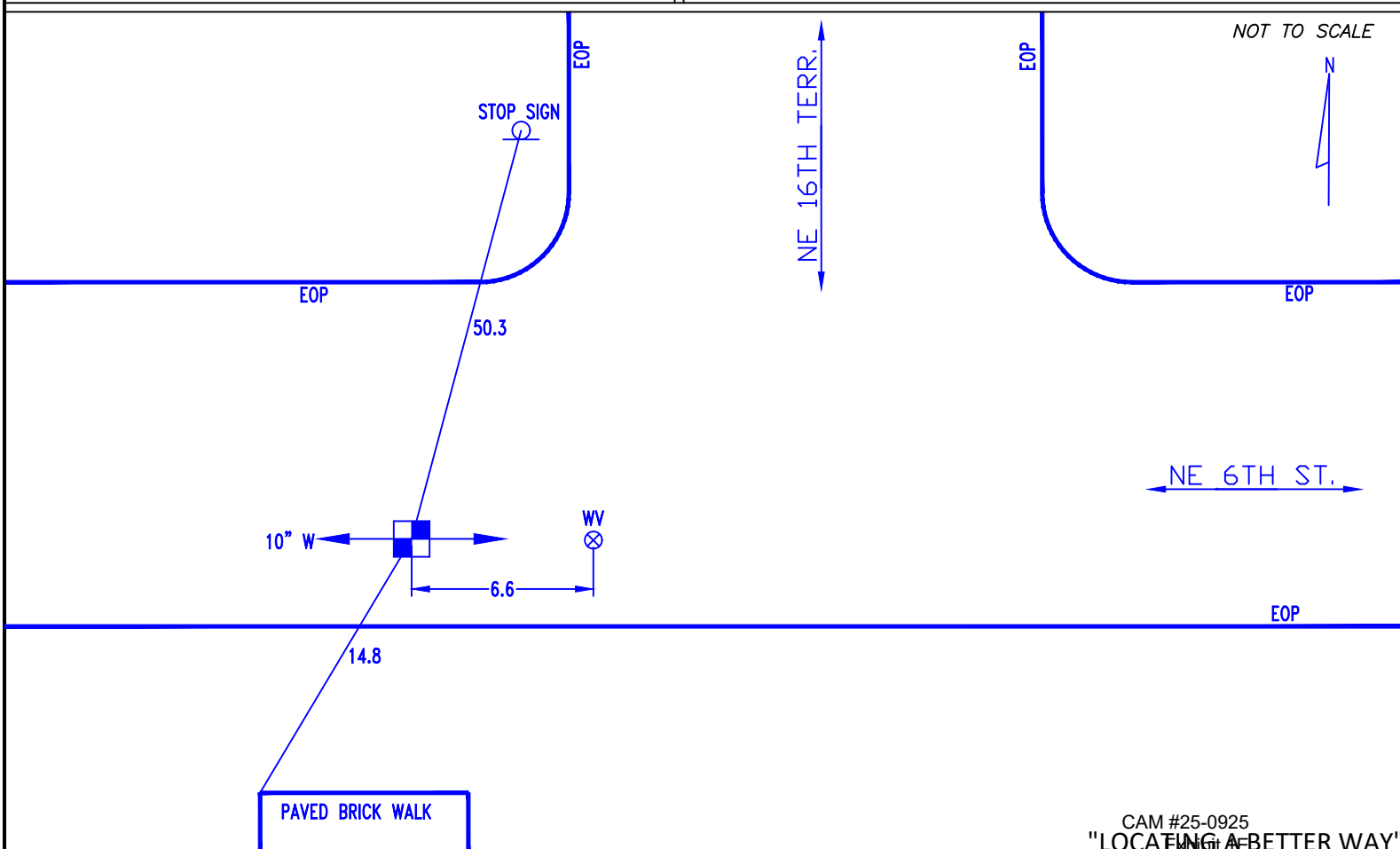
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
653932.40	942715.16	7.67

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:



PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 6" WATER

SHEET #: SD OF 07

PROPOSED: UTILITY WORK

UTILITY FOUND: WATER

FORM BY: SD

ASSISTED BY: DC VT

OF HOLES: 1

MATERIAL AS FOUND: DUCTILE IRON

PAVING CONDITION: GOOD

DATE DUG: 09/16/24

SIZE AS FOUND: 6"

SOIL CONDITIONS: HARD SOFT DRY SAND ROCKY

UTILITY CONDITION: GOOD

ELEV SURVEY PIN

5.89

INSTALLED: PK

AT: CROWN OF UTILITY

MARKING TAPE: BLUE

EXIST. GRADE

0.40 ASPHALT
N/A

COVER (TOP)

2.75

COVER (BOTTOM)

N/A

ELEV. (TOP)

ELEV. (BOTTOM)

N/A

N/A

WIDTH

7"±

FACING

NORTH

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

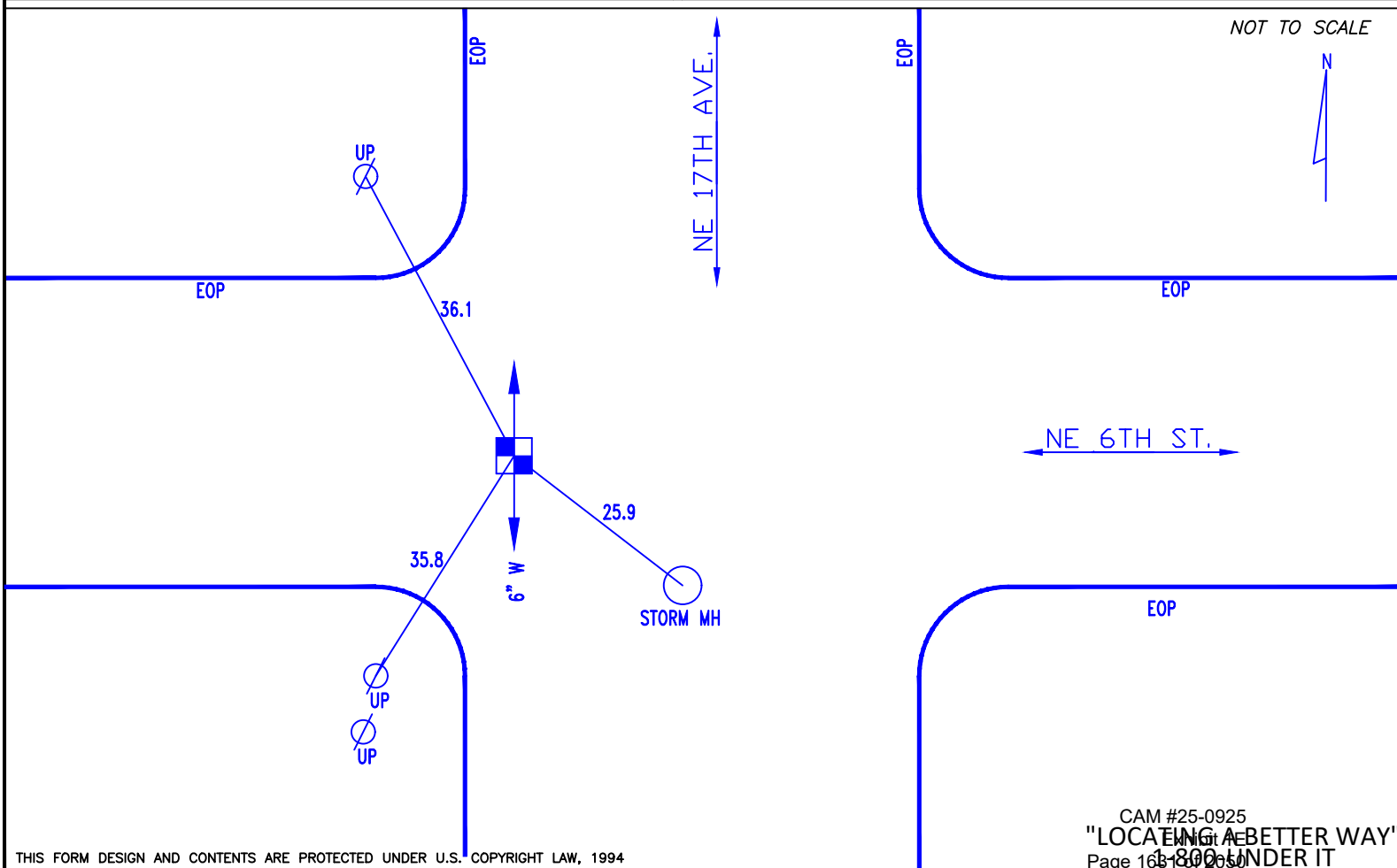
653950.93

943121.72

5.89

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:



PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 10" WATER

SHEET #: SD OF 07

PROPOSED: UTILITY WORK

UTILITY FOUND: WATER

FORM BY: SD

ASSISTED BY: DC VT

OF HOLES: 1

MATERIAL AS FOUND: DUCTILE IRON

PAVING CONDITION: GOOD

DATE DUG: 09/16/24

SIZE AS FOUND: 10"

SOIL CONDITIONS: HARD SOFT DRY SAND ROCKY

UTILITY CONDITION: GOOD

ELEV SURVEY PIN

5.81

INSTALLED: PK

AT: CROWN OF UTILITY

MARKING TAPE: BLUE

EXIST. GRADE

0.30 ASPHALT
N/A

COVER (TOP)

2.95

2.86

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

FACING

EAST

WIDTH

11"±

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

653943.14

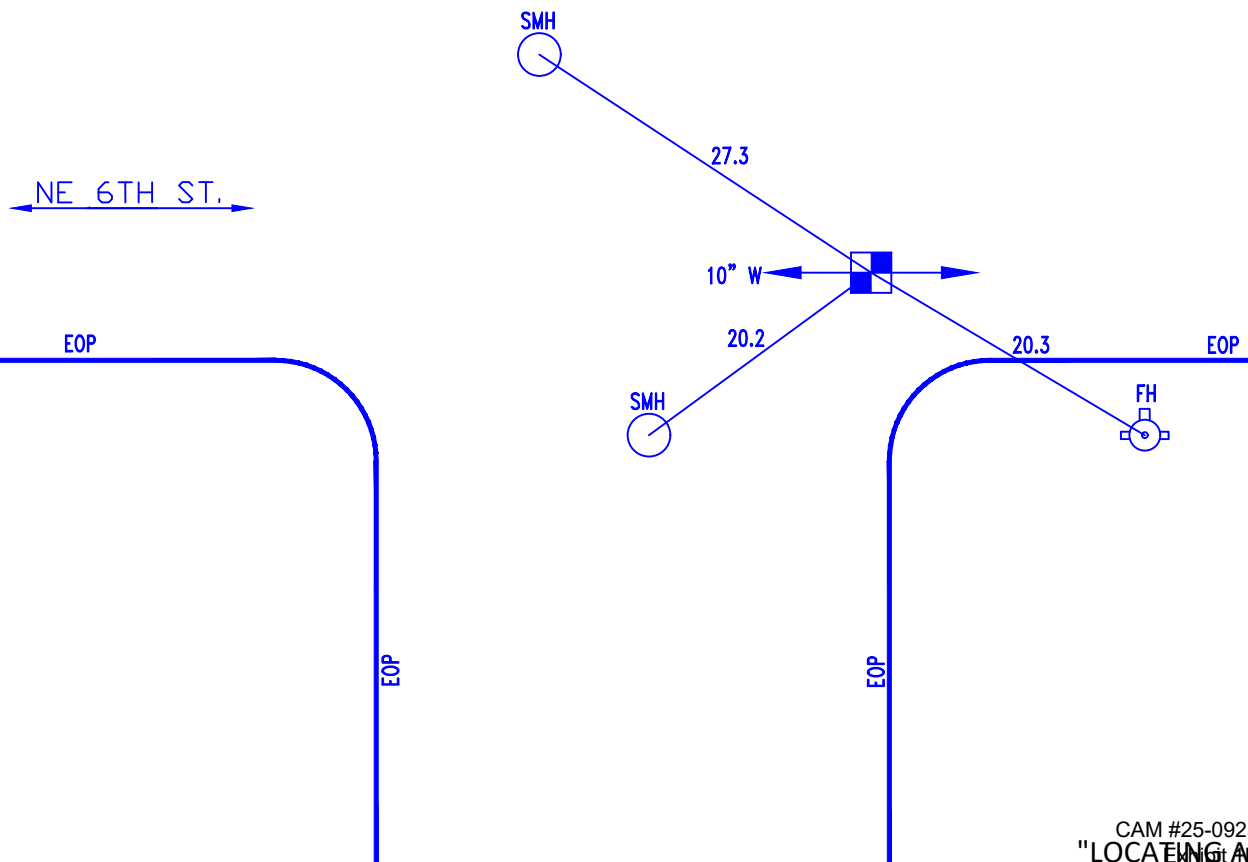
943152.95

5.81

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:

NOT TO SCALE



PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 10" WATER

SHEET #: SD OF 08

PROPOSED: UTILITY WORK

UTILITY FOUND: WATER

FORM BY: DL

ASSISTED BY: JA TJ

OF HOLES: 1

MATERIAL AS FOUND: CAST IRON

PAVING CONDITION: FAIR

DATE DUG: 09/16/24

SIZE AS FOUND: 10"

SOIL CONDITIONS: HARD SOFT DRY SAND ROCKY

UTILITY CONDITION: FAIR

ELEV SURVEY PIN

8.90

INSTALLED: PK

AT: CROWN OF UTILITY

MARKING TAPE: BLUE

EXIST. GRADE

2" ASPHALT
N/A

COVER (TOP)

3.20

5.70

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

FACING

EAST

WIDTH

11"±

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

653952.082

943422.77

8.90

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:

NOT TO SCALE



NE 17TH TERR.

WV

39.6

WV

12.4

10" W

1.9

EOP

NE 6TH ST.

PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 12" WATER UTILITY FOUND: WATER MATERIAL AS FOUND: CAST IRON SIZE AS FOUND: 12"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 08 PROPOSED: UTILITY WORK FORM BY: DL ASSISTED BY: JA TJ # OF HOLES: 1 PAVING CONDITION: FAIR DATE DUG: 09/16/24 SOIL CONDITIONS: HARD DRY SAND ROCKY UTILITY CONDITION: FAIR
--	---

ELEV SURVEY PIN

9.19

COVER (TOP)

3.25

5.94

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

INSTALLLED: **PK** AT: **CROWN OF UTILITY** MARKING TAPE: **BLUE**

SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
653960.61	943430.75	9.19

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:

PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 6" WATER UTILITY FOUND: WATER MATERIAL AS FOUND: CAST IRON SIZE AS FOUND: 6"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 10 PROPOSED: UTILITY WORK FORM BY: DL ASSISTED BY: JA TJ # OF HOLES: 1 PAVING CONDITION: N/A DATE DUG: 09/16/24 SOIL CONDITIONS: SOFT MOIST SAND ROCKY UTILITY CONDITION: FAIR
--	--

ELEV SURVEY PIN

6.92

EXIST. GRADE

COVER (TOP)

3.81

3.11

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

INSTALLED: **HUB & TACK** AT: **CROWN OF UTILITY** MARKING TAPE: **BLUE**

SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
654612.23	943756.17	6.92

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:

FACING

NORTH

WIDTH

7"±

NOT TO SCALE

NE 7TH ST.

NE 17TH WAY

STOP SIGN

WV

4.8

2.2

11.5

6" W

CONCRETE SIDEWALK

N

CAM #25-0925

"LOCATING A BETTER WAY"

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THIS FORM DESIGN AND CONTENTS ARE PROTECTED UNDER U.S. COPYRIGHT LAW, 1994

PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 6" WATER

SHEET #: SD OF 11

PROPOSED: UTILITY WORK

UTILITY FOUND: WATER

FORM BY: DL

ASSISTED BY: JA TJ

OF HOLES: 1

MATERIAL AS FOUND: CAST IRON

PAVING CONDITION: N/A

DATE DUG: 09/16/24

SIZE AS FOUND: 6"

SOIL CONDITIONS: SOFT MOIST SAND ROCKY

UTILITY CONDITION: FAIR

ELEV SURVEY PIN

8.01

INSTALLED: HUB & TACK AT: CROWN OF UTILITY

MARKING TAPE: BLUE

EXIST. GRADE

COVER (TOP)

2.96

5.05

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

FACING

NORTH

WIDTH

7"±

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

655014.87

943751.08

8.01

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:

NOT TO SCALE

NE 17TH WAY

STORM MH

16.7

6" W

MAILBOX

4.7

10.5

FOW

CONCRETE SIDEWALK

N

PROJECT NAME: VICTORIA PARK – TEST HOLES	CLIENT JOB# N/A WORK ORDER # N/A
LOCATE REQUESTED BY: HAZEN & SAWYER	PROJECT LOCATION: FT. LAUDERDALE, FL
UTILITY REQUESTED: WATER	SHEET #: SD OF 13 PROPOSED: UTILITY WORK
UTILITY FOUND: WATER	FORM BY: DC ASSISTED BY: JA TJ # OF HOLES: 1
MATERIAL AS FOUND: SEE NOTE	PAVING CONDITION: FAIR DATE DUG: 09/??/24
SIZE AS FOUND: SEE NOTE	SOIL CONDITIONS: HARD WET SAND ROCKY
UTILITY CONDITION: SEE NOTE	

ELEV SURVEY PIN

1.73

EXIST. GRADE

COVER (TOP)

7.33

ELEV. (TOP)

-5.60

COVER (BOTTOM)

N/A

ELEV. (BOTTOM)

INSTALLED: PK

AT: CROWN OF UTILITY **MARKING TAPE:** BLUE

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH	EAST	GRADE ELEV.
654714.90	944588.27	1.73

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER.

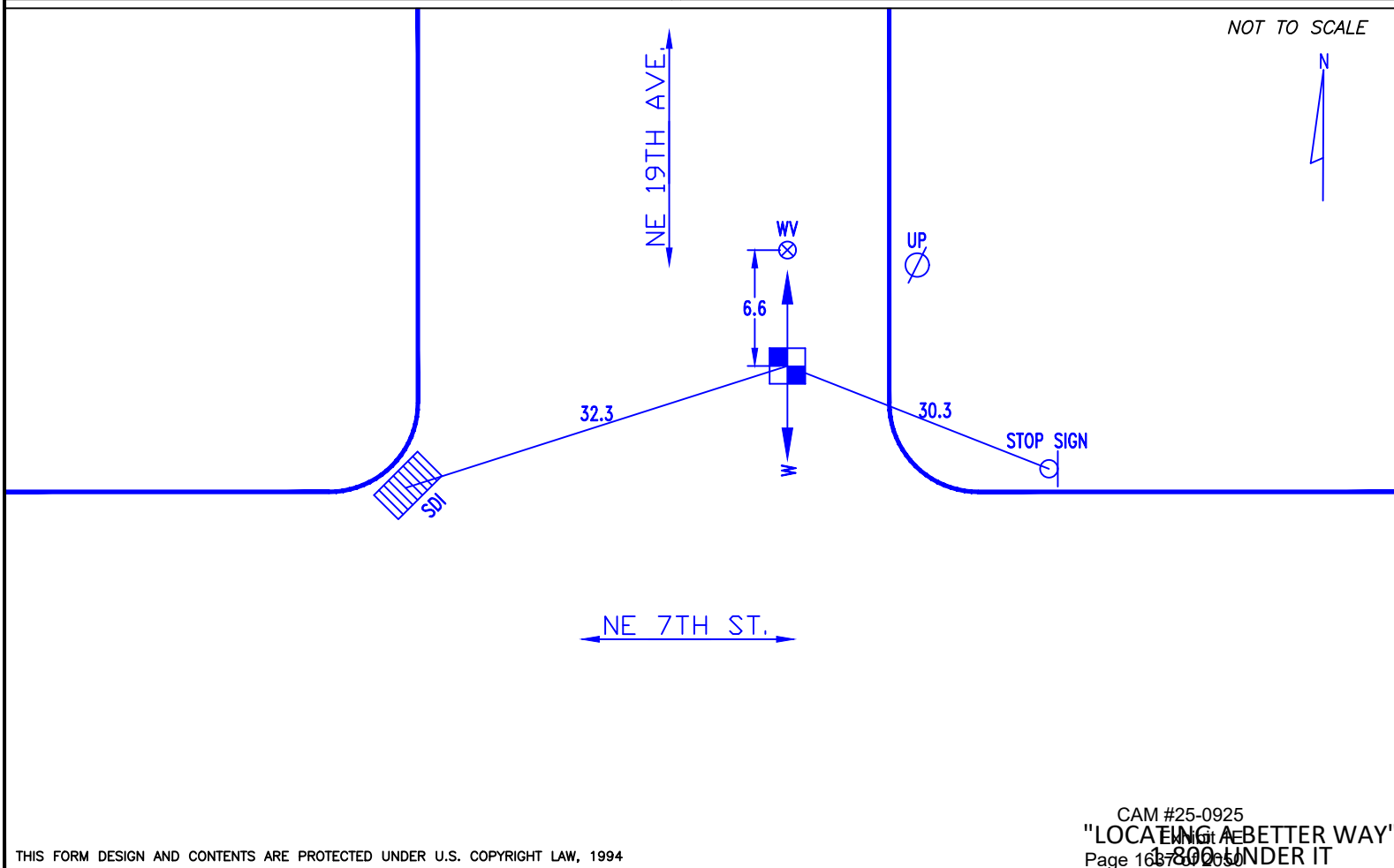
3" ASPHALT

WIDTH

SEE NOTE

FACING

NORTH



PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 6" WATER UTILITY FOUND: WATER MATERIAL AS FOUND: DUCTILE IRON SIZE AS FOUND: 8"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 14 PROPOSED: UTILITY WORK FORM BY: DC ASSISTED BY: DL JA VT # OF HOLES: 1 PAVING CONDITION: FAIR DATE DUG: 09/25/24 SOIL CONDITIONS: HARD WET SAND ROCKY UTILITY CONDITION: FAIR
---	--

ELEV SURVEY PIN

1.87

EXIST. GRADE

COVER (TOP)

1.59

COVER (BOTTOM)

N/A

ELEV. (TOP)

0.28

ELEV. (BOTTOM)

