Key West, FL
DENNIS STREET STORMWATER PUMP STATION
Project No. 193108
ITB NO. 19-015
Addendum No. 1
April 12, 2019

A. **SCOPE.** This Addendum No. 1 consists of pages AD1-1 through AD1-3 and the attachments listed below. The Addendum covers the following additions and changes to the specifications for this project, the updated specifications can be found attached to this document. Additionally, the following attachments are included for bidder reference:

- 4/3/2019 Meeting Minutes
- 4/3/2019 Sign-In Sheet
- Geotechnical Report

B. **QUESTIONS AND RESPONSES FROM PRE-BID MEETING**

1. Is there a geotechnical report available?

a. Yes, see attachment.

2. Underground utility locations to be confirmed by contractor prior to starting construction.

3. Background screening of contractor will be required for work on school district property.

4. Cost for bringing 3-phase power to the site will be covered by the City.

C. **SPECIFICATIONS.**

1. TABLE OF CONTENTS

   a. Page TC-4. ADD Figure "1-1015 – Monroe Country School District Building Permit Application" before Figure 1-01300.

2. Section 01015 – PROJECT REQUIREMENTS

   a. Page 4, Paragraph 4, Notices to Owners and Authorities. ADD "A Monroe County School District building permit shall be completed and coordinated with the school district using Figure 1-01015."

3. Section 13500 – INSTRUMENTATION AND CONTROL SYSTEM

   a. Page 1, 1-1, Scope.
      i. Paragraph 2. ADD "(the System Supplier)" after "sub-contractor".

ii. Paragraph 2. DELETE "System" and REPLACE with "Remote Telemetry Unit (RTU)".

iii. Paragraph 2. ADD "The sole-sourced RTU Supplier shall be: Data Flow Systems Inc. (DFS) 605 N. John Rodes Blvd., Melbourne, FL 32934, Phone (321) 259-5009" after Paragraph 2.

iv. Paragraph 3. DELETE "remote telemetry unit" and REPLACE with "an RTU".

v. Paragraph 3. DELETE "System" and REPLACE with "RTU".

vi. Paragraph 4. DELETE "RTU and associated" and ADD "with the exception of the RTU, radio, antenna and related RTU and SCADA programming/configuration and radio communication link testing. ~~and~~ The RTU Supplier" after "specified herein".

vii. Paragraph 3. DELETE "System" and REPLACE with "RTU".

viii. Paragraph 3. DELETE "System" and REPLACE with "RTU".

ix. Paragraph 3. ADD "The RTU Supplier shall make two site visits. One for antenna installation and another for startup services." at the end of the paragraph.

x. Paragraph 4. DELETE "software, human machine interface (HMI) hardware, input/output hardware," after "complete with all".

b. Page 3, Paragraph 1-2.04, Supplier's Qualifications. DELETE "The Contractor shall select the Owner's pre-approved System Suppliers.: Data Flow Systems Inc. (DFS) 605 N. John Rodes Blvd., Melbourne, FL 32934, Phone (321) 259-5009" and REPLACE with "System Suppliers include Curry Controls, Rocha Controls, Revere Controls and other equals."

c. Page 13, Paragraph 3-2.02, Graphic Screen Displays.

i. DELETE "System Supplier" and REPLACE with "RTU Supplier".

ii. DELETE "custom" and REPLACE with "HMI".

d. Page 14, Paragraph 3-2.03, Report Formats. DELETE "Report formats shall be developed and programmed by the System Supplier using tag names defined in the database creation. Reports shall be provided as summarized below. All reports will be provided with a header on each page to indicate the contents of each column of information. Each page shall be numbered and indicate the name of the report, the date the report was printed, and the time of the printout. The printout shall also include the time span of the information shown on the report.

- Daily Operating Report. A daily report, listing the major plant variables (up to 4 variables) shall be provided. The report shall include hourly values and

minimum/maximum/average values where appropriate. A minimum of 1 separate daily reports shall be provided by the System Supplier.

- Monthly Operating Report. A monthly operating report, which averages the values from the above daily reports, shall be provided. The report shall include monthly minimum/maximum/average values where appropriate."

e. Page 14-15, Paragraph 3-2.04, Configuration Standards and Conventions. DELETE "A "Software Configuration Standards and Conventions" document shall be prepared and submitted by the System Supplier. The document shall be submitted for review and approval before software configuration commences. The document shall describe and define such items as proposed graphic display process line colors/representations; symbology; color standards for "on", "off", "opened", "closed", and "alarm" conditions; alarm handling conventions; how items will be selected for control; methods for navigation between displays; address usage/naming conventions; and security setup. Before submitting the initial draft document, the System Supplier shall meet with the Engineer and/or Owner to review any of the Owner's existing standards and conventions. All copies of this submittal shall be provided in color to insure the accuracy of each item. No black and white copies will be accepted. The colors used in the printed submittal shall accurately depict the colors and shapes proposed for use on the final system.

In addition to submitting the document for review, an updated version of the document shall be submitted as part of the O&M Manuals. The document shall be revised to document any additional standards that are established throughout the configuration process."

f. Page 15, Paragraph 3-2.05, Configuration Review Meetings. DELETE "Proposed graphic screens and report formats shall be reviewed with the Owner and Engineer throughout the configuration process. The System Supplier's programming personnel shall attend all meetings. A second review meeting shall be held at approximately 50 percent completion. Both meetings shall be held at the Owner's facilities."

g. Page 15, Paragraph 3-2.06, Softwater Funtional Requirements. DELETE "General functional requirements for system configuration are indicated on the Drawings and described in the specifications. The information presented herein and indicated on the Drawings illustrates the general functional intent of the system, and may not be sufficient to fully configure the system. The System Supplier shall be responsible for determining what additional information may be required to complete the configuration tasks, and for obtaining this information from the Engineer or the Owner."

4. Section 01015-F1 – MONROE COUNTY SCHOOL DISTRIC BUILDING PERMIT APPLICATION

a. ADD Section 01015-F1 to Section 01380 – Construction Photographs, attached at the end of this document, after Section 01320.

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Section 01015

PROJECT REQUIREMENTS

1. GENERAL DESCRIPTION OF WORK. The Work of constructing a new stormwater treatment device, submersible pump station, valve vault, discharge piping to connect to existing outfall and associated supporting infrastructure to be performed under these Contract Documents shall consist of furnishing and installation of all tools, equipment, materials, supplies, manufactured articles, transportation and services, including fuel, power, water, and essential communications, for the performance of all labor, work, and/or other operations as required for the fulfillment of the Contract in strict conformance with the Contract Documents. The Work shall be complete, and all work, materials, and services not expressly shown or called for in the Contract Documents which may be necessary for the complete and proper construction of the Work in good faith shall be performed, furnished, and installed by the Contractor as though originally so specified or shown, at no increase in cost to the Owner.

The Work shall be performed on Venetia Street west of the intersection with Dennis Street where the pump station will be installed, and extending along Dennis Street to the south side of the Key West High School where an existing outfall discharges to the salt ponds.

The Work to be performed under these Contract Documents is generally described as follows:

a. Demolition and relocation of one existing manhole.
b. Installation of one new stormwater treatment device.
c. Installation of new submersible pumping station wetwell including two submersible pumps.
d. Installation of valve vault including two plug valves, two check valves, and associated discharge piping.
e. Installation of new generator, generator platform, associated electrical appurtenances and necessary instrumentation and controls.
f. Installation of underground discharge piping from valve vault to existing outfall structure on Key West High School property.
g. Connection of discharge piping to existing outfall structure on Key West High School property.

All work shall be in compliance with all applicable federal, state and local laws and regulations, including those for materials that contain lead. All work shall meet Occupational Safety & Health Administration (OSHA) compliance.

2. UNITS OF MEASUREMENT. Both inch-pound (English) and SI (metric) units of measurement are specified herein; the values expressed in inch-pound units shall govern.

3. OTHER CONSTRUCTION CONTRACTS. Not used.

4. COORDINATION. Contractor shall plan, schedule, and coordinate its operations in a manner which will facilitate the simultaneous progress of the Work.

5. WORK BY PUBLIC UTILITIES. Not used.

6. QUALITY CONTROL. The CONTRACTOR shall develop and maintain a program, acceptable to CITY and ENGINEER, to ensure that all work required under this Contract strictly conforms to all requirements of the Contract Documents. The CONTRACTOR shall be responsible for and shall supervise the work of all subcontractors, providing instructions to each when their work does not conform to the requirements of the Quality Control Program and the Contract Documents.

7. WORK BY OWNER. Not used.

8. PROCUREMENT CONTRACTS. Not used.

9. ITEMS FURNISHED BY OWNER. Not used.

10. RESPONSIBILITY FOR MATERIALS AND EQUIPMENT.

10.01. Items Furnished by Owner. Not used.

10.02. Items Furnished by Contractor. Contractor shall be fully responsible for all materials and equipment which it has furnished.

10.03. Delivery and Handling of Items Furnished by Owner. Not used.

11. OFFSITE STORAGE. Offsite storage arrangements shall be approved by Owner for all materials and equipment not incorporated into the Work but included in Applications for Payment. Such offsite storage arrangements shall be presented in writing and shall afford adequate and satisfactory security and protection. Offsite storage facilities shall be accessible to Owner and Engineer.

12. SUBSTITUTES AND "OR-EQUAL" ITEMS. Provisions for evaluation of proposed "or-equal" items of materials or equipment are covered in Paragraph 7.04 of the General Conditions. Provisions for evaluation of proposed substitute items of materials or equipment are covered in Paragraph 7.05 of the General Conditions. Requests for review of equivalency will not be accepted by Engineer from anyone except Contractor, and such requests will not be considered until after the Effective Date of the Agreement.

Whenever the names of proprietary products or the names of particular manufacturers or vendors are used, it shall be understood that the words "or equal" following the enumeration, if not specifically stated, are implied.

13. PREPARATION FOR SHIPMENT. All materials shall be suitably packaged to facilitate handling and protect against damage during transit and storage. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

Each item, package, or bundle of material shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

14. SALVAGE OF MATERIALS AND EQUIPMENT. Existing materials and equipment removed and not reused as a part of the Work shall become Contractor's property.

Existing materials and equipment removed by Contractor shall not be reused in the Work, except where so specified or indicated.

15. EASEMENTS AND RIGHTS-OF-WAY. The easements and rights-of-way for the work will be provided by Owner. Contractor shall confine its construction operations within the limits indicated on the Drawings. Contractor shall use due care in placing construction tools, equipment, excavated materials, and pipeline materials and supplies in order to avoid damage to property and interference with traffic. Contractor will not use public right-of-way for overnight laydown of materials or equipment.

15.01. On Private Property. Easements across private property are indicated on the Drawings. Contractor shall set stakes to mark the boundaries of construction easements across private property. ***Contractor shall furnish, without charge, competent persons and such tools, stakes, and other materials as Engineer may require in staking out the boundaries of construction easements. Contractor will not be required to provide an instrument person.*** The stakes shall be protected and maintained until completion of construction and cleanup.

Contractor shall not enter any private property outside the designated construction easement boundaries without written permission from the owner of the property.

16. ACCESS TO PROPERTIES. All properties in the area the Work may affect shall have continuos access.

17. NOTICES TO OWNERS AND AUTHORITIES. Contractor shall, as provided in the General Conditions, notify owners of adjacent property and utilities when prosecution of the Work may affect them.

When it is necessary to temporarily deny access to property, or when any utility service connection must be interrupted, Contractor shall give notices sufficiently in advance to enable the affected persons to provide for their needs. Notices shall conform to any applicable local ordinance and, whether delivered orally or in writing, shall include appropriate information concerning the interruption and instructions on how to limit inconvenience caused thereby.

Utilities and other concerned agencies shall be notified at least 24 hours prior to cutting or closing streets or other traffic areas or excavating near underground utilities or pole lines.

Before commencement of Work Contractor will coordinate the planning of all activities that will influence Key West High School activities with representative of the school district for Key West High School. **A Monroe County School District building permit shall be completed and coordinated with the school district using Figure 1-01015.**

Doug Pryor
Facilities Planner with Monroe County School District
305-293-1400 ext 53465

18. LINES AND GRADES. Not used.

19. ALLOWANCES. The Contract Price includes allowances for all applicable permits.

20. CONNECTIONS TO EXISTING FACILITIES. Unless otherwise specified or indicated, Contractor shall make all necessary connections to existing facilities, including structures, drain lines, and utilities such as water, sewer, gas, telephone, and electric. In each case, Contractor shall receive permission from Owner or the owning utility prior to undertaking connections. Contractor shall protect facilities against deleterious substances and damage.

Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall proceed continuously (around the clock) if necessary to complete connections in the minimum time. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

21. TRAFFIC MAINTENANCE. Contractor shall provide traffic maintenance plans where required by federal, state, county, or local agencies having jurisdiction.

Contractor shall comply with all rules and regulations of the state, county, and city authorities regarding closing or restricting the use of public streets or highways. No public or private road shall be closed, except by express permission of the Owner. Conduct the work so as to assure the least possible obstruction to traffic and normal commercial pursuits. Protect all obstructions within traveled roadways by installing approved signs, barricades, and lights where necessary for the safety of the public. The convenience of the general public and residents adjacent to the project, and the protection of persons and property are of prime importance and shall be provided for in an adequate and
satisfactory manner.

Where traffic will pass over trenches after they are backfilled and before they are paved, the top of the trench shall be maintained in a condition that will allow normal vehicular traffic to pass over. Temporary access driveways must be provided where required. Cleanup operations shall follow immediately behind backfilling and the worksite shall be kept in an orderly condition at all times.

When flagmen and guards are required by regulation or when deemed necessary for safety, they shall be furnished with approved orange wearing apparel and other regulation traffic-control devices in accordance with FDOT provisions.

Where work is required in Monroe County right-of-way, the Contractor shall obtain a County permit. The Contractor shall provide a MOT completed by a certified engineer with the permit.

21.01 TRAFFIC CONTROL. Traffic control on all city, county and state highway rights-of-way shall meet the requirements of the current edition (including all amendments) of the City of Key West regulations, where applicable, and the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, as well as FDOT standard details for maintenance of traffic, in accordance with the Manual for Uniform Traffic Control and Safe Practices.

The Contractor shall provide at no cost to the Owner a Maintenance of Traffic Plan, including 11- by 17-inch engineered drawings of his intended maintenance of traffic scheme, to the agency having jurisdiction for review and approval. This shall include barrier details, barricade type, and location. Two copies of the agency approved plan with drawings shall be submitted to the Engineer prior to initiation of construction.

22. UNFAVORABLE CONSTRUCTION CONDITIONS. During unfavorable weather, wet ground, or other unsuitable construction conditions, Contractor shall confine its operations to work which will not be affected adversely by such conditions. No portion of the Work shall be constructed under conditions which would affect adversely the quality or efficiency thereof, unless special means or

precautions are taken by Contractor to perform the Work in a proper and satisfactory manner.

22.01 HURRICANE AND STORM WARNINGS. The CONTRACTOR shall take all precautions necessary to protect the job site during hurricane and storm watches and warnings.

23. DEMOLITION, CUTTING AND PATCHING. As provided in General Conditions, Contractor shall perform all cutting and patching required for the Work and as may be necessary in connection with uncovering Work for inspection or for the correction of defective Work.

Contractor shall perform all demolition, cutting and patching required for and in connection with the Work, including but not limited to the following:

Removal of existing structures.
Removal of improperly timed Work.
Removal of samples of installed materials for testing.
Installation of new Work in existing structures.

Contractor shall provide all shoring, bracing, supports, and protective devices necessary to safeguard all Work and existing structures during cutting and patching operations. Contractor shall not undertake any cutting or demolition which may affect the structural stability of the Work or existing structures without Engineer's concurrence.

Materials shall be demolished, cut and removed to the extent indicated on the Drawings or as required to complete the Work. Materials shall be removed in a careful manner, with no damage to adjacent structures or materials. ***Materials which are not salvable shall be removed from the site by Contractor.***

All Work and existing structures affected by cutting operations shall be restored with new materials, or with salvaged materials acceptable to Engineer, to obtain a finished installation with the strength, appearance, and functional capacity required. If necessary, entire surfaces shall be patched and refinished.