N/A

INSTALLED: **PK**

AT: **CROWN OF UTILITY**

MARKING TAPE: **BLUE**

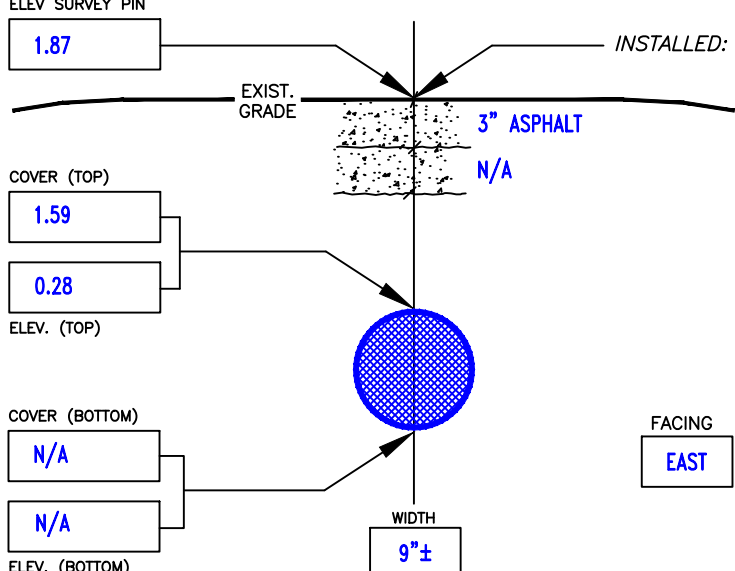
SURVEY PIN LOCATED BY: **IMC**

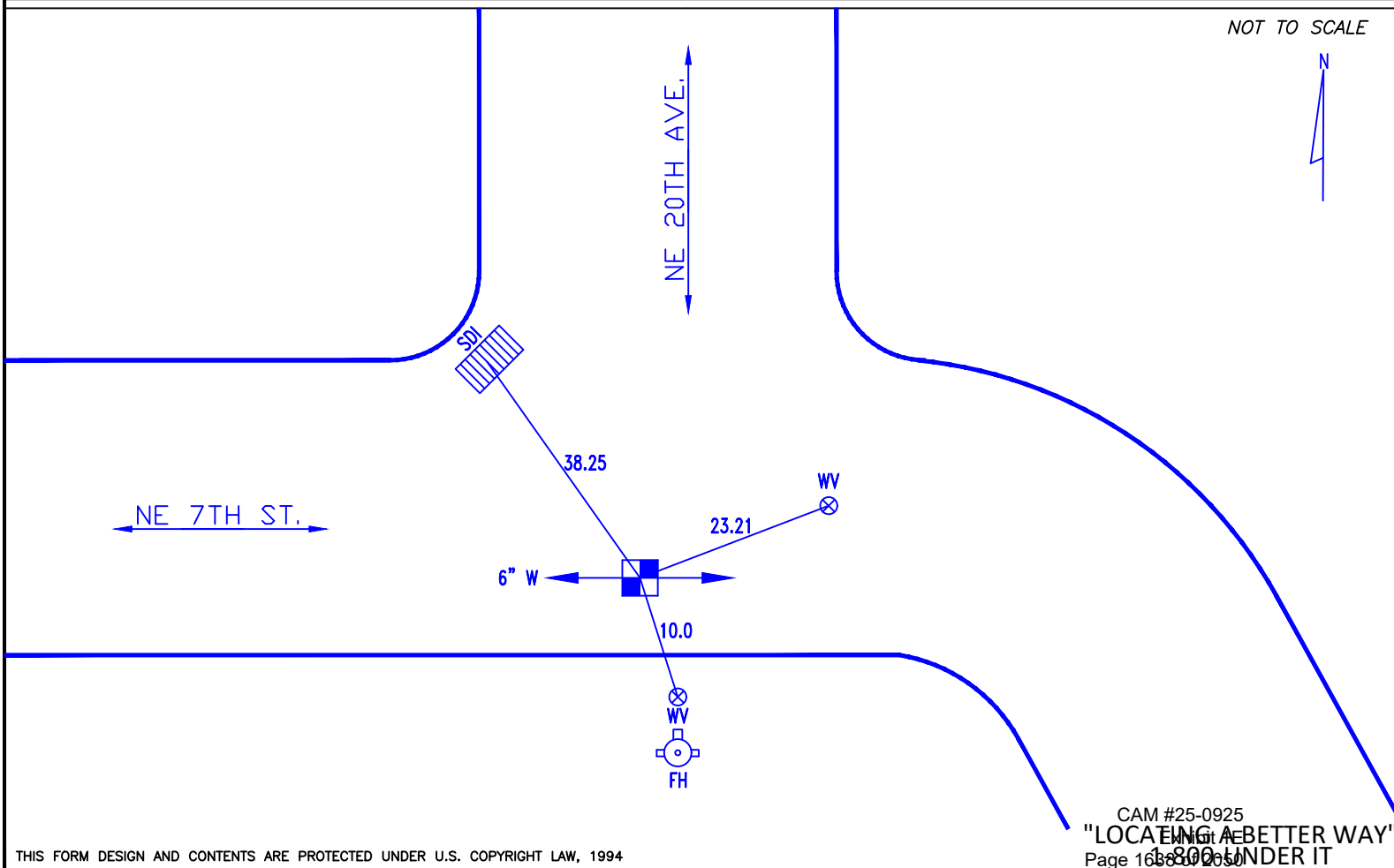
SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
654667.86	944976.06	1.87

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:





PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 8" WATER UTILITY FOUND: WATER MATERIAL AS FOUND: WRAPPED STEEL SIZE AS FOUND: 8"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 17 PROPOSED: UTILITY WORK FORM BY: DC ASSISTED BY: DL JA VT # OF HOLES: 1 PAVING CONDITION: FAIR DATE DUG: 09/25/24 SOIL CONDITIONS: HARD WET MOIST SAND ROCKY UTILITY CONDITION: FAIR
--	--

ELEV SURVEY PIN

1.21

EXIST. GRADE

COVER (TOP)

2.49

COVER (BOTTOM)

N/A

ELEV. (TOP)

-1.28

ELEV. (BOTTOM)

N/A

INSTALLED: **PK**

AT: **CROWN OF UTILITY**

MARKING TAPE: **BLUE**

SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
654393.54	944585.98	1.21

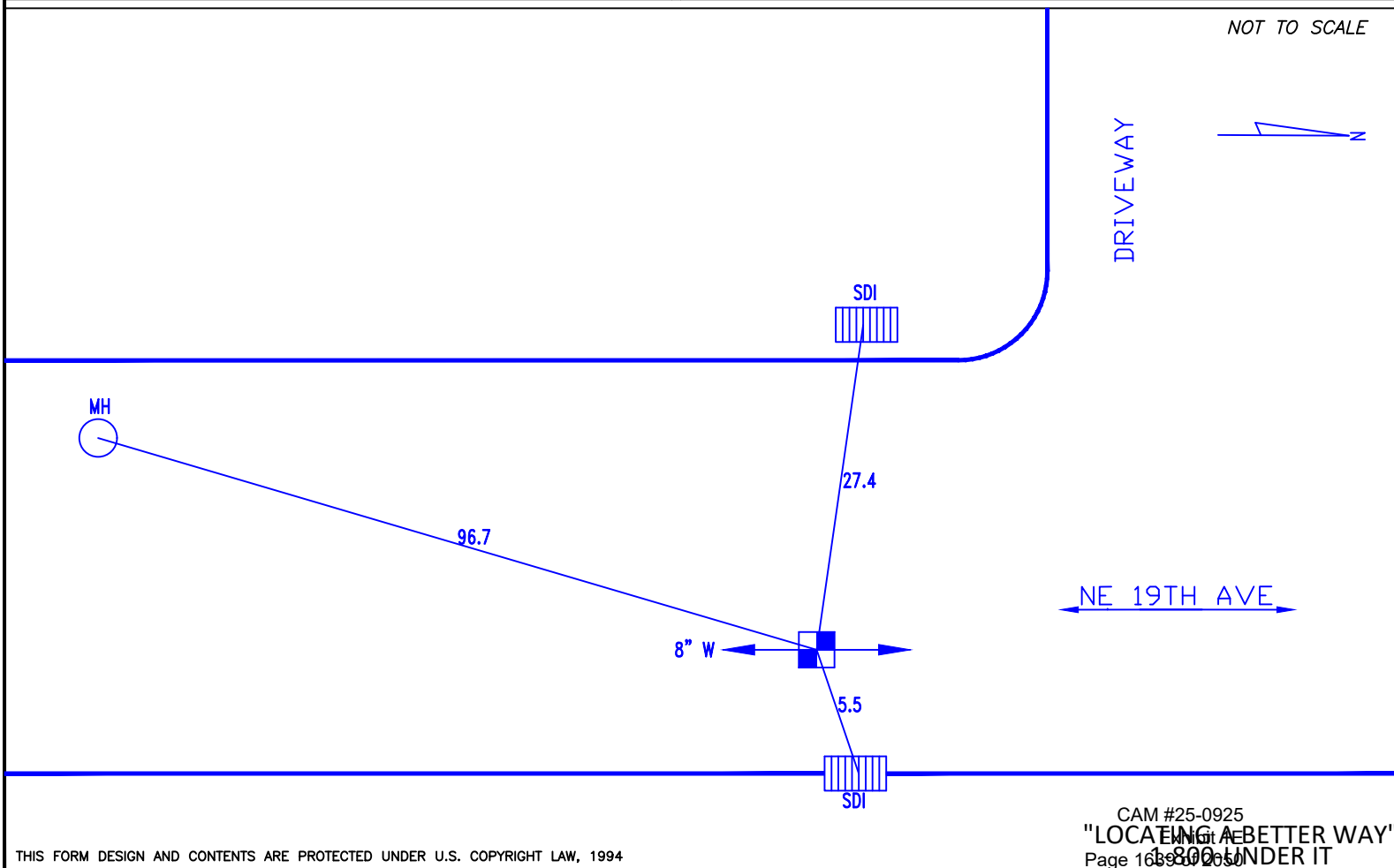
HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:

3" ASPHALT
N/A

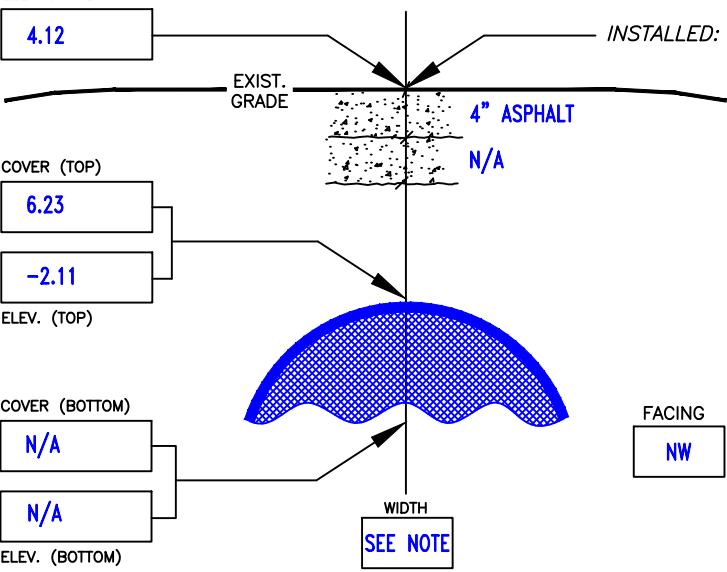
WIDTH
9"±

FACING
NORTH

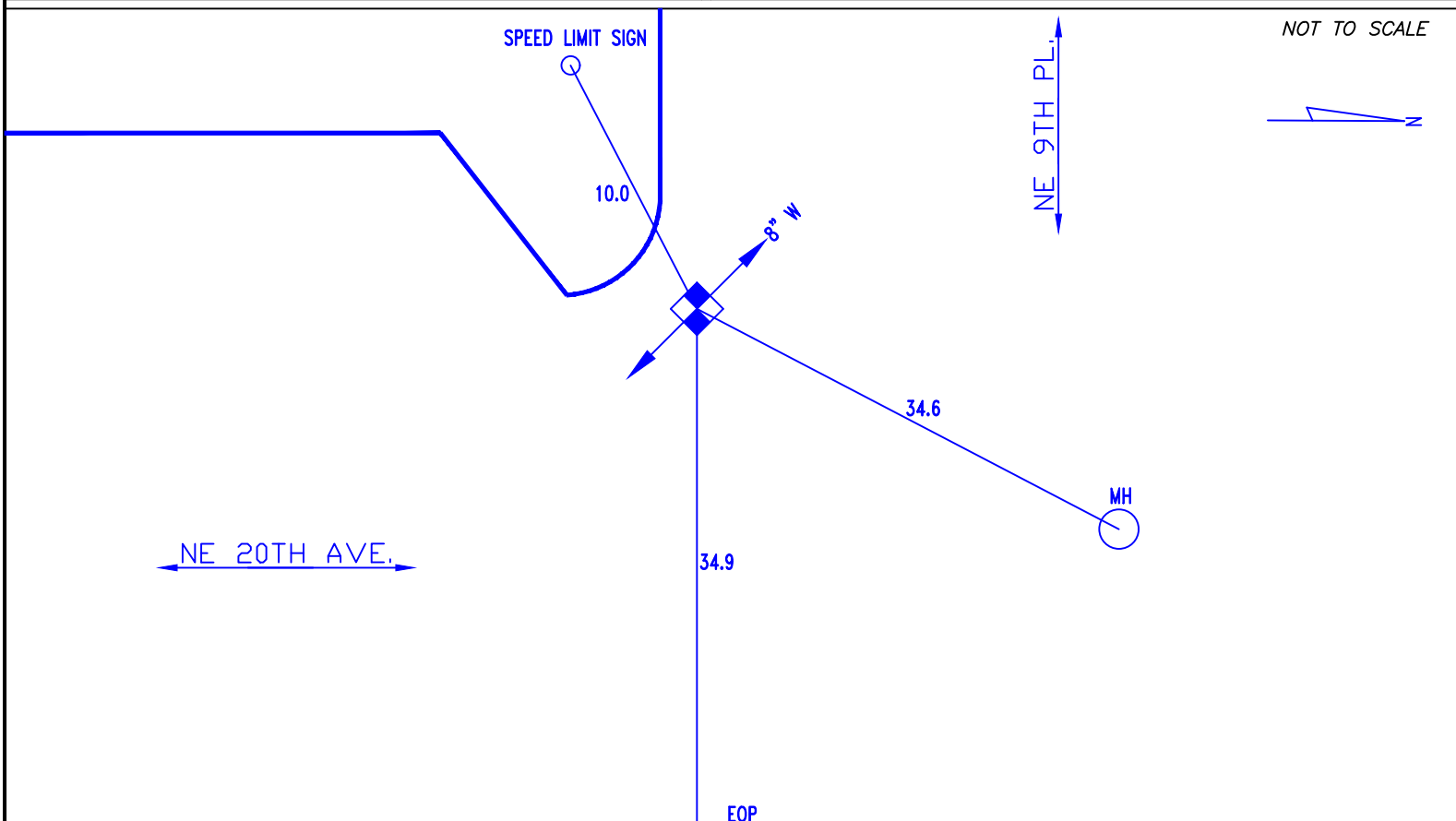


PROJECT NAME: VICTORIA PARK – TEST HOLES	CLIENT JOB# N/A	WORK ORDER # N/A
LOCATE REQUESTED BY: HAZEN & SAWYER	PROJECT LOCATION: FT. LAUDERDALE, FL	
UTILITY REQUESTED: 48" FORCE MAIN	SHEET #: SD OF 18	PROPOSED: UTILITY WORK
UTILITY FOUND: FORCE MAIN	FORM BY: DC	ASSISTED BY: DL JA VT # OF HOLES: 1
MATERIAL AS FOUND: SEE NOTE	PAVING CONDITION: FAIR	DATE DUG: 09/25/24
SIZE AS FOUND: SEE NOTE	SOIL CONDITIONS: HARD WET SAND ROCKY	
UTILITY CONDITION: SEE NOTE		

ELEV SURVEY PIN 4.12	INSTALLED: PK	AT: TOP OF UTILITY	MARKING TAPE: N/A
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SURVEY PIN LOCATED BY: IMC		
SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).		
NORTH	EAST	GRADE ELEV.
656187.46	945006.20	4.12
HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.		
NOTES: UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER AND SOIL INSTABILITY.		



PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 10" SANITARY FORCE MAIN

SHEET #: SD OF 19

PROPOSED: UTILITY WORK

UTILITY FOUND: FORCE MAIN

FORM BY: DL

ASSISTED BY: JA TJ

OF HOLES: 1

MATERIAL AS FOUND: SEE NOTE

PAVING CONDITION: N/A

DATE DUG: 09/25/24

SIZE AS FOUND: SEE NOTE

SOIL CONDITIONS: SOFT WET MOIST SAND ROCKY

UTILITY CONDITION: SEE NOTE

ELEV SURVEY PIN

2.91

INSTALLED: HUB & TACK AT: TOP OF UTILITY

MARKING TAPE: PINK

EXIST. GRADE

COVER (TOP)

3.01

ELEV. (TOP)

COVER (BOTTOM)

N/A

ELEV. (BOTTOM)

FACING

NORTH

WIDTH

SEE NOTE

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

653202.41

943872.07

2.91

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER.

DRIVEWAY

NOT TO SCALE

N/A

UNK

N/A

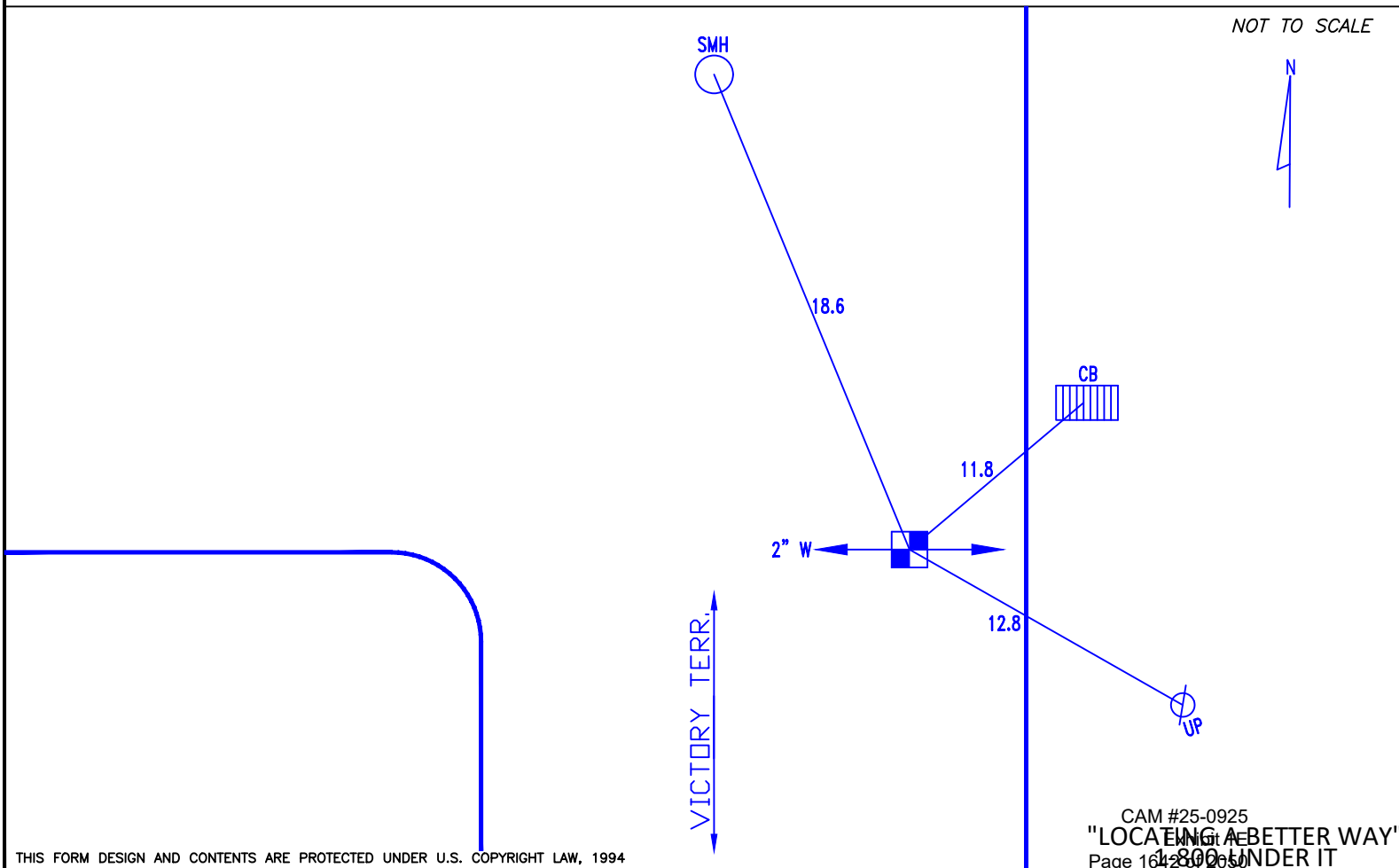
EOP

N/A

VICTORY TERR.

WM

PROJECT NAME: VICTORIA PARK – TEST HOLES	CLIENT JOB# N/A	WORK ORDER # N/A
LOCATE REQUESTED BY: HAZEN & SAWYER	PROJECT LOCATION: FT. LAUDERDALE, FL	
UTILITY REQUESTED: 6" WATER	SHEET #: SD OF 19	PROPOSED: UTILITY WORK
UTILITY FOUND: WATER	FORM BY: DL	ASSISTED BY: SD TJ # OF HOLES: 1
MATERIAL AS FOUND: STEEL	PAVING CONDITION: GOOD	DATE DUG: 09/25/24
SIZE AS FOUND: 2"	SOIL CONDITIONS: SOFT WET MOIST SAND ROCKY	
UTILITY CONDITION: FAIR		
ELEV SURVEY PIN 2.21 EXIST. GRADE 0.30 ASPHALT N/A COVER (TOP) 1.25 0.96 ELEV. (TOP) COVER (BOTTOM) N/A N/A ELEV. (BOTTOM) FACING EAST WIDTH 2.5"± INSTALLED: PK AT: CROWN OF UTILITY MARKING TAPE: BLUE SURVEY PIN LOCATED BY: IMC SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET). NORTH EAST GRADE ELEV. 653275.57 943909.53 2.21 HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT. NOTES:		



PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 16" SANITARY FORCE MAIN

SHEET #: SD OF 20

PROPOSED: UTILITY WORK

UTILITY FOUND: SANITARY FORCE MAIN

FORM BY: DL

ASSISTED BY: JA TJ

OF HOLES: 1

MATERIAL AS FOUND: DUCTILE IRON

PAVING CONDITION: GOOD

DATE DUG: 09/23/24

SIZE AS FOUND: SEE NOTE

SOIL CONDITIONS: SOFT WET MOIST SAND ROCKY

UTILITY CONDITION: SEE NOTE

ELEV SURVEY PIN

3.45

INSTALLED: HUB & TACK AT: CROWN OF UTILITY

MARKING TAPE: GREEN

EXIST. GRADE

N/A
N/A

COVER (TOP)

4.09

COVER (BOTTOM)

-0.64

ELEV. (TOP)

ELEV. (BOTTOM)

N/A

N/A

FACING

NORTH

WIDTH

SEE NOTE

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

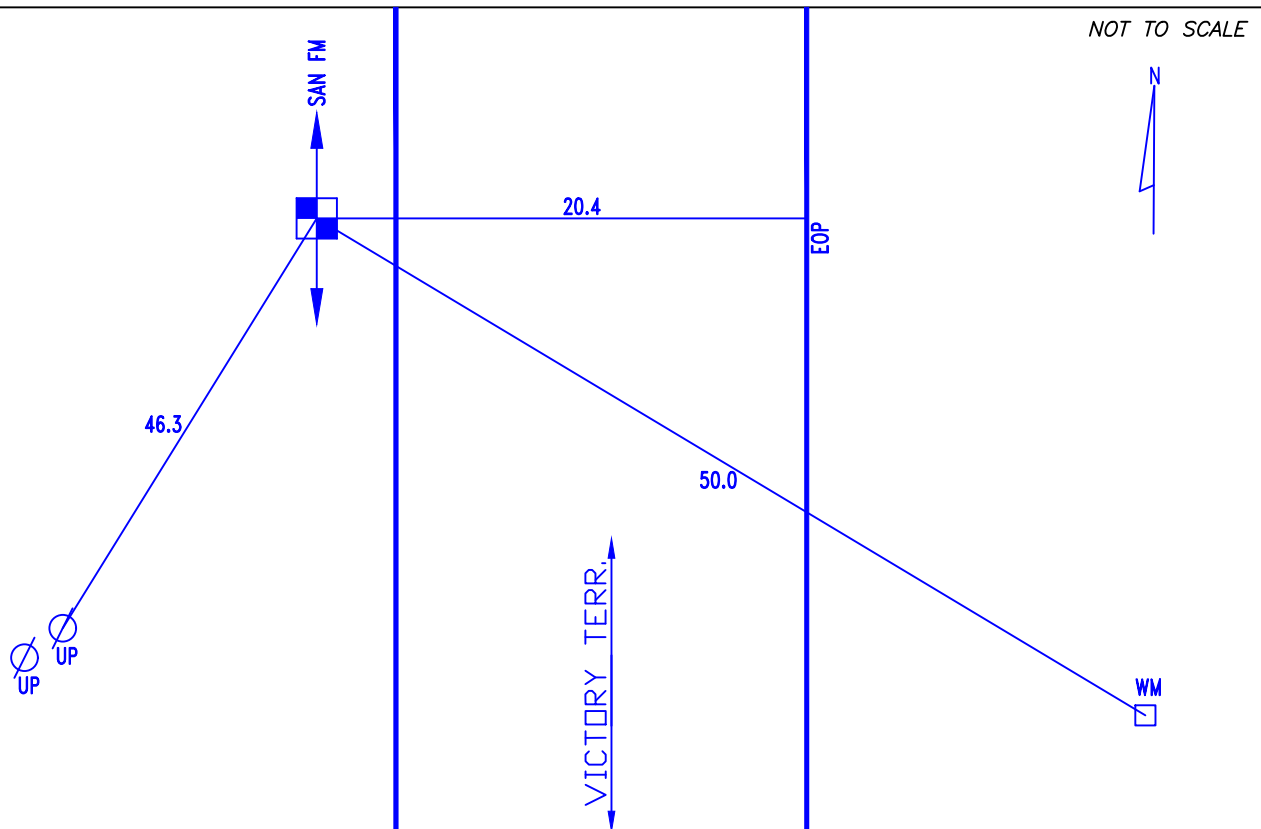
653725.15

943997.22

3.45

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: UNABLE TO VERIFY SIZE DUE TO EXCESSIVE GROUNDWATER.



PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 16" SANITARY FORCE MAIN

SHEET #: SD OF 21

PROPOSED: UTILITY WORK

UTILITY FOUND: SANITARY FORCE MAIN

FORM BY: DL

ASSISTED BY: JA TJ

OF HOLES: 1

MATERIAL AS FOUND: DUCTILE IRON

PAVING CONDITION: FAIR

DATE DUG: 09/22/24

SIZE AS FOUND: SEE NOTE

SOIL CONDITIONS: HARD SOFT WET MOIST SAND ROCKY

UTILITY CONDITION: SEE NOTE

ELEV SURVEY PIN

3.73

INSTALLED: PK

AT: TOP OF UTILITY

MARKING TAPE: GREEN

EXIST. GRADE

3" ASPHALT
N/A

COVER (TOP)

5.07

-1.34

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

FACING

NE

WIDTH

SEE NOTE

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

654137.43

944101.07

3.73

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER.

NOT TO SCALE

NE 6TH CT.

VICTORY TERR.

STOP SIGN

5.7

SAN FM

34.4

16.5

PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 6" WATER UTILITY FOUND: WATER MATERIAL AS FOUND: HDPE SIZE AS FOUND: 6"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 21 PROPOSED: UTILITY WORK FORM BY: SD ASSISTED BY: VT # OF HOLES: 1 PAVING CONDITION: GOOD DATE DUG: 09/17/24 SOIL CONDITIONS: HARD DRY SAND ROCKY UTILITY CONDITION: GOOD
---	--

ELEV SURVEY PIN

3.44

EXIST. GRADE

COVER (TOP)

2.73

COVER (BOTTOM)

N/A

ELEV. (TOP)

0.71

ELEV. (BOTTOM)

N/A

INSTALLED: **PK** AT: **CROWN OF UTILITY** MARKING TAPE: **BLUE**

0.30 ASPHALT
N/A

WIDHTH
7"±

FACING
EAST

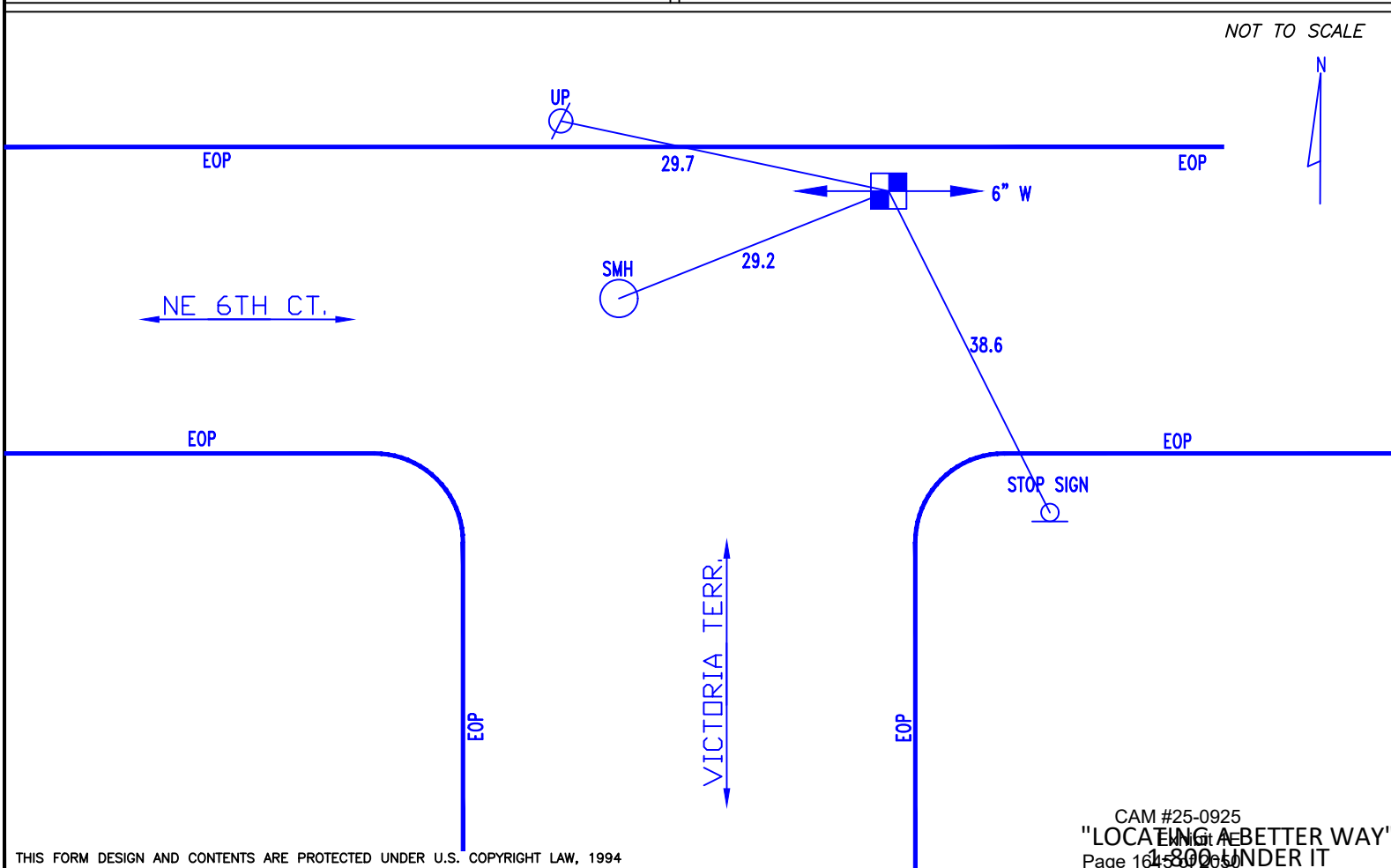
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
654185.50	944147.341	3.44

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:



PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 16" SANITARY FORCE MAIN UTILITY FOUND: SANITARY FORCE MAIN MATERIAL AS FOUND: SEE NOTE SIZE AS FOUND: SEE NOTE	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 22 PROPOSED: UTILITY WORK FORM BY: DL ASSISTED BY: JA TJ # OF HOLES: 1 PAVING CONDITION: FAIR DATE DUG: 09/22/24 SOIL CONDITIONS: HARD SOFT WET MOIST SAND ROCKY UTILITY CONDITION: SEE NOTE
--	--

ELEV SURVEY PIN

2.71

EXIST. GRADE

COVER (TOP)

4.52

ELEV. (TOP)

-1.81

COVER (BOTTOM)

N/A

ELEV. (BOTTOM)

INSTALLED: **PK**

AT: **TOP** OF UTILITY MARKING TAPE: **GREEN**

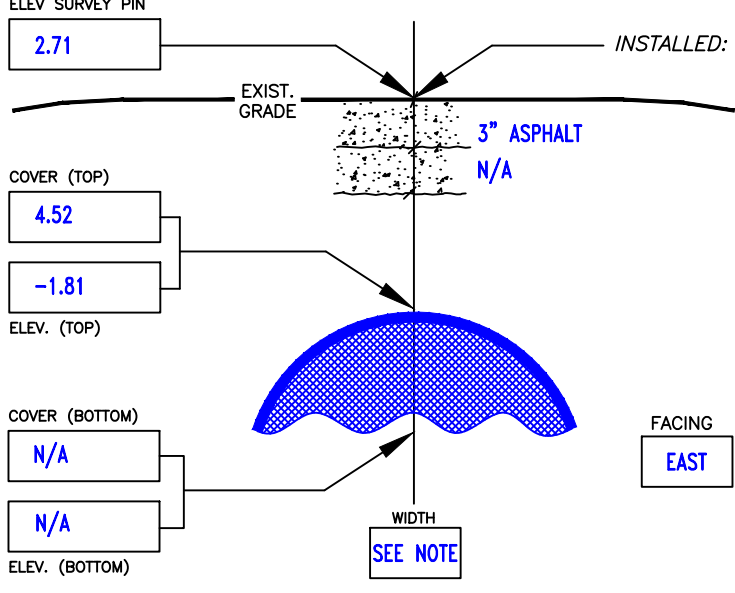
SURVEY PIN LOCATED BY: **IMC**

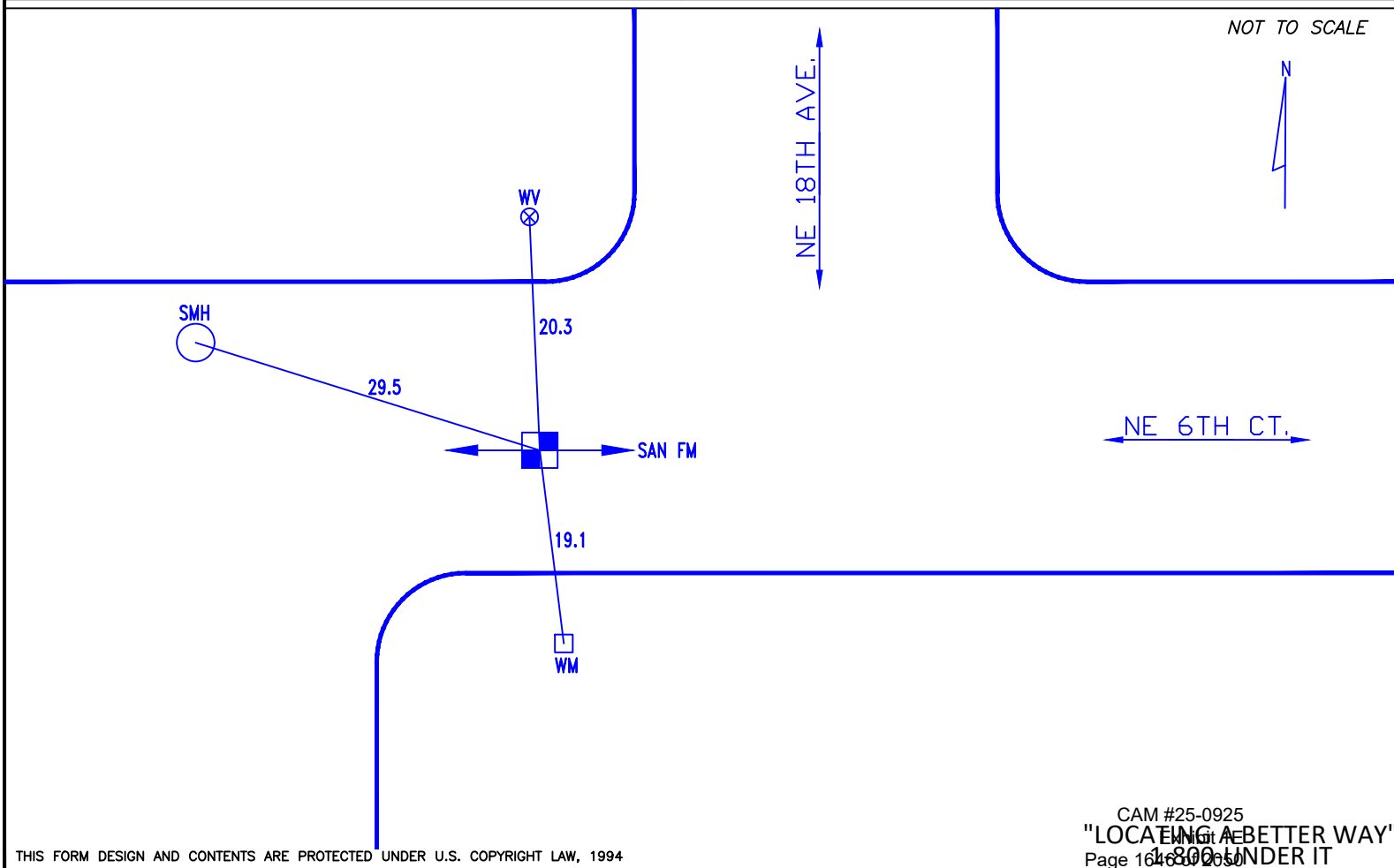
SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
654175.12	944251.97	2.71

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: **UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER.**





PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 18" SANITARY FORCE MAIN UTILITY FOUND: SANITARY FORCE MAIN MATERIAL AS FOUND: SEE NOTE SIZE AS FOUND: SEE NOTE	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 22 PROPOSED: UTILITY WORK FORM BY: DC ASSISTED BY: SD TJ # OF HOLES: 1 PAVING CONDITION: FAIR DATE DUG: 09/24/24 SOIL CONDITIONS: HARD WET MOIST SAND ROCKY UTILITY CONDITION: SEE NOTE
--	---

ELEV SURVEY PIN

1.19

EXIST. GRADE

COVER (TOP)

2.64

COVER (BOTTOM)

N/A

ELEV. (TOP)

-1.45

ELEV. (BOTTOM)

N/A

INSTALLED: **PK**

AT: **TOP** OF UTILITY MARKING TAPE: **GREEN**

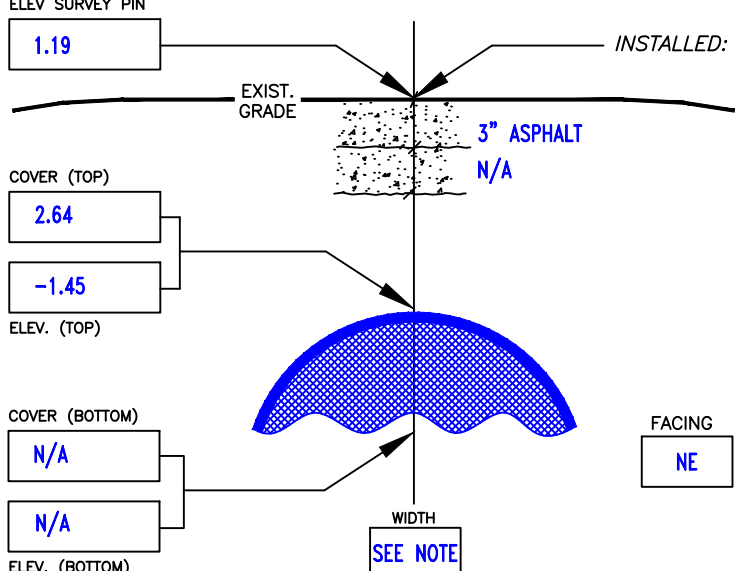
SURVEY PIN LOCATED BY: **IMC**

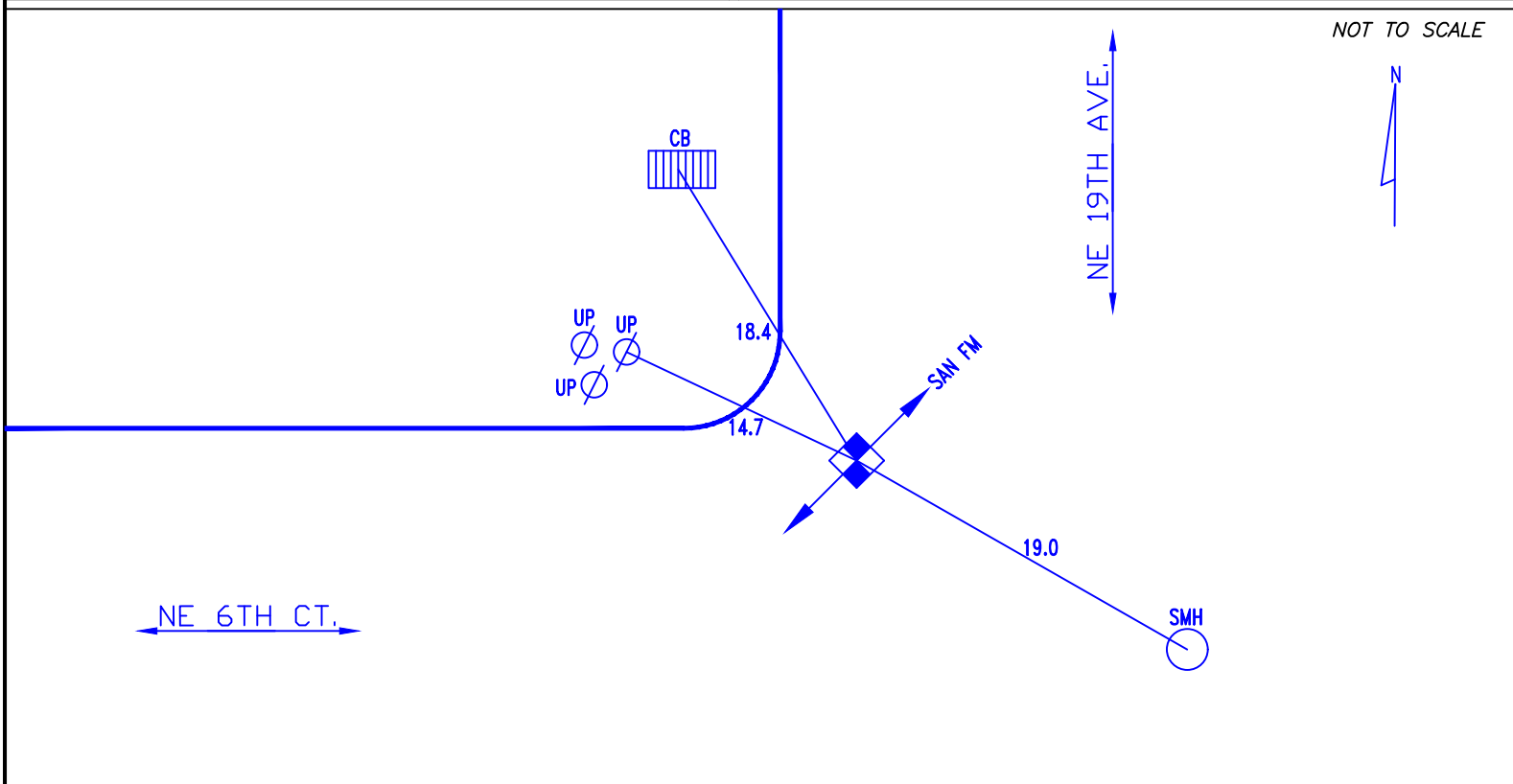
SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
654203.67	944565.61	1.19

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: **UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER.**



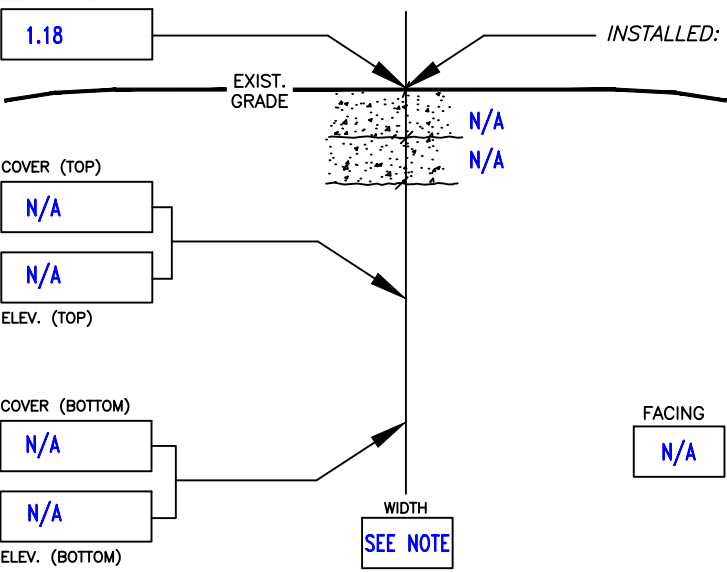


PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: WATER UTILITY FOUND: SEE NOTE MATERIAL AS FOUND: SEE NOTE SIZE AS FOUND: SEE NOTE	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 22 PROPOSED: UTILITY WORK FORM BY: DL ASSISTED BY: SD TJ # OF HOLES: 1 PAVING CONDITION: FAIR DATE DUG: 09/24/24 SOIL CONDITIONS: SOFT WET MOIST SAND ROCKY UTILITY CONDITION: SEE NOTE
---	---

ELEV SURVEY PIN

1.18

EXIST. GRADE



COVER (TOP)

N/A

COVER (BOTTOM)

N/A

ELEV. (TOP)

N/A

ELEV. (BOTTOM)

N/A

WIDTH

SEE NOTE

FACING

N/A

AT: **TOP** OF UTILITY MARKING TAPE: **WHITE**

INSTALLLED: **PK**

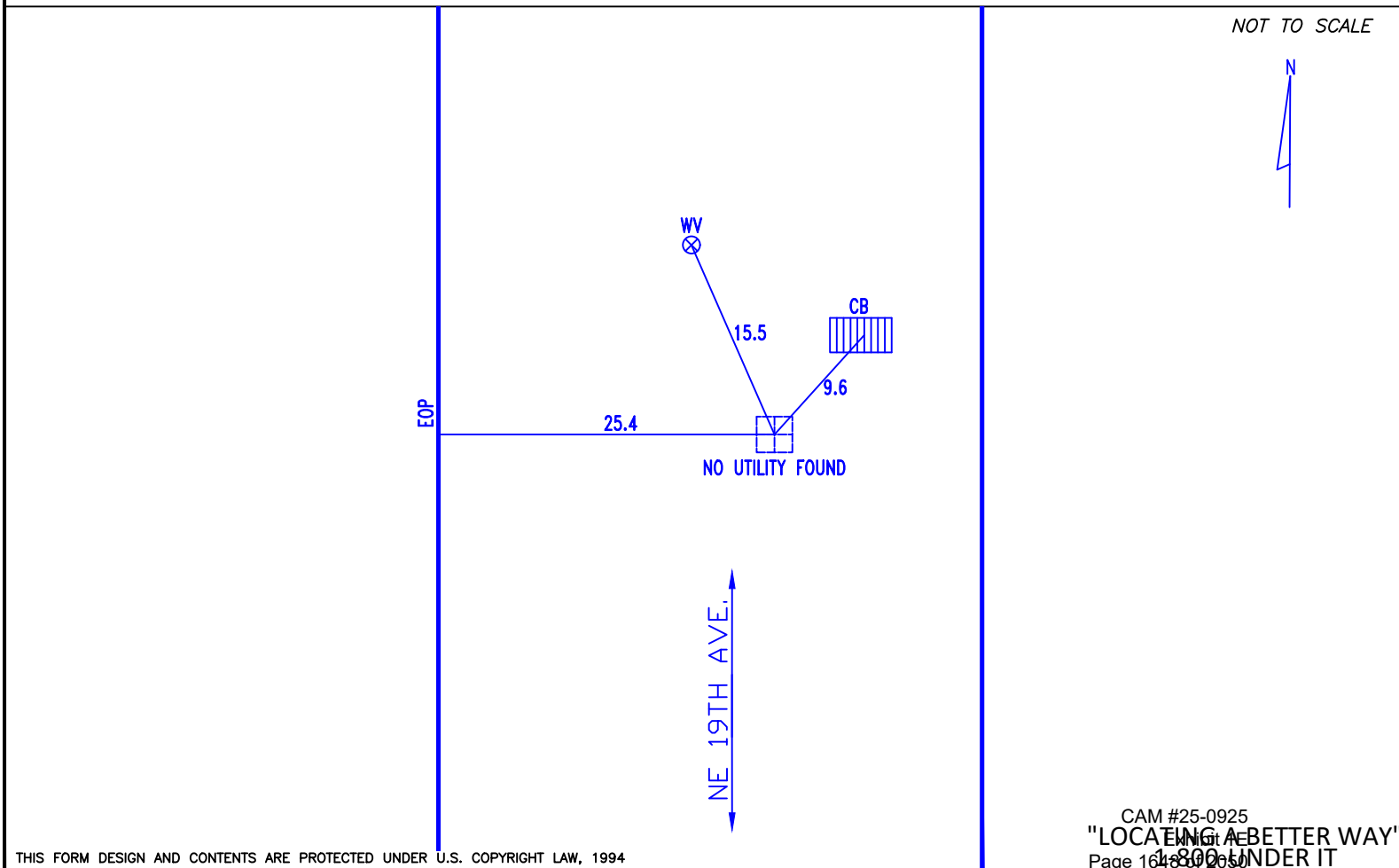
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH	EAST	GRADE ELEV.
654240.96	944593.66	1.18

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: TEST HOLE DUG TO A DEPTH OF 2.5', PROBED TO A DEPTH OF 9.5'. NO UTILITY FOUND.



PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 6" WATER

SHEET #: SD OF 27

PROPOSED: UTILITY WORK

UTILITY FOUND: WATER

FORM BY: DL

ASSISTED BY: SD TJ

OF HOLES: 1

MATERIAL AS FOUND: SEE NOTE

PAVING CONDITION: FAIR

DATE DUG: 09/24/24

SIZE AS FOUND: SEE NOTE

SOIL CONDITIONS: HARD SOFT WET MOIST SAND ROCKY

UTILITY CONDITION: SEE NOTE

ELEV SURVEY PIN

8.43

INSTALLED: PK

AT: CROWN OF UTILITY

MARKING TAPE: BLUE

EXIST. GRADE

3" ASPHALT
N/A

COVER (TOP)

3.08

5.35

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

FACING

EAST

WIDTH

SEE NOTE

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

654265.98

942101.38

8.43

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER.

NOT TO SCALE

NE 15TH AVE.

STOP SIGN



24.0

NE 6TH CT.

WV

W

WV

22.9

7.3

PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 6" WATER

SHEET #: SD OF 28

PROPOSED: UTILITY WORK

UTILITY FOUND: WATER

FORM BY: DL

ASSISTED BY: SD TJ

OF HOLES: 1

MATERIAL AS FOUND: SEE NOTE

PAVING CONDITION: FAIR

DATE DUG: 09/24/24

SIZE AS FOUND: SEE NOTE

SOIL CONDITIONS: HARD SOFT WET MOIST SAND ROCKY

UTILITY CONDITION: SEE NOTE

ELEV SURVEY PIN

8.58

INSTALLED: PK

AT: TOP OF UTILITY

MARKING TAPE: BLUE

EXIST. GRADE

4" ASPHALT
N/A

COVER (TOP)

4.45

4.13

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

FACING

EAST

WIDTH

SEE NOTE

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

654589.17

942096.63

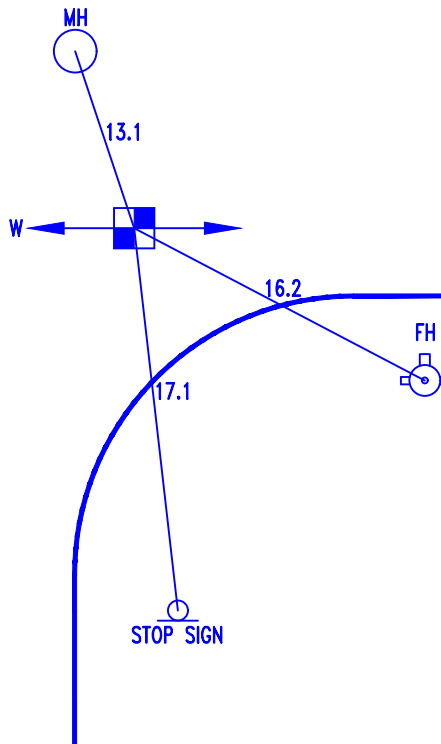
8.58

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER.

NOT TO SCALE

NE 15TH AVE.



NE 7TH ST.

STOP SIGN

PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 36" WATER UTILITY FOUND: WATER MATERIAL AS FOUND: SEE NOTE SIZE AS FOUND: SEE NOTE	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 28 PROPOSED: UTILITY WORK FORM BY: DL ASSISTED BY: SD TJ # OF HOLES: 1 PAVING CONDITION: FAIR DATE DUG: 09/24/24 SOIL CONDITIONS: HARD SOFT WET MOIST DRY SAND ROCKY UTILITY CONDITION: SEE NOTE
--	--

ELEV SURVEY PIN

8.53

EXIST. GRADE

COVER (TOP)

5.43

3.10

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

INSTALLED: **PK** AT: **TOP** OF UTILITY MARKING TAPE: **BLUE**

5" ASPHALT
N/A

FACING
EAST

WIDTH
SEE NOTE

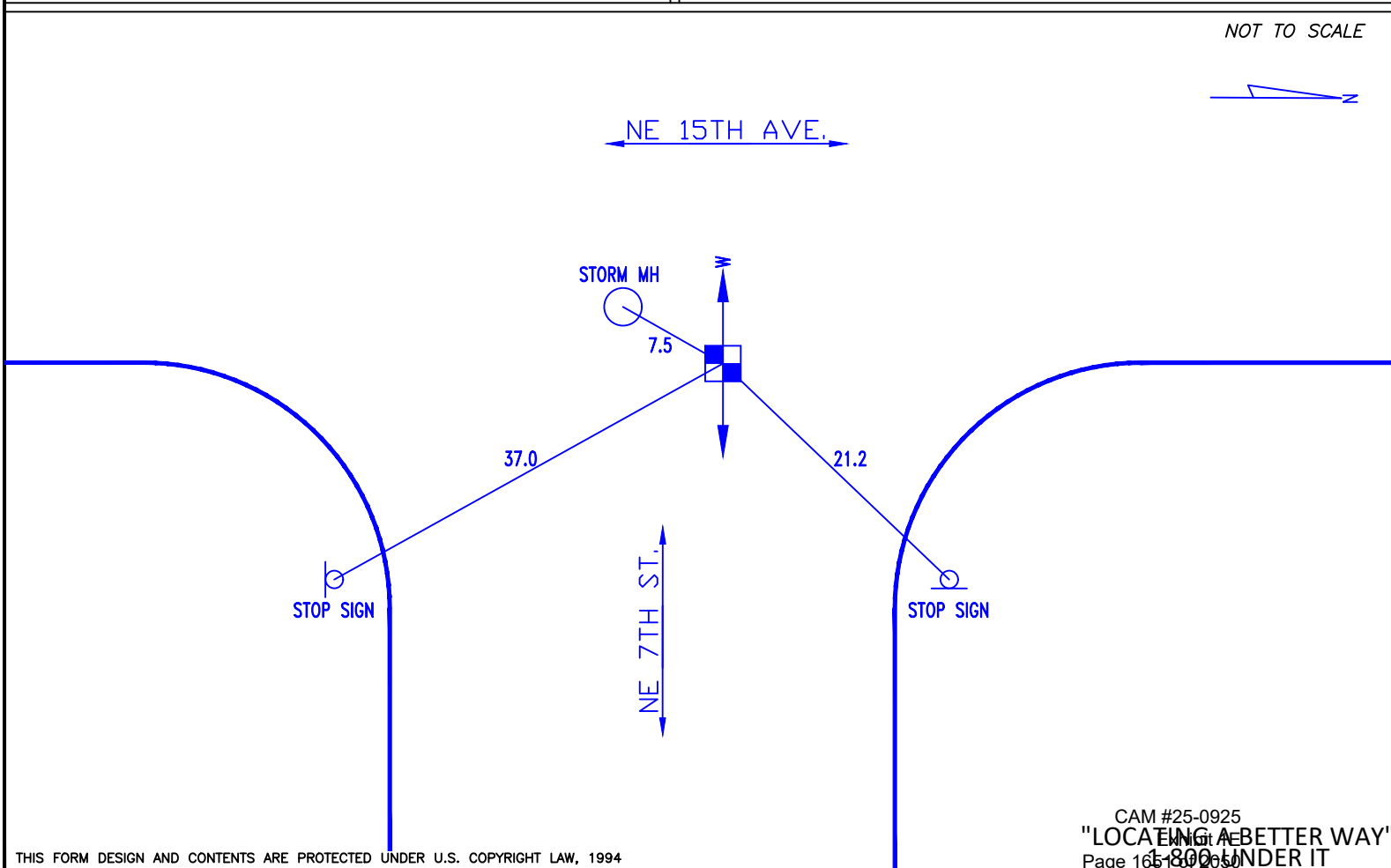
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
654608.99	942094.84	8.53

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: **UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER.**



PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 6" DUCTILE IRON WATER UTILITY FOUND: WATER MATERIAL AS FOUND: DUCTILE IRON SIZE AS FOUND: 6"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 28 PROPOSED: UTILITY WORK FORM BY: SD ASSISTED BY: TJ # OF HOLES: 1 PAVING CONDITION: GOOD DATE DUG: 09/20/24 SOIL CONDITIONS: HARD SOFT DRY SAND ROCKY UTILITY CONDITION: GOOD
--	---

ELEV SURVEY PIN

8.20

EXIST. GRADE

COVER (TOP)

3.05

5.15

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

INSTALLED: **PK** AT: **CROWN OF UTILITY** MARKING TAPE: **BLUE**

0.6 ASPHALT
N/A

FACING
NORTH

WIDTH
7"±

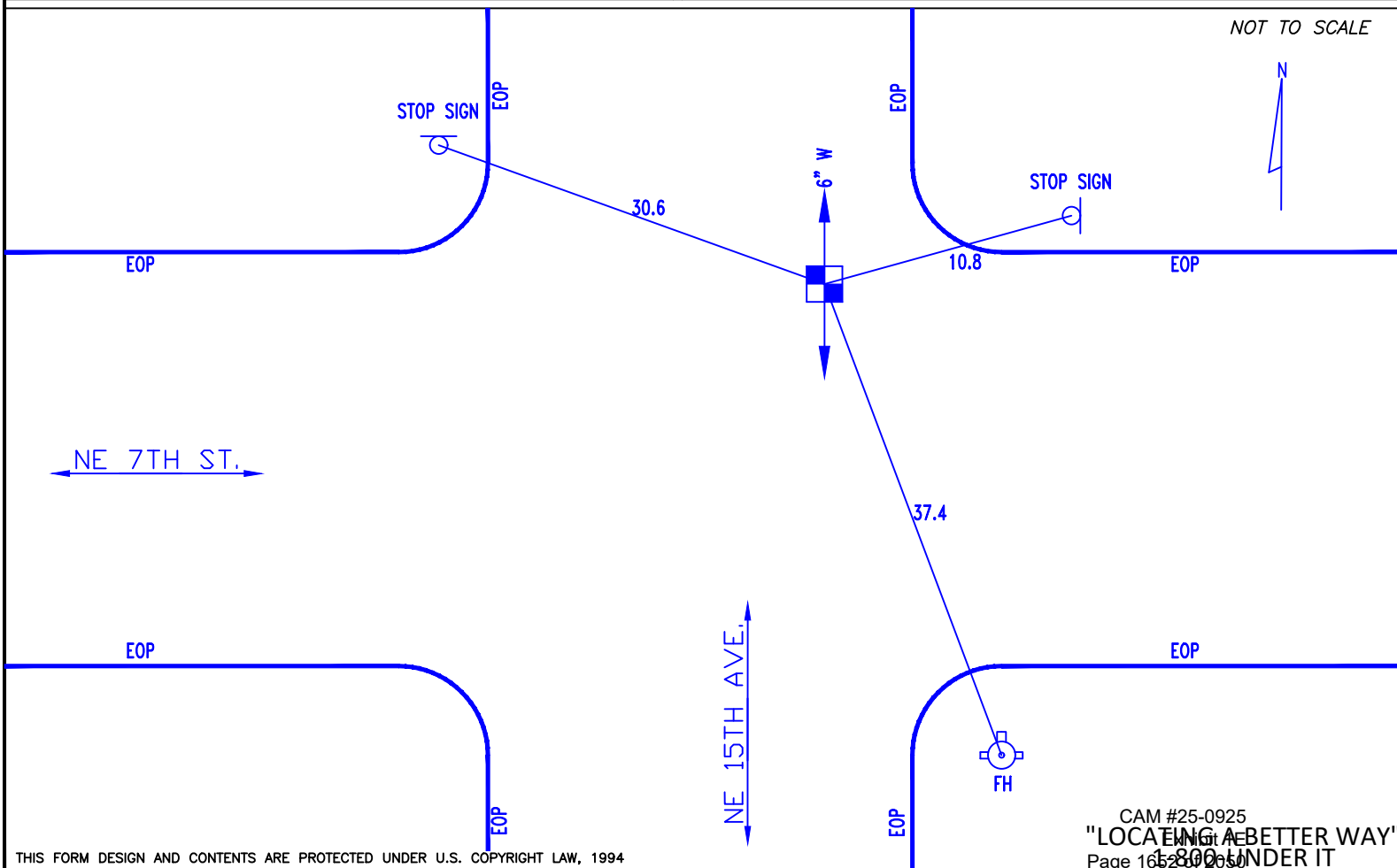
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
654618.74	942102.87	8.20

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:



PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 48" SANITARY FORCE MAIN

SHEET #: SD OF 28

PROPOSED: UTILITY WORK

UTILITY FOUND: SANITARY FORCE MAIN

FORM BY: SD

ASSISTED BY: TJ

OF HOLES: 1

MATERIAL AS FOUND: HDPE

PAVING CONDITION: N/A

DATE DUG: 09/20/24

SIZE AS FOUND: 48"

SOIL CONDITIONS: HARD SOFT DRY SAND ROCKY

UTILITY CONDITION: GOOD

ELEV SURVEY PIN

7.54

INSTALLED: HUB & TACK AT: CROWN OF UTILITY

MARKING TAPE: GREEN

EXIST. GRADE

COVER (TOP)

3.30

ELEV. (TOP)

4.24

COVER (BOTTOM)

N/A

ELEV. (BOTTOM)

N/A

WIDTH

50"±

FACING

NORTH

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

654973.70

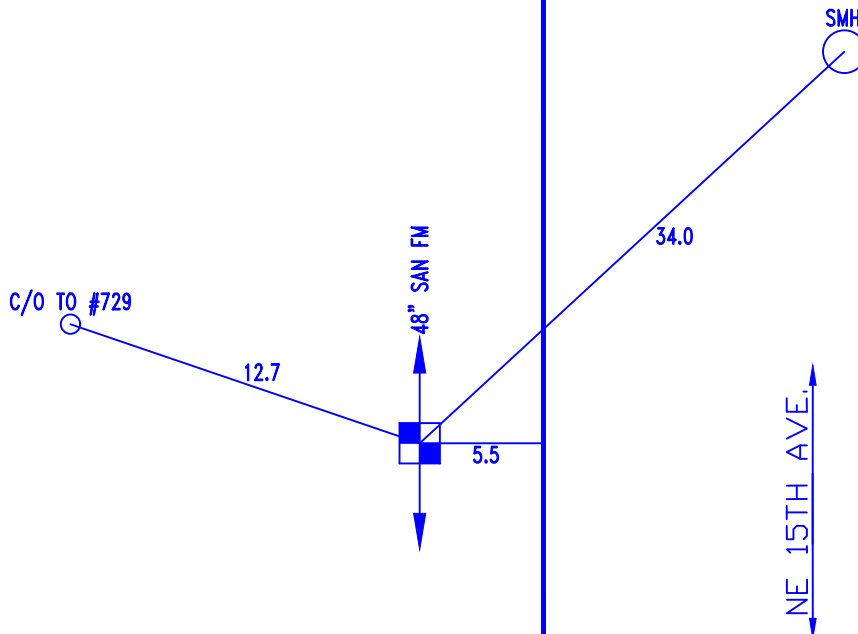
942063.52

7.54

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:

NOT TO SCALE



EOP

EOP

PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 12" WATER UTILITY FOUND: WATER MATERIAL AS FOUND: SEE NOTE SIZE AS FOUND: SEE NOTE	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 29 PROPOSED: UTILITY WORK FORM BY: DC ASSISTED BY: JA VT # OF HOLES: 1 PAVING CONDITION: FAIR DATE DUG: 09/24/24 SOIL CONDITIONS: HARD WET MOIST ROCKY UTILITY CONDITION: SEE NOTE
--	--

ELEV SURVEY PIN

7.40

EXIST. GRADE

COVER (TOP)

10.32

COVER (BOTTOM)

N/A

ELEV. (TOP)

-2.92

ELEV. (BOTTOM)

N/A

INSTALLED: **PK**

AT: **TOP** OF UTILITY MARKING TAPE: **BLUE**

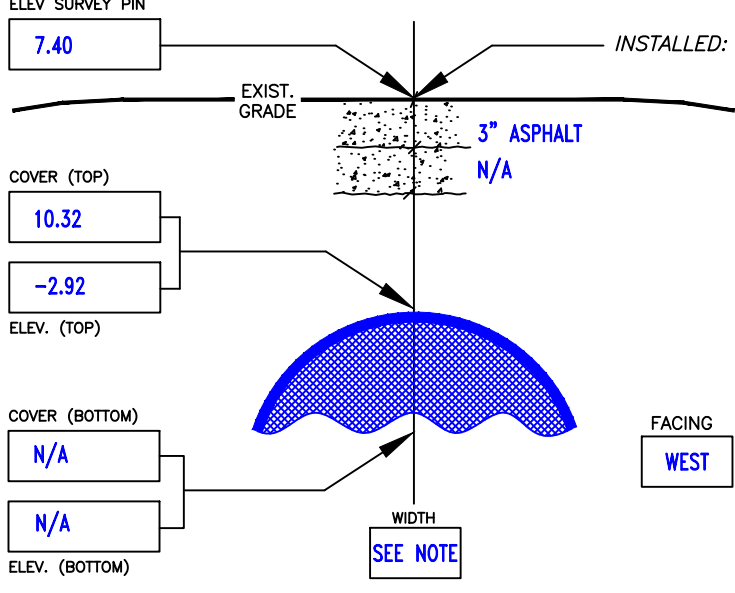
SURVEY PIN LOCATED BY: **IMC**

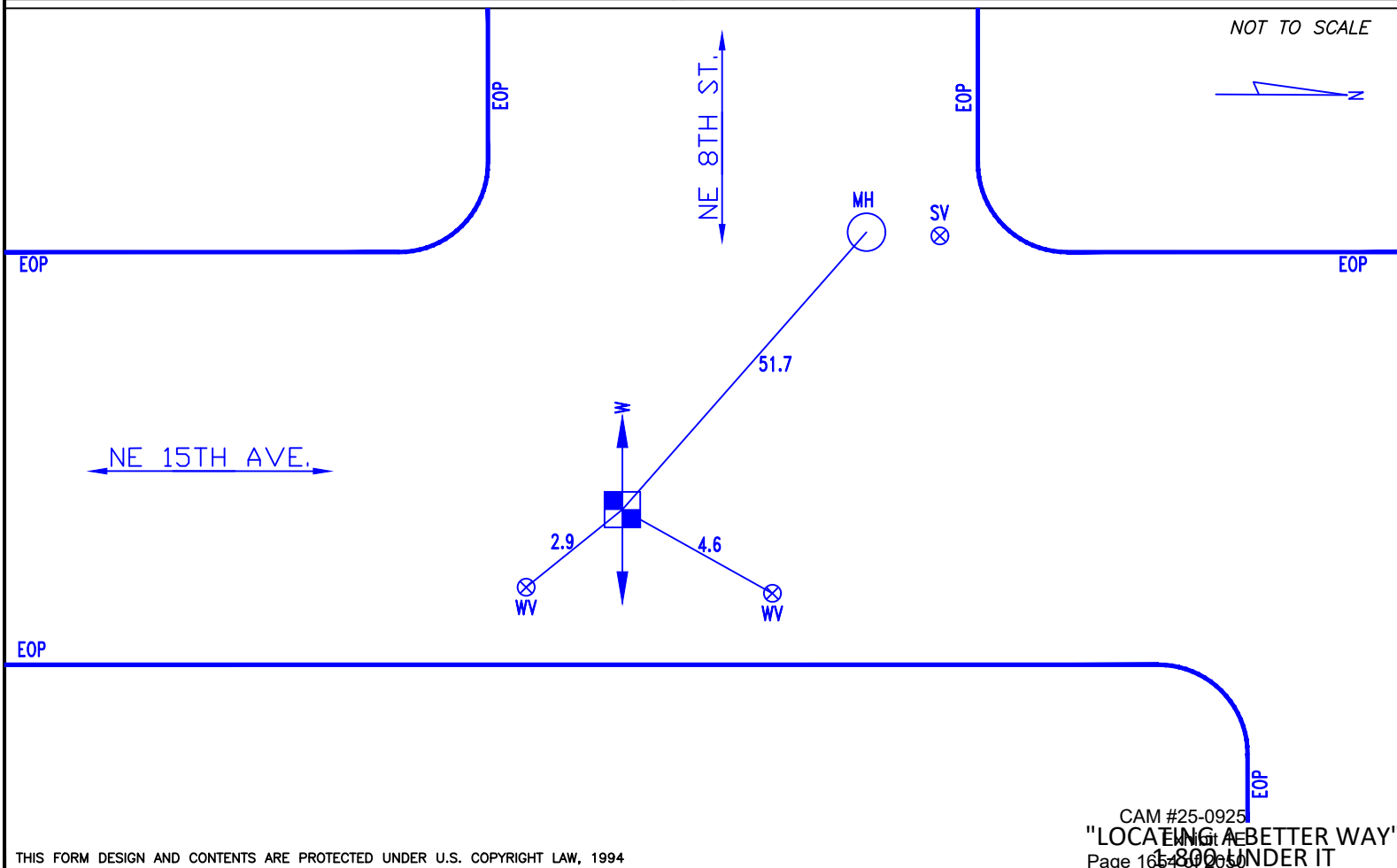
SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
655232.42	942077.72	7.40

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

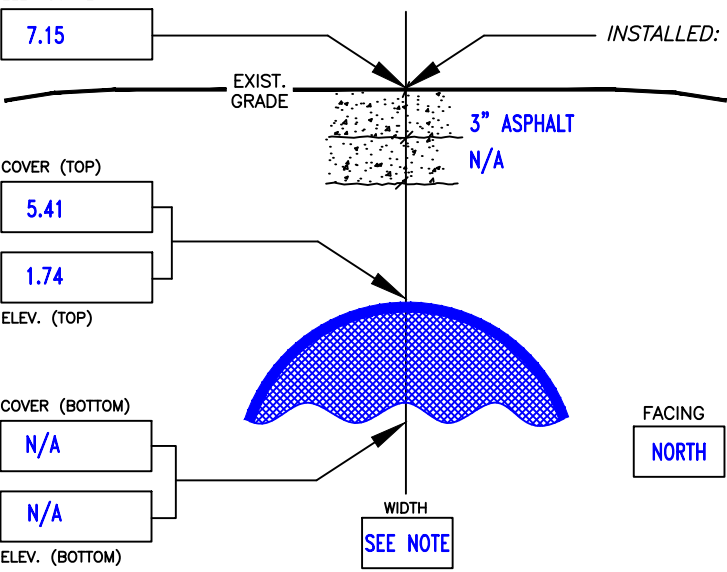
NOTES: **UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER. PLANS INDICATE 48" FORCE MAIN.**





PROJECT NAME: VICTORIA PARK – TEST HOLES	CLIENT JOB# N/A	WORK ORDER # N/A
LOCATE REQUESTED BY: HAZEN & SAWYER	PROJECT LOCATION: FT. LAUDERDALE, FL	
UTILITY REQUESTED: 36" SANITARY FORCE MAIN	SHEET #: SD OF 29	PROPOSED: UTILITY WORK
UTILITY FOUND: SANITARY FORCE MAIN	FORM BY: DL	ASSISTED BY: SD # OF HOLES: 1
MATERIAL AS FOUND: SEE NOTE	PAVING CONDITION: FAIR	DATE DUG: 09/25/24
SIZE AS FOUND: SEE NOTE	SOIL CONDITIONS: HARD SOFT WET SAND ROCKY	
UTILITY CONDITION: FAIR		

ELEV SURVEY PIN 7.15	INSTALLED: PK	AT: CROWN OF UTILITY	MARKING TAPE: GREEN
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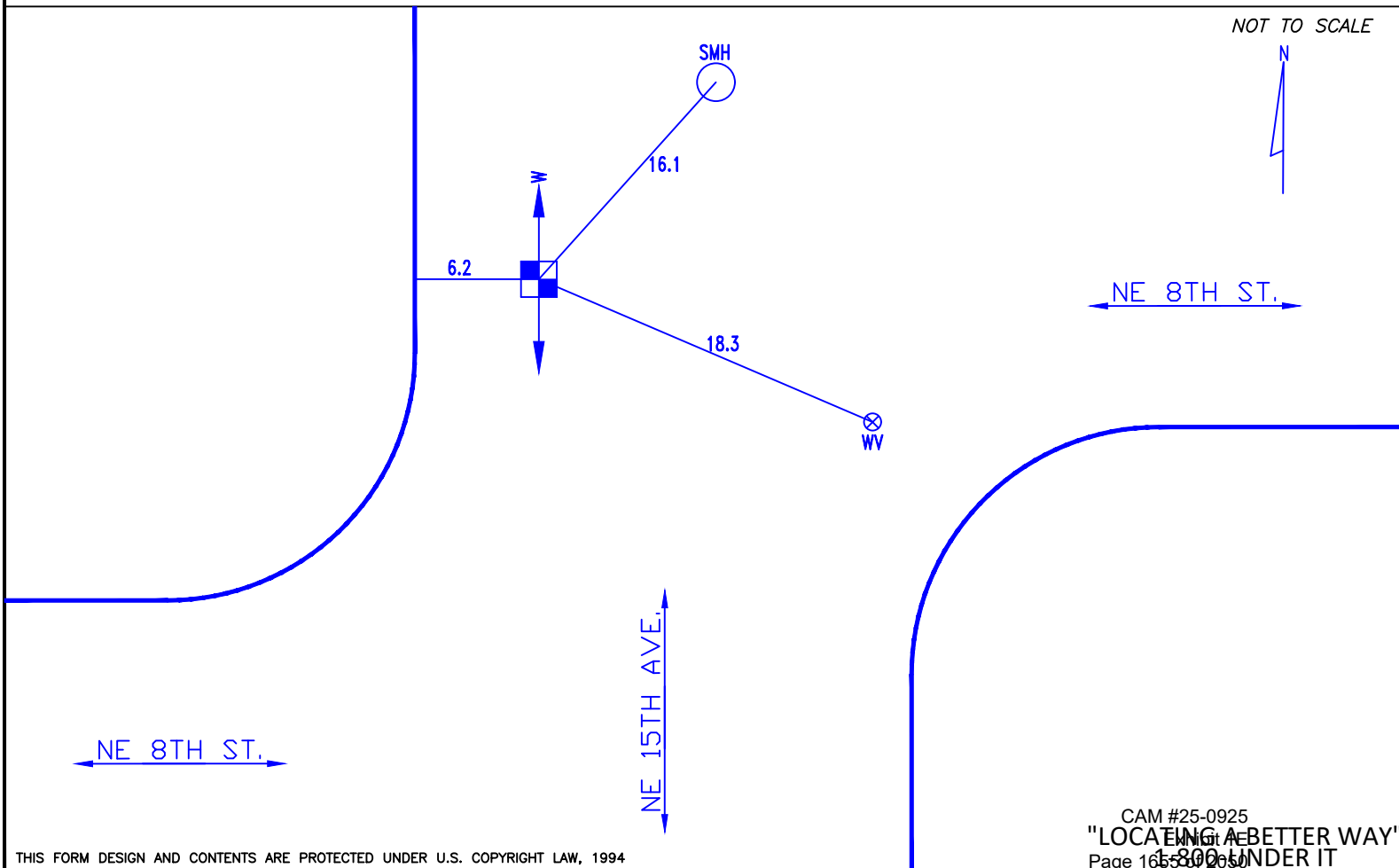


COVER (TOP)	5.41
ELEV. (TOP)	1.74
COVER (BOTTOM)	N/A
ELEV. (BOTTOM)	N/A

WIDTH: SEE NOTE

FACING: NORTH

SURVEY PIN LOCATED BY: IMC		
SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).		
NORTH	EAST	GRADE ELEV.
655276.21	942061.80	7.15
HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.		
NOTES: UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER.		

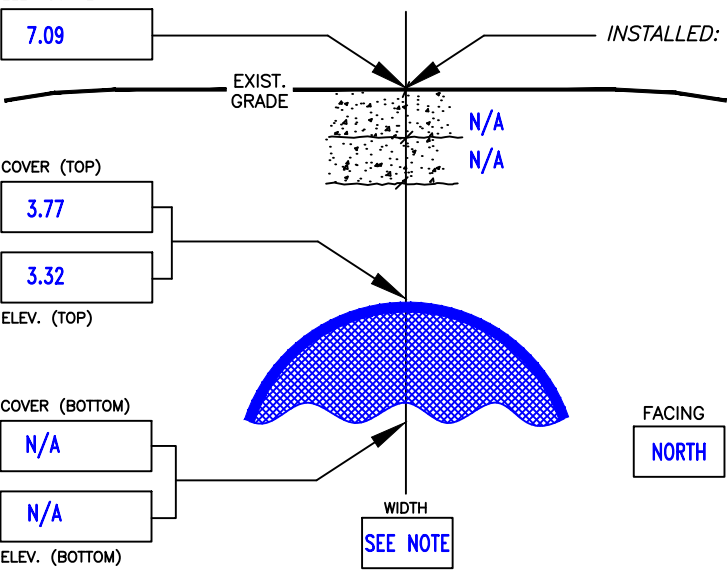


PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 48" SANITARY FORCE MAIN UTILITY FOUND: SANITARY FORCE MAIN MATERIAL AS FOUND: SEE NOTE SIZE AS FOUND: SEE NOTE	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 30 PROPOSED: UTILITY WORK FORM BY: SD ASSISTED BY: TJ # OF HOLES: 1 PAVING CONDITION: GOOD DATE DUG: 09/20/24 SOIL CONDITIONS: HARD SOFT WET MOIST SAND ROCKY UTILITY CONDITION: SEE NOTE
--	---

ELEV SURVEY PIN

7.09

EXIST. GRADE



COVER (TOP)

3.77

3.32

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

WIDTH

SEE NOTE

FACING

NORTH

INSTALLED: **HUB & TACK** AT: **TOP** OF UTILITY MARKING TAPE: **GREEN**

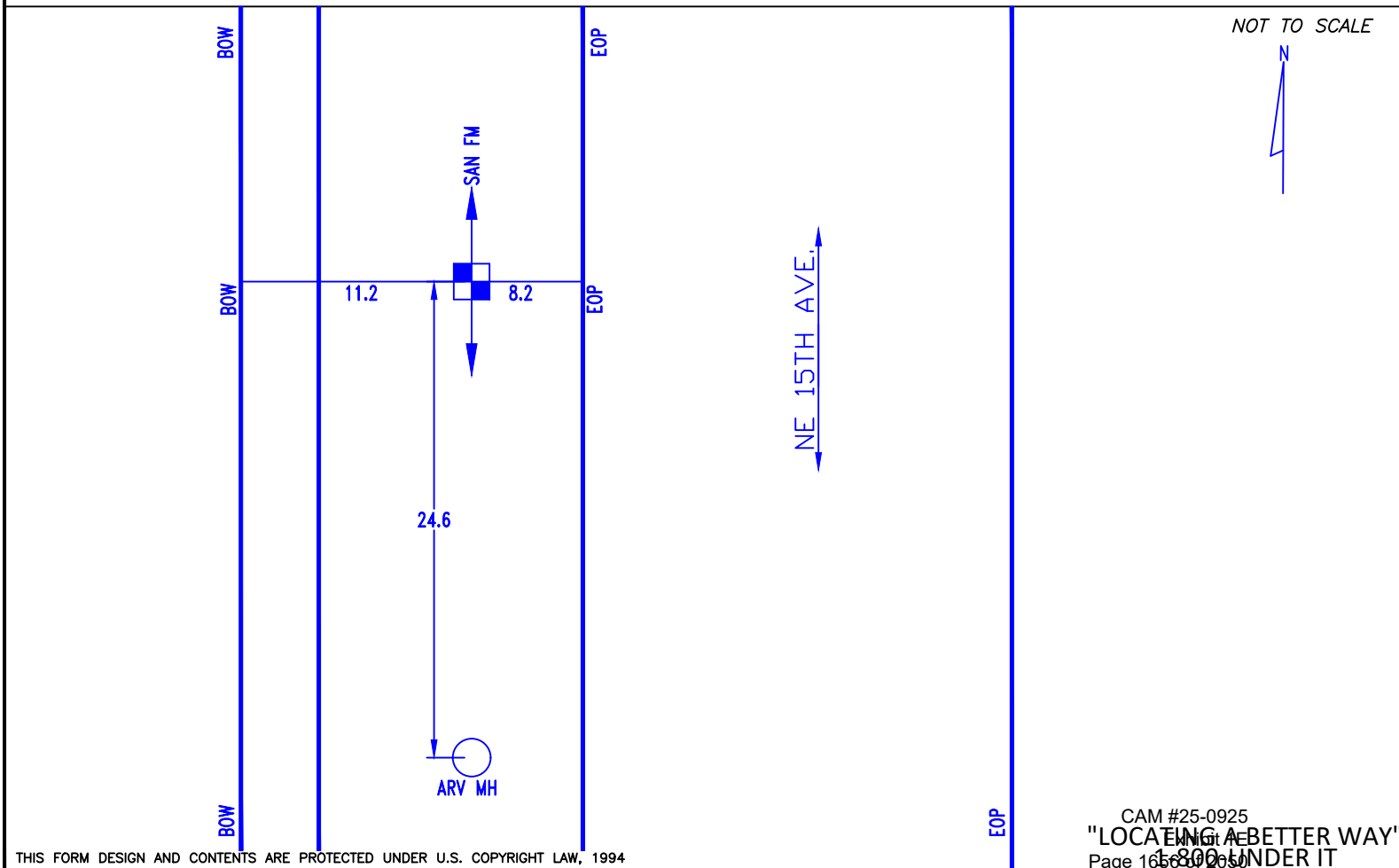
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
655569.36	942039.17	7.09

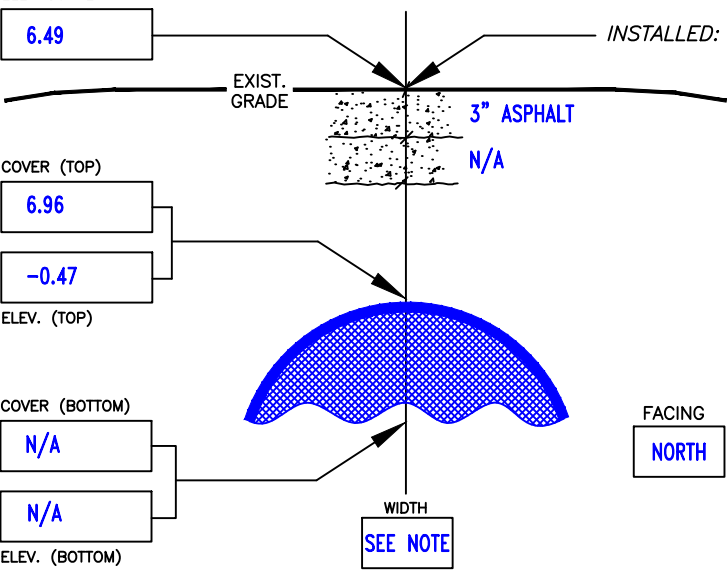
HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: **UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER. PLANS INDICATE 48" FORCE MAIN.**

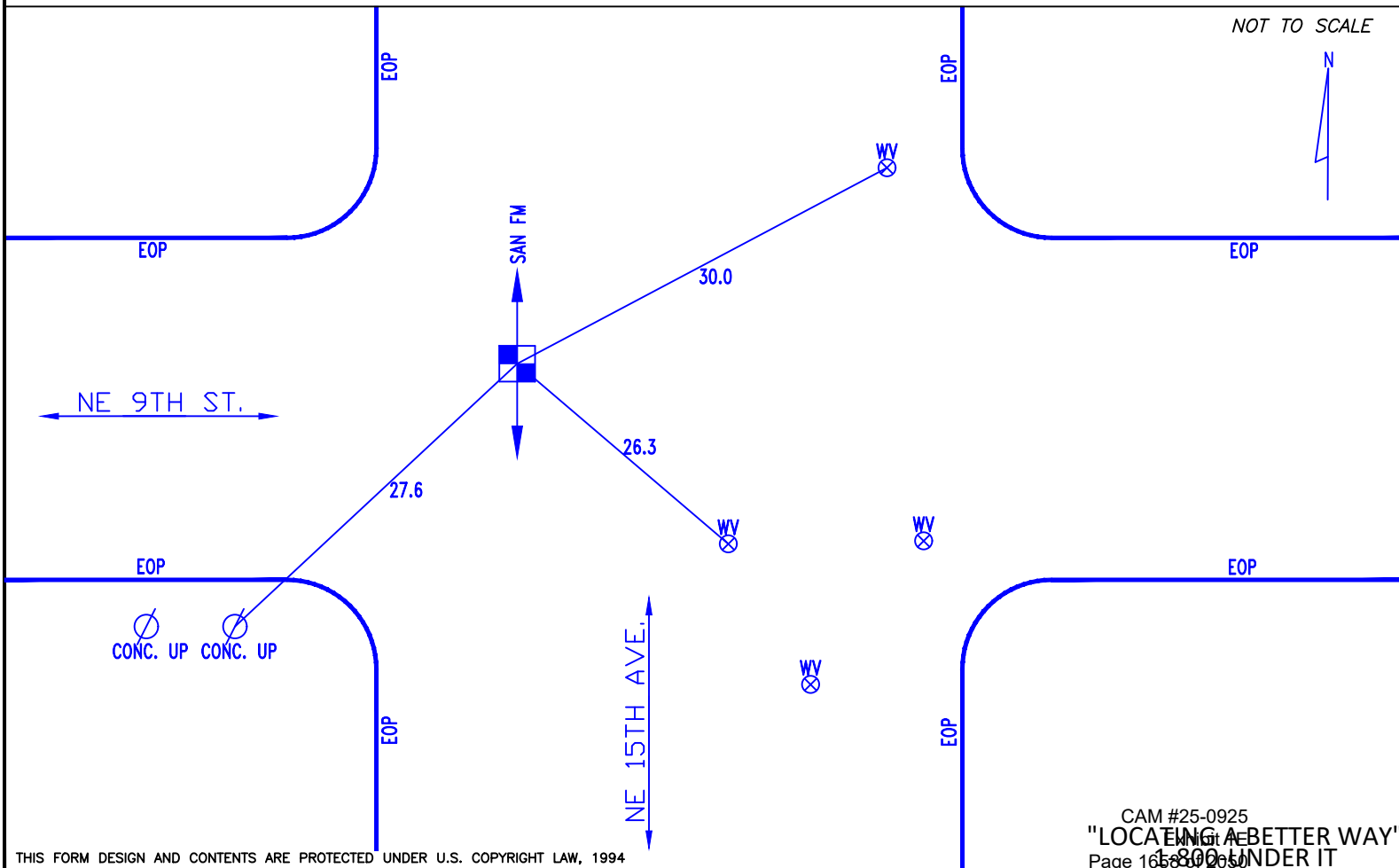


PROJECT NAME: VICTORIA PARK – TEST HOLES	CLIENT JOB# N/A	WORK ORDER # N/A
LOCATE REQUESTED BY: HAZEN & SAWYER	PROJECT LOCATION: FT. LAUDERDALE, FL	
UTILITY REQUESTED: 48" SANITARY FORCE MAIN	SHEET #: SD OF 30	PROPOSED: UTILITY WORK
UTILITY FOUND: SANITARY FORCE MAIN	FORM BY: DL	ASSISTED BY: DC JA # OF HOLES: 1
MATERIAL AS FOUND: SEE NOTE	PAVING CONDITION: FAIR	DATE DUG: 10/12/24
SIZE AS FOUND: SEE NOTE	SOIL CONDITIONS: HARD WET MOIST SAND ROCKY	
UTILITY CONDITION: SEE NOTE		

ELEV SURVEY PIN 6.49	INSTALLED: PK	AT: TOP OF UTILITY	MARKING TAPE: GREEN
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SURVEY PIN LOCATED BY: IMC		
SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).		
NORTH	EAST	GRADE ELEV.
655882.34	942033.46	6.49
HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.		
NOTES: UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER.		



PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 48" SANITARY FORCE MAIN

SHEET #: SD OF 30

PROPOSED: UTILITY WORK

UTILITY FOUND: SANITARY FORCE MAIN

FORM BY: DL

ASSISTED BY: DC JA

OF HOLES: 1

MATERIAL AS FOUND: SEE NOTE

PAVING CONDITION: FAIR

DATE DUG: 10/12/24

SIZE AS FOUND: SEE NOTE

SOIL CONDITIONS: HARD SOFT WET MOIST DRY SAND ROCKY

UTILITY CONDITION: SEE NOTE

ELEV SURVEY PIN

6.45

INSTALLED: PK

AT: TOP OF UTILITY

MARKING TAPE: GREEN

EXIST. GRADE

3" ASPHALT
N/A

COVER (TOP)

8.27

-1.82

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

FACING

EAST

WIDTH

SEE NOTE

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

655888.60

942056.10

6.45

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER.

NOT TO SCALE



NE 9TH ST.

EOP

NE 15TH AVE.

SAN FM

12.1

21.6

28.5

CONC. UP CONC. UP

CAM #25-0925

"LOCATING A BETTER WAY"

Page 16 of 20

PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 12" DUCTILE IRON WATER

SHEET #: SD OF 30

PROPOSED: UTILITY WORK

UTILITY FOUND: WATER

FORM BY: DL

ASSISTED BY: DC JA

OF HOLES: 1

MATERIAL AS FOUND: DUCTILE IRON

PAVING CONDITION: FAIR

DATE DUG: 10/12/24

SIZE AS FOUND: SEE NOTE

SOIL CONDITIONS: HARD SOFT WET MOIST SAND ROCKY

UTILITY CONDITION: FAIR

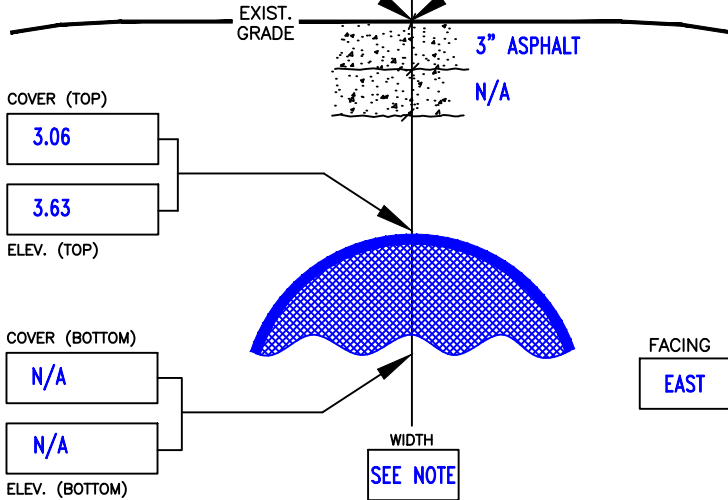
ELEV SURVEY PIN

6.69

INSTALLED: PK

AT: CROWN OF UTILITY

MARKING TAPE: BLUE



SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

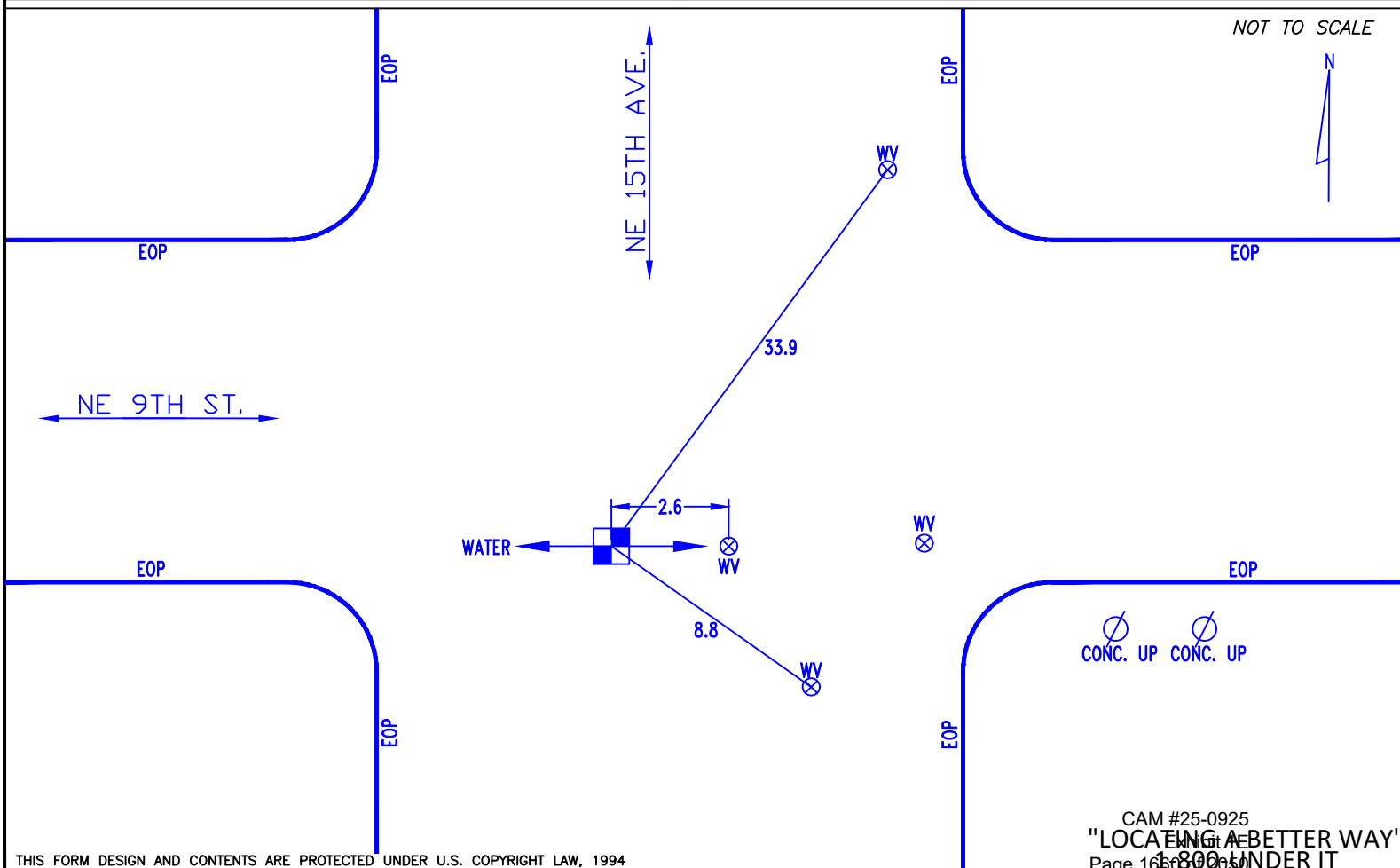
655867.27

942052.28

6.69

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: UNABLE TO VERIFY SIZE DUE TO EXCESSIVE GROUNDWATER.



PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 6" WATER

SHEET #: SD OF 30

PROPOSED: UTILITY WORK

UTILITY FOUND: WATER

FORM BY: DL

ASSISTED BY: DC JA

OF HOLES: 1

MATERIAL AS FOUND: DUCTILE IRON

PAVING CONDITION: FAIR

DATE DUG: 10/12/24

SIZE AS FOUND: 8"

SOIL CONDITIONS: HARD SOFT MOIST SAND ROCKY

UTILITY CONDITION: FAIR

ELEV SURVEY PIN

6.45

INSTALLED: PK

AT: CROWN OF UTILITY

MARKING TAPE: BLUE

EXIST. GRADE

3" ASPHALT
N/A

COVER (TOP)

3.22

ELEV. (TOP)

3.23

COVER (BOTTOM)

N/A

ELEV. (BOTTOM)

N/A

WIDTH

9"±

FACING

NORTH

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

655886.28

942057.99

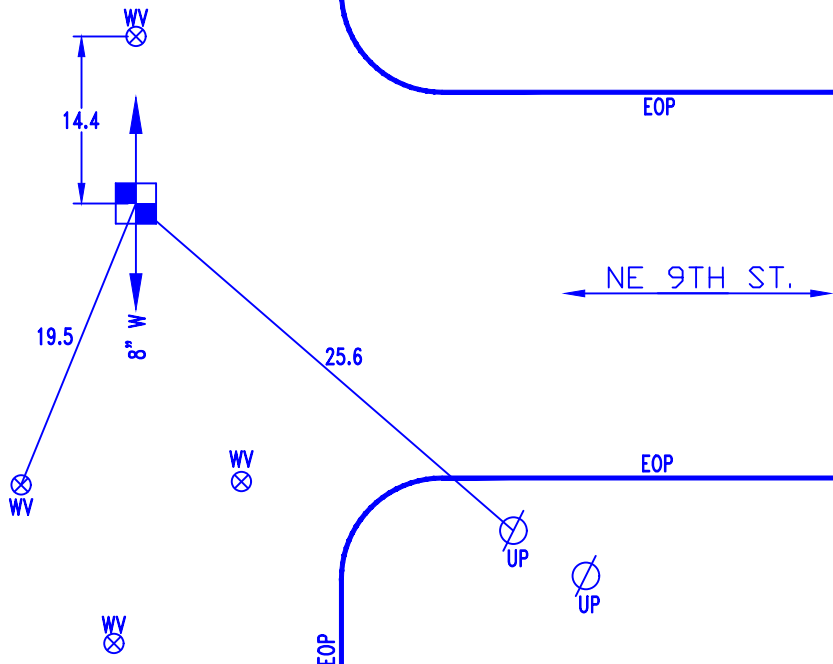
6.45

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:

NOT TO SCALE

NE 15TH AVE.



PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 12" WATER UTILITY FOUND: WATER MATERIAL AS FOUND: DUCTILE IRON SIZE AS FOUND: 12"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 32 PROPOSED: UTILITY WORK FORM BY: SD ASSISTED BY: JA # OF HOLES: 1 PAVING CONDITION: GOOD DATE DUG: 09/19/24 SOIL CONDITIONS: HARD SOFT WET SAND ROCKY UTILITY CONDITION: GOOD
---	---

ELEV SURVEY PIN

4.87

EXIST. GRADE

COVER (TOP)

2.50

2.37

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

INSTALLED: **PK** AT: **CROWN OF UTILITY** MARKING TAPE: **BLUE**

3" ASPHALT
N/A

WATER

WIDTH
13"±

FACING
NORTH

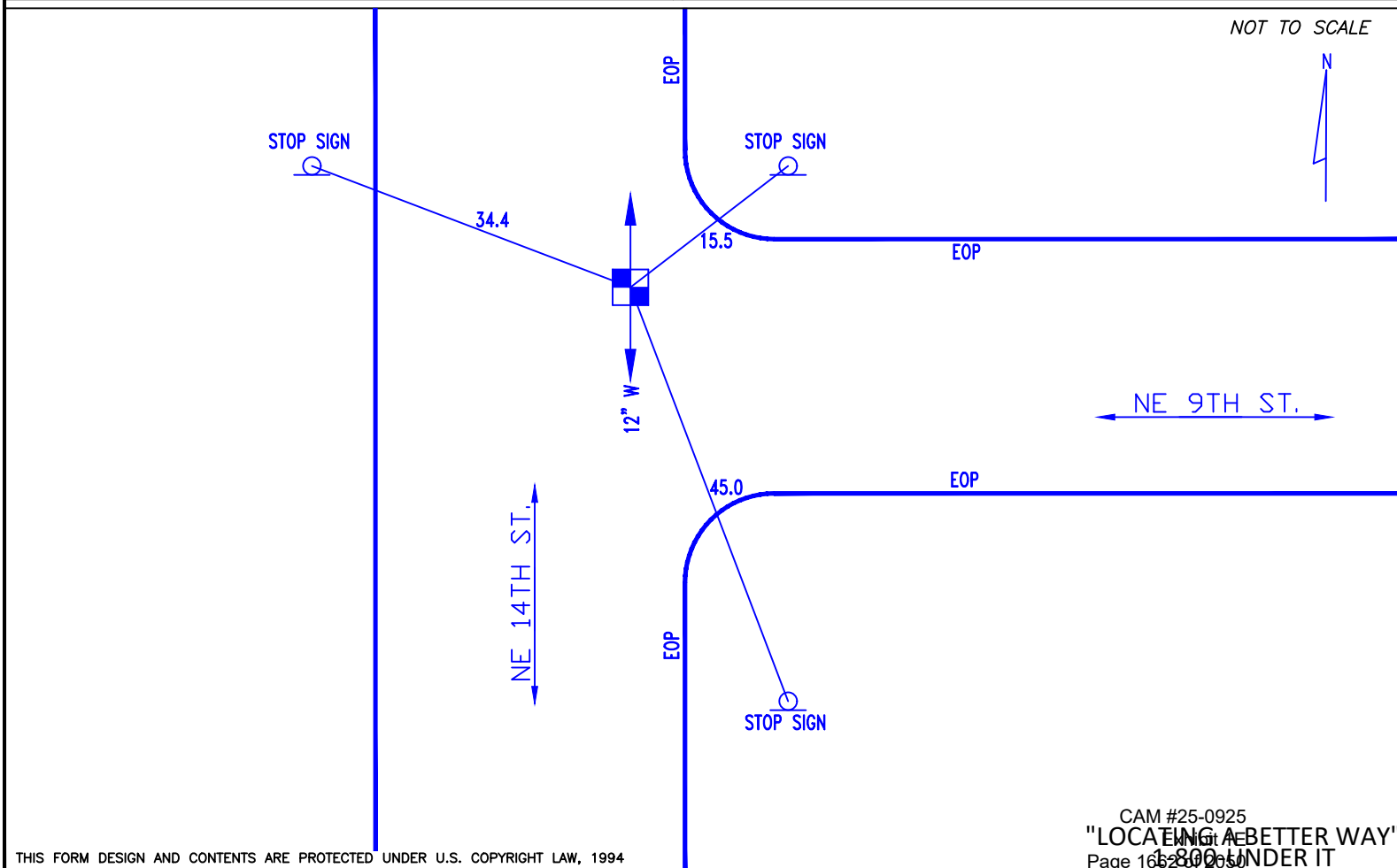
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
655886.86	941739.59	4.87

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:



PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 36" WATER

SHEET #: SD OF 33

PROPOSED: UTILITY WORK

UTILITY FOUND: WATER

FORM BY: SD

ASSISTED BY: JA

OF HOLES: 1

MATERIAL AS FOUND: DUCTILE IRON

PAVING CONDITION: GOOD

DATE DUG: 09/19/24

SIZE AS FOUND: 36"

SOIL CONDITIONS: HARD DRY SAND ROCKY

UTILITY CONDITION: GOOD

ELEV SURVEY PIN

7.41

INSTALLED: PK

AT: CROWN OF UTILITY

MARKING TAPE: BLUE

EXIST.
GRADE

0.40 ASPHALT
N/A

COVER (TOP)

4.45

2.96

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

FACING

NORTH

WIDTH

38"±

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

655302.92

942406.82

7.41

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:

STOP SIGN

EOP

39.2

EOP

EOP

STOP SIGN

23.1

EOP

NE 8TH ST.

EOP

EOP

UP

EOP

EOP

NE 16TH AVE.

32.3

36" W

NOT TO SCALE



PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 6" WATER UTILITY FOUND: UNKNOWN MATERIAL AS FOUND: SEE NOTE SIZE AS FOUND: 2"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 33 PROPOSED: UTILITY WORK FORM BY: SD ASSISTED BY: JA # OF HOLES: 1 PAVING CONDITION: GOOD DATE DUG: 09/19/24 SOIL CONDITIONS: HARD DRY SAND ROCKY UTILITY CONDITION: SEE NOTE
---	--

ELEV SURVEY PIN

7.22

EXIST. GRADE

COVER (TOP)

5.83

COVER (BOTTOM)

N/A

ELEV. (TOP)

1.39

ELEV. (BOTTOM)

N/A

INSTALLED: **PK**

AT: **TOP** OF UTILITY MARKING TAPE: **PINK**

SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
655305.68	942415.57	7.22

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: **DUG ON ELECTRONIC SIGNAL TO A DEPTH OF 4.5' AND PROBED TO 10'. NO WATER MAIN FOUND.**

0.40 ASPHALT

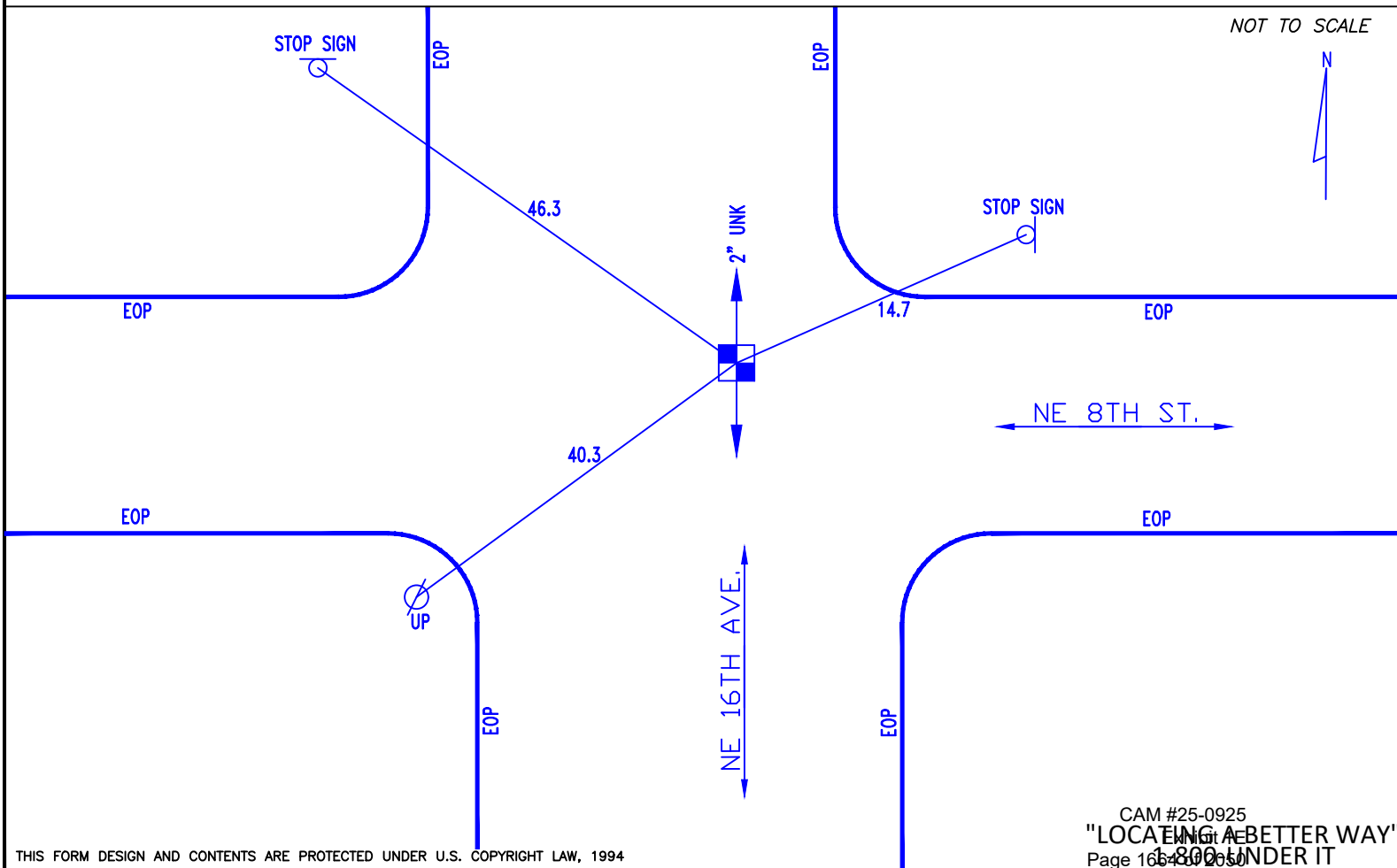
N/A

WIDTH

SEE NOTE

FACING

NORTH



PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 36" WATER UTILITY FOUND: WATER MATERIAL AS FOUND: DUCTILE IRON SIZE AS FOUND: 36"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 34 PROPOSED: UTILITY WORK FORM BY: SD ASSISTED BY: JA # OF HOLES: 1 PAVING CONDITION: GOOD DATE DUG: 09/19/24 SOIL CONDITIONS: HARD DRY SAND ROCKY UTILITY CONDITION: GOOD
---	--

ELEV SURVEY PIN

7.05

EXIST. GRADE

COVER (TOP)

3.43

3.62

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

INSTALLED: **PK** AT: **CROWN OF UTILITY** MARKING TAPE: **BLUE**

0.40 ASPHALT
N/A

WIDTH
38"±

FACING
NORTH

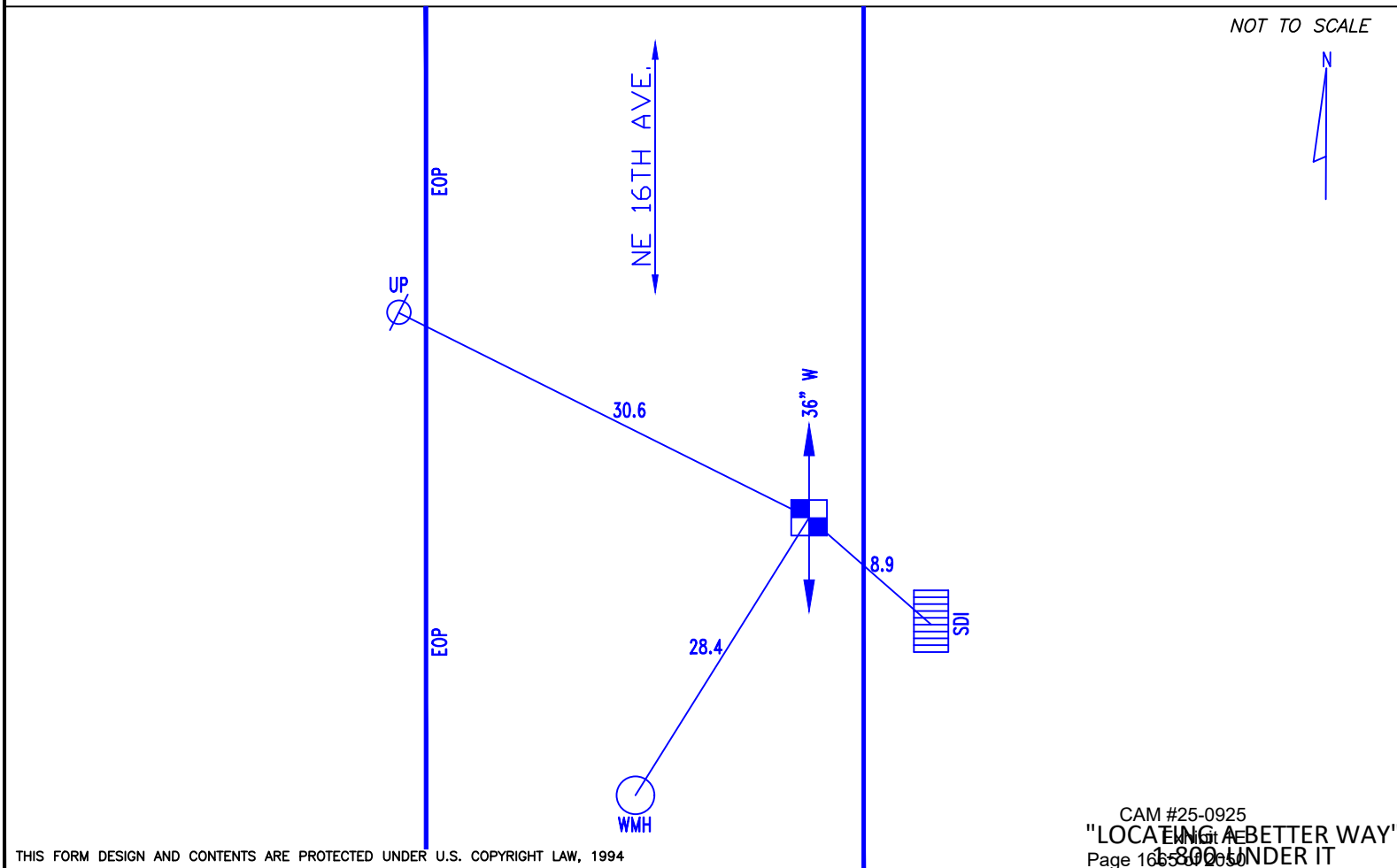
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH	EAST	GRADE ELEV.
655027.13	942430.62	7.05

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:



PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 48" FORCE MAIN UTILITY FOUND: FORCE MAIN MATERIAL AS FOUND: SEE NOTE SIZE AS FOUND: SEE NOTE	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 36 PROPOSED: UTILITY WORK FORM BY: DL ASSISTED BY: JA VT # OF HOLES: 1 PAVING CONDITION: FAIR DATE DUG: 09/25/24 SOIL CONDITIONS: HARD WET SAND ROCKY UTILITY CONDITION: SEE NOTE
--	---

ELEV SURVEY PIN

6.66

EXIST. GRADE

COVER (TOP)

8.44

COVER (BOTTOM)

N/A

ELEV. (TOP)

-1.78

ELEV. (BOTTOM)