24. SITE CONDITIONS. The CONTRACTOR acknowledges that it has satisfied itself as to the conditions affecting the Work, including but not restricted to those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, river stages, tides, water tables or similar physical conditions at the site, the conformation and conditions of the ground, the character of equipment and facilities needed preliminary to and during execution of the Work. The CONTRACTOR further acknowledges that it has satisfied itself as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from

information presented by the Drawings and Specifications made a part of this Contract, or any other information made available to it prior to receipt of Bids. Any failure by the CONTRACTOR to acquaint itself with the available information will not relieve the CONTRACTOR from responsibility for estimating properly the difficulty or cost of successfully performing the Work. The CITY assumes no responsibility for any conclusions or interpretations made by the CONTRACTOR on the basis of the information made available by the CITY.

25. HAZARDOUS ENVIRONMENTAL CONDITIONS AT SITE. No Hazardous Environmental Conditions at the Site in areas that will be affected by the Work are known to the Owner.

25.01. Abatement of Hazardous Environmental Conditions. ***If Contractor's survey of the Site indicates the presence of Hazardous Environmental Conditions, Contractor shall abate the Hazardous Environmental Conditions under a Change Order to the Contract.*** Before commencement of work that may impact, damage or disturb the Hazardous Environmental Conditions at the Site, Contractor shall engage a qualified Subcontractor to encapsulate, enclose, or remove and dispose of all identified ACM, Metal Bearing Protective Coatings, Paints, and Linings, Contaminated Environmental Media, and/or other Hazardous Substances in accordance with current regulations of the Environmental Protection Agency and the U. S. Department of Labor - Occupational Safety and Health Administration, the applicable state regulating agency, and any local government agency.

25.02. Subcontractor's Qualifications. Subcontractor for removal/abatement of Hazardous Environmental Conditions shall be regularly engaged in this type of activity and shall be familiar with the regulations which govern this work. Subcontractor shall demonstrate to the satisfaction of Owner that it has successfully completed removal/abatement projects of similar nature and extent, that it has the necessary staff and equipment to perform the work, and that it has an approved site for disposal of waste materials. Liability insurance covering the Hazardous Environmental Condition removal/abatement work shall be provided as specified in the Supplementary Conditions.

25.03. Removal/Abatement Methods. The Hazardous Environmental Condition removal/abatement Subcontractor shall visit the site of the Work to determine the equipment required for completion of the work, and shall submit a work plan of its proposed removal/abatement procedure to Owner before beginning work and shall certify that the methods are in full compliance with the governing regulations. The work plan shall cover all aspects of the removal/abatement, including health and safety of construction site and owner employees, hygiene facilities, employee certification, clearance criteria, transportation and disposal, enclosure techniques, and other techniques appropriate for the proposed work.

For abatement of ACM, Contractor shall retain an independent third party air monitoring firm to conduct air monitoring as required to demonstrate the effectiveness of the dust containment system. The air quality testing firm shall submit a report documenting the results of the air monitoring. The air monitoring firm shall have at least 5 years of experience in air monitoring for ACM removal.

26. CLEANING UP. Contractor shall keep the premises free at all times from accumulations of waste materials and rubbish. Contractor shall provide adequate trash receptacles about the Site and shall promptly empty the containers when filled.

Construction materials, such as concrete forms and scaffolding, shall be neatly stacked by Contractor when not in use. Contractor shall promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.

Volatile wastes shall be properly stored in covered metal containers and removed daily.

Wastes shall not be buried or burned on the Site or disposed of into storm drains, sanitary sewers, streams, or waterways. All wastes shall be removed from the Site and disposed of in a manner complying with local ordinances and antipollution laws.

Adequate cleanup will be a condition for recommendation of progress payment applications.

27. APPLICABLE CODES. References in the Contract Documents to local codes mean the following:

a. 2017 Florida Building Code
b. Applicable local ordinances for Key West.

Other standard codes which apply to the Work are designated in the Specifications.

28. REFERENCE STANDARDS. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code, or laws or regulations in effect at the time of opening of Bids (or on the effective date of the Contract or Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents. However, no provision of any referenced standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or

employees from those set forth in the Contract Documents, nor shall any such provision or instruction be effective to assign to Owner, Engineer, or any of Engineer's Consultants, agents, or employees, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

29. ALTERNATES. Not used.

30. PRECONSTRUCTION CONFERENCE. Prior to the commencement of Work at the Site, a preconstruction conference will be held at a mutually agreed time and place. The conference shall be attended by:

a. Contractor and its superintendent.
b. Principal Subcontractors.
c. Representatives of principal Suppliers and manufacturers as appropriate.
d. Engineer and its Resident Project Representative.
e. Representatives of Owner.
f. Government representatives as appropriate.
g. Others as requested by Contractor, Owner, or Engineer.

Unless previously submitted to Engineer, Contractor shall bring to the conference a preliminary schedule for each of the following:

a. Progress Schedule.
b. Procurement schedule.
c. Schedule of Values for progress payment purposes.
d. Schedule of Shop Drawings and other submittals.

The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The agenda will include:

a. Contractor's preliminary schedules.
b. Transmittal, review, and distribution of Contractor's submittals.
c. Processing Applications for Payment.
d. Maintaining record documents.
e. Critical Work sequencing.
f. Field decisions and Change Orders.
g. Use of premises, office and storage areas, security, housekeeping, and Owner's needs.
h. Major equipment deliveries and priorities.
i. Contractor's assignments for safety and first aid.

Engineer will preside at the conference and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

31. PROGRESS MEETINGS. Contractor shall schedule and hold regular progress meetings at least monthly and at other times as requested by Engineer or required by progress of the Work. Contractor, Engineer, and all Subcontractors active on the Site shall be represented at each meeting. Contractor may at its discretion request attendance by representatives of its Suppliers, manufacturers, and other Subcontractors.

Contractor shall preside at the meetings. Meeting minutes shall be prepared and distributed by Contractor. The purpose of the meetings will be to review the progress of the Work, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop.

32. SITE ADMINISTRATION. Contractor shall be responsible for all areas of the Site used by it, and by all Subcontractors in the performance of the Work. Contractor shall exert full control over the actions of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically reserved to Owner or others. Contractor shall have the right to exclude from the Site all persons who have no purpose related to the Work or its inspection, and may require all persons on the Site (except Owner's employees) to observe the same regulations as Contractor requires of its employees.

33. USE OF PREMISES. Contractor shall limit site disturbance within the area identified on the Drawings.

34. NONSMOKING BUILDING. Not used.

End of Section

Monroe County School District

Building Department

1310 United Street

Key West, Florida 33040

Application for Building Permit

of application_____

School principal project approval

_____

Permit Number

_____

Current FBC Year

_____

Site Location_____

Job Description_____

_____

_____

_____

Contractor/Co. Name_____

License Number_____

Address_____

Phone_____ Fax_____Cell_____E-Mail_____

Architect/Engineer Address_____ Phone_____

Fax_____Cell_____E-Mail_____ Contact_____

Sub-Contractors: address, phone, contact, license number

Roofing_____ _____

Plumbing_____

Mechanical_____

Electrical_____

Affidavit: I hereby certify I have read and examined this application and know the same to be true and correct. I certify that all work will be performed to meet the standards of all laws regulating in this jurisdiction, whether they are specified herein or not, and that other permits may be required from other governmental agencies.

Signature of contractor/applicant_____

Section 13500

INSTRUMENTATION AND CONTROL SYSTEM

PART 1 – GENERAL

1-1. SCOPE. This section covers the furnishing and installation of an instrumentation and control system designated as the Stormwater 07 Pump Station System.

The Contrator or their sub-contractor ***(the System Supplier)*** is responsible for all installation, panel fabrication and supply of instruments outside of the sole-sourced ~~System~~ ***Remote Telemetry Unit (RTU)*** Supplier's scope described below.

The sole-sourced RTU Supplier shall be:

- ***Data Flow Systems Inc. (DFS) 605 N. John Rodes Blvd., Melbourne, FL 32934, Phone (321) 259-5009***

The installation of Stormwater 07 Pump Station System shall include local and remote monitoring and control of the new wetwell constant-speed submersible pumps and associated instrumentation. Integration of the pump station system shall utilize a***n*** ~~remote telemetry unit (~~RTU~~)~~ that shall retransmit necessary signals via a Data Flow Systems (DTS) radio system to the existing Key West Richard A. Heyman Environmental Protection Facility. The ~~System~~ ***RTU*** Supplier shall provide necessary modifications to the existing remote facility human machine interface (HMI) to accommodate the new pump station and all necessary commands and status indications.

The System Supplier shall furnish the ~~RTU and associated~~ equipment specified herein ***with the exception of the RTU, radio, antenna and related RTU and SCADA programming/configuration and radio communication link testing.*** ~~and~~ ***The RTU Supplier*** shall be responsible for all RTU and SCADA programming. The ~~System~~ ***RTU*** Supplier shall provide and test the radio, antenna, and associated equipment for a fully functional radio system. The ~~System~~ ***RTU*** Supplier shall align the antenna and verify signal integrity through testing to establish a communication link and transmit RTU data to the Environmental Protection Facility. ***The RTU Supplier shall make two site visits. One for antenna installation and another for startup services.***

The Stormwater 07 Pump Station System shall be furnished as specified, complete with all ~~software, human machine interface (HMI) hardware, input/output hardware,~~ instrumentation, and all devices, accessories, appurtenances, testing, and training necessary for proper operation.

1-1.02. Associated Sections. This section also includes the equipment and services specified in the following sections.

Section 13531	REMOTE TERMINAL UNITS
Section 13540	MULTIPLE ADDRESS RADIO EQUIPMENT
Section 13550	SOFTWARE CONTROL BLOCK DESCRIPTIONS
Section 13561	PANEL MOUNTED INSTRUMENTS
Section 13563	PRESSURE AND LEVEL INSTRUMENTS
Section 13564	PROCESS ANALYTICAL INSTRUMENTS
Section 13566	MISCELLANEOUS INSTRUMENTS
Section 13570	PANELS, CONSOLES, AND APPURENANCES
Section 16050	ELECTRICAL

1-2. GENERAL. Equipment furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment and materials furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. Drawings. The Drawings indicate locations and arrangements of equipment and may include installation details and block and one-line diagrams showing connections and interfaces with other equipment. The input/output (I/O) lists are attached as an appendix to the Remote Terminal Units section (section 13531) and .

Principal components of the instrumentation systems shall be as indicated on the P&ID drawings and .

1-2.03. Codes, Permits and Agency Approvals. All work performed and all materials used shall be in accordance with the National Electrical Code, and with applicable local regulations and ordinances. Where mandated by codes, panels, assemblies, materials, and equipment shall be listed by Underwriters' Laboratories. Contractor shall, as part of their work, arrange for and obtain all necessary permits, inspections, and approvals by the authorities having local jurisdiction of such work. This shall include any third-party inspections and testing of panels and equipment.

1-2.04. Supplier's Qualifications. Equipment and software furnished under this section and under other related sections listed in the Scope paragraph above shall be designed, coordinated, and supplied by a single manufacturer or supplier, hereinafter referred to as the System Supplier. The System Supplier shall be regularly engaged in the business of supplying computer-based monitoring, control, and data acquisition systems. The Contractor shall utilize the services of the System Supplier to coordinate all control system related items, to check-out and calibrate instruments, and to perform all testing, training, and startup activities specified to be provided. ***System Suppliers include Curry Controls, Rocha Controls, Revere Controls and other equals.*** ~~The Contractor shall select the Owner's pre-approved System Suppliers.:~~

- ~~Data Flow Systems Inc. (DFS) 605 N. John Rodes Blvd., Melbourne, FL 32934, Phone (321) 259-5009~~

1-2.05. Coordination. Systems supplied under this section shall be designed and coordinated by System Supplier for proper operation with related equipment and materials furnished by other suppliers under other sections of these specifications, under other contracts, and, where applicable, with related existing equipment. All equipment shall be designed and installed in full conformity with the Drawings, specifications, engineering data, instructions, and recommendations of the manufacturer, and the manufacturer of the related equipment.

1-2.06. Related Equipment and Materials. Related equipment and materials may include, but will not be limited to, instrumentation, motor controllers, valve actuators, chemical feeders, analytical measuring devices, conduit, cable, and piping as described in other sections or furnished under other contracts.

1-2.07. Device Tag Numbering System. All devices shall be provided with permanent identification tags. The tag numbers shall agree with System Supplier's equipment drawings and shall be as close as practical to the tag numbers used on the Drawings and device schedules. All field-mounted transmitters and devices shall have stamped stainless steel identification tags. Panel, subpanel, and rack-mounted devices shall have laminated phenolic identification tags securely fastened to the device. Hand-lettered or tape labels will not be acceptable.

1-3. GENERAL REQUIREMENTS. The drawings and specifications indicate the extent and general arrangement of the systems. If any departures from the Drawings or Specifications are deemed necessary by System Supplier, details of such departures and the reasons shall be submitted to Engineer for review with or before the first stage submittal. No departures shall be made without prior written acceptance.

The specifications describe the minimum requirements for hardware and software. Where System Supplier's standard configuration includes additional items of equipment or software features not specifically described herein, such equipment or features shall be furnished as a part of the system and shall be warranted as specified herein.

1-3.01. Governing Standards. Equipment furnished under this section shall be designed, constructed, and tested in accordance with IEEE 519, ANSI C37.90, FCC Part 15 - Class A, and NEMA ICS-1-109.60.

1-3.02. Dimensional Restrictions. Layout dimensions will vary between manufacturers and the layout area indicated on the Drawings is based on typical values. The System Supplier shall review the Drawings, the manufacturer's layout drawings and installation requirements, and make any modifications requisite for proper installation subject to acceptance by Engineer. At least three feet of clear access space shall be provided in front of all instrumentation and control system components.

1-3.03. Workmanship and Materials. System Supplier shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure. Materials shall be suitable for service conditions.

All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thicknesses so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except for testing.

1-3.04. Corrosive Fluids. All parts which are exposed to corrosive conditions shall be made from corrosion resistant materials. System Supplier shall submit certification that the instrument manufacturer approves the selection of materials of primary elements that are in contact with the specified process fluid to be inert to the effects of the process fluid.

1-3.05. Appurtenances. Signal converters, signal boosters, amplifiers, special power supplies, special cable, special grounding, and isolation devices shall be furnished as needed for proper performance of the equipment.

1-3.06. Programming Devices. A programming or system-configuring device shall be provided for systems that contain any equipment that requires such a device for routine calibration, maintenance, and troubleshooting. The programming device shall be complete, newly purchased for this project, and shall be in like-new condition when turned over to Owner at completion of startup.

1-4. SUBMITTALS. Complete dimensional, assembly, and installation drawings, wiring and schematic diagrams; and details, specifications, and data covering the materials used and the parts, devices and accessories forming a part of the system furnished, shall be submitted in accordance with the submittals section. Submittal data shall be grouped and submitted in three separate stages. The submittal for each stage shall be substantially complete. Individual drawings and data sheets submitted at random intervals will not be accepted for review. Equipment tag numbers or identifications used on the Drawings shall be referenced where applicable.

1-4.01. First Stage Submittal. The first stage submittal shall include the following items.

a. A detailed list of any exceptions, functional differences, or discrepancies between the system proposed by System Supplier and this specification.

b. Product catalog cut sheets on all hardware and software items, clearly marked to show the model number, optional features, and intended service of each device.

c. A brief, concise description of the proposed system, including major hardware and software components and personnel training.

d. A block diagram or schematic drawing showing the principal items of equipment furnished, including model numbers, and their interrelationships.

e. Drawings showing floor and wall space or desktop area requirements for all equipment items, including allowances for door swings and maintenance access.

f. Environmental and power requirements, including heat release information for each equipment item.

g. Standard field termination drawings for all process input/output equipment, showing typical terminations for each type of point available in the system.

h. A copy of the proposed software licenses for all software associated with the system.

i, Outline for training classes.

j. Additional Requirements identified in other Division 13 sections.

1-4.02. Second Stage Submittal. Before any equipment is released for shipment to the site and before factory testing is scheduled, the following data shall be submitted.

At System Supplier's option, the first and second stage submittals may be combined.

a. Detailed functional descriptions of all software modules specified and furnished as part of System Supplier's standard system. The descriptions shall be identified with the applicable specification paragraph.

b. Complete panel fabrication drawings and details of panel wiring, piping, and painting. Panel and subpanel drawings shall be to scale and shall include overall dimensions, metal thickness, door swing, mounting details, weight, and front of panel arrangement to show general appearance, with spacing and mounting height of instruments and control devices.

c. Wiring and installation drawings for all interconnecting wiring between components of the system and between related equipment and the equipment furnished under this section. Wiring diagrams shall show complete circuits and indicate all connections. If panel terminal designations, inter-device connections, device features and options, or other features are modified during the fabrication or factory testing, revised drawings shall be submitted before shipment of the equipment to the site.

d. Review of drawings submitted prior to the final determination of related equipment shall not relieve System Supplier from supplying systems in full compliance with the specific requirements of the related equipment.

e. Input/output listings showing point names, numbers, and addresses. Input/output identification numbers from the contract documents shall be cross-referenced in this submittal.

f. Proposed lesson plans or outlines for all training courses specified herein, including schedule, instructors' qualifications and experience, and recommended prerequisites.

g. Standard system engineering and user manuals describing the use of the system and application programming techniques for creating reports, graphics, database, historical records, and adding new process I/O nodes to the system.

h. Additional Requirements identified in other Division 13 sections.

1-4.03. Third Stage Submittal. Complete system documentation, in the form of Operation and Maintenance Manuals, shall be submitted before the commencement of field acceptance testing. Operation and Maintenance Manuals shall include complete instruction books for each item of equipment and software furnished. Where instruction booklets cover more than one specific model or range of device, product data sheets shall be included which indicate the device

model number and other special features. A complete set of "as-built" wiring, fabrication, and interconnection drawings shall be included with the manuals. If field-wiring modifications are made after these drawings are submitted, the affected drawings shall be revised and resubmitted. Additional requirements are identified in other Division 13 specification sections.

1-5. PREPARATION FOR SHIPMENT. All electronic equipment and instruments shall be suitably packaged to facilitate handling and to protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements, shall be kept dry at all times, and shall not be exposed to adverse ambient conditions.

Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. Painted surfaces that are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

Each shipment shall include an appropriate shipping list that indicates the contents of the package, including the specific instrument tags. The shipping list shall be accessible without exposing the instruments to the atmosphere. The shipping list shall also contain any cautionary notes regarding storage of the instruments, including requirements to protect the instrument from static discharge, desensitizing chemicals (solvents, paints, etc.), or ambient atmospheric conditions.

Individual instruments shall be appropriately tagged or labeled to positively identify the device. All identification shall be visible without the need to unpack the instrument from its protective packaging.

Instrument shipment and storage requirements shall be coordinated with Engineer or Owner prior to shipment. System Supplier shall provide adequate storage and be ready to accept the shipment before shipping any equipment to the site. Additional shipping and storage requirements shall be as detailed in the individual instrument specifications.

Components which are shipped loose due to transportation limitations shall be assembled and disassembled by the manufacturer prior to shipment to assure that all components fit together and are adequately supported.

1-6. DELIVERY, STORAGE, AND SHIPPING. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

1-7. SPARE PARTS. Spare parts and consumable items are specified in other sections.

1-7.01. Packaging. All spare parts shall be delivered to Owner before final acceptance of the system. Packaging of spare parts shall provide protection against dust and moisture and shall be suitable for storage. Circuit boards and other electronic parts shall be enclosed in anti-static material. All packages shall be clearly marked with the manufacturer's name, part number or other identification, date of manufacture, and approximate shelf life.

1-7.02. Replacement. System Supplier may utilize spare parts and supplies during system installation, de-bugging, startup, or training, but shall restore all such materials and supplies to the specified quantities before final acceptance of the systems.

PART 2 - PRODUCTS

2-1. GENERAL REQUIREMENTS. All equipment furnished under each section referenced in SCOPE is a part of this section and shall be selected by System Supplier for its superior quality and intended performance. Equipment and materials used shall be subject to review.

2-1.01. Standard Products. The systems furnished shall be standard products. Where two or more units of the same type of equipment are supplied, they shall be the products of the same manufacturer; however, all components of the systems furnished hereunder need not be the products of one manufacturer unless specified herein.

To the extent possible, instruments used for similar types of functions and services shall be of the same brand and model line. Similar components of different instruments shall be the products of the same manufacturer to facilitate maintenance and stocking of repair parts. Whenever possible, identical units shall be furnished.

2-2. PERFORMANCE AND DESIGN REQUIREMENTS. The design of the systems furnished hereunder shall utilize concepts, techniques and features that provide maximum reliability and ease of maintenance and repair. The systems shall include board-level devices such as light emitting diodes or other indicators to facilitate quick diagnosis and repair. Diagnostic software shall be furnished to facilitate system-level troubleshooting.

Where redundant hardware is provided, the system shall be capable of performing all specified functions, without reconfiguring hardware or software, with only one device of each category in service.

2-2.01. Factory Assembly. Equipment shall be shipped completely factory assembled, except where its physical size, arrangement, configuration, or

shipping and handling limitations make the shipment of completely assembled units impracticable.

2-3. POWER SUPPLY AND INSTRUMENT SIGNAL. As indicated on the Drawings, incoming power supply shall be 480 volts, 60 Hz, three phase. Power supply to all control system equipment will be 120 volts, 60 Hz, single phase. System Supplier shall be responsible for distribution of power among enclosures, consoles, peripherals, and other components of the system from the power supply receptacles and junction boxes indicated on the Drawings. Power distribution hardware shall include cables, surge protection devices, power metering, receptacles, and branch circuit overcurrent protection installed in accordance with the Electrical section.

Unless otherwise indicated, power supply to the instrumentation will be unregulated 120 volts ac. Unless otherwise indicated, all transmitted electronic analog instrument signals shall be 4-20 mA dc and shall be linear with the measured variable.

2-3.01. Facility Distribution System. Equipment not indicated to be powered from an uninterruptible power source shall be suitable for being supplied from the facility distribution system and shall be capable of withstanding voltage variations of $\pm$10 percent and harmonics up to the limits of IEEE 519 without affecting operation. System Supplier shall provide voltage conditioning or filtering equipment if necessary to meet the requirements specified.

2-3.02. Power Supplies. Power supplies for voltages other than those listed above shall be an integral part of the equipment furnished. Internal power supplies shall be regulated, current limiting, and self-protected.

2-3.03. Surge Withstand. All equipment shall meet all surge withstand capability tests as defined in ANSI C37.90 without damage to the equipment.

2-3.04. Uninterruptible Power Supply. Not used.

2-4. SERVICE CONDITIONS AND ENVIRONMENTAL REQUIREMENTS. The equipment provided for the instrumentation and control system shall be suitable for the service conditions specified in the attached equipment sections.

All equipment shall be designed and selected to operate without degradation in performance throughout the environmental extremes specified. Equipment shall be designed to prevent the generation of electromagnetic and radio frequency interference and shall be in compliance with FCC Rules and Regulations, Part 15, for Class A computing devices.

2-4.01. Ambient Temperature and Elevation. All system equipment located in air conditioned rooms shall be suitable for operation in ambient temperatures from 10°C to 35°C and a relative humidity of 10 to 80 percent, noncondensing. All equipment located in non air conditioned indoor areas shall be suitable for an ambient temperature range of 0°C to 50°C and a relative humidity of 10 to 95 percent, noncondensing. All equipment located outdoors shall be suitable for operation in an ambient temperature range -20°C to 60°C and a relative humidity of 5 to 100 percent. Heaters and air conditioning/cooling equipment shall be provided where essential to maintain equipment within its manufacturer-recommended operating ranges.

All equipment and instruments shall be designed to operate at the site elevation of 0 ft.

2-4.02. Deleterious Effects. All system equipment will be installed in areas without anti-static floor construction and without any provisions for control of particulates or corrosive gases other than ordinary office-type HVAC filtering. System Supplier shall furnish any additional air cleaning equipment, anti-static chair pads, or other protective measures necessary for proper operation of the system.

All input/output hardware shall meet or exceed, without false operation, all requirements of NEMA ICS-1-109.60, Electrical Noise Tests.

2-4.03. Noise Level. The equivalent "A" weighted sound level for any system equipment located in the control room, except printers, shall not exceed 35 dBA. The sound level for printers shall not exceed 65 dBA. Sound reduction enclosures shall be provided where necessary to comply with these limits.

2-4.04. Lightning Protection. In addition to other environmental protection specified herein, the entire system shall be provided with lightning protection. Lightning protection measures shall include the following.

2-4.04.01. Grounding. All major components of the system shall have a low resistance ground connection. Grounding system provisions indicated on the Drawings shall be modified as recommended by System Supplier.

2-4.04.02. Surge Suppressors. Surge and lightning suppressors shall be non-faulting, non-interrupting, and shall protect against line-to-line and line-to-ground surges. Devices shall be solid-state metal oxide varistor (MOV) or silicon junction type, with a response time of less than 50 nanoseconds. Surge protective devices shall be applied for the following:

a. All 120 VAC power connections to RTUs and instruments. Surge arresters shall be Transtector "ACP-100-HW Series", Power Integrity

Corporation “ZTA Series”, Phoenix Contact “Mains PlugTrab”, or MCG Surge Protection “400 Series”.

b. All analog signal circuits where any part of the circuit is outside of the building envelope. Circuits shall be protected at both the transmitter and the control system end of the circuit. Surge protection devices shall not impede or interfere with the use of smart transmitter calibration/communication. Protection devices located near the transmitter shall be Telematic “TP48.” Protection devices in control panels shall be Transtector “PDS Series or FSP Series”, Telematic “SD Series”, Phoenix Contact “PipeTrab Series”, or Citel “BP1-24.”

c. All radio antenna leads. Surge protection devices shall be as specified in Multiple Address Radio Equipment section.

2-5. SOFTWARE DOCUMENTATION. System Supplier shall furnish complete documentation on all software supplied with the systems specified herein. Operating systems, compilers, assemblers, and utility and diagnostic programs that are standard commercial products of third parties need not be included in the optical media backup. Software documentation shall consist of the following principal items.

a. One backup set of any integrated circuit or solid-state memory-based plug-in firmware used.

b. Two complete back-up copies of system and application software in executable format on optical media compatible with the system furnished.

c. Three sets of user reference manuals for all standard system and application software.

d. One set of user reference manuals for all operating system software.

e. Three sets of printed as-built reference documentation for any special software provided specifically for this contract.

f. For each licensed software product, all documentation provided by the product manufacturer shall be provided. This includes all reference manuals and any other documents that were provided by the manufacturer. One set of this documentation shall be supplied for each and every piece of equipment provided. Multiple pieces of similar equipment or software require multiple copies of this documentation.

2-6. SOFTWARE LICENSE. All software programs supplied as a standard part of System Supplier’s products for this project shall be licensed to Owner for use on the system specified herein. Such license shall not restrict Owner from using the software on the system provided hereunder or its replacement. Owner shall have the right to make copies of the software for use on the system provided.

Specific requirements of System Supplier's software license are subject to review and approval by Owner and Engineer.

2-7. INSTALLATION TEST EQUIPMENT. All necessary testing equipment for calibration and checking of system components shall be provided by System Supplier. System Supplier shall also furnish calibration and maintenance records for all testing and calibration equipment used on the site if requested by Engineer.

2-8. PROGRAMMING DEVICES. The following programming devices shall be provided for the instruments specified in other sections:

Instruments Requiring Programming Devices	Quantity of Programming Devices
Analytical instruments	1

PART 3 – EXECUTION

3-1. INSTALLATION REQUIREMENTS. The installation of equipment furnished hereunder shall be by the Contractor or their assigned subcontractors.

3-1.01. Field Wiring. Field wiring materials and installation shall be in accordance with the electrical section.

3-1.02. Instrument Installation. Instruments shall be mounted so that they can be easily read and serviced and so that all appurtenant devices can be easily operated. Installation details for some instruments are indicated on the Drawings.

All outdoor instrumentation shall be protected from direct sun exposure. Instruments shall be placed in locations to limit south and west sun exposure. Sunshades shall be provided on instruments that are subject to the direct sun exposure. Sunshades shall be located so the opening faces north or east where possible. Sunshades shall be provided as shown on the Drawings.

3-1.03. Salvage of Existing Equipment. Existing equipment and materials removed or replaced under this contract shall be delivered to Owner at a location designated by Owner, or shall be properly disposed of at Owner's discretion. Care shall be taken to avoid damage to equipment delivered to Owner.

Any mounting brackets, enclosures, stilling wells, piping, conduits, wiring, or openings that remain after removal of equipment and support hardware shall be removed or repaired in a manner acceptable to Owner and Engineer. Transmitters or switches containing mercury shall be removed and disposed of

by personnel trained in the handling of hazardous materials and using approved procedures.

3-2. SYSTEM SOFTWARE CONFIGURATION. System software shall be configured by the System Supplier. Configuration services shall consist of the creation of the system database, report formats, operator interface graphic and tabular display screen formats, password and security implementation, and programming of control units to provide a fully functioning system. The System Supplier shall fully configure the system using data provided herein or supplied by the Engineer and/or the Owner after award of the contract.

The system that is delivered to the field for installation, checkout, and startup shall have all files, or databases, that are configurable in size, sized in a manner in which there will be 50% space available for future work after the completion of this project. This sizing should include the addition of memory modules, disk drives, or any other device to insure the 50% spare space availability. All "tuning" of software that is dependent on space requirements shall be done prior to the completion of this project.

Tuning of software programs shall be accomplished in such a manner that the program operates at its highest performance level. These programs include, but are not limited to Microsoft SQL Server, all PLC ladder logic, and others.

3-2.01. Control System Database. The control system database shall be developed and configured by the System Supplier. The System Supplier shall enter information obtainable from the Contract Documents into the database prior to soliciting input from the Engineer and the Owner. The System Supplier shall determine the need for any "pseudo" database points and shall ascertain and enter all information needed to define these points. The System Supplier is responsible for entering all information associated with each point. This includes but is not limited to, descriptions, engineering units, associated displays, areas, security, etc. All fields associated with each database point must be completely filled out accurately.

3-2.02. Graphic Screen Displays. The ~~System Supplier~~ ***RTU Supplier*** shall be responsible for developing and configuring the ~~custom~~ ***HMI*** graphic displays. Each piece of major process equipment that is monitored by the control system shall be displayed on one or more graphic screen. Graphic screens shall be representations of the equipment and piping. The screens must accurately show all devices and equipment that is part of the control loops. These items must be done in accordance to the Configuration Standards and Conventions as described later in this section. Alarm and/or event displays shall also be provided and proven functional prior to acceptance of the system. A means of capturing and printing of all graphic screens shall also be included. The software program provided must be capable of printing the screen in a black and white (using gray scale) or color format. This program must be accessible from all

terminals provided under this contract. The black and white printing shall be done in a manner in which the use of the black background is not represented in the printout. This is done to keep the utilization of ink cartridge and toner cartridge to a minimum.

All graphic screens shall be animated to indicate the current state of the piece of equipment. The following graphic screens shall be provided, as a minimum.

- Update Alarm Summary
- Update Event Summary
- Overview of the Pump Station process area (with vectoring to sub-areas)

A minimum of 4 custom graphic displays shall be provided by the System Supplier.

~~3-2.03. Report Formats. Report formats shall be developed and programmed by the System Supplier using tag names defined in the database creation. Reports shall be provided as summarized below. All reports will be provided with a header on each page to indicate the contents of each column of information. Each page shall be numbered and indicate the name of the report, the date the report was printed, and the time of the printout. The printout shall also include the time span of the information shown on the report.~~

- ~~Daily Operating Report. A daily report, listing the major plant variables (up to 4 variables) shall be provided. The report shall include hourly values and minimum/maximum/average values where appropriate. A minimum of 1 separate daily reports shall be provided by the System Supplier.~~
- ~~Monthly Operating Report. A monthly operating report, which averages the values from the above daily reports, shall be provided. The report shall include monthly minimum/maximum/average values where appropriate.~~

~~3-2.04. Configuration Standards and Conventions. A "Software Configuration Standards and Conventions" document shall be prepared and submitted by the System Supplier. The document shall be submitted for review and approval before software configuration commences. The document shall describe and define such items as proposed graphic display process line colors/representations; symbology; color standards for "on", "off", "opened", "closed", and "alarm" conditions; alarm handling conventions; how items will be selected for control; methods for navigation between displays; address usage/naming conventions; and security setup. Before submitting the initial draft document, the System Supplier shall meet with the Engineer and/or Owner to review any of the Owner's existing standards and conventions. All copies of this submittal shall be provided in color to insure the accuracy of each item. No black and white copies will be accepted. The colors used in the printed submittal shall~~

~~accurately depict the colors and shapes proposed for use on the final system.~~

~~In addition to submitting the document for review, an updated version of the document shall be submitted as part of the O&M Manuals. The document shall be revised to document any additional standards that are established throughout the configuration process.~~

~~3-2.05. Configuration Review Meetings. Proposed graphic screens and report formats shall be reviewed with the Owner and Engineer throughout the configuration process. The System Supplier's programming personnel shall attend all meetings. A second review meeting shall be held at approximately 50 percent completion. Both meetings shall be held at the Owner's facilities.~~

~~3-2.06. Software Functional Requirements. General functional requirements for system configuration are indicated on the Drawings and described in the specifications. The information presented herein and indicated on the Drawings illustrates the general functional intent of the system, and may not be sufficient to fully configure the system. The System Supplier shall be responsible for determining what additional information may be required to complete the configuration tasks, and for obtaining this information from the Engineer or the Owner.~~

3-3. SYSTEMS CHECK. System Supplier shall provide the services of a field manager and a trained and experienced field supervisor to assist the installation contractor during installation, and to calibrate, test, and advise others of the procedures for installation, adjustment, and operation.

3-3.01. Field Manager. System Supplier shall appoint a field services manager who shall be responsible for the coordination of all system check-out and startup activities, and who shall be immediately available to Engineer and Owner by phone or on site for the duration of this project.

3-3.02. Field Inspection at Delivery. The field supervisor shall inspect major equipment items within five working days of delivery, to assure that the equipment was not damaged during shipment and shall supervise or assist with unpacking, initial placement, and initial wiring of the system.

3-3.03. Field Calibration of Instruments. After each instrument has been installed, a technical representative of System Supplier shall calibrate each instrument and shall provide a written calibration report for each instrument, indicating the results and final settings. The adjustments of calibrated instruments shall be sealed or marked, insofar as possible, to discourage tampering. Instrument calibration shall be done before checkout of the system operation. A typical instrument calibration report is attached to the end of this section.

3-3.04. Training for Installation Personnel. The field supervisor shall train the installation personnel in reading and understanding submittal drawings, and in the correct installation and wiring procedures for the equipment. One day shall be included for this training.

3-3.05. Field Inspection Prior to Start Up. After installation and wiring connections are complete, the field supervisor, with additional System Supplier's personnel shall verify that each external connection to the system is correctly wired and field process components and devices are functioning as intended. A minimum of 2 working days shall be included for this task, but System Supplier shall be responsible for completing the following scope of work.

3-3.05.01. Analog Signals. Analog input signals shall be simulated at the transmitting source, and verified to be received at the proper register address in the control system. Analog outputs shall be generated at the control system, and verified to be received with the correct polarity, at the respective receiving device.

3-3.05.02. Discrete Signals. Discrete input and output signals shall be simulated and verified that they are received at the respective receiving device, and at the proper voltage.

3-3.05.03. Devices by Other Suppliers. If interrelated devices furnished by other suppliers, under other contracts, or by Owner, such as valve actuators, motor controls, chemical feeders, and instruments, do not perform properly at the time of system checkout, the field supervisor shall use suitable test equipment to introduce simulated signals to and/or measure signals from these devices to locate the sources of trouble or malfunction.
3-3.05.04. System Check Out Report. The System Supplier shall submit a written report on the results of such tests to Engineer. Additional documentation shall be furnished as requested by Engineer to establish responsibility for corrective measures. System Supplier shall verify, in writing, to Engineer or Owner that System Supplier has successfully completed the external connection check before beginning system startup or field acceptance testing.

3-3.06. Start Up Assistance. After the field supervisor has completed the system check and submitted his report, System Supplier shall supply a factory-trained engineer and programmer to provide on-site start up assistance. During the startup period, these personnel shall thoroughly check all equipment, correct any deficiencies, and verify the proper operation of all components. One working days shall be included for this task.

3-4. TESTING. The system shall be acceptance tested at the factory and on site.

System Supplier shall prepare a testing procedure to be approved by Owner and Engineer that shall demonstrate that the system conforms to the specifications.

The testing procedure shall be submitted at least 30 days in advance of testing. The testing shall be conducted by System Supplier and witnessed by Owner and/or Engineer.

System Supplier shall notify Engineer and Owner in writing at least 14 days before the proposed testing date. If the factory acceptance test is concluded unsuccessfully, the test shall be repeated. System Supplier shall reimburse Owner and Engineer for all expenses incurred in connection with attending repeated factory or site testing necessitated by system failure or inadequate preparation.

3-4.01. Factory Acceptance Testing. After system assembly and debugging at System Supplier's facility, the system shall be tested before the system is shipped to the site. The factory test shall be conducted on

The Stormwater 07 Pump Station Control Panel, HMI , including all peripherals and associated software, shall be factory tested under simulated operating conditions. Both normal operating sequences and fault conditions shall be simulated. The results shall be noted in the HMI alarm/event log. The testing procedures for hardware and software are described below.

All basic functions shall be demonstrated, including I/O processing, communications, alarm handling, HMI display functions, alarm logging, report generation, and historical data storage, as well as the specific functions listed herein. The system shall operate continuously for at least a 72 hours without faults. This operational test may run concurrently with the demonstration of hardware and software functions. The test procedure shall also include at a least four-hour period for discretionary tests to be conducted by Engineer or Owner.

For systems with software configuration by Engineer/Owner, a preliminary version of such configured software may be used as part of the factory acceptance test.

3-4.01.01. Hardware Test. Processors, processor modules, and peripheral devices associated with the system shall be assembled together as they will be installed in the field and shall be tested. The test shall demonstrate proper operation of each hardware device and communications among devices, and shall include verification of selected analog and discrete inputs and outputs.

3-4.01.02. Software Test. All system software modules specified herein shall be demonstrated. Software tests shall include running all diagnostics, debugging routines, and system test routines. The operating system, advanced process control language compiler, and all associated drivers shall be fully tested and operable for the system test. Software "patches" or changes to bypass failed or flawed modules during the test will not be acceptable.

3-4.02. Site Acceptance Testing. After installation and checkout by System Supplier's personnel, the system shall be subjected to an acceptance test.

Site acceptance testing shall be scheduled after receipt of the System Check Out Report and System Supplier shall verify that all field signal changes are reflected in the proper address locations in the system database.

The site acceptance testing shall follow the same procedure as the factory testing and shall operate without loss of basic functions. The number of working days of continuous operation for the test shall be five. The operational demonstration shall confirm that the status, alarm, and process variable signals are valid and are being updated appropriately, and that the discrete and analog output signals from the control system are being correctly transmitted and implemented. Any errors or abnormal occurrences shall be recorded by System Supplier's field representative. System Supplier's field representative need not be continuously present during the site acceptance testing, but shall be available to respond to the site within one hour of notification. The representative shall inspect the system for faults at least once every 24 hours and shall log or record any noted problems. The log shall include a description of the problem, its apparent cause, and any corrective action taken.

3-4.02.01. Failure of Redundant Equipment. Failure of redundant equipment shall not be considered downtime provided that automatic failover occurs as specified and, in the opinion of Engineer, the failure was not caused by deficiency in design or installation. In the event of repeated failure of any hardware component or software module, the acceptance test shall be terminated and re-started.

3-4.02.02. Completion of Test. Successful completion of the site acceptance test, including the operational demonstration, is prerequisite to Substantial Completion as specified in the Supplementary Conditions.

3-5. TRAINING. System Supplier shall conduct training courses for personnel selected by Owner. Training shall be provided in the following categories: instrument, control system maintenance, operator (pre-installation), operator (post-installation), programmer (HMI software), programmer (RTU software), networking, and supplemental shall be provided. Training shall be conducted by experienced instructors who are familiar with the specific system supplied.

3-5.01. General Training Requirements. In general, System Supplier's standard training courses may be used to meet the training objectives specified. Where standard courses do not meet these objectives, additional coursework shall be developed. Clock hour requirements for each level of training are shall be as listed. A "clock hour" is defined as one hour of instruction or supervised training exercise. Training hour requirements are the number of hours of training to be

provided for each student. Additional training time shall be provided if considered necessary to meet the training objectives.

3-5.01.01. Training Costs. All costs associated with the training program; excluding travel, lodging, and per diem expenses for Owner's and Engineer's personnel to attend off-site training programs; shall be the responsibility of System Supplier and shall be included in the contract price.

3-5.01.02. Lessons. Training lesson plans and other information for the second stage submittal as defined herein shall be submitted at least 30 days prior to the start of training.

3-5.01.03. Video Recording. Not used.

3-5.02. Instrument Training. Training on the calibration, maintenance, troubleshooting, and repair for the instrument devices provided under this project shall be provided. Training shall also be provided for any hand-held or computer-based calibration devices and their associated software. Four

3-5.03. Control System Maintenance Training. Not used.

3-5.04. Operator Training. Owner's personnel will utilize the system for day-to-day monitoring and/or control of the facilities. The training program shall provide operators with sufficient knowledge to move from screen to screen within the system, understand the contents of group and detailed point displays, react to and acknowledge alarms, adjust control setpoints and alarm limits, configure and print shift reports, print preconfigured reports on demand, control equipment connected to the system, and react to and resolve minor system errors.

3-5.04.01. Classes. Operator training shall include sessions as specified below.

3-5.04.01.01. Pre-installation Session. Not used.

3-5.04.01.02. Post-installation Session. The post-installation training shall include three separate, but identical, sessions for three shifts of personnel and shall be conducted at Owner's facilities. Each class shall consist of 2 hours of instruction using the lesson plan submitted and approved for use. The post-installation sessions may have to be conducted outside normal working hours to accommodate the working schedule of Owner's personnel. The post-installation training sessions shall be conducted for 4 of the Owner's operating personnel.

3-5.04.02. Content of Classes. Each session shall cover at least the following topics.

a. Logging on and off the system and the use of passwords.

b. Access and interpretation of standard displays and diagnostics.
c. Moving from screen to screen within the graphic display environment.
d. Response to and acknowledgment of alarms.
e. Configuration and printing of shift and other reports by schedule or on demand.
f. Control of field equipment and devices connected to the system.
g. Manual entries to database points.
h. Generation of current (real-time) and historical custom and predefined reports and trend displays.
i. Appropriate responses to software and hardware errors.
j. Enabling and disabling individual inputs and outputs.

The operator-training program shall be developed for personnel with no prior experience with the hardware and software provided as part of the project.

3-5.05. Programmer Training (HMI Software). Not used.

3-5.06. Programmer Training (PLC Software). Not used.

3-5.07. Network Training. Not used.

End of Section

INSTRUMENT NAME & SERVICE:		
BRAND & MODEL NO.:		
TAG OR LOOP NO.:		
INPUT/OUTPUT RANGE:		
INPUT	ACTUAL OUTPUT	DESIRED OUTPUT
PROPORTIONAL BAND:		
RESET:		
POSITION OF SWITCHES, JUMPERS, ETC.		
COMMENTS:		
DATE OF CALIBRATION: CALIBRATED BY:		
Black & Veatch	INSTRUMENT CALIBRATION REPORT	Figure 1-13500

BLACK & VEATCH	SIGN IN SHEET

Date:	4/3/2019	**Time (start and end time):**	10:00-11:00
Location:	Intersection of Dennis St. & Venetia St., Key West, FL		
Presenter(s):	John Paul Castro, Steve Gardner, Tammy Martin		
Project:	Dennis Street Storm Water Improvements Pump Station		
Subject/Purpose:	Pre-Bid Meeting		

Name	Title	Company	E-Mail	Initials
STEVE GARDNER	PROJECT MANAGER	CITY OF K.W.	SGARDNER@CITYOFKEYWEST-FL.GOV	SG
Jeff Kink		Nearshore Elect.	Nearshore@Bellsouth.net	JK
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Ronald J Winstrom	Prj Manager	DN Higgins	RonA@DNHiggins.com	RJW
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JOHN ZELENKA	Business Development	KIEWIT INFRASTRUCTURE SOUTH	JOHN.ZELENKA@KIEWIT.com	JAZ
Rick CLEMVLL	APM	JACOBS		RC
Danny Caraballo	Maintenance Mgr	Jacobs	Danny.Caraballo@Jacobs.com	
John Paul Castro	Utilities Director	CoKw	Jcastro@cityofkeywest-fl.gov	JPC
Tammy Martin	Engineering Manager	Black & Veatch	MartinTM@bv.com	TM
Eric Diversike	President	PSI Technologies	epic@psi-Tech.com	ED

BLACK & VEATCH	Meeting Minutes

Project Name	Project No.	File No.
Key West – Dennis Street Pump Station	193108	14.2200.07
Subject		**Meeting No.**
Pre-Bid Meeting		01
Location	**Date**	**Time**
Dennis St. & Venetia St., Key West, FL	April 3, 2019	10:00-11:00
Prepared By		
Tammy Martin		

No.	Subject
1.	Sign-In sheet
2.	Project Overview
3.	Specific Project Requirements • Coordination with Key West High School o *Coordinate with Doug Pryor* o *Contractor must complete school district permit form* o *Background screening of contractor will be required for work on school district property* • Coordination with Keys Energy for 3-phase power o *Cost for bringing 3-phase power to the site will be covered by the City* • MOT • Access to all homes • Permitting o *ERP and WUP applications are being handled by Black & Veatch* • Dewatering o *Contractor will be responsible for meeting permit requirements* • Contractor lay down area
4.	Project's significant dates: • Bid Date o *4/24/2019* o *Last day to submit questions: 4/14/2019* • Tentative Award Date o *5/22/2019* • *Tentative NTP* o *6/5/2019* • Final Completion o *6/5/2020*

BLACK & VEATCH	Meeting Minutes

No.	Subject
5.	See Bid Documents for the following information: • Qualification Requirements for Bidders • Insurance Requirements • Preparation and Submission of Bids • State and Local Legal Requirements • Quality Control • Temporary Facilities
6.	Site Tour
7.	Questions • *Is geotechnical report available?* • *Underground utility locations*

CITY OF KEY WEST
DENNIS STREET STORMWATER IMPROVEMENTS
PUMP STATION AND DRAINAGE WELL
CITY OF KEY WEST, FLORIDA

REPORT OF SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING EVALUATIONS

PREPARED FOR: BLACK AND VEATCH CORPORATION

PREPARED BY: GEOSOL, INC.

SEPTEMBER 1, 2017

Black & Veatch Corporation
2855 North University Drive, Suite 210
Coral Springs, Florida 33065

September 1, 2017

Attention: Ms. Tammy Martin, PE – Engineering Manager

Re: **Report of Subsurface Exploration and Geotechnical Engineering Evaluations**
City of Key West Dennis Street Stormwater Improvements
Proposed Pump Station and Drainage Well
City of Key West, Florida
Geosol Project No. 217145

Dear Ms. Martin,

Geosol, Inc. (GEOSOL) is pleased to submit this report presenting the results of our geotechnical services for the above-referenced project. The services were provided in accordance with our proposal No. P-216113 dated February 29, 2016. You provided authorization to perform our geotechnical services by means of a Consulting Services Agreement dated August 7, 2017.

The results of our field exploration and laboratory testing programs for the proposed pump station and drainage well improvements that are part of this project as well as our geotechnical engineering evaluations are presented in the accompanying report.

GEOSOL appreciates the opportunity to work on this interesting project. If you have any question or need additional information, please do not hesitate to call our office.

Sincerely,
GEOSOL, INC.

9/1/17

Oracio Riccobono, P.E.
Senior Geotechnical Engineer
Florida License No. 49324

Adnan Ismail, P.E.
Project Geotechnical Engineer
Florida License No. 76014

cc: Addressee (4)
File (1)

GEOSOL, Inc.
5795-A NW 151st Street
Miami Lakes, FL 33014
Phone (305) 828-4367; Fax (305) 828-4235
E-mail: geosolusa@bellsouth.net

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APPENDICES

1.0 INTRODUCTION

1.1 Project Information

Based on the information provided to us by Black & Veatch Corporation (BV) on February 24, 2016 and August 8, 2017, we understand that The City of Key West has decided to improve their existing storm water system by constructing a new pump station, stormwater drainage well and associated supporting infrastructure. Currently, the stormwater system consists of approximately 63 permitted outfalls and associated stormwater collection systems, 54 vertical exfiltration drains, 5 pressurized wells, approximately 121 stormwater gravity recharge wells, and associated collection and treatment systems. The stormwater improvements are required in sub-basin 3340 near the Key West High School, which currently has consistent standing water issues. There is an existing gravity well at Dennis Street that is too low to be effective. This project will achieve the goal of lifting water to a new pressurized drainage well in order to reduce the duration of standing water in the area surrounding the High School. As we understand it, the proposed pump station and drainage well will be located mid-block on Venetia Street between Dennis Street and Bertha Street, and will be similar to a pump station and drainage well that the City of Key West has already constructed in the vicinity of the Police Station at the intersection of Ashby Street and Catherine Street with dimensions of about 35-feet by 16 feet, and a depth of about 16 feet below existing grades.

Based on our discussions, geotechnical services were required to explore the subsurface conditions to obtain geotechnical data for use in the proposed pump station and drainage well design and construction, and to develop design soil/rock parameter recommendations for the design and construction considerations related to the temporary ground support systems to be used during construction.

Geotechnical services were required to explore the subsurface conditions near the proposed construction site. Specifically, the geotechnical services included the performance of a Standard Penetration Test (SPT) boring in the vicinity of the proposed pump station and drainage well to characterize the subsurface conditions near the proposed pump station and drainage well. The results of the field exploration and laboratory testing programs were used to investigate the subsurface and groundwater conditions and to provide geotechnical engineering recommendations for the proposed construction. The design of temporary ground support systems for excavation is not part of our scope of services and we are assuming it will be performed by others.

1.2 Purpose

The purpose of this study was to evaluate the underground conditions (i.e. subsurface and groundwater) in light of the proposed pump station and drainage well. This report presents the results of our field exploration, laboratory testing, geotechnical engineering evaluations, and considerations for the proposed design and construction.

2.0 SCOPE OF SERVICES

The scope consisted of providing the following services:

1. Performing site reconnaissance, locating and coordinating for existing utilities.

2. Providing maintenance of traffic control during the drilling operations.

3. Performing one (1) Standard Penetration Test (SPT) borings to a depth of 30 feet below existing grades in the vicinity of the proposed pump station and drainage well.

4. Measuring groundwater levels at the test boring location.

5. Backfilling the borehole using grout and restoring the site to its original condition.

6. Visually examining and classifying all recovered soil samples obtained from the field in the laboratory using the Unified Soil Classification System (USCS) in accordance with ASTM test designation D-2488, titled "Standard Procedure for Description and Identification of Soils (Visual-Manual Procedure)" and ASTM D-2487 titled "Standard Test Method for Classification of Soils for Engineering Purposes."

7. Performing laboratory classification testing which consisted of grain-size analysis, percent passing the No. 200 sieve, moisture content, organic content, and environmental classification testing on selected representative samples.

8. Evaluating the results of the SPT boring information.

9. Deriving soil/rock parameters for use in the design of the temporary ground support systems.

10. Providing discussion of critical design or construction considerations based on the subsurface and groundwater conditions developed from the results of the geotechnical investigations.

11. Providing foundation evaluations and analysis for the proposed pump station and drainage well, including evaluation and analysis of rock anchors for uplift resistance.

12. Preparing a geotechnical engineering report summarizing the field testing data, subsurface and groundwater conditions, geotechnical analyses and evaluations.

3.0 SITE CONDITIONS

Our understanding of the site conditions is based on our observations during the performance of the field exploration program. The proposed pump station and drainage well will be located mid-block on Venetia Street between Dennis Street and Bertha Street in the City of Key West, Florida. The area of the proposed pump station and drainage well generally consists of residential building, with the Key West High School to the west. We have appended a Site Vicinity Map that identifies the location of the study area. This map is presented in Sheet 1 of Appendix "A."

4.0 FIELD EXPLORATION

4.1 General

The field exploration program consisted of the performing of one (1) Standard Penetration Test (SPT) boring (PS-1) to a depth of 30 feet below existing grades in the vicinity of the proposed pump station and drainage well. The field exploration program performed by GEOSOL was done on August 18, 2017.

The test boring location was marked in the field by representatives of GEOSOL using the Overall Site Plan provided to us on August 9, 2017 showing the requested test boring location. The test was performed as close as possible to the requested location considering constraints such as existing utilities and equipment accessibility. The approximate test boring location was obtained by means of a hand-held Global Positioning System (GPS) device. The latitude and longitude coordinates obtained with the GPS device were converted to northing and easting using the software "Corpscon" developed by the United States Army Corps of Engineers. The ground surface elevation at the test boring location was estimated from the Overall Site Plan provided to us on August 9, 2017, and should be considered approximate. The approximate test location is presented in Table 1 and in the Test Location Plan presented in Appendix "A."

4.2 Standard Penetration Test (SPT) Borings

The SPT boring procedures were conducted in general conformance with ASTM D-1586. All SPT borings were performed with a truck-mounted drill rig (Foremost Mobile B-53) equipped with a recently calibrated automatic hammer. After seating the sampler 6 inches, the number of successive blows required to drive the sampler 12 inches into the soil constitutes the test result commonly referred to as the "N"-value. The "N"-value has been empirically correlated with various soil properties and is considered to be indicative of the relative density of cohesionless soils and the consistency of cohesive soils. All borings were advanced using full length casing and rotary wash method. The N-value information for the SPT boring is presented in the Report of Core Boring sheet that is included in Appendix "A" of this report.

4.3 Water Level Measurements

Water level depths were obtained during the performance of the test boring operations. They are noted on the Report of Core Boring sheet presented in Appendix "A." In relatively pervious soils, such as sandy (granular) soils and porous rocks, the indicated depths are usually reliable ground water levels. Seasonal variations, tidal conditions, temperature variations, land uses, and recent rainfall conditions may influence the depth of groundwater levels.

5.0 LABORATORY TESTING PROGRAM

5.1 General

Representative samples collected from the test boring were visually reviewed in the laboratory by a geotechnical engineer to confirm the field classifications. The soil samples from the structural borings were then classified using the Unified Soil Classification System (USCS) in general accordance with the American Society of Testing and Materials (ASTM) test designation D-2488, titled "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)" and ASTM D-2487 titled "Standard Test Method for Classification of Soils for Engineering Purposes." The classification was based on visual observations with the aids of limited laboratory testing which consisted of grain-size analysis, moisture content, and percent passing the #200 sieve. A summary of the laboratory classification test results are presented in Table 2 of Appendix "B." Also, FDOT environmental classification testing was performed on a water sample obtained from an SPT boring location performed for this project. The environmental classification test results are summarized in Table 3 of Appendix "B."

5.2 Grain-Size Analysis

The grain-size analyses were conducted in general accordance with the FDOT Test Designation FM1-T88 (ASTM Test Designation D-422, titled "Particle-Size Analysis of Soils"). The grain-size analysis test measures the percentage passing the No. 200 Sieve. In this manner, the grain-size distribution of a soil is measured. The percentage by weight passing the No. 200 sieve is the amount of silt and clay sized particles. A summary of these test results are presented on Table 2 in Appendix "B." The grain-size analysis curves are presented in Appendix "B."

5.3 Percent Passing No. 200 Sieve

The grain-size analyses were conducted in general accordance with the FDOT Test Designation FM1-T88 (ASTM Test Designation D-422, titled "Particle-Size Analysis of Soils"). The grain-size analysis test measures the percentage passing the No. 200 Sieve. In this manner, the grain-size distribution of a soil is measured. The percentage by weight passing the No. 200 Sieve is the amount of silt and clay sized particles. The test results are presented in Appendix "B."

5.4 Moisture Content

Laboratory moisture content test consists of the determination of the percentage of moisture contents in selected samples in general accordance with FDOT Test Designation FM1-T265 {ASTM Test Designation D-2216, titled "Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures"}. Briefly, the moisture content is determined by weighing a sample of the selected material and then drying it in a warm oven. Care is taken to use a gentle heat so as not to destroy any organics. The sample is removed from the oven and reweighed. The difference of the two weights is the amount of moisture removed from the sample. The weight of the moisture divided by the weight of the dry soil sample is the percentage by weight of moisture in the sample. The moisture content test results are presented in Appendix "B."

5.5 Environmental Classification Testing

As requested, GEOSOL performed environmental corrosion testing on water samples collected from SPT boring locations performed for this project. Environmental corrosion tests include parameters such as pH, resistivity, sulfate content and chloride content. The environmental corrosion tests were conducted in general accordance with the FDOT Test Designations FM5-550, 5-551, 5-552, and 5-553. Based on the laboratory test results and the FDOT's "Structures Design Guidelines," Section 1.3, the environment in the vicinity of the proposed improvements can been classified as extremely aggressive for the substructures and slightly aggressive for the superstructures. The results of the environmental classification testing are presented in Table 3 of Appendix "B."

6.0 GENERALIZED SUBSURFACE CONDITIONS

6.1 Monroe County Regional Geology

The proposed project is located on the Southern Flank of the Florida Plateau. A stable, carbonate platform on which deposits of limestone, dolomite and evaporated have accumulated. Within the investigative depths of this study, the natural limestone formation was encountered. Above the limestone formation, deposits of organic soils, silts and man-made fill materials were encountered. The natural limestone formation is a rock formation of the Pleistocene Epoch, deposited 10,000 to 2 million years before the present.

Although the natural limestone formation can be very porous and have a sponge-like, open interconnected network of vugs and small voids, large cavities do not exist and there is no potential for sinkhole activity. The rock formations encountered in this area are typically much softer than the "bedrock" formations encountered in other areas of the country.

The strength of the natural limestone as well as its deformation characteristics depends upon the degree of cementation of the formation and its alteration by solutioning and weathering subsequent to deposition. One of the most important characteristics of the limestone encountered in the project area is the degree of erosion. Past surface solutioning of the limestone has resulted in formation called "pinnacle rock". In some cases nearly vertical cylindrical-shaped solution cavities are filled with surficial fine sands extending below the groundwater level. The subsurface conditions encountered at the site are presented in the following section.

6.2 Monroe County Soil Survey

The *Soil Survey of Monroe County, Florida*, published by the United States Department of Agriculture (USDA), was reviewed for general near-surface soil information within the general project vicinity. This information indicates that there is one (1) primary mapping unit within the project vicinity, as follows:

- Urban Land (11)

A reproduction of the USDA map for the project area is illustrated on Sheet 2 in Appendix “A.”

7.0 SITE SUBSURFACE CONDITIONS

7.1 General

Detailed information regarding the subsurface conditions disclosed by the test boring performed for this study is presented in the Report of Core Borings presented in Appendix "A." The stratification shown is based on visual examination of recovered samples, interpretation of the field logs by a geotechnical engineer and limited laboratory testing. The soil types shown represent observations made in the test boring and may not reflect variations in adjacent locations and beyond the depths explored. Specifically, we have identified four (4) strata along the project alignment and they are described in Table "A" on the following page.

TABLE "A" – SUMMARY OF GENERALIZED SUBSURFACE STRATIGRAPHY

STRATUM No.	DEPTH INTERVAL (FEET)	MATERIAL DESCRIPTION	USCS SYMBOL
1	0 to 0.4	Asphalt Pavement	N/A
2	0.4 to 2.5	Brown Silty Fine to Medium SAND with Trace of Limerock Fragments (FILL)	SM
3	2.5 to 13	Light Brown Silty Fine to Medium SAND with Little Limestone Fragments	SM
4	13 to 30	Light Brown Sandy LIMESTONE	N/A

7.2 Groundwater Conditions

The groundwater table was measured at the test boring location immediately following completion of drilling operations performed on August 18, 2017. The boring performed for this phase of the project was done during the wet season. The "static" groundwater table in the SPT test boring location was measured after a short stabilization period and was found be about 2.5 feet below the existing grades, corresponding to an elevation of about -1.6 feet (NAVD, 1988). Given the granular nature of the soils and type of limestone formation, we consider the recorded levels to stabilize in a short time and to be reasonably reliable.

Based on our interpretation of the site conditions using the results of our test boring data and review of available data in the project vicinity, it should be anticipated that the groundwater levels may be 12 to 18 inches higher than the levels measured at the test boring locations during the peak of the wet season and the designer shall make provisions for this variation in the design and construction of this project. The Report of Core Boring sheet presented in Appendix "A" show the groundwater table information at each boring location.

8.0 RECOMMENDED GEOTECHNICAL PARAMETERS FOR DESIGN

8.1 Geotechnical Design Soil/Rock Parameters

The geotechnical design parameters for this study were obtained on the basis of empirical relationships between the SPT "N"-values and the shear strength of the soil strata, statistical evaluation of the field data, in general accordance with the FDOT's *Soils and Foundations Handbook (2017)*, literature review, and our local experience. It is to be noted that the SPT borings were performed with the use of an automatic hammer. Thus, the SPT "N"-values were corrected for hammer efficiency in accordance with the recommended relationship presented in the FDOT *Soils and Foundations Handbook (2017)* ($N_{safety} = 1.24*N_{automatic}$). Hence, any reference to SPT "N"-values have been corrected to safety hammer N-values (N_{safety}) and are referenced as such in the following paragraphs only. The following strata (besides the topsoil) were encountered during the performance of the field exploration program:

❖ **Granular Fill (Stratum 2)**:

The subsurface material from this layer consists of silty fine to medium sand with variable percentages of limerock fragments. It was encountered below the asphalt pavement (Stratum 1). The materials from this stratum can be classified as SM in accordance with the USCS. The relative density of this layer is dense with a N_{safety}-value of 47 blows per foot (bpf). Based on established empirical correlations between the N_{safety}-value and the internal friction angle (ϕ) as well as statistical evaluation of the data, we recommend an internal friction angle (ϕ) and total unit weight (γ_t) of 36 degrees and 115 pcf, respectively. The active, passive and at-rest Coulomb earth pressure coefficients (i.e. Ka, Kp and Ko) for this layer are 0.24, 5.95 and 0.41, respectively.

❖ **Silty Sand (Stratum 3)**:

The subsurface material from this layer consists of silty fine to medium sand with variable percentages of limestone fragments. It was encountered below the granular fill. The materials from this stratum can be classified as SM in accordance with the USCS. The relative density of this layer is dense with N_{safety}-values ranging from 26 to 46 blows per foot (bpf), with a statistical average N_{safety}-value of about 34 bpf. Based on established empirical correlations between the N_{safety}-value and the internal friction angle (ϕ) as well as statistical evaluation of the data, we recommend an internal friction angle (ϕ) and total unit weight (γ_t) of 32 degrees and 115 pcf, respectively. The active, passive and at-rest Coulomb earth pressure coefficients (i.e. Ka, Kp and Ko) for this layer are 0.28, 4.65 and 0.47, respectively.

❖ **Natural Limestone Formation (Stratum 4)**:

This layer was encountered below the silty sand layer (Stratum 3). The material from this stratum had N_{safety}-values ranging from 16 bpf to 50 blows per 5 inch of sampler penetration (refusal conditions), with a statistical average N_{safety}–value of about 35 bpf. Predrilling (typical FDOT also refers to this as preforming) of Stratum 4 is anticipated for the installation of sheet pile wall, due to the hard rock layer encountered. As such, we recommend that this layer be treated as granular materials. Based on established empirical correlations between the N_{safety}-value and the internal friction angle (ϕ) as well as statistical evaluation of the data, we recommend an internal friction angle (ϕ) and total unit weight (γ_t) of 34 degrees and 120 pcf, respectively. The active, passive and at-rest Coulomb earth pressure coefficients (i.e. Ka, Kp and Ko) for this layer are 0.26, 5.15 and 0.44, respectively.

Table "B" below presents a summary of the recommended geotechnical design parameters for use in the design.

TABLE "B"- SUMMARY OF GEOTECHNICAL DESIGN SOIL/ROCK PARAMETERS

General Material Description	Unit Weight (PCF)		Friction Angle (Degrees)	Wall Friction (Degrees)	Cohesion (psf)	Coulomb Earth Pressure Coefficients		
	Total	Effective				Active	Passive	At-Rest
	γ_{total}	γ_{eff}	ϕ	δ	C	K_a	K_p	K_o
Acceptable Structural Fill[(2)]	115	53	32	16	-	0.28	4.65	0.47
Granular Fill (Stratum 2)	115	53	36	18	-	0.24	5.95	0.41
Silty Sand (Stratum 3)	115	53	32	16	-	0.28	4.65	0.47
Natural Limestone Formation (Stratum 4)	120	58	34 [(3)]	17 [(3)]	4,000 [(4)]	0.26 [(3)]	5.15 [(3)]	0.44 [(3)]

Note: (1) Stratum No. 1 is the asphalt pavement.
(2) Design soil parameters for Acceptable Structural Fill as specified per Section 9.2.8 of this report.
(3) Value accounts for and takes into consideration predrilling of hard rock layer for installation of sheet piles and backfilling the holes with sand.
(4) Although the intact limestone layer has a cohesion value, however in our opinion, the installation of sheet piles cannot be accomplished without pre-drilling due to the very hard nature of the natural limestone. If this limestone layer is pre-drilled, then the cohesion value shall be taken as 0 psf and treated as granular soils with friction angle of 34 degrees.

8.2 Seismic Design Parameters

We recommend that all structures be built in accordance with the seismic design provisions presented in the International Building Code (IBC), and the American Society of Civil Engineers (ASCE) Document 07-05. Table "C" on the following page presents a summary of the Seismic Design Parameters based on the results of our field exploration, literature review, our local experience, and in accordance with Section 1613 of the IBC.

TABLE "C"- SUMMARY OF SEISMIC DESIGN PARAMETERS

PARAMETER	VALUE
Soil Site Class	D
Seismic Design Category	A
Site Coefficient, F_a	1.6
Site Coefficient, F_v	2.4
Mapped MCE Spectral Response Acceleration at period 0.2 Second, S_s	0.022 g
Mapped MCE Spectral Response Acceleration at period 1 Second, S_1	0.014 g
Adjusted MCE Spectral Response Acceleration at period 0.2 Second, S_{ms}	0.035 g
Adjusted MCE Spectral Response Acceleration at period 1 Second, S_{m1}	0.034 g
Design Spectral Response Acceleration at period 0.2 Second, S_{ds}	0.023 g
Design Spectral Response Acceleration at period 1 Second, S_{d1}	0.022 g

9.0 FOUNDATION ANALYSES AND EVALUATIONS FOR THE PROPOSED PUMP STATION AND DRAINAGE WELL

9.1 General

Based on the information provided to us by Black & Veatch Corporation (B&V), the proposed pump station and drainage well will be located mid-block on Venetia Street between Dennis Street and Bertha Street, and will be similar to a pump station and drainage well that the City of Key West has already constructed in the vicinity of the Police Station at the intersection of Ashby Street and Catherine Street with dimensions of about 35-feet by 16 feet, and a depth of about 16 feet below existing grades.

Results of this study indicate that the site is generally suitable for the construction of the proposed pump station and drainage well when viewed from a geotechnical engineering perspective. Geotechnical analysis and evaluations for foundation design and related construction are presented in subsequent sections of this report. Specifically, we have provided design and construction criteria for supporting the proposed pump station and drainage well on shallow foundations. Design criteria for the conventional shallow foundations and slab-on-grade are provided in the following section of the report.

9.2 Conventional Shallow Foundations Design and Construction Considerations

9.2.1 Foundation Design

Based on the results of our subsurface exploration and foundation evaluations, the proposed pump station and drainage well may be supported on conventional shallow foundations consisting of spread and/or continuous footings bearing on the surface of the existing natural limestone formation or on the surface on acceptable compacted structural fill materials or compacted existing soils. The foundations should be designed using a maximum allowable bearing capacity of 3,000 psf for footings resting on the surface on acceptable compacted structural fill materials or compacted existing soils, or 4,000 pounds per square foot (psf) for footings resting on the natural limestone formation. A geotechnical engineer prior to foundation construction should inspect the limestone surface at the footing locations. For footings resting on acceptable compacted structural fill materials or compacted existing soils, the site preparation recommendation presented in this report must be properly implemented. Additional criteria regarding footing design and construction is presented in the following sections of the report. It is to be noted that the pump station and drainage well structure shall be designed by the designer as to not become buoyant when dewatered for maintenance purposes.

9.2.2 Footings Bearing on Acceptable Structural Fill Materials or Compacted Existing Soils

The shallow foundations may bear on the surface on acceptable compacted structural fill or compacted existing soils. Preparation of the site to receive the new construction should include removal of any existing topsoil, utilities, grass and/or vegetation system. We recommend that the footings bearing on acceptable compacted structural fill or compacted existing soils be designed using a net allowable bearing capacity of 3,000 psf.

Foundations subject to transient lateral loads will resist these forces through a combination of base shearing resistance mobilized at the footing-subgrade interface and earth pressure acting on the vertical faces of the footings at right angles to the direction of applied load. Base shearing resistance should be determined using a friction factor of 0.60. Earth pressure resistance should be computed using an equivalent fluid pressure of 35 pounds per square foot per foot depth, for granular backfill material. Resistance to sliding determined in accordance with the above should be considered available/ultimate resistance. Accordingly, the design for the sliding should include a factor of safety. We recommend that factor of safety of at least 1.5 be used.

To calculate the resistance of a foundation to uplift forces, a prismatic failure block with vertical faces should be assumed above the footing base. The resisting forces will be provided by the combination of footing weight, overburden soil weight in the failure block, and shearing resistance along the faces of the soil block. The weight of the soil above the water table should be taken as 115 pounds per cubic foot (pcf). For submerged soil, a buoyant weight of 55 pcf should be used. For the shallow foundations planned, an average allowable unit soil shearing resistance of 25 pounds per square foot (psf) would be appropriate. The factor of safety against uplift should not be less than 1.5.

9.2.3 Footings Bearing on the Natural Limestone Formation

Shallow foundations may bear on the surface of the existing natural limestone formation. If sandy soils are encountered at the level of the foundation design elevations, we recommend that these soils be excavated to the surface of the limestone formation and replaced with lean concrete to the foundation bearing elevations. If pockets of soft soils or solution features in the form of slots or chimneys infilled with loose sand are found at the surface of the natural limestone formation at the time of foundation construction, they should be excavated to a depth of three (3) times the feature width or diameter and backfilled with lean concrete. A Geotechnical Engineer should inspect the footing bearing surfaces for the integrity of the natural limestone formation surface. We recommend that the footings bearing on the natural limestone formation or on lean concrete be designed using a net allowable bearing pressure of 4,000 pounds per square foot (psf). The weight of the footing and soil backfill may be neglected in the foundation sizing computations. In addition for shallow foundations bearing on or within the competent limestone, certain criteria must be followed to maintain the minimum factors of safety as follows:

- The load bearing ability of the natural limestone formation depends directly on its thickness below and adjacent to the base of the foundation. It is, therefore, imperative to maintain the foundations bearing levels as high as possible to maximize this thickness. We recommend that foundations bear no deeper than three (3) feet below existing surface of the natural limestone formation.

- The load bearing ability of the natural limestone formation depends on its continuity that affects its ability to spread the foundation loads over a large area. It is, therefore, recommended that restrictions be made to prevent the excavation of utility trenches deeper than 5 feet into the rock formation and within 20 feet of the foundation locations.

- Excavations into the natural limestone formation performed beyond 20 feet from the edge of the foundations should be limited to a depth achieved by projecting a 2H:1V slope down from an elevation of the bottom of the foundation and 20 feet horizontally from the foundation perimeter in order to preserve the continuity of the supporting rock.

9.2.4 Settlement Potential

The amount of settlement that shallow foundations founded on top on acceptable compacted structural fill, compacted existing soils, or natural limestone formation will experience is primarily governed by the compressibility of the acceptable compacted structural fill or compacted existing soils, the sizes and depths of the foundations, and the pressure imposed on the supporting materials. We have compared the data obtained from the SPT borings performed with our foundation design experience with similar structures founded on top on acceptable compacted structural fill or compacted existing soils. Footings designed with the criteria in Sections 9.2.1, 9.2.2 and 9.2.3 and constructed in the manner recommended in Section 9.2.5 are estimated to sustain maximum total settlements in the range of one (1) inch, which corresponds to the maximum allowable bearing pressures in the range of about 3,000 psf to 4,000 psf. Differential settlements between adjacent footings are expected to be one-half of the total settlement.

The sandy limestone materials, acceptable compacted structural fill or compacted existing soils which will provide support to the foundations, have low compressibility and any settlement due to pressure applied by the foundations is likely to occur almost immediately upon application of the loads. In this case, nearly all of the settlement of the foundations due to dead loads is expected to take place during construction. The portion of the settlement due to the live loadings of the structure will generally take place soon after the first application of this load.

9.2.5 Shallow Foundation Construction

The shallow foundations may bear on the surface on acceptable compacted structural fill, compacted existing soils, or natural limestone formation. For foundations bearing on acceptable compacted structural fill or compacted existing soils, it is recommended that the structural fill or existing soils at the bottoms of the foundations excavations be compacted in-place. These materials should be compacted to achieve no less than 98% of the modified Proctor maximum dry density determined by the ASTM designation D-1557. If the foundation bearing materials become disturbed due to surface water resulting from precipitation and runoff, the disturbed soils should be overexcavated and replaced with structural fill as specified in Section 9.2.8 of this report.

9.2.6 Site Preparation

We recommend that any existing unsuitable materials such as asphalt/concrete pavement, substructures, and vegetation system be stripped from the proposed construction areas. In addition, any underground utilities that might exist within the structure footprints should be entirely removed and replaced with structural fill. After stripping is completed, the surface soils at the proposed structure areas should be leveled and densified prior to the placement of the subfloor fill. Where the above site preparation procedures created excavations below the final proposed grade, the excavations should be brought to final grade with structural fill as specified in Section 9.2.8 of this report.

9.2.7 In-Situ Densification of Soils

Compaction of the in-place soils should be performed in the proposed construction footprint plus a 5-foot wide perimeter extending beyond the outer lines of the structure areas, where practical. Any compaction taking place within a distance of 25 feet from any existing structure or utility should be compacted with a vibratory plate or small walk behind vibratory roller to avoid damage to any existing utility of structure.

Compaction of the bearing surface soils should continue until no further vertical settlement of the surface is visually discernible. Density control should be exercised in the upper 12 inches of the subgrade (if feasible). Soils in this interval should be compacted to 98% of the modified Proctor maximum dry density determined per ASTM D-1557. Addition of moisture by frequent wetting of the subgrade may be necessary during the rolling operations to prevent drying and loosening of the upper 6 to 12 inches of soil.

9.2.8 Acceptable Structural Fill and Backfill

Proper control of the placement and compaction of new fills for the project should be exercised by a representative of the Geotechnical Engineer. The fill materials should be placed in lifts not exceeding 12 inches in loose thickness. Each lift should be compacted to a minimum of 98% of the modified Proctor maximum dry density near the optimum moisture content as determined by ASTM D-1557. Fill to be compacted with a vibratory plate or a small walk behind vibratory roller should be placed in lifts not exceeding six (6) inches in loose thickness.

It is imperative that any fill supporting the base slab be placed, compacted and tested in accordance with the specifications of this report. The tests should be performed by a qualified soils technician working under the supervision of a Geotechnical Engineer in accordance with appropriate ASTM procedures. Any fill indicating less than the recommended relative compaction should be re-compacted until the required density is obtained prior to the placement of subsequent lifts or concrete for the substructure.

The structural fill should be free of organic matter and consist of granular material containing less than 12 percent material passing the No. 200 mesh sieve. The fill material may be composed of either clean sand and/or crushed limerock. The structural fill should have a Unified Soil Classification System (USCS) designation of SP, SW, SP-SM or SW-SM. If crushed limerock fill is used, it should have no particle size in excess of three (3) inches. If structural fill is to be placed below the groundwater, it should consist of crushed limerock and should have a USCS designation of GP or GW.

9.2.9 Dewatering Consideration

Successful removal of the existing subsurface materials, proper control of the placement and compaction of new fills, proper compaction of soils, and construction of the proposed pump station and drainage well may necessitate that the work be performed in-the-dry. During foundation construction and initial concrete curing area, water levels should be maintained at least 1 foot below the foundation bearing elevation. It is to be noted that the natural limestone formation maybe difficult to dewater, and that a well point system may be required.

As we understand it, steel sheet piling will be constructed for the dewatering and excavation of the construction area. Any dewatering system shall be designed by a professional engineer registered in the State of Florida. The water from the on-site dewatering operations should be directed to a suitable discharge point and must be adequate to satisfy any local, state or federal regulatory agency.

10.0 GEOTECHNICAL DESIGN PARAMETERS FOR THE PROPOSED SHEET PILE WALLS

10.1 General

As we understand it, steel sheet pile walls will be constructed for the dewatering and excavation of the construction area. The geotechnical soil/rock parameters presented in Table "B" of this report may be used for the design of the proposed sheet pile walls.

10.2 Predrilling

Predrilling is anticipated through the relatively hard natural limestone formation (Stratum 4) for the installation of sheet piles for proposed sheet pile walls. Predrilling is generally required through materials that may damage the pile during installation (i.e. hard limestone). Predrilling is accomplished by drilling a hole with a diameter that is approximately 2 inches larger than the largest dimension across the pile cross-section prior to pile installation. All predrilling shall be carried out in accordance with Sections 455 of the FDOT *"Standard Specifications for Road and Bridge Construction"*. All predrilled holes shall be backfilled as described in 455-5.9.1 with clean A-3 sand or sand meeting the requirements of 902-3.3.

10.3 Sheet Pile Wall Construction Considerations

The following are our suggestions for the installation of the proposed sheet piling based on the results of the test borings.

1. The strata encountered within the project site correspond to dense soils and rock formations that offer high resistance to driving and excavation. Special equipment and breaking tools are typically required to excavate or penetrate these layers. These layers are also difficult to dewater due to their high porosity and permeability. For sheet pile and other retaining wall system related work, these layers typically require predrilling holes to the minimum tip elevation to prevent refusal conditions, structural damage, or to minimize vibration-induced damage to nearby structures. Include the cost of excavation, backfilling, predrilling, and difficulties in dewatering in the associated pay item.

2. The sheet pile installation equipment will produce vibration and noise levels that may be considered disturbing to people and can produce vibrations noticeable in existing structures, and/or utilities. The potential for damage to any adjacent structures and/or nearby utilities during the sheet pile installations will be dependent on the distance from the adjacent structures to the location of the sheet piles installation, the subsurface conditions, and the level of sensitivity of the structure and/or nearby utilities to any type of vibration. The recommendations provided in Sections 108 and 455-1.1 of the FDOT Standard Specifications and those typical of City of Key West projects and/or practices should be followed for the protection of the existing structures and/or nearby utilities during sheet piling operations. All those structures and/or utilities located adjacent to the proposed excavation shall be surveyed as well as monitored for vibrations and settlements in accordance with Sections 108 and 455-1.1 of the FDOT Standard Specifications and those typical of City of Key West projects and/or practices. The Contractor shall provide surveys and settlement/vibration monitoring of the existing structures in accordance with Section 455-1.1 of the FDOT Standard Specifications and those typical of City of Key West projects and/or practices.

3. The contractor shall submit a settlement/vibration monitoring plan prior to commencing work. Such plan shall describe the equipment to be used for driving the sheet piles and list all structures to be monitored, including number and location of monitoring points.

4. After the sheet piles are installed to their required tip elevations, or the temporary ground support is set in place, the excavation of the subsurface materials can be made.

11.0 CONSTRUCTION CONSIDERATIONS

11.1 Excavation Recommendations

The proposed improvements will likely require excavation of the existing subsurface materials. Temporary excavation side slopes of 1V: 2H in the granular subsurface materials (Strata 2 and 3), 1V: 1H in the natural limestone formation (Stratum 4) are stable and have a minimum factor of safety of 1.3. If steeper sides are used, the excavations will require the need of temporary ground support systems in order to maintain the stability of the excavations and for safety reasons. Based on the results of the soil boring, an unsupported vertical cut is not considered stable or safe during construction. An unsupported vertical cut will cause cracks at the grade surface and on the surface of the asphalt-paved roadway because the angle of repose of the granular soils will be exceeded and a failure surface will develop behind the vertical face of the excavation. The existing subsurface granular materials (excluding the natural limestone formations) may be excavated using conventional excavation equipment. It is to be noted that the natural limestone formation may require special equipment to excavate and/or penetrate.

The temporary ground support system should be in conformance with the Occupational Safety and Health Administration (OSHA) Standards. The soil/rock parameters presented in Table "B" may be used for design of the temporary ground support system. Materials removed from the excavation should not be stockpiled immediately adjacent to the cut, inasmuch as this load may cause a sudden collapse of the temporary ground support system.

11.2 Ground Water Control

Dewatering will likely be required depending on the construction technique utilized, the invert elevation of the proposed structures and the time of the year when the construction occurs. Successful removal of the existing subsurface materials and installation of the pump station and drainage well may necessitate that the work be performed in-the-dry, thereby possibly requiring temporary lowering of the groundwater table in the proposed excavation areas. De-watering involves lowering the ambient groundwater table below the existing groundwater levels. The Contractor shall be aware that dewatering of the limestone formations may be difficult due to the relatively high permeability of the rock formations, and that a well point system may be required. The water from the on-site dewatering operations should be directed to a suitable discharge point and must be adequate to satisfy any local, state or federal regulatory agency. Caution must be exercised by The Contractor to prevent unnecessary dewatering for prolonged periods of time in order to prevent ground settlement and/or settlement of any nearby structures, utilities, or roadway as a result of the added overburden pressure resulting from lowering of the groundwater table. All those structures and/or utilities located adjacent to the proposed excavation shall be surveyed as well as monitored for settlements during the dewatering operations in accordance with the FDOT Standard Specifications.

12.0 ON SITE SOIL SUITABILITY

All materials to be used for backfill or compacted fill construction should be evaluated and tested by an independent testing laboratory retained the Contractor, and the test results should be submitted to the Owner prior to placement to demonstrate that the proposed materials are suitable for the intended use. In general, based on the boring results, the majority of the on-site sand (fill materials, can be used as general subgrade fill and backfill in the proposed structures areas, provided that it is free of rubble, clay, rock, roots and organic matter. Suitable structural fill materials should consist of limerock and fine to medium sand with less than twelve (12) percent passing the No. 200 sieve, free of rubble, organics, clay, debris and other unsuitable material. Any off-site materials used as fill should be approved by the Owner prior to acquisition.

13.0 REPORT LIMITATIONS

Our professional services have been performed, our findings obtained, and our analyses and evaluations prepared in accordance with generally accepted geotechnical engineering principles and practices. This company is not responsible for the conclusions, opinions or recommendations made by others based on these data. No other warranties are expressed or implied.

The scope of the investigation was intended to specifically evaluate subsurface conditions within the influence of the proposed project. The analyses and evaluations submitted in this report are based upon the data obtained from the test boring performed at the locations indicated. If any subsoil variations become evident during the course of this project, a re-evaluation of the analyses and evaluations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design.

The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of our client.

APPENDIX "A"

Sheet 1: Site Vicinity Map
Sheet 2: USDA Soil Survey Map
Sheet 3: USGS Map
Table 1 – Summary of Test Boring Location
Sheet 4: Test Location Plan
Sheet 5: Report of Core Borings
Test Boring Records

APPROXIMATE SITE LOCATION

SITE VICINITY MAP

COUNTY: MONROE, FLORIDA

REFERENCE: GOOGLE EARTH, 2017

DATE: AUGUST, 2017

SITE VICINITY MAP

DENNIS STREET STORMWATER IMPROVEMENTS
PUMP STATION AND DRAINAGE WELL
CITY OF KEY WEST, FLORIDA

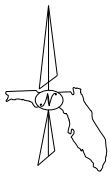
GEOSOL, INC.

DRAWN	SCALE	PROJ. No.
AI	N.T.S.	217145
CHECKED	DATE	
OR	AUG., 2017	SHEET 1

APPROXIMATE SITE LOCATION

USDA SOILS SURVEY MAP

MAP UNIT	SOIL NAME
11	URBAN LAND



COUNTY: MONROE, FLORIDA

REFERENCE: NRCS WEB SOILS SURVEY, 2017

DATE: AUGUST, 2017

USDA SOILS SURVEY MAP

DENNIS STREET STORMWATER IMPROVEMENTS
PUMP STATION AND DRAINAGE WELL
CITY OF KEY WEST, FLORIDA

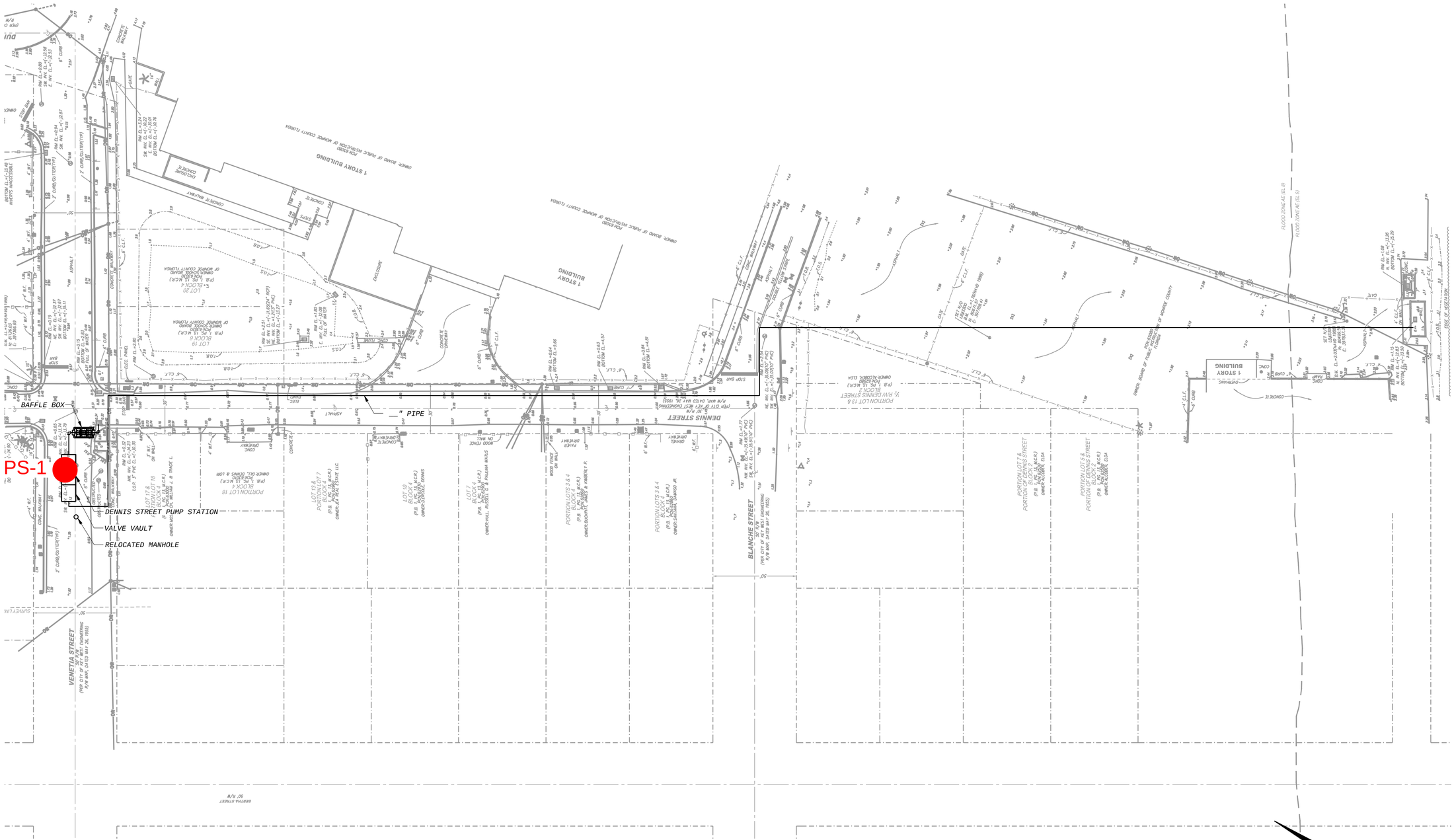
GEOSOL, INC.

DRAWN	SCALE	PROJ. No.
AI	N.T.S.	217145
CHECKED	DATE	
OR	AUG., 2017	SHEET 1

City of Key West Dennis Street Stormwater Improvements
Pump Station and Drainage Well
City of Key West, Florida
Geosol Project No. 217145

TABLE 1 - SUMMARY OF TEST BORING LOCATIONS

BORING No.	APPROXIMATE TEST LOCATION (FEET)		GROUND SURFACE ELEVATION (FEET; NAVD, 1988)
	NORTHING	EASTING	
PS-1	81092	397332	0.9



LEGEND:

PS-1 APPROXIMATE TEST BORING LOCATION

PRELIMINARY - NOT FOR CONSTRUCTION

NO.	BY	CHK	APP	DATE	REVISIONS AND RECORD OF USE

BLACK & VEATCH

Black & Veatch Corporation
2855 N. University Drive, Suite 210
Coral Springs, FL 33065 Certificate No. 8132

CITY OF KEY WEST
DENNIS STREET STORMWATER IMPROVEMENTS
PUMP STATION AND DRAINAGE WELL

TEST LOCATION PLAN

DESIGNED: KAC
DETAILED: VVV
CHECKED:
APPROVED:
DATE: SEPTEMBER 2017

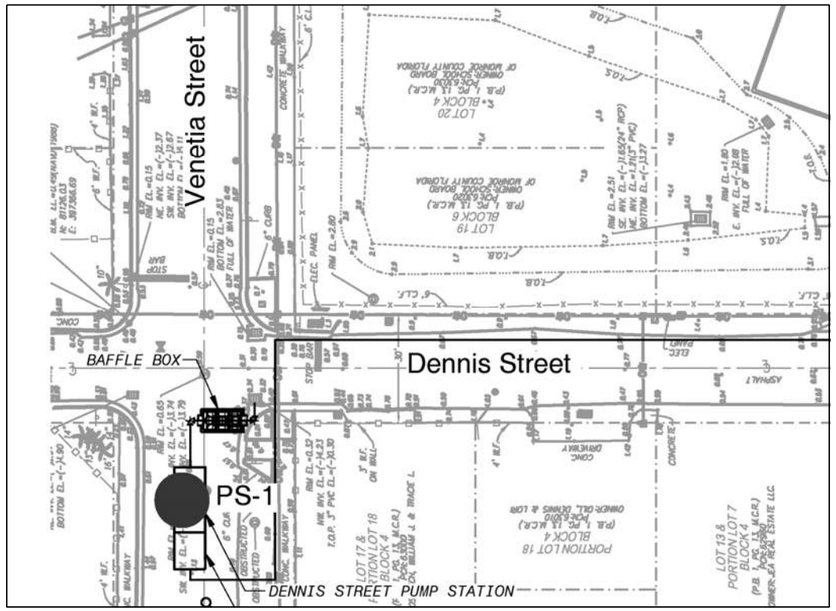
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

PROJECT NO.
193108

SHEET
3

C-101.dwg
VAN16643, 8/8/2017 3:18:23 PM
VAN16643, 8/8/2017 3:23:21 PM

FD193108
D9000



LEGEND

- ASPHALT PAVEMENT
- SILTY SAND (FILL; SM)
- SILTY SAND (SM)
- ▽ WATER TABLE AT TIME OF DRILLING
- ● SPT BORING LOCATION
- ‖ CASING USED
- N NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12" PENETRATION (UNLESS OTHERWISE NOTED).
- NMC NATURAL MOISTURE CONTENT (%)
- -200 FINES PASSING THE #200 SIEVE (%)
- → PERIODIC TOTAL LOSS OF DRILLING FLUID CIRCULATION

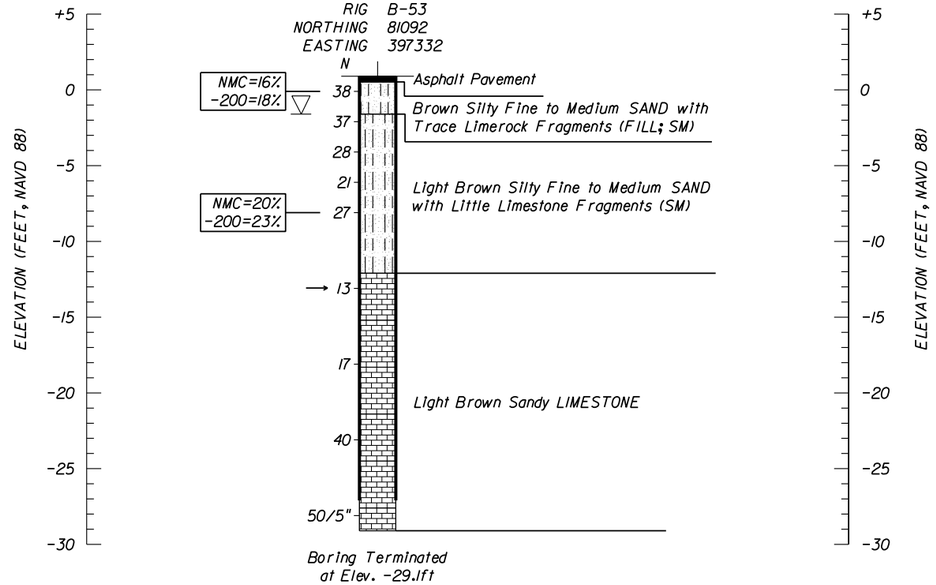
NOTES:

1) SPT BORINGS PERFORMED PER ASTM D-1586 WITH A HAMMER WEIGHT OF 140 LBS FALLING 30 INCHES.
2) REF: B/L SURVEY SR 915/NE 6 AVE

CONSTRUCTION NOTES:

1) THE STRATA ENCOUNTERED WITHIN THE PROJECT SITE CORRESPOND TO ROCK FORMATIONS THAT OFFER HIGH RESISTANCE TO DRIVING AND EXCAVATION. SPECIAL EQUIPMENT AND BREAKING TOOLS ARE TYPICALLY REQUIRED TO EXCAVATE OR PENETRATE THESE LAYERS. THESE LAYERS ARE ALSO DIFFICULT TO DEWATER DUE TO THEIR HIGH POROSITY AND PERMEABILITY. FOR SHEET PILE AND OTHER RETAINING WALL SYSTEM RELATED WORK, THESE LAYERS TYPICALLY REQUIRE PREFORMING HOLES TO MINIMUM TIP ELEVATION TO PREVENT REFUSAL CONDITIONS, STRUCTURAL DAMAGE, OR TO MINIMIZE VIBRATION-INDUCED DAMAGE TO NEARBY STRUCTURES. INCLUDE THE COST OF EXCAVATION, BACKFILLING, PREFORMING, AND DIFFICULTIES IN DEWATERING IN THE ASSOCIATED PAY ITEM.
2) THE CONTRACTOR IS ADVISED THAT CAVING SATURATED SANDY SOILS MAY BE ENCOUNTERED DURING THE EXCAVATION FOR INSTALLATION OF THE PROPOSED STRUCTURES.
3) THE CONTRACTOR IS ADVISED THAT PERIODIC TOTAL LOSS OF CIRCULATION WAS EXPERIENCED DURING THE PERFORMANCE OF THE BORINGS WHICH MAY MAKE IT DIFFICULT TO MAINTAIN THE FLUID LEVEL IN THE EXCAVATION.

BOR # PS-1
ELEV. +0.9
DATE 8/18/2017
DRILLER R.Morales - GEOSOL, Inc.
HAMMER Auto
RIG B-53
NORTHING 81092
EASTING 397332



GRANULAR MATERIALS- RELATIVE DENSITY	AUTOMATIC SPT HAMMER (BLOWS PER FOOT)
VERY LOOSE	LESS THAN 3
LOOSE	3-8
MEDIUM DENSE	8-24
DENSE	24-40
VERY DENSE	GREATER THAN 40
SILTS AND CLAYS CONSISTANCY	**AUTOMATIC SPT HAMMER (BLOWS PER FOOT)**
VERY SOFT	LESS THAN 1
SOFT	1-3
FIRM	3-6
STIFF	6-12
VERY STIFF	12-24
HARD	GREATER THAN 24

ENVIRONMENTAL CLASSIFICATION:

SUPERSTRUCTURE: EXTREMELY AGGRESSIVE
SUBSTRUCTURE: EXTREMELY AGGRESSIVE

WATER:

pH:	7.5
CHLORIDE:	19,900 PPM
SULFATE:	2,520 PPM
RESISTIVITY:	7 OHM-CM

0 2 10
Feet
VERTICAL SCALE
HORIZONTAL SCALE: N.T.S.

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

ENGINEER OF RECORD:
GEOSOL, INC.
ORACIO RICCOBONO, P.E.
P.E. LICENSE NO. 49324
5795-A NW 151ST STREET
MIAMI LAKES, FL 33014
PHONE: (305) 828-4367
CERTIFICATE OF AUTHORIZATION 8530

DRAWN BY: J.G. 08-17
CHECKED BY: A.I. 08-17
DESIGNED BY: O.R. 08-17
CHECKED BY: O.R. 08-17

CITY OF KEY WEST

SHEET TITLE: REPORT OF CORE BORINGS

REF. DWG. NO.

PROJECT NAME: CITY OF KEY WEST DENNIS STREET STORMWATER IMPROVEMENTS PUMP STATION AND DRAINAGE WELL - CITY OF KEY WEST, FLORIDA

SHEET NO. 4

APPENDIX "B"

Table 2 – Summary of Laboratory Test Results
Table 3 – Summary of Environmental Classification Test Results
Moisture Content Test Results
Percent Passing the No. 200 Sieve Test Results
Grain-Size Analysis Results and Curves
Environmental Classification Test Results

TABLE 2 - SUMMARY OF LABORATORY TEST RESULTS
CITY OF KEY WEST DENNIS STREET STORMWATER IMPROVEMENTS
MONROE COUNTY, FLORIDA
GEOSOL PROJECT No.: 217145

BORING NUMBER	SAMPLE NUMBER	USCS SYMBOL	Sample Depth (FEET)	Sieve Analysis (Percent Passing)									Organic Content (%)	Natural Moisture Content (%)
				1"	3/4"	3/8"	#4	#10	#40	#60	#100	#200		
PS-1	1	SM	0.4 - 2.0	100	100	97	92	82	66	52	36	18	-	16
PS-1	5	SM	8.0 - 10.0	100	100	97	87	75	53	34	25	23	-	20

TABLE 3 - SUMMARY OF ENVIRONMENTAL CLASSIFICATION TEST RESULTS
CITY OF KEY WEST DENNIS STREET STORMWATER IMPROVEMENTS
MONROE COUNTY, FLORIDA
GEOSOL PROJECT No.: 217145

SAMPLE LOCATION	SAMPLE TYPE	Depth (ft)	pH	Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)	FDOT ENVIRONMENTAL CLASSIFICATION	
							Steel	Concrete
PS-1	WATER	3.0	7.5	7	19900	2520	EA	EA

NOTES: (1) The following FDOT laboratory test methods were utilized.

FM5-550: pH FM5-552: Chlorides

FM5-551: Resistivity FM5-553: Sulfates

(2) SA: SLIGHTLY AGGRESSIVE

(3) MA: MODERATELY AGGRESSIVE

(4) EA: EXTREMELY AGGRESSIVE

FDOT Criteria for Substructure Environmental Classification

Classification	Environmental Condition	Units	Steel		Concrete	
			Water	Soil	Water	Soil
Extremely Aggressive (If any of these conditions exist)	pH		< 6.0		< 5.0	
	Cl	ppm	> 2000		> 2000	
	SO_4	ppm	N.A.		> 1500	> 2000
	Resistivity	Ohm-cm	< 1000		< 500	
Slightly Aggressive (If all of these conditions exist)	pH		> 7.0		> 6.0	
	Cl	ppm	N.A.		< 500	
	SO_4	ppm	N.A.		< 150	< 1000
	Resistivity	Ohm-cm	> 5000		> 3000	
Moderately Aggressive	This classification must be used at all sites not meeting requirements for either slightly aggressive or extremely aggressive environments.					
pH = acidity ($-\log_{10}H^+$; potential of Hydrogen), Cl = chloride content, SO_4 = Sulfate content.						

MOISTURE CONTENT TEST RESULTS (ASTM D-2216)

PROJECT NAME: CITY OF KEY WEST DENNIS STREET STORMWATER IMPROVEMENTS
LOCATION: MONROE COUNTY, FLORIDA
PROJECT No.: 217145

Boring No.	PS-1	PS-1
Sample No.	1	5
Sample Depth (Feet)	0.4-2	8-10
Tare No.	B	N-3
Tare plus wet soil (grams)	337.5	445.5
Tare plus dry soil (grams)	293.0	371.5
Water W_w (grams)	44.5	74.0
Tare (grams)	7.5	7.5
Dry soil W_s (grams)	285.5	364.0
Water Content w (%)	15.6	20.3

MATERIAL PASSING THE # 200 SIEVE TEST RESULTS (AASHTO T-11)

PROJECT NAME: CITY OF KEY WEST DENNIS STREET STORMWATER IMPROVEMENTS
LOCATION: MONROE COUNTY, FLORIDA
PROJECT No.: 217145

Boring No.	PS-1	PS-1
Sample No.	1	5
Sample Depth (Feet)	0.4-2	8-10
Original Dry Weight of Soil (grams)	285.5	364
Weight of Soil After Washing (grams)	235.0	279.0
Weight of Soil Passing 200 Sieve (grams)	50.5	85.0
Percent of Soil Passing 200 Sieve (%)	17.7	23.4

Note: The percent passing the No. 200 sieve results presented above were determined using the wash method.

GRAIN SIZE DATA SHEET

PROJECT NAME: CITY OF KEY WEST DENNIS STREET STORMWATER IMPROVEMENTS
GEOSOL PROJECT No. 217145
GENERAL LOCATION: MONROE COUNTY, FLORIDA

Boring No. PS-1
Sample No. 1
Depth (feet) 0.4-2

SOIL DESCRIPTION: Brown Silty Fine to Medium SAND with Trace Limerock Fragments (FILL; SM)

Tare #	Dry Wt. - Tare Wt.
B	285.5

Sieve Size	Sieve Sizes	Cumulative Wt. Retained	% RETAINED	% PASSING	% PASSING TOTAL SAMPLE	WEIGHT RETAINED (Grams)
75	75mm 3"	0.0	0.0	100	100	0.0
50	50mm 2"	0.0	0.0	100	100	0.0
37.5	37.5mm 1.5"	0.0	0.0	100.0	100.0	0.0
25	25mm 1"	0.0	0.0	100.0	100.0	0.0
19	19mm 3/4"	0.0	0.0	100.0	100.0	0.0
9.5	9.5mm 3/8"	10.0	3.5	96.5	96.5	10.0
4.75	4.75mm #4	23.0	8.1	91.9	91.9	13.0
2.36	2 mm #10	52.0	18.2	81.8	81.8	29.0
0.6	425um #40	96.0	33.6	66.4	66.4	44.0
0.3	250um #60	138.0	48.3	51.7	51.7	42.0
0.15	150um #100	184.0	64.4	35.6	35.6	46.0
0.075	75um #200	235.0	82.3	17.7	17.7	51.0
PAN	-	285.5	100.0	0.0	0.0	50.5

NOTES: The percent of soil passing the -200 sieve was determined by wash method

ASTM D 2487 Classification of Soil for Engineering Purposes

Coarse Gravel	< 3" and > 3/4"
Fine Gravel	< 3/4" and > #4

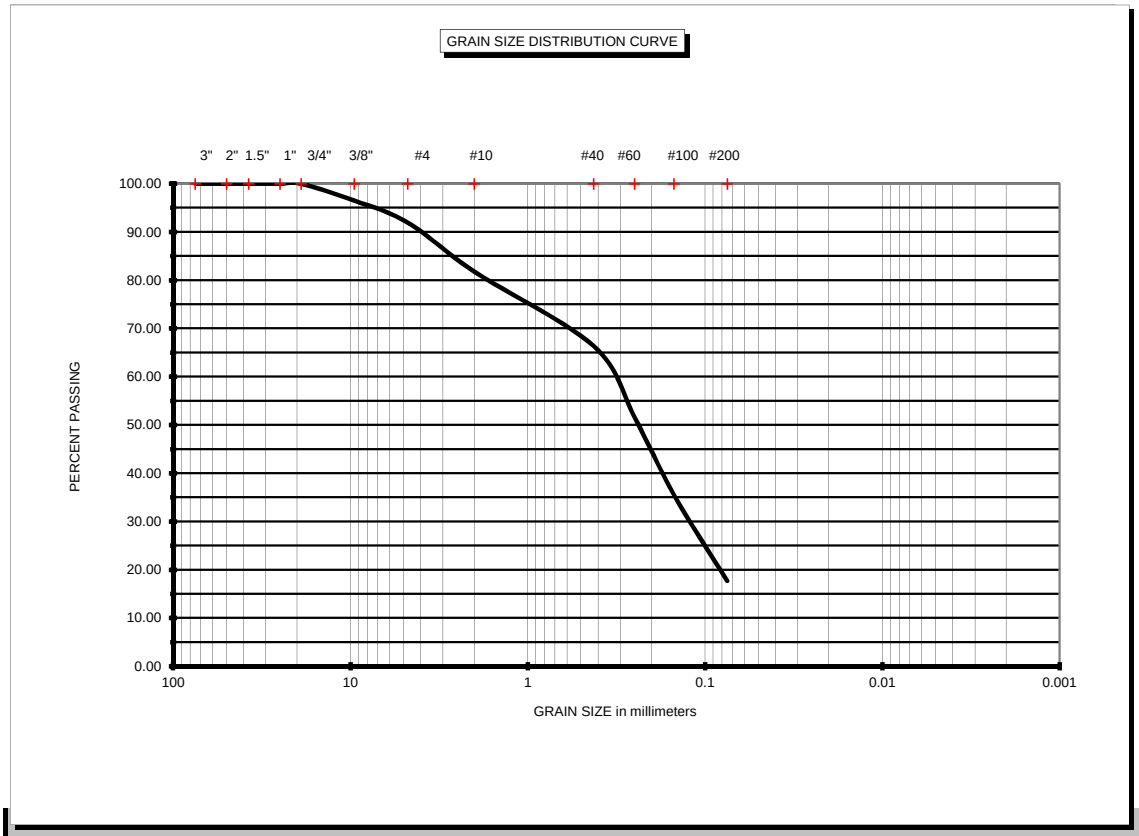
Coarse Sand	< #4 and > #10
Medium Sand	< #10 and > #40
Fine Sand	< #40 and > #200

Cu = D60 / D10
Cc = (D30)^2 / (D10 x D60)
1000 um = 1 mm

tested by: O. Riccobono computed by: O. Riccobono checked by: D.R.

GRAIN SIZE DATA SHEET

PROJECT NAME: CITY OF KEY WEST DENNIS STREET STORMWATER IMPROVEMENTS
GEOSOL PROJECT No. 217145
GENERAL LOCATION: MONROE COUNTY, FLORIDA



ASTM D 2487 Classification of Soil for Engineering Purposes			Coarse Sand	< #4 and > #10	Cu = D60 / D10
Coarse Gravel	< 3" and > 3/4"		Medium Sand	< #10 and > #40	Cc = (D30)^2 / (D10 x D60)
Fine Gravel	< 3/4" and > #4		Fine Sand	< #40 and > #200	

BORING # PS-1 **SAMPLE #** 1 **Depth (feet)** 0.4-2

SOIL DESCRIPTION: Brown Silty Fine to Medium SAND with Trace Limerock Fragments (FILL; SM)

Natural Moisture Content: 15.6%

GRAIN SIZE DATA SHEET

PROJECT NAME: CITY OF KEY WEST DENNIS STREET STORMWATER IMPROVEMENTS
GEOSOL PROJECT No. 217145
GENERAL LOCATION: MONROE COUNTY, FLORIDA

Boring No. PS-1
Sample No. 5
Depth (feet) 8-10

SOIL DESCRIPTION: Light Gray Silty Fine to Medium SAND with Little Limestone Fragments (SM)

Tare #	Dry Wt. - Tare Wt.
B	364.0

Sieve Size	Sieve Sizes	Cumulative Wt. Retained	% RETAINED	% PASSING	% PASSING TOTAL SAMPLE	WEIGHT RETAINED (Grams)
75	75mm 3"	0.0	0.0	100	100	0.0
50	50mm 2"	0.0	0.0	100	100	0.0
37.5	37.5mm 1.5"	0.0	0.0	100.0	100.0	0.0
25	25mm 1"	0.0	0.0	100.0	100.0	0.0
19	19mm 3/4"	0.0	0.0	100.0	100.0	0.0
9.5	9.5mm 3/8"	12.5	3.4	96.6	96.6	12.5
4.75	4.75mm #4	48.5	13.3	86.7	86.7	36.0
2.36	2 mm #10	93.0	25.5	74.5	74.5	44.5
0.6	425um #40	169.5	46.6	53.4	53.4	76.5
0.3	250um #60	242.0	66.5	33.5	33.5	72.5
0.15	150um #100	272.5	74.9	25.1	25.1	30.5
0.075	75um #200	279.0	76.6	23.4	23.4	6.5
PAN	-	364.0	100.0	0.0	0.0	85.0

NOTES: The percent of soil passing the -200 sieve was determined by wash method

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Coarse Sand	< #4 and > #10
Medium Sand	< #10 and > #40
Fine Sand	< #40 and > #200

Cu = D60 / D10
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tested by: O. Riccobono computed by: O. Riccobono checked by: D.R.

GRAIN SIZE DATA SHEET

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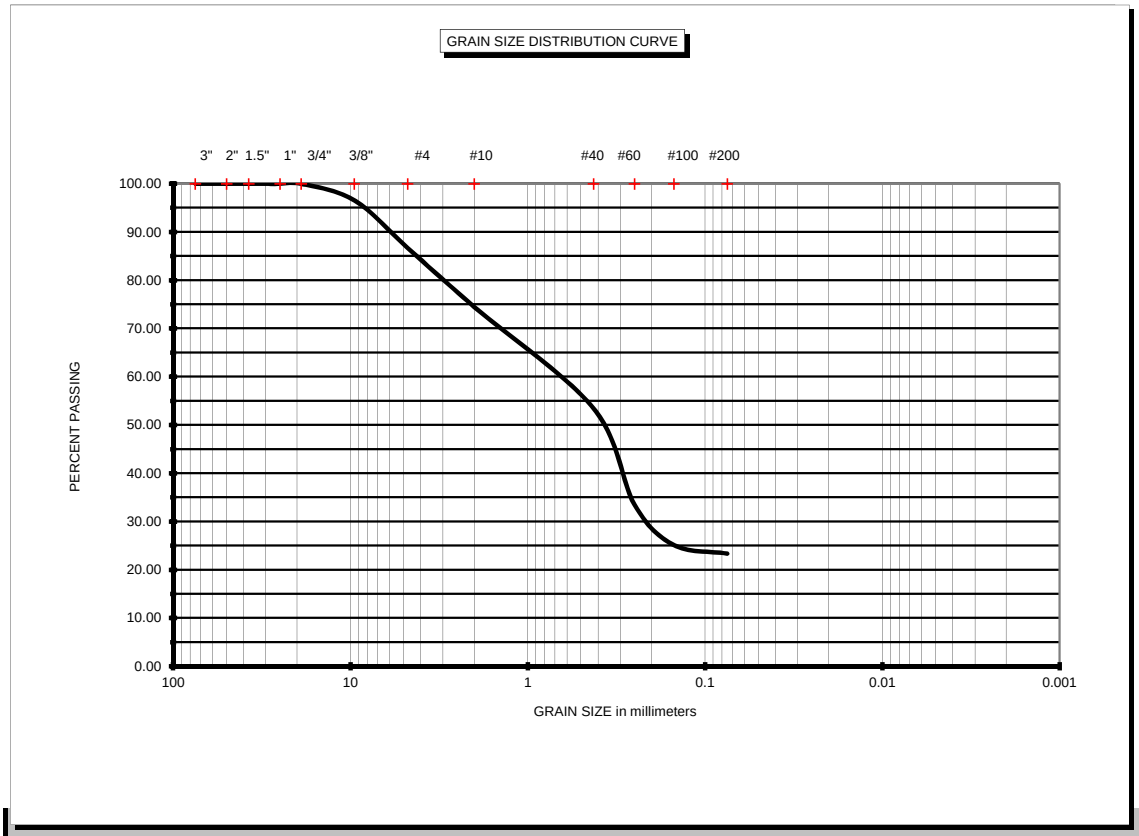

ASTM D 2487 Classification of Soil for Engineering Purposes			Coarse Sand	< #4 and > #10	Cu = D60 / D10
Coarse Gravel	< 3" and > 3/4"		Medium Sand	< #10 and > #40	Cc = (D30)^2 / (D10 x D60)
Fine Gravel	< 3/4" and > #4		Fine Sand	< #40 and > #200	

BORING # PS-1 **SAMPLE #** 5 **Depth (feet)** 8-10

SOIL DESCRIPTION: Light Gray Silty Fine to Medium SAND with Little Limestone Fragments (SM)

Natural Moisture Content: 20.3%

Pace Analytical Services, LLC
3610 Park Central Blvd N
Pompano Beach, FL 33064
954-582-4300

ANALYTICAL RESULTS

Project: City of Key West Storm Basin
Pace Project No.: 35331546

Sample: PS-1 **Lab ID: 35331546001** Collected: 08/18/17 17:00 Received: 08/21/17 17:40 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
4500H+ pH, Electrometric	Analytical Method: SM 4500-H+B								
Temperature, Water (C)	**25.1**	deg C	0.010	0.010	1		08/30/17 16:05		
pH at 25 Degrees C	**7.5**	Std. Units	0.10	0.10	1		08/30/17 16:05		Q
Resistivity	Analytical Method: EPA 120.1 Resistivity								
Resistivity	**7.2**	ohms-cm			1		08/30/17 15:40		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**19900**	mg/L	1000	500	200		08/23/17 23:04	16887-00-6	
Sulfate	**2520**	mg/L	1000	500	200		08/23/17 23:04	14808-79-8	

REPORT OF LABORATORY ANALYSIS