N/A

INSTALLED: **PK**

AT: **TOP** OF UTILITY MARKING TAPE: **GREEN**

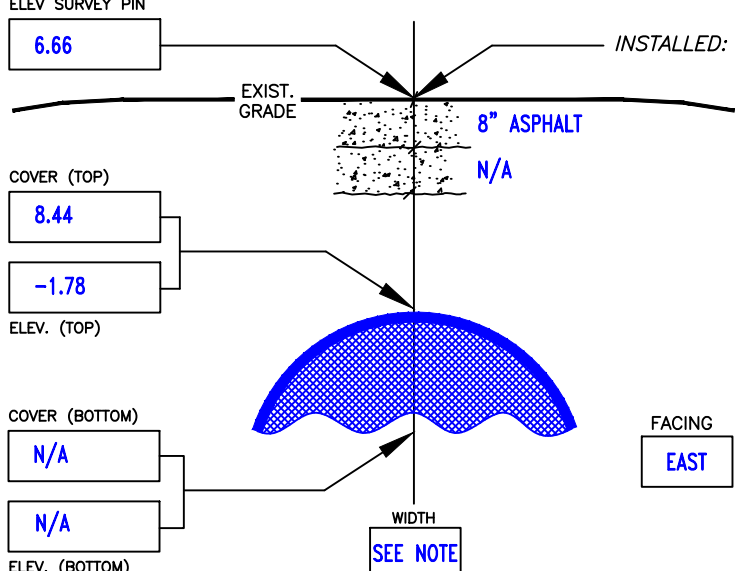
SURVEY PIN LOCATED BY: **IMC**

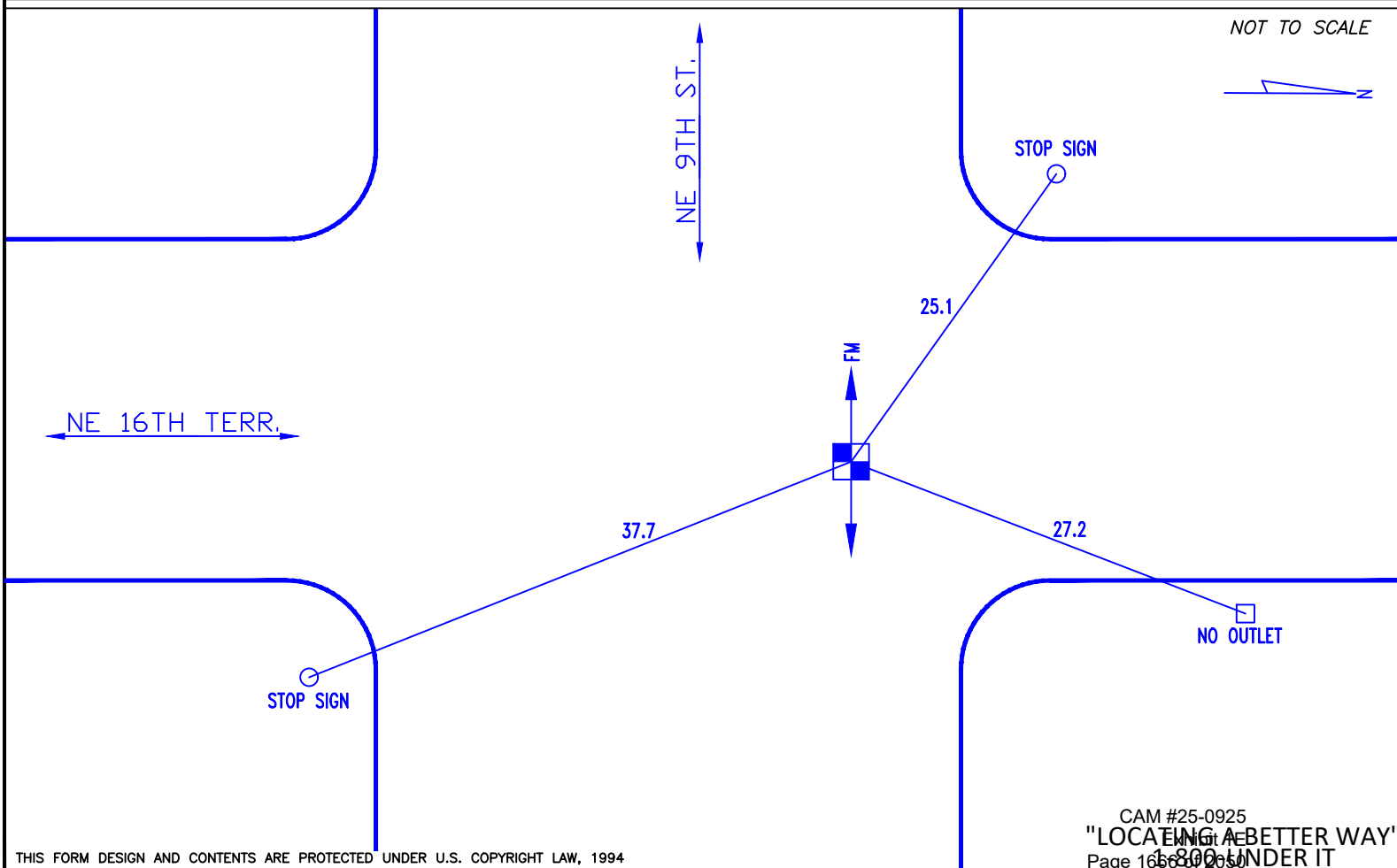
SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
655912.79	942671.95	6.66

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: **UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER AND SOIL INSTABILITY.**





PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 6" WATER UTILITY FOUND: UNKNOWN MATERIAL AS FOUND: SEE NOTE SIZE AS FOUND: SEE NOTE	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 38 PROPOSED: UTILITY WORK FORM BY: DL ASSISTED BY: SD TJ # OF HOLES: 1 PAVING CONDITION: FAIR DATE DUG: 09/26/24 SOIL CONDITIONS: HARD SOFT WET MOIST DRY SAND ROCKY UTILITY CONDITION: SEE NOTE
---	--

ELEV SURVEY PIN

6.00

EXIST. GRADE

COVER (TOP)

5.03

0.97

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

INSTALLED: **PK** AT: **TOP** OF UTILITY MARKING TAPE: **PINK**

2" ASPHALT
N/A

FACING
EAST

WIDTH
SEE NOTE

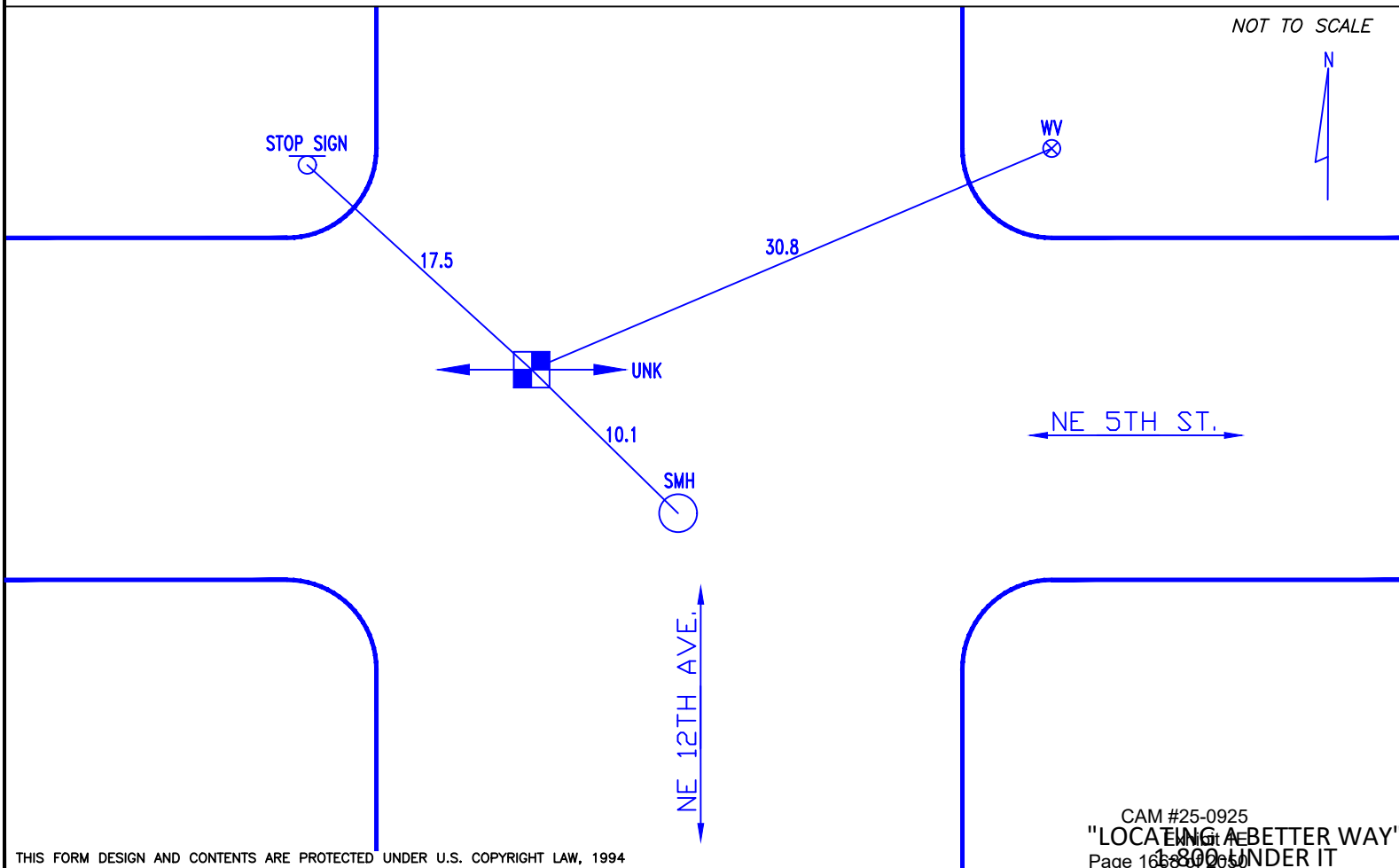
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
652544.44	941193.49	6.00

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: **UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER.**



PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 12" WATER

SHEET #: SD OF 39

PROPOSED: UTILITY WORK

UTILITY FOUND: WATER

FORM BY: DC

ASSISTED BY: VT

OF HOLES: 1

MATERIAL AS FOUND: CAST IRON

PAVING CONDITION: N/A

DATE DUG: 09/18/24

SIZE AS FOUND: 3"

SOIL CONDITIONS: HARD WET SAND ROCKY

UTILITY CONDITION: POOR

ELEV SURVEY PIN

5.94

INSTALLED: HUB & TACK AT: CROWN OF UTILITY

MARKING TAPE: BLUE

EXIST. GRADE

COVER (TOP)

1.70

4.24

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

FACING

EAST

WIDTH

3.5"±

SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

652544.44

941193.49

5.94

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:

NOT TO SCALE

WV

39.1

SMH

25.3

7.6

FOW

3" W

CONCRETE SIDEWALK

NE 12TH AVE.

NE 4TH ST.

PN: PF23119

VACUUM TEST HOLE REPORT NO.: 57

PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 48" FORCE MAIN UTILITY FOUND: FORCE MAIN MATERIAL AS FOUND: SEE NOTE SIZE AS FOUND: SEE NOTE	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 39 PROPOSED: UTILITY WORK FORM BY: DC ASSISTED BY: VT # OF HOLES: 1 PAVING CONDITION: N/A DATE DUG: 09/18/24 SOIL CONDITIONS: HARD WET SAND ROCKY UTILITY CONDITION: SEE NOTE
--	--

ELEV SURVEY PIN

5.97

COVER (TOP) **6.49**

COVER (BOTTOM) **N/A**

ELEV. (TOP) **-0.52**

ELEV. (BOTTOM) **N/A**

WIDTH **SEE NOTE**

FACING **EAST**

INSTALLED: **HUB & TACK** AT: **TOP** OF UTILITY MARKING TAPE: **GREEN**

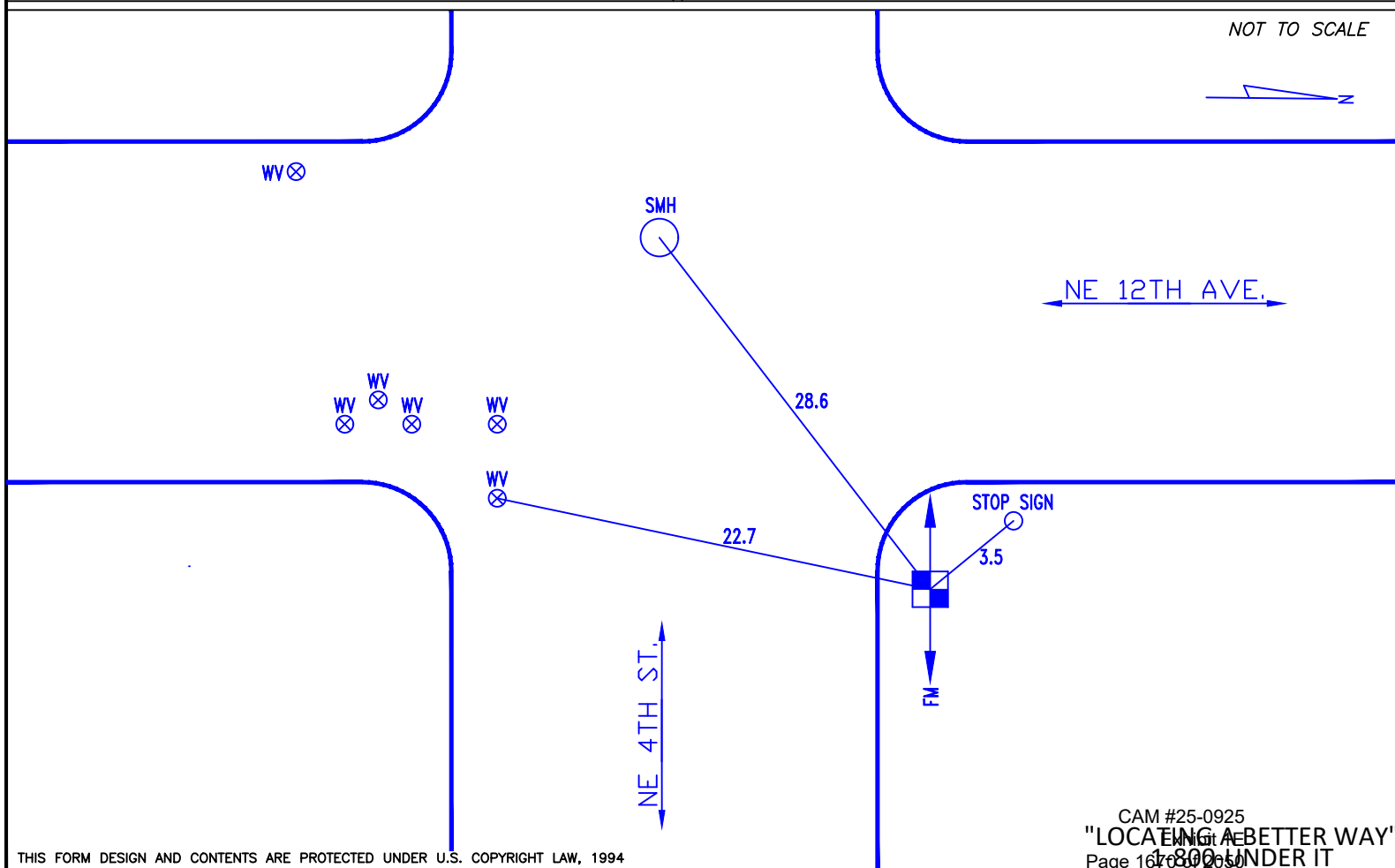
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
652571.57	941195.72	5.97

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: **UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER. PLANS INDICATE 48" FORCE MAIN.**



PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 6" WATER UTILITY FOUND: WATER MATERIAL AS FOUND: CAST IRON SIZE AS FOUND: 6"	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 40 PROPOSED: UTILITY WORK FORM BY: DC ASSISTED BY: JA TJ # OF HOLES: 1 PAVING CONDITION: N/A DATE DUG: 09/17/24 SOIL CONDITIONS: HARD WET SAND ROCKY UTILITY CONDITION: FAIR
--	--

ELEV SURVEY PIN

5.43

EXIST. GRADE

COVER (TOP)

3.32

2.11

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

INSTALLED: **PK** AT: **CROWN OF UTILITY** MARKING TAPE: **BLUE**

3" ASPHALT
N/A

WIDTH
7"±

FACING
NORTH

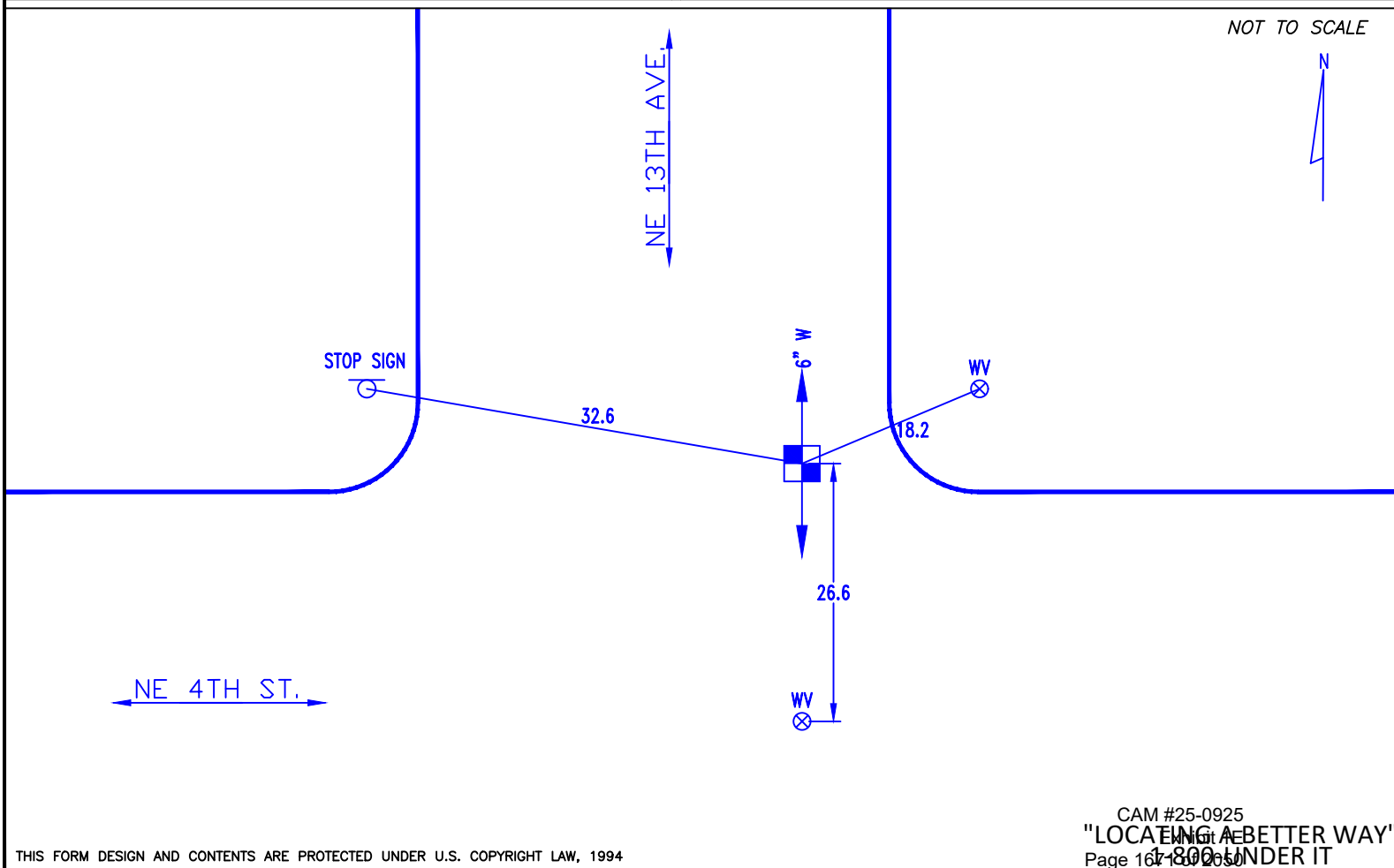
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH	EAST	GRADE ELEV.
652575.22	941518.83	5.43

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES:



PROJECT NAME: VICTORIA PARK – TEST HOLES LOCATE REQUESTED BY: HAZEN & SAWYER UTILITY REQUESTED: 48" FORCE MAIN UTILITY FOUND: FORCE MAIN MATERIAL AS FOUND: SEE NOTE SIZE AS FOUND: SEE NOTE	CLIENT JOB# N/A WORK ORDER # N/A PROJECT LOCATION: FT. LAUDERDALE, FL SHEET #: SD OF 40 PROPOSED: UTILITY WORK FORM BY: DC ASSISTED BY: JA TJ # OF HOLES: 1 PAVING CONDITION: N/A DATE DUG: 09/17/24 SOIL CONDITIONS: HARD WET SAND ROCKY UTILITY CONDITION: SEE NOTE
--	---

ELEV SURVEY PIN

5.55

COVER (TOP)

6.10

-0.55

ELEV. (TOP)

COVER (BOTTOM)

N/A

N/A

ELEV. (BOTTOM)

INSTALLED: **HUB & TACK** AT: **TOP** OF UTILITY MARKING TAPE: **GREEN**

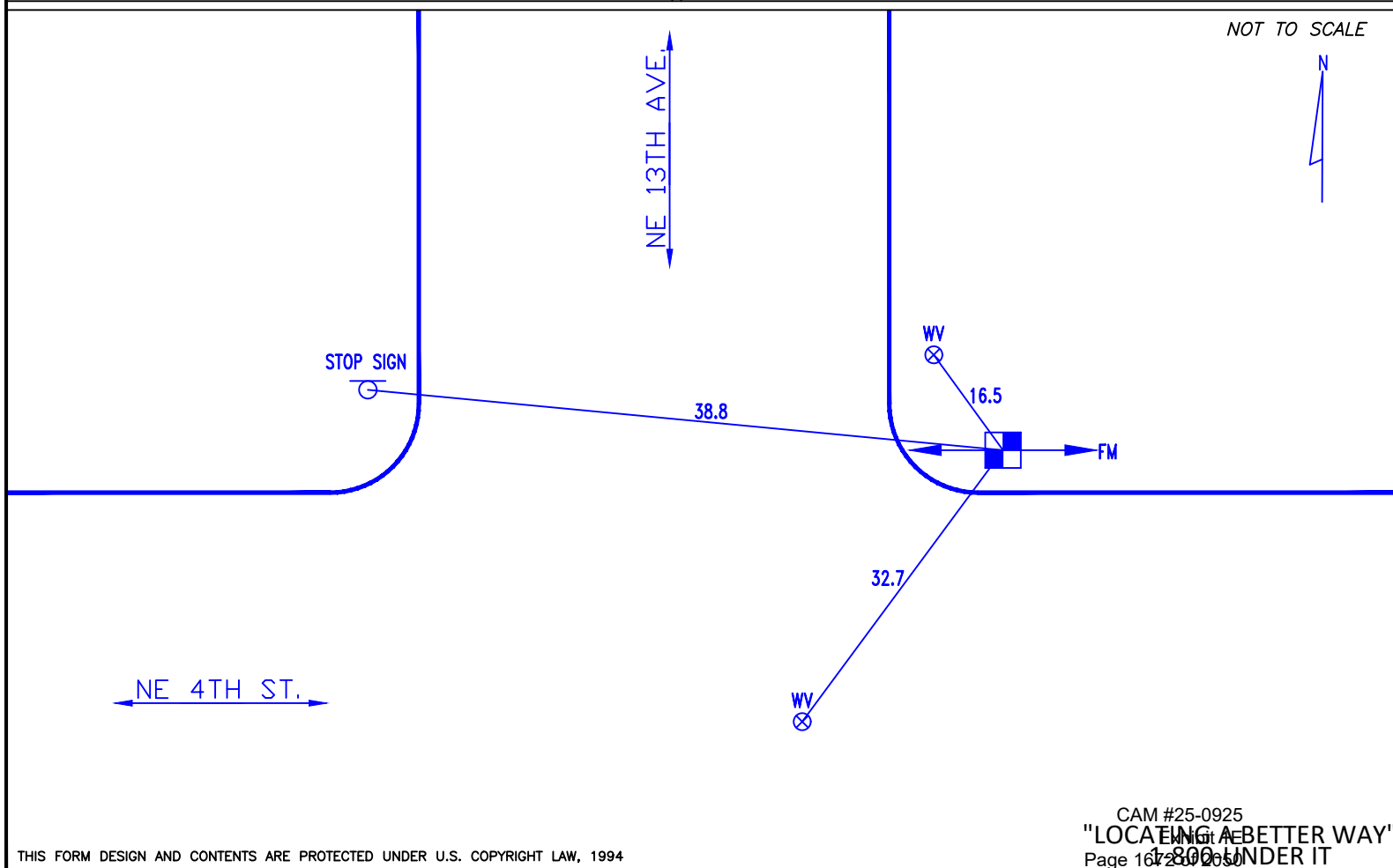
SURVEY PIN LOCATED BY: **IMC**

SURVEY INFO.: **ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).**

NORTH	EAST	GRADE ELEV.
652580.14	941527.99	5.55

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: **UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER.**



PROJECT NAME: VICTORIA PARK – TEST HOLES

CLIENT JOB# N/A

WORK ORDER # N/A

LOCATE REQUESTED BY: HAZEN & SAWYER

PROJECT LOCATION: FT. LAUDERDALE, FL

UTILITY REQUESTED: 36" WATER

SHEET #: SD OF 41

PROPOSED: UTILITY WORK

UTILITY FOUND: WATER

FORM BY: DL

ASSISTED BY: JA TJ

OF HOLES: 1

MATERIAL AS FOUND: SEE NOTE

PAVING CONDITION: FAIR

DATE DUG: 09/17/24

SIZE AS FOUND: SEE NOTE

SOIL CONDITIONS: HARD WET SAND ROCKY

UTILITY CONDITION: SEE NOTE

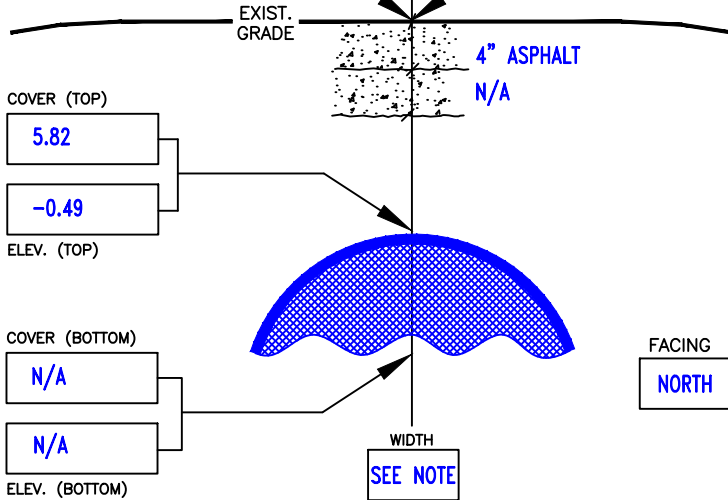
ELEV SURVEY PIN

5.33

INSTALLED: PK

AT: TOP OF UTILITY

MARKING TAPE: BLUE



SURVEY PIN LOCATED BY: IMC

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NORTH

EAST

GRADE ELEV.

652592.93

941852.12

5.33

HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT.

NOTES: UNABLE TO VERIFY SIZE & MATERIAL DUE TO EXCESSIVE GROUNDWATER.

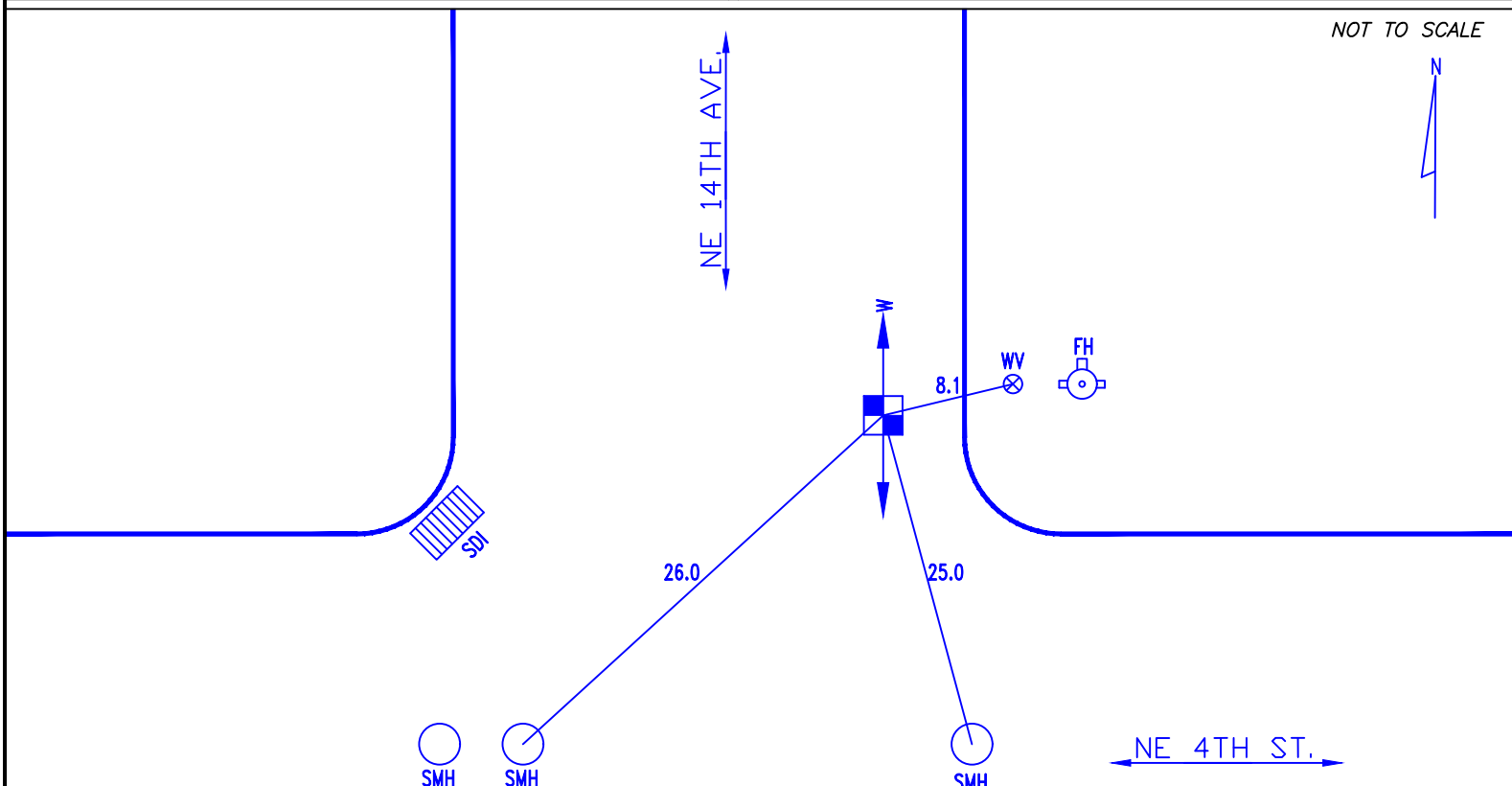


EXHIBIT 1

WIFIA PROGRAM BORROWER GUIDE TO FEDERAL REQUIREMENTS

WIFIA TERMS AND CONDITIONS

APPENDIX: WIFIA SPECIFICATION PACKAGE AND BID CONTRACT LANGUAGE

Last Updated: November 2022

This is a reference document that provides all necessary contract language for WIFIA funded projects. Please note that some of the contract language in this package is required and must be included verbatim and some is suggested. For *Suggested Contract Language*, you may use your own language so long as it still ensures that provisions are included to guarantee compliance with the federal requirements.

EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THE FEDERAL LANGUAGE PROVISIONS WITH RESPECT TO STATE OR LOCAL LAW.

ECONOMIC AND MISCELLANEOUS AUTHORITIES

DEBARMENT AND SUSPENSION AND PROHIBITIONS RELATING TO VIOLATIONS OF CWA AND CAA WITH RESPECT TO FEDERAL CONTRACTS, GRANTS, OR LOANS

Suggested Contract Language:

Debarment and Suspension. Contractor certifies that it will not knowingly enter into a contract with anyone who is ineligible under the 2 CFR part 180 and part 1532 (per Executive Order 12549, 51 FR 6370, February 21, 1986) or who is prohibited under Section 306 of the Clean Air Act or Section 508 of the Clean Water Act to participate in the [Project]. Suspension and debarment information can be accessed at <http://www.sam.gov>. Contractor represents and warrants that it has or will include a term or conditions requiring compliance with this provision in all of its subcontracts under this Agreement.

NEW RESTRICTIONS ON LOBBYING

Suggested Contract Language:

Federal Lobbying Restrictions (31 U.S.C 1352). Recipients of federal financial assistance may not pay any person for influencing or attempting to influence any officer or employee of a federal agency, a member of Congress, an officer or employee of Congress, or an employee of a member of Congress with respect to the award, continuation, renewal, amendment, or modification of a federal grant, loan, or contract. These requirements are implemented for USEPA in 40 CFR Part 34, which also describes types of activities, such as legislative liaison activities and professional and technical services, which are not subject to this prohibition. Upon award of this contract, Contractor shall complete and submit to the City the certification and disclosure forms in Appendix A and Appendix B to 40 CFR Part 34. Contractor shall also require all subcontractors and suppliers of any tier awarded a subcontract over \$100,000 to similarly complete and submit the certification and disclosure forms pursuant to the process set forth in 40 CFR 34.110.

CIVIL RIGHTS, NONDISCRIMINATION, AND EQUAL EMPLOYMENT OPPORTUNITY AUTHORITIES

AGE DISCRIMINATION ACT, SECTION 504 OF THE REHABILITATION ACT, TITLE VI OF THE CIVIL RIGHTS ACT OF 1964, AND SECTION 13 OF THE CLEAN WATER ACT

Suggested Contract Language:

CIVIL RIGHTS OBLIGATIONS. Contractor shall comply with the following federal non-discrimination requirements:

- a. Title VI of the Civil Rights Act of 1964, which prohibits discrimination based on race, color, and national origin, including limited English proficiency (LEP). (42 U.S.C 2000D, *et. seq*)
- b. Section 504 of the Rehabilitation Act of 1973, which prohibits discrimination against persons with disabilities. (29 U.S.C. 794, supplemented by EO 11914, 41 FR 17871, April 29, 1976 and EO 11250, 30 FR 13003, October 13, 1965)
- c. The Age Discrimination Act of 1975, which prohibits age discrimination. (42 U.S.C 6101 *et. seq*)
- d. Section 13 of the Federal Water Pollution Control Act Amendments of 1972, which prohibits discrimination on the basis of sex.
- e. 40 CFR Part 7, as it relates to the foregoing.

EQUAL EMPLOYMENT OPPORTUNITY

Required *Contract Language. Note the requirements include three separate sections to include in contracts: EEO, Standard Federal Equal Employment Opportunity Construction Contract Specifications, and Segregated Facilities. This language must be included verbatim:*

Equal Employment Opportunity (EEO). The Contractor shall comply with Executive Order 11246, entitled 'Equal Employment Opportunity,' as amended by Executive Order 11375, and as supplemented in Department of Labor regulations (41 CFR Part 60). (EO 11246, 30 FR 12319, September 28, 1965)

Contractor's compliance with Executive order 11246 shall be based on implementation of the Equal Opportunity Clause, and specific affirmative active obligations required by the Standard Federal Equal Employment Opportunity Construction Contract Specifications, as set forth in 41 CFR Part 60-4.

During the performance of this contract, the contractor agrees as follows:

- 1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following: employment, upgrading,

demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

- 2) The contractor will, in all solicitations or advancements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.
- 3) The contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the contractor's legal duty to furnish information.
- 4) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
- 5) The contractor will comply with all provisions of Executive Order No. 11246 of Sept. 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
- 6) The contractor will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
- 7) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of Sept. 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
- 8) The contractor will include the provisions of paragraphs (1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, that in the event the contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor

as a result of such direction, the contractor may request the United States to enter into such litigation to protect the interests of the United States. [Sec. 202 amended by EO 11375 of Oct. 13, 1967, 32 FR 14303, 3 CFR, 1966–1970 Comp., p. 684, EO 12086 of Oct. 5, 1978, 43 FR 46501, 3 CFR, 1978 Comp., p. 230, EO 13665 of April 8, 2014, 79 FR 20749, EO 13672 of July 21, 2014, 79 FR 42971]

Standard Federal Equal Employment Opportunity Construction Contract Specifications. (41 CFR 60-4.3)

- 1) As used in these specifications:
 - a) “Covered area” means the geographical area described in the solicitation from which this contract resulted;
 - b) “Director” means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;
 - c) “Employer identification number” means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.
 - d) “Minority” includes:
 - i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
 - ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
 - iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
 - iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).
- 2) Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.
- 3) If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.
- 4) The Contractor shall implement the specific affirmative action standards provided in paragraphs 7 a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and

female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered Construction contractors performing construction work in geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

- 5) Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.
- 6) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.
- 7) The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:
 - a) Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.
 - b) Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.
 - c) Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.
 - d) Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the

union referral process has impeded the Contractor's efforts to meet its obligations.

- e) Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.
- f) Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.
- g) Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.
- h) Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.
- i) Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.
- j) Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.
- k) Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR part 60-3.
- l) Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.
- m) Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations

under these specifications are being carried out.

- n) Ensure that all facilities and company activities are non-segregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.
 - o) Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.
 - p) Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.
- 8) Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.
- 9) A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).
- 10) The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, sexual orientation, gender identity, or national origin.
- 11) The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.
- 12) The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.
- 13) The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the

implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

- 14) The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.
- 15) Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

Segregated Facilities. (41 CFR 60-1.8) The contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, sexual orientation, gender identity, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensuring that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. This obligation extends to all contracts containing the equal opportunity clause regardless of the amount of the contract. The term "facilities," as used in this section, means waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, wash rooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees; Provided, That separate or single-user restrooms and necessary dressing or sleeping areas shall be provided to assure privacy between the sexes.

Required EEO language in bid solicitations only (or equivalent). Goals for minority participation must be filled in for the locality of work.

Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11246) located at 41 CFR § 60-4.2:

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.
2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Timetables	Goals for minority participation for each trade	Goals for female participation in each trade
	15.5 ²	6.9% ³

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and non-federally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.
4. As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is (insert description of the geographical areas where the contract is to be performed giving the state, county and city, if any).

² Goals can be found at: <https://www.dol.gov/agencies/ofccp/construction>

³ Nationwide goal for all covered areas

PARTICIPATION BY DISADVANTAGED BUSINESS ENTERPRISES IN PROCUREMENT UNDER EPA FINANCIAL ASSISTANCE AGREEMENTS

Note: The WIFIA program only requires use of the EPA DBE program's six good faith efforts during contract procurement. States may require additional DBE reporting.

Suggested Contract Language:

Disadvantaged Business Enterprises (DBE). The contractor must ensure that the DBE's six good faith efforts are used during the procurement of subcontractors for the [Project]. The six good faith efforts are found at: <https://www.epa.gov/grants/disadvantaged-business-enterprise-program-requirements#sixgoodfaithefforts>.

AMERICAN IRON AND STEEL (AIS) REQUIREMENT

Suggested Contract Language:

The Contractor acknowledges to and for the benefit of **[Insert WIFIA Borrower Name]** (“Purchaser”) and the United States Environmental Protection Agency (“EPA”) that it understands the goods and services under this Agreement are being funded with monies made available by the Water Infrastructure Finance and Innovation Act program of the EPA that has statutory requirements commonly known as “American Iron and Steel” that requires all of the iron and steel products used in the project to be produced in the United States (“American Iron and Steel Requirement”) including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents, warrants and covenants to and for the benefit of the Purchaser and the EPA that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the EPA. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or the EPA to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Purchaser or the EPA resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the EPA or any damages owed to the EPA by the Purchaser). While the Contractor has no direct contractual privity with the EPA, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the EPA is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the EPA.

LABOR LAWS AND STANDARDS

Note that the language below addresses Davis Bacon and Related Acts and incorporates the WIFIA borrower as an authorized representative, in accordance with the WIFIA loan agreement, to ensure compliance with this federal requirement.

Required Contract Language.

Compliance with Davis-Bacon and Related Acts.

(a) In any contract in excess of \$2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in 29 C.F.R. § 5.1, the following clauses (or any modifications thereof to meet the particular needs of the agency, provided that such modifications are first approved by the Department of Labor):

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its

subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii)

(A) The WIFIA assistance recipient, [name of WIFIA borrower], on behalf of the U.S. Environmental Protection Agency (EPA), shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The WIFIA assistance recipient shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the WIFIA assistance recipient agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent to the Administrator of the Wage and Hour Division (WHD Administrator), U.S. Department of Labor, Washington, DC 20210. The WHD Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the WIFIA assistance recipient or will notify the WIFIA assistance recipient within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the WIFIA assistance recipient do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the WIFIA assistance recipient shall refer the questions, including the views of all interested parties and the recommendation of the WIFIA assistance recipient, to the WHD Administrator for determination. The WHD Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the WIFIA assistance recipient or will notify the WIFIA assistance recipient within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor

may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

- (2) Withholding. [name of WIFIA borrower], shall upon written request of the WIFIA Director or an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the WIFIA Director may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

- (3) Payrolls and basic records.

- (i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

- (ii) {no text here}

- (A) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to [name of WIFIA borrower] . The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <https://www.dol.gov/agencies/whd/forms/wh347> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to [name of WIFIA borrower], for transmission to the EPA, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to [name of WIFIA borrower].
- (B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:
- (1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;
 - (2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;
 - (3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.
- (C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.
- (D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.
- (iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of [name of the borrower, EPA, or the Department of Labor, and shall permit such

representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the EPA may, after written notice to the [name of WIFIA borrower], take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees –

- (i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the WHD Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.
- (ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to

and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the WHD Administrator determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

- (iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.
- (5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.
- (6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.
- (7) Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.
- (8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.
- (9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and [name of WIFIA borrower], EPA, the U.S.

Department of Labor, or the employees or their representatives. (10) Certification of eligibility.

- (i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).
- (ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).
- (iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(b) Contract Work Hours and Safety Standards Act. The following clauses set forth in paragraphs (b)(1), (2), (3), and (4) of this section shall be inserted in full in any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by § 5.5(a) or § 4.6 of part 4 of this title. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

- (1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
- (2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of \$25 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.
- (3) Withholding for unpaid wages and liquidated damages. The [name of WIFIA borrower] shall upon its own action or upon written request of an authorized representative of the Department of Labor, or the EPA, withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.
- (4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors

to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

- (c) In addition to the clauses contained in paragraph (b), in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in § 5.1, the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the EPA shall cause or require the [name of WIFIA borrower] to insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the [name of WIFIA borrower], EPA and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

LATEST UPDATES ON FEDERAL REQUIREMENTS

BUILD AMERICA, BUY AMERICA ACT

Other language may be included on contracts for clarity on this federal requirement if an applicable waiver applies. For example, if the WIFIA program has determined program waiver coverage, indicate in contract documents, “This Project is covered under the WIFIA Program Waiver (June 22, 2022), which waives BABA requirements.”

Suggested Contract Language:

Build America, Buy America (Effective May 14, 2022)

The Contractor acknowledges to and for the benefit of (“Purchaser”) and the United States Environmental Protection Agency (“EPA”) that it understands the goods and services under this Agreement are being funded with federal monies made available by the Water Infrastructure Finance and Innovation Act program of EPA that have statutory requirements commonly known as “Build America, Buy America;” that requires all of the iron and steel, manufactured products, and construction materials used in the project to be produced in the United States (“Build America, Buy America Requirements”) including iron and steel, manufactured products, and construction materials provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and Funding Authority (a) the Contractor has reviewed and understands the Build America, Buy America Requirements, (b) all of the iron and steel, manufactured products, and construction materials used in the project will be and/or have been produced in the United States in a manner that complies with the Build America, Buy America Requirements, unless a waiver of the requirements is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the Build America, Buy America Requirements, as may be requested by the Purchaser or the Funding Authority. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or Funding Authority to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Purchaser or Funding Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the Funding Authority or any damages owed to the Funding Authority by the Owner). If the Contractor has no direct contractual privity with the Funding Authority, as a lender or awardee to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the Funding Authority is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the Funding Authority.

PROHIBITION ON CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE SERVICES OR EQUIPMENT

Suggested Contract Language:

Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment (Effective August 13, 2020). The John S. McCain National Defense Authorization Act for Fiscal Year 2019 (P.L. 115-232), at Section 889, prohibits EPA financial assistance recipients, including WIFIA borrowers, from expending loan funds to procure or obtain; extend or renew a contract to procure or obtain; or enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that use covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in the Act, “covered telecommunications equipment or services” means:

- a) Telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).
- b) For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).
- c) Telecommunications or video surveillance services provided by such entities or using such equipment.
- d) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

The Act does not prohibit:

- a) Procuring with an entity to provide a service that connects to the facilities of a third-party, such as backhaul, roaming, or interconnection arrangements.
- b) Telecommunications equipment that cannot route or redirect user data traffic or permit visibility into any user data or packets that such equipment transmits or otherwise handles.

Appendix B

WAGE DETERMINATION

Superseded General Decision Number: FL20240107

State: Florida

Construction Type: Heavy

County: Broward County in Florida.

HEAVY CONSTRUCTION PROJECTS (Including Sewer and Water Lines)

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least \$17.75 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least \$13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2025.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

Modification Number	Publication Date
0	01/03/2025
1	04/04/2025

* ELEC0728-006 03/01/2025

	Rates	Fringes
ELECTRICIAN.....	\$ 40.25	15.20

ENGI0487-023 07/01/2023

	Rates	Fringes
OPERATOR: Crane		
All Cranes 75 Tons and below.....	\$ 37.07	14.90
All Cranes Over 300 Ton, Electric Tower, Luffing Boom Cranes.....	\$ 40.40	14.90
Cranes 130-300 Ton.....	\$ 39.38	14.90
Cranes 76 ton to 129 Ton....	\$ 37.57	14.90

ENGI0487-026 07/01/2023

	Rates	Fringes
OPERATOR: Drill		
Drill Rig, Truck Mounted, Sterling Class.....	\$ 27.00	14.90
Drill Rig, Truck Mounted, Watson Class.....	\$ 32.75	14.90
OPERATOR: Oiler.....	\$ 27.53	14.90

IRON0272-005 10/01/2024

	Rates	Fringes
IRONWORKER, STRUCTURAL.....	\$ 28.84	15.72

LAB01652-004 05/01/2018

	Rates	Fringes
LABORER: Grade Checker.....	\$ 22.05	7.27

PAIN0365-007 06/01/2021

	Rates	Fringes
PAINTER: Brush, Roller and Spray.....	\$ 20.21	12.38

* SUFL2009-146 06/24/2009

	Rates	Fringes
CARPENTER, Includes Form Work....	\$ 17.00 **	2.51
CEMENT MASON/CONCRETE FINISHER...	\$ 15.00 **	8.64
LABORER: Common or General.....	\$ 9.87 **	3.24
LABORER: Landscape.....	\$ 7.25 **	0.00
LABORER: Pipelayer.....	\$ 14.00 **	2.42

LABORER: Power Tool Operator
(Hand Held Drills/Saws,

Jackhammer and Power Saws Only).....	\$ 10.63 **	2.20
OPERATOR: Asphalt Paver.....	\$ 11.59 **	0.00
OPERATOR: Backhoe Loader Combo.....	\$ 16.10 **	2.44
OPERATOR: Backhoe/Excavator.....	\$ 18.77	1.87
OPERATOR: Bulldozer.....	\$ 14.95 **	0.81
OPERATOR: Grader/Blade.....	\$ 16.00 **	2.84
OPERATOR: Loader.....	\$ 14.00 **	2.42
OPERATOR: Mechanic.....	\$ 14.32 **	0.00
OPERATOR: Roller.....	\$ 10.95 **	0.00
OPERATOR: Scraper.....	\$ 11.00 **	1.74
OPERATOR: Trackhoe.....	\$ 20.92	5.50
OPERATOR: Tractor.....	\$ 10.54 **	0.00
TRUCK DRIVER, Includes Dump Truck.....	\$ 9.60 **	0.00
TRUCK DRIVER: Lowboy Truck.....	\$ 12.73 **	0.00
TRUCK DRIVER: Off the Road Truck.....	\$ 12.21 **	1.97

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 (\$17.75) or 13658 (\$13.30). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO