

Contract Documents

Lee County Utilities

Fiddlesticks Water Main Replacement: Phase 2 Technical Specifications

CONTRACT NO: 2170958

AUGUST 2019

ISSUED FOR BID DECEMBER 2, 2019

UPDATED PER LEE COUNTY PROCUREMENT JANUARY 6, 2020

THESE CONTRACT DOCUMENTS ARE FOR USE WITH THE CONSTRUCTION PLANS
PREPARED BY WESTON & SAMPSON ENGINEERS, INC. ENTITLED

“FIDDLESTICKS POTABLE WATER MAIN REPLACEMENT”, AUGUST 2019

The sheet containing the digital signature, date and seal of the Engineer-of-Record is on page 3 of the table of contents.

The name of the duly authorized engineering business printed name, address and certificate of authorization number of the engineering business is also included on said sheet.

 Weston & SampsonSM

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Certificate of Authorization No. 26190

LEE COUNTY UTILITIES

FIDDLESTICKS WATER MAIN REPLACEMENT: Phase 2

TECHNICAL SPECIFICATIONS

REFERENCE DOCUMENTS

Contractor shall complete all work in conformance with the Lee County Utilities Design Manual, latest revision, and as provided herein these technical specifications. The latest version of the Design Manual is available at the Lee County website: <https://www.leegov.com/utilities/design-manual>

Contractor shall complete all applicable work in conformance with the latest version of the FDOT indices: <http://www.fdot.gov/design/standardplans/current/default.shtm>

All utility related materials shall comply with Lee County Utility's Approved Materials List: <http://www.leegov.com/utilities/design-manual/approved-materials>

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WESTON & SAMPSON
SUPPLEMENTAL TECHNICAL SPECIFICATIONS**

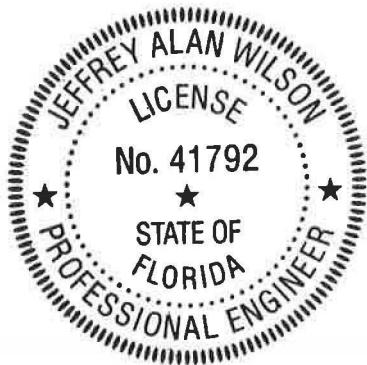
*Denotes specification section prepared by Weston & Sampson to supplement Lee County Utilities Technical Specifications.

<u>DIVISION 1 - GENERAL REQUIREMENTS</u>	<u>SECTION</u>
*Summary of Work (Supplemental)	STS- 01010
*Measurement and Payment (Supplemental)	STS- 01026
*Construction Facilities and Temporary Controls (Supplemental)	STS- 01500

<u>DIVISION 2 - SITE AND UTILITY WORK</u>	<u>SECTION</u>
*Excavation – Earth and Rock (Supplemental)	STS- 02222
*Jacking, Augering, and Mining (Supplemental)	STS- 02226
*High Density Polyethylene (HDPE) Pipe and Fittings (Supplemental)	STS- 02620
*Polyvinyl Chloride (PVC) Water Main Pipe (Supplemental)	STS- 02623
*Ductile Iron Pipe and Fittings (Supplemental)	STS- 02630
*Hydrants (Supplemental)	STS- 02645

<u>DIVISION 15 – MECHANICAL</u>	<u>SECTION</u>
* Water Valves and Appurtenances (Supplemental)	STS- 15100

Supplemental Technical Specifications prepared under the direction of the undersigned.



This item has been digitally signed and sealed by Jeffrey A. Wilson, P.E. on the date adjacent to the seal.

Printed copies of this document are not considered signed and sealed. The signature must be verified on any electronic copies.

Weston & Sampson Engineers, Inc.
1520 Royal Palm Square Boulevard, Suite 260
Fort Myers, FL 33919
Certificate of Authorization No. 26190
Jeffrey A. Wilson, P.E. No. 41792

This document also includes Standard Technical Specifications that have been developed by the Lee County Utilities Department. These standard technical specifications have been reviewed by the undersigned Engineer-of-Record and have been deemed acceptable for use on this project

The above listed Professional Engineer does not take responsibility for the Subsurface Soil Exploration Report(s) provided as Attachment A by Gary Drew PE of Ardaman & Associates.

**LEE COUNTY UTILITIES
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SECTION STS - 01010

SUMMARY OF WORK

The OWNER'S technical specifications for Summary of Work are supplemented, modified, and/or amended as follows:

1.1 DESCRIPTION OF WORK

- A. General: The work on this contract consist of the installation of approximately 44,200 linear feet of HDPE and PVC water main inside of the Fiddlesticks Country Club community located in Fort Myers, Florida.
- B. The Work includes:
 - 1. Furnishing of all labor, material, superintendence, plant, power, light, heat, fuel, water, tools, appliances, equipment, supplies, services and other means of construction necessary or proper for performing and completing the Work.
 - 2. Furnishing and installing of all pipes, fittings restrained joint pipe and fittings, valves, tapping saddles, plugs, caps, adapters, clamps, harnessing, polyethylene wrap, mylar detectable tape, initial and final pipe bedding, backfill, connections to existing mains, abandonment of existing mains, surface restoration, testing removal and replacement of existing services, reconnection of existing services, traffic control signage, trenchless crossing using horizontal directional drilling, and placement of the proposed water main in service as shown on the plans and specified in the Contract Documents.
 - 3. Providing all compaction, dewatering, sheeting and shoring, turbidity control and monitoring, disposal of all excess material encountered including rock, backfill, and other substrate material not necessarily designated in the Contract Documents necessary for complete installation of the work.
 - 4. Sole responsibility for adequacy of plant and equipment.
 - 5. Maintaining the Work area and site in a clean and acceptable manner.
 - 6. Maintaining existing facilities in service at all times except where specifically provided for otherwise herein.
 - 7. Protection of finished and unfinished Work.
 - 8. Repair and restoration of Work damaged during construction.
 - 9. Furnishing as necessary proper equipment and machinery, of a sufficient capacity, to facilitate the Work and to handle all emergencies normally encountered in Work of this character.

10. Cooperating with the OWNER to pressure test, bacteriological test, clear the new water main for use, and place it into service prior to removing or grouting the existing main.
11. Preparing a Maintenance of Traffic Plan subject to review and approval by Lee County DOT and completing all work in compliance with all applicable permit requirements and restrictions.
12. Keeping and maintaining a record copy of the drawings as the work progresses and preparing and furnishing detailed Record Survey drawings and other closeout documents upon the completion of the Work.

C. Implied and Normally Required Work: It is the intent of these Specifications to provide the OWNER with complete operable systems, subsystems and other items of Work. Any part or item of Work which is reasonably implied or normally required to make each installation satisfactorily and completely operable is deemed to be included in the Work and the Contract Amount. All miscellaneous appurtenances and other items of Work incidental to meeting the intent of these Specifications are included in the Work and the Contract Amount even though these appurtenances may not be specifically called for in these Specifications.

D. Quality of Work: Regard the apparent silence of the Contract Documents as to any detail, or the apparent omission from them of a detailed description concerning any Work to be done and materials to be furnished as meaning that only the best general practice is to prevail and that only materials and workmanship of the best quality are to be used. Interpretation of these specifications will be made upon this basis.

1.2 CONSTRAINTS

A. The Contract Documents are intended to allow the CONTRACTOR flexibility in construction of the Work, however, the following constraints apply:

1. All work to be done under this Contract shall be done with minimum inconvenience to the OWNER, and Lee County Utilities' customers being served by the existing water main. The CONTRACTOR shall coordinate his work with the OWNER such that facilities operation is maintained to the maximum extent possible.
2. The CONTRACTOR shall notify the OWNER at least 72 hours prior to any shutdown of existing facilities.
3. All Work shall be done in accordance with permits issued by the following agencies: Lee County Health Department and Lee County Government.
4. Prior Notice of at least 72 hours will be given to residents before open cutting driveways, lawn or private property. Access will be restored to all properties by end of the work day.
5. Water service disruption to LCU customers must be minimized, and shall not occur over weekends. CONTRACTOR must schedule Bacteriological sampling for a Monday and Tuesday, unless otherwise approved in advance by LCU. CONTRACTOR may be fined at the Liquidated Damages daily rate when Boil Water Notice periods extend beyond 72 hours.

Site will be cleared and restored as work progresses; at no time will United States Postal Service be interrupted to the individual properties.

6. The Contractor shall coordinate with utility companies for the relocation of existing utilities in conflict with the work.

1.3 WORK BY OTHERS

- A. Work on the Project, which may take place concurrently with this CONTRACT and which is excluded from this CONTRACT, is as follows:

1. Repositioning or relocation of existing utilities in conflict with the new water main.

1.4 CONTRACTOR'S USE OF SITE

- A. In addition to the requirements of the General Conditions, limit use of site and premises for work and storage to allow for the following:

1. OWNER occupancy and access to operate existing facilities.
 2. Coordination of site use with ENGINEER.
 3. Responsibility for protection and safekeeping of products under this CONTRACT.
 4. Providing additional off-site storage at no additional cost to OWNER as needed.

1.5 WORK SEQUENCE

- A. Construct Work in stages to accommodate OWNER's use of premises during construction period and in accordance with the limitations on the sequence of construction specified. Coordinate construction schedules and operations with ENGINEER.
- B. Coordinate Work of all subcontractors.

1.6 OWNER OCCUPANCY

- A. OWNER will occupy premises during entire period of construction in order to maintain normal operations. Cooperate with OWNER's representative in all construction operations to minimize conflict, and to facilitate OWNER usage.
- B. Conduct operations so as to inconvenience the general public in the least.

PART 3 EXECUTION

- C. Starting Work: Start Work within 10 days following the date stated in the Notice to Proceed and execute with such progress as may be required to prevent delay to other contractors or to the general completion of the project. Execute Work at such items and in or on such parts of the project, and with such forces, material and equipment, as to complete the Work in the time

established by the Contract. At all times, schedule and direct the Work so that it provides an orderly progression to completion within the specified time for completion.

END OF SECTION STS - 01010

SECTION STS - 01026

MEASUREMENT AND PAYMENT

The OWNER'S technical specifications for Measurement and Payment are supplemented, modified, and/or amended as follows:

1.1 EXPLANATION AND DEFINITIONS

- A. The following explanation of the Measurement and Payment for the bid form items is made for information and guidance. The omission of reference to any item in this description shall not, however, alter the intent of the bid form or relieve the CONTRACTOR of the necessity of furnishing such as a part of the Contract.

1.2 MEASUREMENT

- A. The quantities set forth in the bid form are approximate and are given to establish a uniform basis for the comparison of bids. The OWNER reserves the right to increase or decrease the quantity of any class or portion of the work during the progress of construction in accord with the terms of the Contract.

1.3 PAYMENT

- A. Payment shall be made for the items listed on the Bid Form on the basis of the work actually performed and completed, such work including but not limited to, the furnishing of all necessary labor, materials, equipment, transportation, clean up, restoration of disturbed areas, and all other appurtenances to complete the construction and installation of the work as shown on the drawings and described in the specifications.
- B. Unit prices are used as a means of computing the final figures for bid and Contract purposes, for periodic payments for work performed, for determining value of additions or deletions and wherever else reasonable.

1.4 SCHEDULE OF VALUES

- A. Approval of Schedule: Submit for approval a preliminary schedule of values, in duplicate, for all of the Work. Prepare preliminary schedule in accordance with the General Conditions. Submit preliminary schedule of values within 10 calendar days after the Effective Date of the Agreement. Submit final schedule of values in accordance with the General Conditions.
- B. Format: Utilize a format similar to the Table of Contents of the Project Specifications. Identify each line item with number and title of the major specification. Identify site mobilization, bonds and insurance. Include within each line item, a direct proportional amount of CONTRACTOR's overhead profit.
- C. Revisions: With each Application for Payment, revise schedule to list approved Change Orders.

1.5 APPLICATION FOR PAYMENT

- A. Required Copies: Submit three copies of each application on the "Estimate and Requisition for Payment" form CMO:013. Present required information in typewritten form or on electronic media printout.
- B. Execute certification by signature of authorized officer.
- C. Use data from approved Schedule of Values.
- D. Stored Materials: When payment for materials stored is permitted, submit a separate schedule for Materials Stored showing line item, description, previous value received, value incorporated into the Work and present value.
- E. Change Orders: List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for an original item of work.
- F. Final Payment: Prepare Application for Final Payment as required in the General Conditions.
- G. Submit an updated construction schedule for each Application for Payment.
- H. Submit application for payment to ENGINEER on, or before, the 25th of each month.

EXECUTION

1.6 MEASUREMENT AND PAYMENT

- A. Payment shall be made on the basis of work actually performed completing each item in the Bid, such work including, but not limited to, the furnishing of all necessary labor, materials, equipment, transportation, dewatering, protection of existing utilities, restorations, bacteriological clearing and testing, cleanup, and all other appurtenances to complete the construction and installation of the work to the configuration and extent as shown on the drawings and described in the specifications. Payment for each item includes compensation for cleanup and restorations. Cleanup and surface restorations (including pavement replacement) will be considered as ten percent (10%) of each pay item and complete payment will not be made until cleanup, restorations, and as-builts are completed.
- B. Retainage will be withheld from the final payment until written acceptance by the Owner's Representative for all final clean up, restoration and Record Drawings/As-Builts.

ITEM 1-1A Mobilization/Demobilization

General Description: Perform preparatory work and operations in mobilizing for beginning work on project.

What Pay Item Includes: Under Contract Item 1a for Mobilization/Demobilization, furnish all labor, materials, equipment and services to perform those operations necessary for the movement of personnel, equipment, supplies and incidentals to and from the project site and for establishment of temporary offices, buildings, safety equipment,

sanitary facilities and first aid supplies as required by the specifications and state and local law and regulations. The cost of assistance to the ENGINEER shall also be included under this Contract Item. The costs of any other pre-construction or post-construction expense necessary to the start or completion of the work, excluding the cost of construction materials, shall also be included under this Contract Item. The cost of all other work as shown and specified that is not specifically included under other Contract Items shall also be included under this Contract Item. This item includes the cost of Performance and Payment Bond Premiums and Insurance and preparation of Record Survey Drawings.

Payment Determination: Payment for the Mobilization/Demobilization shall be made at the Contract Lump Sum Prices according to the following schedule:

Percent of Original Contract Amount Earned*	Allowable Percent of The Lump Sum price of Mobilization
3	First 50
10	First 90**

*Work installed and not including Mobilization/Demobilization or stored materials.

**Up to five percent of the original contract amount for the Project. Any remaining Mobilization amount will be paid upon completion of all work on the Project, including record survey and final punch list work items.

ITEM 1-1B Maintenance of Traffic

General Description: Maintain traffic within the limits of the project for the duration of the construction period, including any temporary suspensions of the work.

What Pay Item Includes: Contract Item 1b for Maintenance of Traffic shall conform to the sections headed "Project Coordination" and "Traffic Regulation."

Payment Determination: Payment for Maintenance of Traffic will be made at the contract lump sum price. Payment for Mobilization/Demobilization and Maintenance of Traffic will be subject to retainage as described in these Contract Documents.

ITEM 1-1C Pre-Construction Video

General Description: Prior to any construction, equipment, or material mobilization, CONTRACTOR shall perform this audio-video survey along the length of the project in any areas that have the potential to be disturbed by the CONTRACTOR'S operations such as any areas to be entered by vehicles or equipment, any paved or unpaved areas that will be used by vehicles or equipment, and any other areas that will be affected by work such as work staging areas, field offices, or any areas deemed necessary by the OWNER.

What Pay Item Includes: The surface features recorded shall include, but are not limited to, roadways, driveways, sidewalks, curbs, culverts, headwalls, retaining walls, buildings, above-ground utilities, parks, lawns, landscaping, tree canopies, shrubbery and fences. The area recorded should extend to a minimum of 15 feet outside the actual right-of-way and extend 50 feet from the proposed work site as well as covering all working areas as described above.

The video portion of the recording shall produce bright, sharp, and clear pictures with accurate colors and shall be free from any form of picture imperfection. The audio portion of the recording shall reproduce precise and concise explanatory notes by the camera operator with proper volume, clarity, and freedom from distortions of any kind. To preclude any possibility of tampering or editing, the DVD shall display continuous digital information including the date and time of recording, date information containing the month, day and year; time information containing hours, minutes and seconds separated by colons. It should also have the engineering stationing corresponding to the stationing on the contract documents, or as directed by the OWNER.

All video recording shall take place during regular business hours unless otherwise approved by the OWNER and no video recording shall take place if the weather is not acceptable, such as rain or in the case of elongated shadows that distort perception and prevent clear resolution.

Payment Determination: Payment for Pre-Construction video done by the Contractor will be done at the Contract lump sum price which includes the original and one (1) copy of a continuous color and audio-video DVD recording of the project site.

ITEM1-1D Preparation of As-Built Drawings

General Description: Preparation of digital and paper copy of as-built drawings to be submitted to OWNER.

What Pay Item Includes: This item shall include, but is not limited to, all labor, equipment, certifications and materials necessary to provide the OWNER with five (5) paper sets of prints and one (1) electronic file of as-built information of the project. Current acceptable software platform is AutoCAD 2000 or later. AutoCAD drawings will only be acceptable if drawn to the NAD 1983 State Plane Florida East (feet) coordinate system and with the United States Survey Feet (USFEET) units, as established by a registered Florida surveyor and mapper. The following items shall be accurately depicted on the Record Drawings:

- State plane coordinate values to the nearest hundredth for all fire hydrants, fittings (water and wastewater), manholes, meters, and valves. (ie E: 698055.12 N: 839365.27)
- Pipeline runs in excess of 500 feet without fittings shall include vertical alignments and coordinates at 500-foot intervals.
- Each main will be marked with its size and type of material.
- Each fitting will be marked with its size.
- Each fitting will be marked with its material if the material is different than the main's material.
- Valves will be marked with their size and type.

- Each service / lateral will be marked with its size.
- Each water service line will be marked with its material unless the material is specified in a note or detail.

Payment Determination: Payment for signed and sealed As-built drawings shall be made at the Contract lump sum price for preparation of digital and paper copies of as-built drawings to be submitted to OWNER.

ITEM 2-1 Water Main Open-Cut Installation

General Description: The water main pipe and method of installation shall conform to the requirements of the Specification sections headed “High Density Polyethylene Pipe and Fittings”, “Polyvinyl Chloride (PVC) Water Main Pipe”, “Ductile Iron Pipe and Fittings” and “Laying and Jointing Buried Pipelines”.

What Pay Item Includes: This item includes all necessary fittings, labor, equipment and materials for the furnishing and laying of the pipe, construction stakeout, coordination with Lee County Utilities, installing and maintaining silt fence, erosion control, clearing and grubbing, signs, fittings, joint restraint, maintenance of traffic, dewatering, compaction, pipe bedding, backfilling, sheeting, mylar detectable tape, tracer wire, polyethylene sleeve, clamps, harnessing, plugs and caps, adapters, excavation of all material encountered including rock, bedding, backfill, site grading, seeding and mulching, replacement of grass, sod, pavement, driveways, sidewalks, mailboxes, culverts, storm sewers, and other surface materials not specifically designated in the Bid, clean-up, line flushing, pressure testing, disinfection, sample points, bacteriological testing, connections to existing mains, and all other work incidental to the construction of the water main by open cut. Measurement of the pipe shall be to the nearest foot along the centerline including the lengths of valves and fittings. Linear footage measurement shall be horizontal.

The work also includes complying with all permits. Include in the bid price for the work all costs for complying with all permits.

Payment Determination: Payment for furnishing and installing pipe and fittings by open cut will be made at the appropriate Contract unit price per linear foot for the pipe in place, exclusive of carrier pipe in steel casings.

ITEM 2-2 HDPE Water Main by Directional Drilling

General Description: The water main pipe and method of installation shall conform to the requirements of the Specification sections headed “High Density Polyethylene Pipe and Fittings” and “Horizontal Directional Drilling”.

What Pay Item Includes: The work includes erosion control measures; excavation of all material encountered including rock, backfill, replacement of grass, sod, clearing and grubbing, sidewalks mailboxes, culverts, storm sewers, and other surface materials not

specifically designated in the Bid; shoring; bracing; dewatering; access shafts; installation; pipe; pipe work; off-loading and protection of pipe; bentonite material and drilling fluids; tracking/locating wire; protection, repair and replacement of utilities and house services; nonpermanent pavement replacement; protection, trimming and replacement of trees and shrubs; protection, repair and replacement of culverts and other storm sewerage facilities; reconstruction or regarding of road shoulders and ditches; settlement monitoring; protection of existing structures and pavement; butt-fused adapters and connections to water main; disposal of surplus excavated material; and all other work incidental to the construction of the water main by horizontal directional drilling construction complete in place. Work shall include other surface materials not specifically designated in the Bid, clean-up, line flushing, pressure testing, disinfection sample points, bacteriological testing, connections to existing mains, and all other work incidental to the construction of the water main to be open cut. Measurement of the pipe shall be to the nearest foot along the centerline including the lengths of valves and fittings. Linear footage measurement shall be horizontal.

The work also includes complying with all permits. Include in the bid price of the work all costs for complying with all permits.

Payment Determination: Payment for furnishing and installing water main will be made at the Contract unit price per lineal foot for the pipe in place. This item includes all necessary fittings, labor, warning signs, equipment and materials for the furnishing and installation for the pipe by horizontal directional drilling.

ITEM 2-3 Gate Valves

General Description: Furnish and install all gate valves and appurtenances required as shown on plans.

What Pay Item Includes: This item includes the valve, box and all necessary labor, materials and equipment for installation, including valve stem, valve box extensions, joints, and concrete pads. This item also includes the installation of base material below the valve in accordance with the detail shown in the Plans.

Payment Determination: Payment for furnishing and installing buried gate valves will be made at the appropriate Contract unit price per valve acceptably installed, exclusive of valves installed as part of fire hydrant assemblies.

ITEM 2-4 Tie-Ins to Existing Water Mains

General Description: Furnish and install all pipe and fittings required to connect to existing mains.

What Pay Item Includes: This item includes all necessary labor, equipment and materials for installing the connection, piping, fittings, joint restraints, adaptor sleeves, plugs, caps, disconnecting existing water main, excavations, dewatering, disposal of existing

pipe, compaction and backfilling, restoration, assistance notifying customers of temporary shutdown, sterilization, testing, clean up and all other work necessary for a complete installation.

Bid Item	Connection to Existing System				
	Existing Main Size	Area	Street	Plan Sheet	Approx. Station
2-4A	8-inch	A	Canongate Dr	C-A1	535+00
		A	Glenlyon Ct	C-A12	602+50
		B	Fiddlesticks Blvd	C-B5	163+00
		C	Fiddlesticks Blvd	C-C1	362+00
		C	Greenock Lane	C-C14	301+00
2-4B	12-inch	B	Glenfinnan Cir	C-B8	11009+50
2-4C	30-inch	D	Fiddlesticks Blvd	C-D15	285+00

Payment Determination: Payment for furnishing and connecting to existing water mains will be made at the contract unit price per point of connection acceptably installed.

ITEM 2-5 Fire Hydrant Assemblies

General Description: The fire hydrant assembly consists of the tee or tapping sleeve in the water main through the fire hydrant, inclusive.

What Pay Item Includes: This item includes all labor, equipment, and materials for furnishing and installing fire hydrants with all necessary pipe, fittings, connections, joint restraints, thrust blocks, slabs, valves, valve boxes, concrete pad, excavation, pipe bedding, dewatering, compaction, removal and replacement of grass, sod, shrubs, pavement, driveways, culverts and storm sewers, mailboxes, sidewalks and other surface materials not specifically designated in the Bid, cleanup, testing and all other work for a complete installation. All piping shall be 6" ductile iron pipe from the tee to the hydrant. The Contractor shall be responsible to set the hydrant to grade in accordance with the detail shown on the plans.

Payment Determination: Payment for furnishing and installing fire hydrant assemblies will be made at the Contract unit price for each fire hydrant assembly acceptably installed.

ITEM 2-6 Fire Line Connection

General Description: The fire line connection consists of all items beginning with the saddle on the main up to the first elbow fitting connecting to the backflow preventer.

What Pay Item Includes: This item includes all labor, equipment, and materials for furnishing and installing fire line connection with all necessary pipe, fittings, connections, joint restraints, thrust blocks, slabs, valves, valve boxes, concrete pad, excavation, pipe bedding, dewatering, compaction, removal and replacement of grass, sod, shrubs,

pavement, driveways, culverts and storm sewers, mailboxes, sidewalks and other surface materials not specifically designated in the Bid, cleanup, testing and all other work for a complete installation in accordance with the detail shown on the plans.

Payment Determination: Payment for furnishing and installing fire line connections will be made at the appropriate Contract unit price per each service installed.

ITEM 2-7 New 1" Water Services

General Description: Services consist of all items beginning with the service saddle on the main through the meter box, inclusive. The meter will be furnished by the OWNER and installed by the CONTRACTOR.

What Pay Item Includes: This item includes all labor, equipment, and materials for furnishing and installing water services with all necessary pipe, fittings, connections, service saddles, corporation stops, couplings, curb stops, meter boxes, excavation, pipe bedding, dewatering, compaction, removal and replacement of grass, sod, shrubs, pavement, driveways, culverts and storm sewers, mailboxes, sidewalks and other surface materials not specifically designated in the Bid, cleanup, testing and all other work for a complete installation in accordance with the detail shown on the plans.

Payment Determination: Payment for furnishing and installing new 1" water services will be made at the appropriate Contract unit price per each service installed.

ITEM 2-8 New 2" Water Services

General Description: Services consist of all items beginning with the service saddle on the main through the meter box, inclusive. The meter will be furnished by the OWNER and installed by the CONTRACTOR.

What Pay Item Includes: This item includes all labor, equipment, and materials for furnishing and installing water services with all necessary pipe, fittings, connections, service saddles, corporation stops, couplings, curb stops, meter boxes, excavation, pipe bedding, dewatering, compaction, removal and replacement of grass, sod, shrubs, pavement, driveways, culverts and storm sewers, mailboxes, sidewalks and other surface materials not specifically designated in the Bid, cleanup, testing and all other work for a complete installation in accordance with the detail shown on the plans.

Payment Determination: Payment for furnishing and installing new 2" water services will be made at the appropriate Contract unit price per each service installed.

ITEM 2-9 New Meter Bank Assembly

General Description: Meter bank assemblies consist of all items beginning with the service saddle on the main through the meter boxes, inclusive. The meters will be furnished by the OWNER and installed by the CONTRACTOR.

What Pay Item Includes: This item includes all labor, equipment, and materials for furnishing and installing meter bank assemblies with all necessary pipe, fittings, connections, service saddles, corporation stops, couplings, curb stops, meter boxes, excavation, pipe bedding, dewatering, compaction, removal and replacement of grass, sod, shrubs, pavement, driveways, culverts and storm sewers, mailboxes, sidewalks and other surface materials not specifically designated in the Bid, cleanup, testing and all other work for a complete installation in accordance with the detail shown on the plans.

Payment Determination: Payment for furnishing and installing new meter bank assemblies will be made at the appropriate Contract unit price per each meter bank assembly acceptably installed.

ITEM 2-10 Existing Water Main & Appurtenance Abandonment/Grouting

What Pay Item Includes: These items include all labor, equipment, and materials for abandoning and grouting designated water mains, including all equipment setup and removal, pipe caps, grout, valve/valve stem removal, valve box removal/filling, hydrant removal, excavation, backfilling, compaction, removal and replacement of grass, sod, shrubs, pavement, driveways, culverts and storm sewers, mailboxes, sidewalks cleanup, and all other work necessary, but not specifically designated in the Bid.

Payment Determination: Payment for abandoning and grouting water mains in place will be made at the Contract unit price per lineal foot of pipe grout-filled.

Payment for removing and disposing of existing valves will be made at the Contract unit price per each valve acceptably removed and disposed of.

Payment for removing and disposing of existing fire hydrant assemblies will be made at the Contract unit price per each fire hydrant acceptably removed and disposed of.

ITEM 2-11 Leak Detection Assembly

What Pay Item Includes: The leak detection assembly consist of all required items. This item includes all labor, equipment, and materials for furnishing and installing water services with all necessary pipe, fittings, connections, service saddles, corporation stops, couplings, curb stops, meter boxes, excavation, pipe bedding, dewatering, compaction, removal and replacement of grass, sod, shrubs, pavement, driveways, culverts and storm sewers, mailboxes, sidewalks and other surface materials not specifically designated in the Bid, cleanup, testing and all other work for a complete installation in accordance with the detail shown on the plans.

Payment Determination: Payment for furnishing and installing a new leak detection assembly will be made at the appropriate Contract unit price per each service installed.

ITEM 3-1 Project Landscape Allowance

General Description: The Project Landscape Allowance is included to address unforeseen issues that may arise in order to provide for a fully functional water distribution main.

What Pay Item Includes: These issues may include but are not limited to the restoration of existing trees and shrubs damaged during construction.

Payment Determination: Work to be paid for under this pay item must be authorized by Lee County Utilities Project Manager in writing in advance of work being executed by the Contractor.

Work may be conducted on a lump sum basis and/or on a time and materials basis as authorized by the County Project Manager. The Contractor will provide a rate sheet for personnel, materials and equipment as part of the Schedule of Values.

ITEM 3-2 Potable Water System Allowance

General Description: The Potable Water System Allowance is included, but not limited to, any unforeseen items pertaining to the furnishing and installation of water mains, diversions, relocations, services and related items.

What Pay Item Includes: To be determined as necessary.

Payment Determination: Work to be paid for under this pay item must be authorized by Lee County Utilities Project Manager in writing in advance of work being executed by the Contractor. Work may be conducted on a lump sum basis and/or on a time and materials basis as authorized by the County Project Manager. The Contractor will provide a rate sheet for personnel, materials and equipment as part of the Schedule of Values.

ITEM 3-3 Utility Relocation Allowance

General Description: The Utility Relocation Allowance is included to address any unforeseen items pertaining to the relocation of existing utility lines and related items.

What Pay Item Includes: To be determined as necessary.

Payment Determination: Work to be paid for under this pay item must be authorized by Lee County Utilities Project Manager in writing in advance of work being executed by the Contractor. Work may be conducted on a lump sum basis and/or on a time and materials basis as authorized by the County Project Manager. The Contractor will provide a rate sheet for personnel, materials and equipment as part of the Schedule of Values.

ITEM 3-4 Project Pavement Allowance

General Description: The Project Pavement Allowance is included to address any unforeseen items pertaining to the replacement of pavement, golf cart paths, sidewalk, or roadways and related items.

What Pay Item Includes: To be determined as necessary.

Payment Determination: Work to be paid for under this pay item must be authorized by Lee County Utilities Project Manager in writing in advance of work being executed by the Contractor. Work may be conducted on a lump sum basis and/or on a time and materials basis as authorized by the County Project Manager. The Contractor will provide a rate sheet for personnel, materials and equipment as part of the Schedule of Values.

ITEM 3-5 Project Driveway Allowance

General Description: The Project Driveway Allowance is included to address any unforeseen items pertaining to the driveways and related items.

What Pay Item Includes: To be determined as necessary.

Payment Determination: Work to be paid for under this pay item must be authorized by Lee County Utilities Project Manager in writing in advance of work being executed by the Contractor. Work may be conducted on a lump sum basis and/or on a time and materials basis as authorized by the County Project Manager. The Contractor will provide a rate sheet for personnel, materials and equipment as part of the Schedule of Values.

END OF SECTION

SECTION STS - 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

The OWNER'S technical specifications for Construction facilities and Temporary controls are supplemented, modified, and/or amended as follows:

1.7 SECURITY

C. Work on Private Property

Work Hours:

CONTRACTOR shall coordinate all work hours with the general manager of the Fiddlesticks Master Association (FMA) in general.

1. Work Hours shall be 7:00 A.M. to 6:00 P.M., Monday through Friday
2. Weekends, holidays, and special events require permission of the FMA.

1.9 TRAFFIC REGULATIONS

Parking:

CONTRACTOR employee parking shall be located at the off-site CONTRACTOR project storage yard, outside the Fiddlesticks main gate, unless otherwise approved by the FMA.

1.10 CONTRACTOR STORAGE/ UNKNOWN AREAS/ FIELD OFFICES

Contractor storage/laydown areas: CONTRACTOR is urged to obtain an off-site equipment and materials storage yard. Potential areas within the Fiddlesticks community are extremely limited.

1. Be advised that any on-site storage areas will need approval of the specific property owner, Fiddlesticks master association and sub-association (if applicable)

END OF SECTION

SECTION STS – 02222

EXCAVATION - EARTH AND ROCK

The OWNER'S technical specifications for Excavation – Earth and Rock are supplemented, modified, amended, and/or replaced as follows:

1.1 SUMMARY

B. Related Work Specified In Other Sections Includes:

5. Section 02530 – Groundwater Control for Open Cut Excavation

1.4 SITE CONDITIONS

A. Geotechnical Investigation: Geotechnical investigations and reports were prepared for the design of the project and are included in the Appendix of the project specifications booklet for information only.

1. There is no guarantee or implication that information contained in the geotechnical investigation reports is accurate or complete, or that materials encountered on the project will be similar to those encountered at the locations where the soil borings were taken.
2. The geotechnical investigation reports are provided for information only, and are not part of the Contract Documents.

3.6 ROCK EXCAVATION

I. Blasting: Obtain written authorization from the OWNER and ENGINEER prior to commencement of any blasting operations. Perform authorized blasting by authorized and qualified workers as approved as to the number, length, placing and direction, and loading of holes. Do not use charges which will make the excavation unduly large or irregular, nor shatter the rock upon or against which masonry is to be built, nor injure masonry or existing structures at the site or in the vicinity.

3.12 REMOVAL OF WATER

A. Water Removal: At all times during the excavation period and until completion and acceptance of the WORK at final inspection, provide ample means and equipment with which to remove promptly and dispose of properly all water entering any excavation or other parts of the WORK.

1. The CONTRACTOR shall be responsible for obtaining and complying with any dewatering permits.

END OF SECTION STS – 02222

(NO TEXT FOR THIS PAGE)

SECTION STS – 02226

JACKING, AUGERING AND MINING

The OWNER'S technical specifications for Jacking, Augering and Mining are supplemented, modified, amended, and/or replaced as follows:

PART 2 PRODUCTS

2.1 MATERIALS

C. The following Casing Spacer manufacturers/models are acceptable for use on this project:

- Powerseal Series 4810
- Cascade Series CCS

END OF SECTION STS – 02226

(NO TEXT FOR THIS PAGE)

SECTION STS – 02620

HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

The OWNER's technical specifications for High Density Polyethylene (HDPE) Pipe and Fittings are supplemented, modified, amended, and/or replaced as follows:

PART 2 PRODUCTS

2.1 POLYETHYLENE PIPE AND FITTINGS

D. Approved Manufacturer: Manufacturers that are qualified and approved are listed below:

- Performance Pipe (A Division of Chevron Phillips Chemical Co. LLP)
 - DriscoPlex ® PE3408
 - DriscoPlex ® 4100
 - DriscoPlex ® 4300
- National Pipe
- JM Eagle
- Independent Pipe Products, Inc. (HDPE to DIP adapters)

END OF SECTION STS – 02620

FIDDLESTICKS WATER MAIN REPLACEMENT: PHASE 2

SECTION STS-02620
HIGH DENSITY POLYETHYLENE (HDPE)
PIPE AND FITTINGS
PAGE 2 OF 2

SECTION STS – 02623

POLYVINYL CHLORIDE (PVC) WATER MAIN PIPE

The OWNER'S technical specifications for Polyvinyl Chloride (PVC) Water Main Pipe are supplemented, modified, amended, and/or replaced as follows:

PART 2 PRODUCTS

2.1 WATER MAIN

A. POLYVINYL CHLORIDE (PVC) PIPE

5. The following manufacturers are acceptable for use on this project:
 - Diamond
 - North American
 - JM Eagle
 - National Pipe

D. Joint Restraining Devices acceptable and approved are:

1. Ductile Iron Mechanical Joint Fittings

- EBBA Iron, Inc. (PVC – Series 200PV, DI – Series 1100)
- Sigma (PVC – Series SLCE, DI – Series SLDE)
- Ford Uni-Flange, Series 1400
- Star Pipe Products (PVC – Series 4000, DI – Series 3000)
- Infact (Foster Adaptor)

2. Bell Joint Restraint

- EBBA Iron, Inc. (PVC – Series 1600, DI – Series 1700)
- Sigma (PVC – Series PWP, DI – Series SLDEH)
- Star Pipe Products Series 1100
- Ford Uni-Flange, Series 1300

3. DIP Fittings shall be cement lined and come from the following manufacturers:

- Tyler Union
- Sigma
- Star Pipe Products

E. Joint Design: Push-on gaskets allowed are:

- US Pipe Tyton
- American Fastite
- McWayne Tyton

F. Transition Couplings acceptable and approved are:

- Romac Series 500
- Krausz Hymax
- Powerseal Powermax

END OF SECTION STS – 02623

SECTION STS – 02630

DUCTILE IRON PIPE & FITTINGS

The OWNER'S technical specifications for Ductile Iron Pipe & Fittings are supplemented, modified, amended, and/or replaced as follows:

PART 2 PRODUCTS

2.3 MATERIALS

A. DUCTILE IRON PIPE

1. The following manufacturers are acceptable for use on this project:
 - American
 - US Pipe
 - McWayne

C. Transition Couplings acceptable and approved are:

- Romac Series 500
- Krausz Hymax
- Powerseal Powermax

2.4 SPECIALS AND FITTINGS

A. DIP Fittings shall be cement lined and come from the following manufacturers:

- Tyler Union
- Sigma
- Star Pipe Products

2.5 DESIGN OF PIPE

E. Joint Design: Push-on gaskets allowed are:

- US Pipe Tyton
- American Fastite
- McWayne Tyton

F. Joint Restraining Devices acceptable and approved are:

1. Ductile Iron Mechanical Joint Fittings

- EBBA Iron, Inc. (PVC – Series 200PV, DI – Series 1100)
- Sigma (PVC – Series SLCE, DI – Series SLDE)
- Ford Uni-Flange, Series 1400
- Star Pipe Products (PVC – Series 4000, DI – Series 3000)

- Infact (Foster Adaptor)

2. Bell Joint Restraint

- EBBA Iron, Inc. (PVC – Series 1600, DI – Series 1700)
- Sigma (PVC – Series PWP, DI – Series SLDEH)
- Star Pipe Products Series 1100
- Ford Uni-Flange, Series 1300

2.8 CORROSION PROTECTION

B. V-Bio Enhanced Polyethylene Encasement (Flat Sheet) shall come from the following manufacturer:

- American Ductile Iron Pipe
- McWayne Ductile
- US Pipe and Foundry

END OF SECTION STS – 02630

SECTION STS – 02645

HYDRANTS

The OWNER'S technical specifications for Hydrants are supplemented, modified, amended, and/or replaced as follows:

PART 2 PRODUCTS

2.1 FIRE HYDRANTS

F. The following manufacturers/models are acceptable for use on this project:

- Kennedy K81A
- American Darling B84B
- Clow Medallion

END OF SECTION STS – 02645

(NO TEXT FOR THIS PAGE)

SECTION STS – 15100
WATER VALVES AND APPURTENANCES

The OWNER'S technical specifications for Water Valves and Appurtenances are supplemented, modified, amended, and/or replaced as follows:

PART 2 PRODUCTS

2.2 MANUFACTURERS

A. The following manufacturers for Gate, Resilient, or Wedge Valves are acceptable for use on this project:

- Kennedy Series C500
- American Series 2500
- Clow Series C500
- Mueller Model 2361 (Mechanical Joint)
- Mueller Model 7126 (Flanged)

2.3 DESIGN

B. Valves for Buried Services

2. Approved manufacturer's list for valve boxes includes:

- Star Pipe Products
- Tyler Union
- Bingham & Taylor Corp.
- Sigma

F. Air Release Valves

1. Acceptable manufacturers and models for Air Release Valves include:

- ARI Model D040
- HTEC Model 993 HaVent

2. Acceptable manufacturers and models for Air Release Boxes include:

- Channell Model 1212 Blue
- Pencell Model 1212 Blue
- Water Plus Model 1212 Blue

G. Tapping Valves and Sleeves

4. Approved manufacturers are:

- Double Strap Service Saddles:
 - i. Ford Series 202
 - ii. JCM Industries Series 402
 - iii. Romac Series 202 & HDPE Series 202N-H
 - iv. Powerseal Series 3412

- Stainless Steel Main Line Tapping Sleeves
 - i. Powerseal Series 3412
 - ii. JCM Industries Series 432
 - iii. Triple Tap Series MJSF
 - iv. Smith Blair Series 662

H. Meter Boxes

Approved manufacturers are:

- 5/8" to 1": Hubbell PG1118BB12 box with Hubbell C00111802P_x cover
- 1 1/2" to 2": Hubbell B00173012M box with Hubbell C00173002P cover

I. Approved Water Service poly tubing manufacturers are:

- ENDOT (3/4" to 2")

J. Approved manufacturers of Service Brass (Curb Stops, Corporation Stops, Couplings, etc.) are:

- A.Y. McDonald Mfg. Co. (Lead Free)
- Ford Meter Box (Lead Free)

3.2 SHOP PAINTING

The primer used on ferrous surfaces shall be Phenolic Primer Red Oxide.

END OF SECTION STS – 15100

SECTION 01040
PROJECT MEETINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Coordination
- B. Preconstruction Conference
- C. Progress Meetings

1.2 COORDINATION

- A. General: Coordinate scheduling, submittals, and Contract work to assure efficient and orderly sequence of installation of interdependent construction elements.
- B. Accessory Placement: Place conduits, saddles, boxes, cabinets, sleeves, inserts, foundation bolts, anchors and other like work in floors, roofs or walls of buildings and structures in conformity with the construction program.

1.3 PRECONSTRUCTION CONFERENCE

- A. General: Prior to commencement of the Work, in accordance with the General Conditions, the OWNER will conduct a preconstruction conference to be held at a predetermined time and place.
- B. Delineation of Responsibilities: The purpose of the conference is to designate responsible personnel, to establish a working relationship among the parties and to identify the responsibilities of the OWNER, plant personnel and the CONTRACTOR/VENDOR. Matters requiring coordination will be discussed and procedures for handling such matters, established. The agenda will include:
 - 1. Submittal procedures
 - 2. Partial Payment procedures
 - 3. Maintenance of Records
 - 4. Schedules, sequences and maintenance of facility operations
 - 5. Safety and First Aid responsibilities
 - 6. Change Orders and Field Directive Changes
 - 7. Use of site
 - 8. Housekeeping
 - 9. Equipment delivery
- C. Attendees: The preconstruction conference is to be attended by the representatives of the CONTRACTOR/VENDOR, the OWNER and plant personnel that will be associated with the project. Representatives of regulatory agencies, subcontractors, and principal suppliers may also attend when appropriate.

D. Chair and Minutes: The preconstruction conference will be chaired by the Owner who will also arrange for the keeping and distribution of minutes to all attendees.

1.4 PROGRESS MEETINGS

A. Meeting Frequency and Format: Schedule progress meetings on at least a monthly basis or more frequently as warranted by the complexity of the Project, to review the Work, discuss changes in schedules, maintain coordination and resolve potential problems. Invite OWNER, ENGINEER and all SUBCONTRACTOR/VENDORS. Suppliers may be invited as appropriate. Minutes of the meeting will be maintained by CONTRACTOR/VENDOR and reviewed by ENGINEER prior to distribution by the CONTRACTOR/VENDOR. Distribute reviewed minutes to attendees within 5 calendar days after each meeting.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01041
PROJECT COORDINATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Work Progress
- B. Private Land
- C. Work Locations
- D. Open Excavations
- E. Test Pits
- F. Maintenance of Traffic
- G. Maintenance of Flow

1.2 WORK PROGRESS

- A. Furnish personnel and equipment which will be efficient, appropriate and large enough to secure a satisfactory quality of work and a rate of progress which will allow the completion of the work within the time stipulated in the Bid of these Specifications. If at any time such personnel appears to the ENGINEER to be inefficient, inappropriate or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he may order the CONTRACTOR to increase the efficiency, change the character or increase the personnel and equipment, and the CONTRACTOR shall conform to such order. Failure of the ENGINEER to give such order shall in no way relieve the CONTRACTOR of his obligations to secure the quality of the work and rate of progress.

1.3 PRIVATE LAND

- A. Do not enter or occupy private land outside of easements, except by permission of OWNER. Construction operations shall be conducted in accordance with Section 01500.

1.4 WORK LOCATIONS

- A. Structures and pipelines shall be located substantially as indicated on the Drawings, but the ENGINEER reserves the right to make such modifications in locations as may be found desirable to avoid interference noted on the Drawings, such notation is for the CONTRACTOR's convenience and does not relieve him from laying and jointing different or additional items where required.

1.5 OPEN EXCAVATIONS

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The CONTRACTOR shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by the public and workmen.

1.6 TEST PITS

- A. Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the CONTRACTOR. Test pits shall be backfilled immediately after their purpose has been satisfied and maintained in a manner satisfactory to the ENGINEER. The costs for such test pits shall be borne by the CONTRACTOR.

1.7 MAINTENANCE OF TRAFFIC

- A. Maintenance of traffic shall be in accordance with Sections 01570 and 02230.
- B. All projects and work on highways, roads, and streets, shall have a traffic control plan, (TCP), as required by Florida Statute and Federal regulations. All work shall be executed under the established plan and Department approved procedures. The TCP is the result of considerations and investigations made in the development of a comprehensive plan for accommodating vehicular and pedestrian traffic through the construction zone.
- C. The complexity of the TCP varies with the complexity of the traffic problems associated with a project. Many situations can be covered adequately with reference to specific sections from the Manual on Uniform Traffic Control Devices (MUTCD), the Traffic Control Devices Handbook (TCDH), or Roadway and Traffic Design Standard Series 600.

1.8 MAINTENANCE OF FLOW

- A. Provide for the flow of sewers, drains, courses interrupted during the progress of the work, and shall immediately cart away and remove all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the ENGINEER well in advance of the interruption of any flow.

PART 2 PRODUCTS

2.1 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. All newly constructed work shall be carefully protected from damage in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions damaged shall be reconstructed by the CONTRACTOR at his own expense.
- B. All structures shall be protected in a manner approved by the ENGINEER. Should any of the floors or other parts of the structures become heaved, cracked or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the CONTRACTOR at his own expense and to the satisfaction of the ENGINEER. Special

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PROJECT COORDINATION

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attention is directed to substructure bracing requirements, described in Section 02151. If, in the final inspection of the work, any defects, faults or omissions are found, the CONTRACTOR shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. The CONTRACTOR shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the guarantee period described in the contract.

- C. Take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the OWNER.

PART 3 EXECUTION

3.1 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. Sequence and schedule work in a manner to preclude delays and conflicts between the work of various trades and contractors. Each trade shall keep informed as to the work of other trades on the project and shall execute their work in a manner that will not interfere with the work of other trades.

3.2 DIAGRAMMATIC NATURE OF DRAWINGS

- A. Where layout is diagrammatic, such as pipelines, conduits, ductwork, etc., it shall be followed as closely as other work will permit. Changes from diagrams shall be made as required to conform to the construction requirements.
- B. Before running lines, carefully verify locations, depths and sizes and confirm that lines can be run as contemplated without interfering with other construction. Any deviation shall be referred to the ENGINEER for approval before lines are run. Minor changes in location of the equipment, fixtures, piping, etc., from those shown on the Drawings, shall be made without extra charge if so directed by the ENGINEER before installation.
- C. Determine the locations and sizes of equipment, fixtures, conduit, ducts, openings, etc., in order that there will be no interference in the installation of the work or delay in the progress of other work. In the event that interferences develop, the ENGINEER's decision regarding relocation of work will be final.
- D. Any changes made necessary through failure to make proper arrangements to avoid interference shall not be considered as extras. Cooperate with those performing other work in preparation of interference drawings, to the extent that the location of piping, ductwork, etc., with respect to the installations of other trades shall be mutually agreed upon by those performing the work.

3.3 PROVISIONS FOR LATER INSTALLATION

- A. Where any work cannot be installed as the construction is progressing, provide for boxes, sleeves, inserts, fixtures or devices as necessary to permit installation of the omitted work during later phases of construction. Arrange for chases, holes, and other openings in the

masonry, concrete or other work and provide for subsequent closure after placing equipment. Arrangement for and closure of openings shall be subject to the approval of the ENGINEER and all costs therefore shall be included in the contract price for the work.

3.4 COORDINATION

- A. The CONTRACTOR shall be fully responsible for the coordination of his work and the work of his employees, subcontractors, and suppliers with the OWNER, and regulatory agencies, and assure compliance with schedules.

END OF SECTION

SECTION 01045
CUTTING AND PATCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General Requirements
- B. Scheduling of Shutdown

1.2 RELATED SECTIONS

- A. Section 01010 - Summary of Work
- B. Section 02575 – Pavement Repair and Restoration

1.3 GENERAL REQUIREMENTS

- A. CONTRACTOR shall be responsible for all cutting, fitting and patching, including attendant excavation and backfill, required to complete the work or to:
 - 1. Make its several parts fit together properly.
 - 2. Uncover portions of the work to provide for installation of ill-timed work.
 - 3. Remove and replace defective work.
 - 4. Remove and replace work not conforming to requirements of Contract Documents.
 - 5. Remove samples of installed work as specified for testing.
 - 6. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.
- B. Coordination: Perform all cutting, fitting or patching of the Work that may be required to make the several parts thereof join in accordance with the Contract Documents. Perform restoration with competent workmen skilled in the trade.
- C. Improperly Timed Work: Perform all cutting and patching required to install improperly timed work, to remove samples of installed materials for testing, and to provide for alteration of existing facilities or for the installation of new Work in the existing construction.
- D. Limitations: Except when the cutting or removal of existing construction is specified or indicated, do not undertake any cutting or demolition which may affect the structural stability of the Work or existing facilities without the ENGINEER's concurrence.

1.4 SUBMITTALS

- A. Submit a written request to the ENGINEER well in advance of executing any cutting or alteration which affects:
 - 1. Work of the OWNER or any separate contractor.

2. Structural value or integrity of any element of the project or work.
3. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
4. Efficiency, operational life, maintenance or safety of operational elements.
5. Visual qualities of sight-exposed elements.

B. Request shall include:

1. Identification of the work.
2. Description of affected work.
3. The necessity for cutting, alteration or excavation.
4. Effect on work of OWNER or any separate contract, or on structural or weatherproof integrity of work.
5. Description of proposed work:
 - a. Scope of cutting, patching, alteration, or excavation.
 - b. Trades who will execute the work.
 - c. Products proposed to be used.
 - d. Extent of refinishing to be done.
6. Alternatives to cutting and patching.
7. Cost proposal, when applicable.
8. Written permission of any separate contractor whose work will be affected.

C. SUBMIT WRITTEN NOTICE TO THE ENGINEER DESIGNATING THE DATE AND THE TIME THE WORK WILL BE UNCOVERED.

1.5 SCHEDULING OF SHUTDOWN

A. Connections to Existing Facilities: If any connections, replacement, or other work requiring the shutdown of an existing facility is necessary, schedule such work at times when the impact on the OWNER's normal operation is minimal. Overtime, night and weekend work without additional compensation from the OWNER, may be required to make these connections, especially if the connections are made at times other than those specified.

B. Request for Shutdowns: Submit a written request for each shutdown to the OWNER and the ENGINEER sufficiently in advance of any required shutdown.

PART 2 PRODUCTS

2.1 MATERIALS

A. Comply with specifications and standards for each specific product involved.

PART 3 EXECUTION

3.1 INSPECTION

A. Inspect existing conditions of projects, including elements subject to damage or to movement during cutting and patching.

- B. After uncovering work, inspect conditions affecting installation of products, or performance of the work.
- C. Report unsatisfactory or questionable conditions to the ENGINEER in writing; do not proceed with work until the ENGINEER has provided further instructions.

3.2 PREPARATION

- A. Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of work.
- B. Provide devices and methods to protect other portions of project from damage.
- C. Provide protection from elements for that portion of the project which may be exposed by cutting and patching work, and maintain excavations free from water.
- D. Material Removal: Cut and remove all materials to the extent shown or as required to complete the Work. Remove materials in a careful manner with no damage to adjacent facilities. Remove materials which are not salvageable from the site.

3.3 PERFORMANCE

- A. Execute cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation of repairs.
- B. Execute excavating and backfilling by methods which will prevent settlement or damage to other work.
- C. Employ original installer or fabricator to perform cutting and patching for:
 1. Weather-exposed or moisture-resistant elements.
 2. Sight-exposed finished surfaces.
- D. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.
- E. Restore work which has been cut or removed; install new products to provide completed work in accord with requirements of contract documents.
- F. Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.
- G. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:
 1. For continuous surfaces, refinish to nearest intersection.
 2. For an assembly, refinish entire unit.

3.4 PAVEMENT RESTORATION

- A. Restore all pavement or roadway surfaces in accordance with Section 02575 – Pavement Repair and Restoration.

- B. The restoration of existing street paving, including underdrains, if any are encountered, where damaged, shall be restored by the CONTRACTOR and shall be replaced or rebuilt using the same type of construction as was in the original. The CONTRACTOR shall be responsible for restoring all such work, including subgrade, base courses, curb and gutter or other appurtenances where present. The CONTRACTOR shall obtain and pay for at his own expense such local or other governmental permits as may be necessary for the opening of streets and shall satisfy himself as to any requirements other than those herein set forth which may affect the type, quality and manner of carrying on the restoration of surfaces by reason of jurisdiction of such governmental bodies.
- C. This section does not describe the construction of new road surfaces or the complete resurfacing of existing pavements.
- D. In all cases, the CONTRACTOR will be required to maintain, without additional compensation, all permanent replacement of street paving, done by him under this Contract for a period of 12 months after the acceptance of the Contract, including the removal and replacement of such work wherever surface depressions or underlying cavities result from settlement of trench backfill.
- E. The CONTRACTOR shall do all the final resurfacing or repaving of streets or roads, over the excavations that he has made and he shall be responsible for relaying paving surfaces of roads that have failed or been damaged, at any time before the termination of the maintenance period on account of work done by him and he shall resurface or repave over any tunnel jacking, or boring excavation that shall settle or break the surface, shall be repaved to the satisfaction of the OWNER and at the CONTRACTOR's sole expense. Backfilling of trenches and the preparation of subgrades shall conform to the requirements of excavation and backfilling of pipeline trenches.
- F. Where pipeline construction crosses paved streets, the CONTRACTOR may elect, at no additional cost to the OWNER, to place the pipe by the jacking or boring or tunneling method in lieu of cutting and patching of the paved surfaces.

END OF SECTION

SECTION 01051
LINES AND GRADES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General
- B. Surveys
- C. Datum Plane
- D. Protection of Survey Data

1.2 GENERAL

- A. Construct all work in accordance with the lines and grades shown on the Drawings. Assume full responsibility for keeping all alignment and grade.

1.3 SURVEYS

- A. Reference Points: The OWNER will provide reference points for the work as described in the General Conditions. Base horizontal and vertical control points will be designated by the ENGINEER and used as datum for the Work. Perform all additional survey, layout, and measurement work.

1. Keep ENGINEER informed, sufficiently in advance, of the times and places at which work is to be performed so that base horizontal and vertical control points may be established and any checking deemed necessary by ENGINEER may be done, with minimum inconvenience to the ENGINEER and at no delay to CONTRACTOR. It is the intention not to impede the Work for the establishment of control points and the checking of lines and grades set by the CONTRACTOR. However, when necessary, suspend working operations for such reasonable time as the ENGINEER may require for this purpose. Costs associated with such suspension are deemed to be included in the Contract Price, and no time extension or additional costs will be allowed.
2. Provide an experienced survey crew including an instrument operator, competent assistants, and any instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement of work performed by the CONTRACTOR.

1.4 DATUM PLANE

- A. All elevations indicated or specified refer to North American Vertical Datum of 1988, the current vertical datum for the contiguous United States and Alaska. CONTRACTOR shall record the exact location of all changes in vertical and horizontal alignment with coordinates with respect to the NAVD 1988 State Plane Florida West Coordinate System as well as all requirements set forth in the LCU Design Manual.

1.5 PROTECTION OF SURVEY DATA

- A. General: Safeguard all points, stakes, grade marks, known property corners, monuments, and bench marks made or established for the Work. Reestablish them if disturbed, and bear the entire expense of checking reestablished marks and rectifying work improperly installed.
- B. Records: Keep neat and legible notes of measurements and calculations made in connection with the layout of the Work. Furnish copies of such data to the ENGINEER for use in checking the CONTRACTOR's layout. Data considered of value to the OWNER will be transmitted to the OWNER by the ENGINEER with other records on completion of the Work.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01090
REFERENCE STANDARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Abbreviations and Symbols
- B. Reference Standards
- C. Definitions

1.2 RELATED SECTIONS

- A. Information provided in this section is used where applicable in individual Specification Sections, Divisions 2 through 16.

1.3 REFERENCE ABBREVIATIONS

- A. Reference to a technical society, trade association or standards setting organization, may be made in the Specifications by abbreviations in accordance with the following list:

AABC	Associated Air Balance Council
AAMA	Architectural Aluminum Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ACI	American Concrete Institute
ADC	Air Diffusion Council
AFBMA	Anti-friction Bearing Manufacturers Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AHA	Association of Home Appliance Manufacturers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association, Inc.
ANSI	American National Standards Institute
APA	American Plywood Association
ARI	American Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders' Hardware Manufacturers Association

BIA	Brick Institute of American
CABO	Council of American Building Officials
CAGI	Compressed Air and Gas Institute
CISPI	Cast Iron Soil Pipe Institute
CMAA	Crane Manufacturers Association of America
CRD	U.S. Corps of Engineers Specifications
CRSI	Concrete Reinforcing Steel Institute
CTI	Cooling Tower Institute
DHI	Door and Hardware Institute
DOH	Department of Health
DOT	Department of Transportation
Fed. Spec.	Federal Specifications
FGMA	Flat Glass Marketing Association
FM	Factory Mutual
HMI	Hoist Manufacturing Institute
HPMA	See HPVA
HPVA	Hardwood Plywood Veneer Association
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IFI	Industrial Fasteners Institute
MIL	Military Specifications
MSS	Manufacturer's Standardization Society
NAAMM	National Association of Architectural Metal Manufacturers
NACM	National Association of Chain Manufacturers
NBS	National Bureau of Standards, See NIST
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NETA	National Electrical Testing Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NFPA	National Fluid Power Association
NIST	National Institute of Standards and Technology
NLMA	National Lumber Manufacturers Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Act
PCI	Prestressed Concrete Institute
PDI	Plumbing and Drainage Institute
SAE	Society of Automotive Engineers
SCPRF	Structural Clay Products Research Foundation
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SPI	Society of the Plastics Industry
SSPC	Steel Structures Painting Council
STI	Steel Tank Institute
TCA	Tile Council of American
TIMA	Thermal Insulation Manufacturers' Association
UL	Underwriters' Laboratories, Inc.
USBR	U. S. Bureau of Reclamation
USBS	U. S. Bureau of Standards, See NIST

1.4 REFERENCE STANDARDS

- A. Latest Edition: Construe references to furnishing materials or testing, which conform to the standards of a particular technical society, organization, or body, to mean the latest standard, code, or specification of that body, adopted and published as of the date of bidding this Contract. Standards referred to herein are made a part of these Specifications to the extent which is indicated or intended.
- B. Precedence: The duties and responsibilities of the OWNER, CONTRACTOR or ENGINEER, or any of their consultants, agents or employees are set forth in the Contract Documents, and are not changed or altered by any provision of any referenced standard specifications, manuals or code, whether such standard manual or code is or is not specifically incorporated by reference in the Contract Documents. Any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority, to undertake responsibility contrary to the powers of the ENGINEER as set forth in the Contract Documents cannot be assigned to the ENGINEER or any of the ENGINEER's consultants, agents or employees.

1.5 DEFINITIONS

- A. In these Contract Documents the words furnish, install and provide are defined as follows:
 1. Furnish (Materials): to supply and deliver to the project ready for installation and in operable condition.
 2. Install (services or labor): to place in final position, complete, anchored, connected in operable condition.
 3. Provide: to furnish and install complete. Includes the supply of specified services. When neither furnish, install or provide is stated, provided is implied.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01092

ABBREVIATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Abbreviations
- B. Standards for Abbreviations

1.2 RELATED SECTIONS

- A. Abbreviations provided in this section are used where applicable in individual Specification Sections, Divisions 2 through 16.

1.3 ABBREVIATIONS

- A. Abbreviations which may be used in Divisions 1 through 16 for units of measure are as follows:

alternating current	ac
American wire gauge	AWG
ampere(s)	amp
ampere-hour(s).....	AH
annual.....	ann
Ampere Interrupting Capacity	AIC
atmosphere(s)	atm
average	avg
biochemical oxygen demand.....	BOD
Board Foot.....	FBM
brake horsepower.....	bhp
Brinell Hardness.....	BH
British thermal unit(s).....	Btu
calorie (s)	cal
carbonaceous biochemical oxygen demand.....	CBOD
Celsius (centigrade)	C
Center to Center	C to C
centimeter(s)	cm
chemical oxygen demand.....	COD
coefficient, valve flow	C_v
cubic.....	cu
cubic centimeter(s).....	cc
cubic feet per day	cfd
cubic feet per hour	cfh

cubic feet per minute	cfm
cubic feet per minute, standard conditions	scfm
cubic feet per second.....	cfs
cubic foot (feet)	cu ft
cubic inch(es)	cu in
cubic yard(s)	cu yd
decibels	dB
decibels (A scale)	dBa
degree(s)	deg
dewpoint temperature	dpt
diameter	dia
direct current	dc
dissolved oxygen	DO
dissolved solids.....	DS
dry-bulb temperature	dbt
efficiency	eff
elevation	el
entering water temperature	ewt
entering air temperature	eat
equivalent direct radiation	edr
face area	fa
face to face	f to f
Fahrenheit	F
feet per day	fpd

feet per hour	fph	kilovolt-ampere(s).....	kVA
feet per minute	fpm	kilowatt(s).....	kW
feet per second	fps	kilowatt-hour(s)	kWh
foot (feet).....	ft		
foot-candle.....	fc		
foot-pound	ft-lb	linear foot (feet)	LF or lin ft
foot-pounds per minute	ft-lb/min	liter(s)	L
foot-pounds per second	ft-lb/sec		
formazin turbidity unit(s).....	FTU		
frequency.....	freq		
gallon(s)	gal	megavolt-ampere(s).....	MVA
gallons per day.....	gpd	meter(s).....	m
gallons per day per		micrograms per liter.....	ug/L
cubic foot.....	gpd/cu ft	miles per hour.....	mph
gallons per day per		milliampere(s).....	mA
square foot	gpd/sq ft	milligram(s)	mg
gallons per hour	gph	milligrams per liter.....	mg/L
gallons per minute	gpm	milliliter(s)	mL
gallons per second.....	gps	millimeter(s)	mm
gas chromatography and		million gallons.....	MG
mass spectrometry.....	GC-MS	million gallons per day	mgd
gauge	ga	millisecond(s).....	ms
grain(s)	gr	millivolt(s)	mV
gram(s).....	g	minute(s).....	min
grams per cubic centimeter	gm/cc		
Heat Transfer Coefficient	U		
height	hgt		
Hertz.....	Hz	mixed liquor suspended	
horsepower	hp	solids	MLSS
horsepower-hour	hp-hr		
hour(s)	hr	nephelometric turbidity	
humidity, relative	rh	unit	NTU
hydrogen ion concentration	pH	net positive suction head	NPSH
inch(es)	in	noise criteria.....	nc
inches per second	ips	noise reduction coefficient	NRC
inside diameter	ID	number	no
Jackson turbidity unit(s)	JTU		
kelvin	K	ounce(s).....	oz
kiloamperes.....	kA	outside air	oa
kilogram(s)	kg	outside diameter.....	OD
kilometer(s)	km		
kilovar (kilovolt-amperes		parts per billion	ppb
reactive).....	kvar	parts per million.....	ppm
kilovolt(s).....	kV	percent	pct
		phase (electrical).....	ph
		pound(s).....	lb
		pounds per cubic foot	pcf
		pounds per cubic foot	pcf
		per hour	pcf/hr
		pounds per day	lbs/day
		pounds per day per	
		cubic foot	lbs/day/cu ft
		pounds per day per	
		square foot.....	lbs/day/sq ft

pounds per square foot..... psf
pounds per square foot
per hour psf/hr
pounds per square inch psi
pounds per square inch
absolute psia
pounds per square inch
gauge psig
power factor PF
pressure drop or
difference dp
pressure, dynamic
(velocity)..... vp
pressure, vapor..... vap pr
quart(s)..... qt

Rankine R
relative humidity rh
resistance..... res
return air ra
revolution(s) rev
revolutions per minute rpm
revolutions per second rps
root mean squared..... rms
safety factor sf
second(s)..... sec
shading coefficient..... SC
sludge density index..... SDI

Sound Transmission

Coefficient..... STC
specific gravity sp gr
specific volume Sp Vol
sp ht at constant pressure Cp
square sq
square centimeter(s) sq cm
square foot (feet)..... sq ft
square inch (es) sq in
square meter(s)..... sq m
square yard(s)..... sq yd
standard std
static pressure st pr
supply air..... sa
suspended solids..... SS

temperature temp
temperature difference TD

temperature entering TE
temperature leaving TL
thousand Btu per hour Mbh
thousand circular mils kcmil
thousand cubic feet Mcf
threshold limit value TLV
tons of refrigeration tons
torque TRQ
total dissolved solids TDS
total dynamic head TDH
total kjeldahl nitrogen TKN
total oxygen demand TOD
total pressure TP
total solids TS
total suspended solids TSS
total volatile solids TVS

vacuum vac
viscosity visc
volatile organic chemical VOC
volatile solids VS
volatile suspended solids VSS
volt(s)..... V
volts-ampere(s) VA
volume vol

watt(s) W
watthour(s)..... Wh
watt-hour demand WHD
watt-hour demand meter WHDM
week(s)..... wk
weight wt
wet-bulb WB
wet bulb temperature WBT

yard(s)..... yd
year(s)..... yr

1.4 STANDARD FOR ABBREVIATIONS

- A. Use ASME Y1.1-1989, "Abbreviations for use on Drawings and in Text" for abbreviations for units of measure not included in Paragraph 1.3.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01300
SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Description of Requirements
- B. Submittal Procedures
- C. Specific Submittal Requirements
- D. Action on Submittals
- E. Repetitive Review

1.2 DESCRIPTION OF REQUIREMENTS

- A. This section specifies procedural requirements for Shop Drawings, product data, samples, and other miscellaneous Work-related submittals.
- B. Procedures concerning items such as listing of manufacturers, suppliers, subcontractors, construction progress schedule, schedule of Shop Drawing submissions, bonds, payment applications, insurance certificates, and schedule of values are specified elsewhere.
- C. Work-Related Submittals:
 - 1. Substitution or "Or Equal" Items:
 - a. Includes material or equipment CONTRACTOR requests ENGINEER to accept, after Bids are received, as substitute for items specified or described in Specifications by using name of a proprietary item or name of particular supplier.
 - 2. Shop Drawings:
 - a. Includes technical data and drawings specially prepared for this Project, including fabrication and installation drawings, diagrams, actual performance curves, data sheets, schedules, templates, patterns, reports, instructions, design mix formulas, measurements, and similar information not in standard printed form.
 - b. Standard information prepared without specific reference to the Project is not considered a Shop Drawing.
 - 3. Product Data:
 - a. Includes standard printed information on manufactured products, and systems that has not been specially prepared for this Project, including manufacturer's

product specifications and installation instructions, catalog cuts, standard wiring diagrams, printed performance curves, mill reports, and standard color charts.

4. Samples:

- a. Includes both fabricated and manufactured physical examples of materials, products, and units of work, partial cuts of manufactured or fabricated work, swatches showing color, texture, and pattern, and units of work to be used for independent inspection and testing.
- b. Mock-ups are special forms of samples which are too large or otherwise inconvenient for handling in manner specified for transmittal of sample submittals.

5. Working Drawings:

- a. When used in the Contract Documents, the term "working drawings" shall be considered to mean the CONTRACTOR'S plans for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities control systems, forming and false work for underpinning; temporary by-pass pumping and for such other work as may be required for construction but does not become an integral part of the project.
- b. Copies of working drawings shall be submitted to the ENGINEER at least fourteen (14) calendar days (unless otherwise specified by the ENGINEER) in advance of the required work.
- c. Working drawings shall be signed by a registered Professional Engineer currently licensed to practice in the State of Florida and shall convey, or be accompanied by, calculation or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use.

6. Miscellaneous Submittals:

- a. Work-related submittals that do not fit in the previous categories, such as guarantees, warranties, certifications, experience records, maintenance agreements, Operating and Maintenance Manuals, workmanship bonds, survey data and reports, physical work records, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, and similar information, devices, and materials applicable to the Work.

1.3 SUBMITTAL PROCEDURES

A. Scheduling:

1. Submit for approval, a preliminary schedule of shop drawings and samples submittals, in duplicate, and in accordance with the General Conditions.

2. Prepare and transmit each submittal to ENGINEER sufficiently in advance of scheduled performance of related work and other applicable activities.

B. Coordination:

1. Coordinate preparation and processing of submittals with performance of work. Coordinate each submittal with other submittals and related activities such as substitution requests, testing, purchasing, fabrication, delivery, and similar activities that require sequential activity.
2. Coordinate submission of different units of interrelated work so that one submittal will not be delayed by ENGINEER's need to review a related submittal. ENGINEER may withhold action on any submittal requiring coordination with other submittals until related submittals are forthcoming.

C. Submittal Preparation:

1. Stamp and sign each submittal certifying to review of submittal, verification of products, field measurement, field construction criteria, coordination of information within submittal with requirements of the Work and the Contract Documents, coordination with all trades, and verification that product will fit in space provided.
2. Transmittal Form: In the transmittal form forwarding each specific submittal to the ENGINEER include the following information as a minimum.
 - a. Date of submittal and dates of previous submittals containing the same material.
 - b. Project title and number.
 - c. Submittal and transmittal number.
 - d. Contract identification.
 - e. Names of:
 1. Contractor
 2. Supplier
 3. Manufacturer
 - f. Identification of equipment and material with equipment identification numbers, model numbers, and Specification section number.
 - g. Variations from Contract Documents and any limitations which may impact the Work.
 - h. Drawing sheet and detail number as appropriate.

D. Resubmittal Preparation:

1. Comply with the requirements described in Submittal Preparation. In addition:

- a. Identify on transmittal form that submittal is a resubmission.
- b. Make any corrections or changes in submittals required by ENGINEER's notations on returned submittal.
- c. Respond to ENGINEER's notations:
 1. On the transmittal or on a separate page attached to CONTRACTOR's resubmission transmittal, answer or acknowledge in writing all notations or questions indicated by ENGINEER on ENGINEER's transmittal form returning review submission to CONTRACTOR.
 2. Identify each response by question or notation number established by ENGINEER.
 3. If CONTRACTOR does not respond to each notation or question, resubmission will be returned without action by ENGINEER until CONTRACTOR provides a written response to all ENGINEER's notations or questions.
- d. CONTRACTOR initiated revisions or variations:
 1. On transmittal form identify variations or revisions from previously reviewed submittal, other than those called for by ENGINEER.
 2. ENGINEER's responsibility for variations or revisions is established in the General Conditions.

1.4 SPECIFIC SUBMITTAL REQUIREMENTS

- A. Specific submittals required for individual elements of work are specified in the individual Specification sections. Except as otherwise indicated in Specification sections, comply with requirements specified herein for each indicated type of submittal.
- B. Requests for Substitution or "Or Equal"
 1. Collect data for items to be submitted for review as substitution into one submittal for each item of material or equipment in accordance with the General Conditions.
 2. Submit with other scheduled submittals for the material or equipment allowing time for ENGINEER to evaluate the additional information required to be submitted.
 3. If CONTRACTOR requests to substitute for material or equipment specified but not identified in Specifications as requiring submittals, schedule substitution submittal request in Submittal schedule and submit as scheduled.

C. Shop Drawings:

1. Check all drawings, data and samples before submitting to the ENGINEER for review. Each and every copy of the drawings and data shall bear CONTRACTOR's stamp showing that they have been so checked. Shop drawings submitted to the ENGINEER without the CONTRACTOR's stamp will be returned to the CONTRACTOR for conformance with this requirement. All shop drawings shall be submitted through the CONTRACTOR, including those from any subcontractors.
2. Submit newly prepared information, with graphic information at accurate scale. Indicate name of manufacturer or supplier (firm name). Show dimensions and clearly note which are based on field measurement; identify materials and products which are included in the Work; identify revisions. Indicate compliance with standards and notation of coordination requirements with other work. Highlight, encircle or otherwise indicate variations from Contract Documents or previous submittals.
3. Include on each drawing or page:
 - a. Submittal date and revision dates.
 - b. Project name, division number and descriptions.
 - c. Detailed specifications section number and page number.
 - d. Identification of equipment, product or material.
 - e. Name of CONTRACTOR and Subcontractor.
 - f. Name of Supplier and Manufacturer.
 - g. Relation to adjacent structure or material.
 - h. Field dimensions, clearly identified.
 - i. Standards or Industry Specification references.
 - j. Identification of deviations from the Contract Documents.
 - k. CONTRACTOR's stamp, initialed or signed, dated and certifying to review of submittal, certification of field measurements and compliance with Contract.
 - l. Physical location and location relative to other connected or attached material at which the equipment or materials are to be installed.
4. Provide 8-inch by 3-inch blank space for CONTRACTOR and ENGINEER stamps.
5. Submittals:
 - a. Submit 3 blue line or black line prints, or 2 reverse sepia reproducible and 1 blue or black line print. One reproducible or one print will be returned.

6. Distribution:

- a. Do not proceed with installation of materials, products or systems until copy of applicable product data showing only approved information is in possession of installer.
- b. Maintain one set of product data (for each submittal) at Project site.
- c. Mark 5 additional copies with the date of approval and forward to the ENGINEER for use in field and for OWNER's records.

D. Product Data:

1. Preparation:

- a. Collect required data into single submittal for each element of work or system. Where product data has been printed to include information on several similar products, some of which are not required for use on Project or are not included in submittal, mark copies to clearly show such information is not applicable.
- b. Where product data must be specially prepared for required products, materials or systems, because standard printed data are not suitable for use, submit data as a Shop Drawing and not as product data.

2. Submittals:

- a. Submittal is for information and record, and to determine that products, materials, and systems comply with Contract Documents. Submittal is final when returned by ENGINEER marked "Approved" or "Approved as Noted".
- b. Submit 3 copies.

3. Distribution:

- a. Do not proceed with installation of materials, products or systems until copy of applicable product data showing only approval information is in possession of installer.
- b. Maintain one set of product data (for each submittal) at Project site, available for reference by ENGINEER and others.
- c. Mark 5 additional copies with the date of approval and forward to the ENGINEER for use in field and for OWNER records.

E. Samples:

1. Preparation:

- a. Where possible, provide samples that are physically identical with proposed materials or products to be incorporated into the Work. Where variations in color, pattern or texture are inherent in material or product represented by sample, submit multiple units (not less than 3 units) showing approximate limits of variations.
- b. Provide full set of optional samples where ENGINEER's selection required. Prepare samples to match ENGINEER's selection where so indicated.
- c. Include information with each sample to show generic description, source or product name and manufacturer, limitations, and compliance with standards.
- d. Submit samples for ENGINEER's visual review of general generic kind, color, pattern, texture, and for final check of coordination of these characteristics with other related elements of work.

2. Submittals:
 - a. At CONTRACTOR's option, and depending upon nature of anticipated response from ENGINEER, initial submittal of samples may be either preliminary or final submittal.
 - b. A preliminary submittal, consisting of a single set of samples, is required where specifications indicate ENGINEER's selection of color, pattern, texture or similar characteristics from manufacturer's range of standard choices is necessary. Preliminary submittals will be reviewed and returned with ENGINEER's "Action" marking.
 - c. Final Submittals: Submit 3 sets of samples in final submittal, 1 set will be returned.
3. Distribution:
 - a. Maintain returned final set of samples at Project site, in suitable condition and available for quality control comparisons throughout course of performing work.
 - b. Returned samples intended or permitted to be incorporated in the Work are indicated in Specification sections, and shall be in undamaged condition at time of use.

F. Mock-Ups:

1. Mock-ups and similar samples specified in Specification sections are recognized as special type of samples. Comply with samples submittal requirements to greatest extent possible. Process transmittal forms to provide record of activity.

G. Miscellaneous Submittals:

1. Inspection and Test Reports:

- a. Classify each inspection and test report as being either "Shop Drawings" or "product data", depending on whether report is specially prepared for Project or standard publication of workmanship control testing at point of production. Process inspection and test reports accordingly.
2. Guarantees, Warranties, Maintenance Agreements, and Workmanship Bonds:
 - a. Refer to Specification sections for specific requirements. Submittal is final when returned by ENGINEER marked "Approved" or "Approved as Noted".
 - b. In addition to copies desired for CONTRACTOR's use, furnish 2 executed copies. Provide 2 additional copies where required for maintenance data.
3. Survey Data:
 - a. Refer to Specification sections for specific requirements on property surveys, building or structure condition surveys, field measurements, quantitative records of actual Work, damage surveys, photographs, and similar data required by Specification sections. Copies will not be returned.
 1. Survey Copies: Furnish 2 copies. Provide 10 copies of final property survey (if any).
 2. Condition Surveys: Furnish 2 copies.
4. Certifications:
 - a. Refer to Specification sections for specific requirement on submittal of certifications. Submit 7 copies. Certifications are submitted for review of conformance with specified requirements and information. Submittal is final when returned by ENGINEER marked "Approved".
5. Closeout Submittals:
 - a. Refer to Specification Section 01720 for specific requirements on submittal of closeout information, materials, tools, and similar items.
 1. Record Documents: Section 01720.
 2. Materials and Tools: Spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.
 3. Operating and maintenance data.

H. Operation and Maintenance Manuals:

1. Submit Operation and Maintenance Manuals in accordance with Section 01730.

I. General Distribution:

1. Unless required elsewhere, provide distribution of submittals to subcontractors, suppliers, governing authorities, and others as necessary for proper performance of work.

1.5 ACTION ON SUBMITTALS

A. ENGINEER's Action:

1. General:

- a. Except for submittals for record and similar purposes, where action and return on submittals are required or requested, ENGINEER will review each submittal, mark with appropriate action, and return. Where submittal must be held for coordination, ENGINEER will also advise CONTRACTOR without delay.
- b. ENGINEER will stamp each submittal with uniform, self-explanatory action stamp, appropriately marked with submittal action.

B. Action Stamp:

1. Approved:

- a. Final Unrestricted Release: Where submittals are marked "Approved", Work covered by submittal may proceed PROVIDED IT COMPLIES WITH CONTRACT DOCUMENTS. Acceptance of Work will depend upon that compliance.

2. Approved As Noted:

- a. When submittals are marked "Approved as Noted", Work covered by submittal may proceed PROVIDED IT COMPLIES WITH BOTH ENGINEER'S NOTATIONS OR CORRECTIONS ON SUBMITTAL AND WITH Contract Documents. Acceptance of Work will depend on that compliance. Re-submittal is not required.

3. Comments Attached - Confirm or Resubmit:

- a. When submittals are marked "Examined and Returned for Correction", do not proceed with Work covered by submittal. Do not permit Work covered by submittal to be used at Project site or elsewhere where Work is in progress.
- b. Revise submittal or prepare new submittal in accordance with ENGINEER's notations in accordance with Paragraph 1.3D of this section. Resubmit submittal without delay. Repeat if necessary to obtain different action marking.

1.6 RE-SUBMITTAL REVIEW

- A. Cost of Subsequent Reviews: Shop Drawings and Operation and Maintenance Manuals submitted for each item will be reviewed no more than twice at the OWNER's expense. All subsequent reviews will be performed at times convenient to the ENGINEER and at the CONTRACTOR's expense based on the ENGINEER's then prevailing rates including all direct and indirect costs and fees. Reimburse the OWNER for all such fees invoiced to the OWNER by the ENGINEER.
- B. Time Extension: Any need for more than one resubmission, or any other delay in ENGINEER's review of submittals, will not entitle CONTRACTOR to extension of the Contract Time.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01310
PROGRESS SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Form of Schedules
- B. Content of Schedules: Submit for approval, a preliminary progress schedule in accordance with the General Conditions.
- C. Schedule Revisions
- D. Submittal Requirements

1.2 FORM OF SCHEDULES

- A. Prepare schedules in form of a horizontal bar chart.
 - 1. Provide separate horizontal bar for each trade or operation.
 - 2. Utilize a horizontal time scale and identify first work day of each week.
 - 3. Utilize scale and spacings to allow space for notations and future revisions.
- B. Utilize a listing format which chronologically indicates the order of start of each item of work.
- C. Identify each listing by major specification section numbers.

1.3 CONTENT OF SCHEDULES

- A. Completion Dates: Show the beginning and ending contract dates stated in documents. Schedules showing completion prior to the contract completion date will be accepted but in no event will they be considered basis for a claim for delay against the OWNER by the CONTRACTOR for the period between the early completion date and the completion date provided in the Contract Documents.
- B. Show complete sequence of construction by activity.
- C. Show dates for beginning and completion of each major element of construction and installation dates for major items of equipment. Elements shall include, but not be limited to, the following:
 - 1. Shop drawing receipt from supplier/manufacturer submitted to ENGINEER, review and return to supplier/manufacturer
 - 2. Material and equipment order, manufacturer, delivery, installation, and checkouts
 - 3. Performance tests and supervisory services activity

4. Construction of various facilities
5. Demolition
6. Excavation, sheeting, shoring, dewatering
7. Concrete placement sequence
8. Structural steel erection
9. Wall and roof construction
10. Piping and equipment installation
11. Electrical work activity
12. Heating, ventilating, and air conditioning work activity
13. Plumbing work activity
14. Sewer installation
15. Connection to existing sewers
16. Water main installation
17. Miscellaneous concrete placement
18. Subcontractor's items of work
19. Backfilling, grading, seeding, sodding, landscaping, fence construction, and paving
20. Final cleanup
21. Allowance for inclement weather
22. Coordination with concurrent Work on site

D. Show projected percentage of completion for each item as of first day of each month.

1.4 SCHEDULE REVISIONS

- A. As a minimum, revise construction schedule every 30 calendar days to reflect changes in progress of Work for duration of Contract.
- B. Indicate progress of each activity at date of submittal.
- C. Show changes occurring since previous submittal of schedule.
 1. Major change in scope
 2. Activities modified since previous submittal

3. Revised projections of progress and completion
4. Other identifiable changes

D. Provide a written report as needed to define:

1. Problem areas, anticipated delays, and impact on schedule
2. Corrective action recommended and its effect
3. Effect of changes on schedules of other Contractors

1.5 SUBMITTAL REQUIREMENTS

- A. Schedule: Submit final progress schedule in accordance with the General Conditions.
- B. For preliminary and final submittal of construction progress schedule and subsequent revisions thereof furnish three copies to ENGINEER.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01390
COLOR AUDIO-VIDEO CONSTRUCTION RECORD

PART 1 GENERAL

1.1 SCOPE

A. Prior to commencing work, the CONTRACTOR shall have a continuous color audio-video electronic media site recording taken along the entire length of the project to serve as a record of preconstruction conditions. The electronic media used shall be consistent with the latest available auto-video technology and approved by the ENGINEER.

1.2 CONSTRUCTION SCHEDULE

A. Electronic media site recordings shall not be made more than fifteen (15) calendar days prior to construction. No construction shall begin prior to review and approval of the site recordings covering the construction area by the OWNER.

1.3 PROFESSIONAL ELECTROGRAPHERS (VIDEOGRAPHERS)

A. The CONTRACTOR shall engage the services of a professional electrographer. The color audio-video site recordings shall be prepared by a responsible commercial firm known to be skilled and regularly engaged in the business of preconstruction color audio-video site documentation.

1. The OWNER shall have the authority to reject all or any portion of a site recording not conforming to specifications and order that it be redone at no additional charge. The CONTRACTOR shall reschedule unacceptable coverage within five (5) calendar days after being notified. The OWNER shall designate those areas, if any, to be omitted from or added to the audiovisual coverage. All site recordings and written records shall become the property of OWNER.

PART 2 PRODUCTS

2.1 GENERAL

A total audio-video site recording system and the procedures employed in its use shall be such as to produce a finished project that will fulfill the technical requirements of the project. The video portion of the recording shall produce bright sharp, clear pictures with accurate colors and shall be free from distortion or any other form of picture imperfection. All video recordings shall, by electronic means, display on the screen the time of day, the month, day and year of the recording. This time and date information must be continuously and simultaneously generated with the actual recording. The audio portion of the recording shall produce the commentary of the camera operator with proper clarity and be free from distortion.

2.2 EQUIPMENT

A. Industrial Grade, consistent with the current standards and approved by the ENGINEER.

- B. Recorder: The recording shall be made with an Industrial Grade recorder, consistent with the current standards and approved by the ENGINEER.
- C. Electronic Media: The electronic media shall be an Industrial Grade media, consistent with the current standards and approved by the ENGINEER. The electronic media shall be new and thus shall not have been used for any previous recording.
- D. Electronic media site recordings playback compatibility: The recordings shall be compatible for playback with any American TV Standard electronic media player.

PART 3 EXECUTION

3.1 COVERAGE

- A. The recordings shall contain coverage of all surface features within the construction zone of influence. These features shall include, but not be limited to, all roadways, pavement, retention ponds, railroad tracks, curbs, driveways, sidewalks, culverts, headwalls, retaining walls, landscaping, trees, and fences. Of particular concern shall be the existence or non-existence of any faults, fractures or defects. Electronic media coverage shall be limited to one side of the street at one time and shall include all surface conditions located within the zone of influence supported by appropriate audio description. Panning, zoom-in and zoom-out rates shall be sufficiently controlled to maintain a clear view of the object.

3.2 AUDIO RECORDING

- A. Accompanying the video recording of each electronic media presentation shall be a corresponding and simultaneously recorded audio recording. This audio recording, exclusively containing the commentary of the camera operator shall assist in viewer orientation and in any needed identification, differentiation, clarification, or objective description of the features being shown in the video portion of the recording. The audio recording shall also be free from any conversation between the camera operator and any other production technicians.

3.3 ELECTRONIC MEDIA INDEXING

- A. All electronic media site recordings shall be permanently labeled and shall be properly identified by electronic media site recording number and project title.
- B. Electronic media site recordings log: Each electronic media site recording shall have a log of that recording's contents. The log shall describe the various segments of coverage contained on that recording e.g., the names of the streets or easements, coverage beginning and end, directions of coverage, video unit counter numbers, engineering stationing numbers when possible, and the date of recording.

3.4 TIME OF EXECUTION

- C. Visibility: All recording shall be performed during time of good visibility; no recording shall be

done during periods of significant precipitation, mist or fog. The recording shall only be done when sufficient sunlight is present to properly illuminate the subject and to produce sharp, bright video recordings of those subjects.

3.5 CONTINUITY OF COVERAGE

- D. In order to insure the continuity of coverage, the coverage shall consist of a single continuous unedited recording which begins at one end of a particular construction area; however, where coverage is required in areas not accessible by conventional wheeled vehicles and smooth transport of the recording system is not possible, such coverage shall consist of an organized interrelated sequence of recordings at various positions along that proposed construction area e.g., wooded easement area. Such coverage shall be obtained by walking or by a special conveyance approved by the OWNER.

3.6 COVERAGE RATES

- E. The average rate of travel during a particular segment of coverage shall be directly proportional to the number, size and value of the surface features within that construction area's zone of influence.

3.7 CAMERA OPERATION

- F. Camera Height and Stability: When conventional wheeled vehicles are used as conveyances for the recording system, the vertical distance between the camera lens and the ground shall not exceed ten (10) feet. The camera shall be firmly mounted such that transport of the camera during the recording process will not cause an unsteady picture.
- G. Camera Control: Camera pan, tilt, zoom-in and zoom-out rate shall be sufficiently controlled such that recorded objects shall be clearly viewed during audio-video playback. In addition, all other camera and recording system controls, such as lens focus and aperture, video level, pedestal, chroma, white balance and electrical focus shall be properly controlled or adjusted to maximize picture quality.
- H. Viewer Orientation Techniques: The audio and video portions of the recording shall maintain viewer orientation. To this end, overall establishing views of all visible house and business addresses shall be utilized. In areas where the proposed construction location will not be readily apparent to the electronic media viewer, highly visible yellow flags shall be placed, by the CONTRACTOR, in such a fashion as to clearly indicate the proposed center line of construction.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01400
QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Submittals
- B. Inspection Services
- C. Inspection of Materials
- D. Quality Control
- E. Costs of Inspection
- F. Acceptance Tests
- G. Failure to Comply with Contract

1.2 RELATED SECTIONS

- A. Section 01300 - Submittals: Specific Submittal Requirements

1.3 SUBMITTALS

- A. General: Provide all submittals, including the following, as specified in Division 1.
- B. Certificate Submittals: Furnish the ENGINEER authoritative evidence in the form of Certificates of Manufacture that the materials and equipment to be used in the Work have been manufactured and tested in conformity with the Contract Documents. Include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

1.4 INSPECTION SERVICES

- A. OWNER's Access: At all times during the progress of the Work and until the date of final completion, afford the OWNER and ENGINEER every reasonable, safe, and proper facility for inspecting the Work at the site. The observation and inspection of any work will not relieve the CONTRACTOR of any obligations to perform proper and satisfactory work as specified. Replace work rejected due to faulty design, inferior, or defective materials, poor workmanship, improper installation, excessive wear, or nonconformity with the requirements of the Contract Documents, with satisfactory work at no additional cost to the OWNER. Replace as directed, finished or unfinished work found not to be in strict accordance with the Contract, even though such work may have been previously approved and payment made therefor.

- B. Rejection: The OWNER and the OWNER's Authorized Representatives have the right to reject materials and workmanship which are defective or require correction. Promptly remove rejected work and materials from the site.
- C. Inferior Work Discoveries: Failure or neglect on the part of the OWNER or the OWNER's Authorized Representatives to condemn or reject bad or inferior work or materials does not imply an acceptance of such work or materials. Neither is it to be construed as barring the OWNER or the OWNER's Authorized Representatives at any subsequent time from recovering damages or a sum of money needed to build anew all portions of the Work in which inferior work or improper materials were used.
- D. Removal for Examination: Should it be considered necessary or advisable by the OWNER or the OWNER's Authorized Representatives, at any time before final acceptance of the Work, to make examinations of portions of the Work already completed, by removing or tearing out such portions, promptly furnish all necessary facilities, labor, and material, to make such an examination. If such Work is found to be defective in any respect, defray all expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the cost of examination and restoration of the Work will be considered a change in the Work to be paid for in accordance with applicable provisions of the Contract.
- E. Operation Responsibility: Assume full responsibility for the proper operation of equipment during tests and instruction periods. Make no claim for damage which may occur to equipment prior to the time when the OWNER accepts the Work.
- F. Rejection Prior to Warranty Expiration: If at anytime prior to the expiration of any applicable warranties or guarantees, equipment is rejected by the OWNER, repay to the OWNER all sums of money received for the rejected equipment on progress certificates or otherwise on account of the Contract lump sum prices, and upon the receipt of the sum of money, OWNER will execute and deliver a bill of sale of all its rights, title, and interest in and to the rejected equipment. Do not remove the equipment from the premises of the OWNER until the OWNER obtains from other sources, equipment to take the place of that rejected. The OWNER hereby agrees to obtain other equipment within a reasonable time and the CONTRACTOR agrees that the OWNER may use the equipment furnished by the CONTRACTOR without rental or other charge until the other new equipment is obtained.

1.5 INSPECTION OF MATERIALS

- A. Premanufacture Notification: Give notice in writing to the ENGINEER sufficiently in advance of the commencement of manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. When required, notice to include a request for inspection, the date of commencement, and the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, ENGINEER will arrange to have a representative present at such times during the manufacture or testing as may be necessary to inspect the materials, or will notify CONTRACTOR that the inspection will be made at a point other than the point of manufacture or testing, or that the inspection will be waived. Comply with these provisions before shipping any materials. Such inspection will not constitute a release from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

B. Testing Standards: Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized, applicable test codes except as may otherwise be stated herein.

1.6 QUALITY CONTROL

A. Testing

1. Field and Laboratory

- a. Provide personnel to assist the ENGINEER in performing the following periodic observation and associated services.
 1. Soils: Observe and test excavations, placement and compaction of soils. Determine suitability of excavated material. Observe subgrade soils and foundations.
 2. Concrete: Observe forms and reinforcement; observe concrete placement; witness air entrainment tests, facilitate concrete cylinder preparation and assist with other tests performed by ENGINEER.
 3. Masonry: Sample and test mortar, bricks, blocks and grout; inspect brick and block samples and sample panels; inspect placement of reinforcement and grouting.
- b. When specified in Divisions 2 through 16 of the Contract Documents, provide an independent laboratory testing facility to perform required testing. Qualify the laboratory as having performed previous satisfactory work. Prior to use, submit to the ENGINEER for approval.
- c. Cooperate with the ENGINEER and laboratory testing representatives. Provide at least 24 hours notice prior to when specified testing is required. Provide labor and materials, and necessary facilities at the site as required by the ENGINEER and the testing laboratory.
- d. Provide an independent testing agency, a member of the National Electrical Testing Association, to perform inspections and tests specified in Division 16 of these Specifications.
2. Equipment: Coordinate and demonstrate test procedures as specified in the Contract Documents or as otherwise required during the formal tests.
3. Pipeline and Other Testing: Conform to test procedures and requirements specified in the appropriate Specification Section.

B. Reports

1. Certified Test Reports: Where transcripts or certified test reports are required by the Contract Documents, meet the following requirements:

- a. Before delivery of materials or equipment submit and obtain approval of the ENGINEER for all required transcripts, certified test reports, certified copies of the reports of all tests required in referenced specifications or specified in the Contract Documents. Perform all testing in an approved independent laboratory or the manufacturer's laboratory. Submit for approval reports of shop equipment tests within thirty days of testing. Transcripts or test reports are to be accompanied by a notarized certificate in the form of a letter from the manufacturer or supplier certifying that tested material or equipment meets the specified requirements and the same type, quality, manufacture and make as specified. The certificate shall be signed by an officer of the manufacturer or the manufacturer's plant manager.
2. Certificate of Compliance: At the option of the ENGINEER, or where not otherwise specified, submit for approval a notarized Certificate of Compliance. The Certificates may be in the form of a letter stating the following:
 - a. Manufacturer has performed all required tests
 - b. Materials to be supplied meet all test requirements
 - c. Tests were performed not more than one year prior to submittal of the certificate
 - d. Materials and equipment subjected to the tests are of the same quality, manufacture and make as those specified
 - e. Identification of the materials

1.7 COSTS OF INSPECTION

- A. OWNER's Obligation: Initial inspection and testing of materials furnished under this Contract will be performed by the OWNER or his authorized Representatives or inspection bureaus without cost to the CONTRACTOR, unless otherwise expressly specified. If subsequent testing is necessary due to failure of the initial tests or because of rejection for noncompliance, reimburse the OWNER for expenditures incurred in making such tests.
- B. CONTRACTOR's Obligation: Include in the Contract Price, the cost of all shop and field tests of equipment and other tests specifically called for in the Contract Documents.
- C. Reimbursements to OWNER:
 1. Materials and equipment submitted by the CONTRACTOR as the equivalent to those specifically named in the Contract may be tested by the OWNER for compliance. Reimburse the OWNER for expenditures incurred in making such tests on materials and equipment which are rejected for noncompliance.
 2. Reimburse OWNER for the costs of any jobsite inspection between the hours of 7:00 p.m. and 6:00 a.m.
 3. Reimburse OWNER for all costs associated with Witness Tests which exceed 5 Calendar Days per kind of equipment.

1.8 ACCEPTANCE TESTS

- A. Preliminary Field Tests: As soon as conditions permit, furnish all labor and materials and services to perform preliminary field tests of all equipment provided under this Contract. If the preliminary field tests disclose that any equipment furnished and installed under this Contract does not meet the requirements of the Contract Documents, make all changes, adjustments and replacements required prior to the acceptance tests.
- B. Final Field Tests: Upon completion of the Work and prior to final payment, subject all equipment, piping and appliances installed under this Contract to specified acceptance tests to demonstrate compliance with the Contract Documents.
 - 1. Furnish all labor, fuel, energy, water and other materials, equipment, instruments and services necessary for all acceptance tests.
 - 2. Conduct field tests in the presence of the ENGINEER. Perform the field tests to demonstrate that under all conditions of operation each equipment item:
 - a. Has not been damaged by transportation or installation
 - b. Has been properly installed
 - c. Has been properly lubricated
 - d. Has no electrical or mechanical defects
 - e. Is in proper alignment
 - f. Has been properly connected
 - g. Is free of overheating of any parts
 - h. Is free of all objectionable vibration
 - i. Is free of overloading of any parts
 - j. Operates as intended
 - 3. Operate work or portions of work for a minimum of 100 hours or 14 days continuous service, whichever comes first. For those items of equipment which would normally operate on wastewater or sludge, plant effluent may be used if available when authorized by ENGINEER. If water can not properly exercise equipment, conduct 100-hour test after plant startup. Conduct test on those systems which require load produced by weather (heating or cooling) exercise only when weather will produce proper load.
- C. Failure of Tests: If the acceptance tests reveal defects in material or equipment, or if the material or equipment in any way fails to comply with the requirements of the Contract Documents, then promptly correct such deficiencies. Failure or refusal to correct the deficiencies, or if the improved materials or equipment, when tested again, fail to meet the guarantees or specified requirements, the OWNER, notwithstanding its partial payment for work and materials or equipment, may reject said materials or equipment and may order the CONTRACTOR to remove the defective work from the site at no addition to the Contract Price, and replace it with material or equipment which meets the Contract Documents.

1.9 FAILURE TO COMPLY WITH CONTRACT

- A. Unacceptable Materials: If it is ascertained by testing or inspection that the material or equipment does not comply with the Contract, do not deliver said material or equipment, or if delivered remove it promptly from the site or from the Work and replace it with acceptable material without additional cost to the OWNER. Fulfill all obligations under the terms and

conditions of the Contract even though the OWNER or the OWNER's Authorized Representatives fail to ascertain noncompliance or notify the CONTRACTOR of noncompliance.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01500
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General Requirements
- B. Temporary Utilities
- C. Temporary Construction
- D. Barricades and Enclosures
- E. Fences
- F. Security
- G. Temporary Controls
- H. Traffic Regulation
- I. Field Offices and Sheds

1.2 GENERAL REQUIREMENTS

- A. Plant and Facilities: Furnish, install, maintain and remove all false work, scaffolding, ladders, hoistways, braces, pumping plants, shields, trestles, roadways, sheeting, centering forms, barricades, drains, flumes, and the like, any of which may be needed in the construction of any part of the Work and which are not herein described or specified in detail. The CONTRACTOR shall accept responsibility for the safety and efficiency of such works and for any damage that may result from their failure or from their improper construction, maintenance or operation.
- B. First Aid: Maintain a readily accessible, completely equipped first aid kit at each location where work is in progress.
- C. Safety Responsibility: Accept sole responsibility for safety and security at the site. Indemnify and hold harmless the OWNER and the OWNER's Authorized Representatives, including the ENGINEER, for any safety violation, or noncompliance with governing bodies and their regulations, and for accidents, deaths, injuries, or damage at the site during occupancy or partial occupancy of the site by CONTRACTOR's forces while performing any part of the Work.
- D. Hazard Communication: Furnish two copies of the CONTRACTOR's Hazard Communication Program required under OSHA regulations before beginning on site activities. Furnish two copies of amendments to Hazard Communications Program as they are prepared.

1.3 TEMPORARY UTILITIES

- A. Water: Provide all necessary and required water without additional cost, unless otherwise specified. If necessary, provide and lay water lines to the place of use; secure all necessary permits; pay for all taps to water mains and hydrants and for all water used at the established rates.
- B. Light and Power: Provide without additional cost to the OWNER temporary lighting and power facilities required for the proper construction and inspection of the Work. If, in the ENGINEER's opinion, these facilities are inadequate, do NOT proceed with any portion of the Work affected thereby. Maintain temporary lighting and power until the Work is accepted.
- C. Heat: Provide temporary heat, whenever required, for work being performed during cold weather to prevent freezing of concrete, water pipes, and other damage to the Work or existing facilities.
- D. Sanitary Facilities: Provide sufficient sanitary facilities for construction personnel. Prohibit and prevent nuisances on the site of the Work or on adjoining property. Discharge any employee who violates this rule. Abide by all environmental regulations or laws applicable to the Work.
- E. Connections to Existing Utilities:
 - 1. Unless otherwise specified or indicated, make all necessary connections to existing facilities including structures, drain lines, and utilities such as water, sewer, gas, telephone, and electricity. In each case, obtain permission from the OWNER or the owning utility prior to undertaking connections. Protect facilities against deleterious substances and damage.
 - 2. Thoroughly plan in advance all connections to existing facilities. Have on hand at the time of undertaking the connections, all material, labor and required equipment. Proceed continuously to complete connections in minimum time. Arrange for the operation of valves or other appurtenances on existing utilities, under the direct supervision of the owning utility.

1.4 TEMPORARY CONSTRUCTION

- A. Bridges: Design and place suitable temporary bridges where necessary for the maintenance of vehicular and pedestrian traffic. Assume responsibility for the sufficiency and safety of all such temporary work or bridges and for any damage which may result from their failure or their improper construction, maintenance, or operation. Indemnify and save harmless the OWNER and the OWNER's representatives from all claims, suits or actions, and damages or costs of every description arising by reason of failure to comply with the above provisions.

1.5 BARRICADES AND ENCLOSURES

- A. Protection of Workmen and Public: Effect and maintain at all times during the prosecution of the Work, barriers and lights necessary for the protection of Workmen and the Public. Provide suitable barricades, lights, "danger" or "caution" or "street closed" signs and watchmen at all

places where the Work causes obstructions to normal traffic, excavation sites, or constitutes in any way a hazard to the public.

B. Barricades and Lights:

1. Protect all streets, roads, highways, excavations and other public thoroughfares which are closed to traffic; use effective barricades which display acceptable warning signs. Locate barricades at the nearest public highway or street on each side of the blocked section.
2. Statutory Requirements: Install and maintain all barricades, signs, lights, and other protective devices within highway rights-of-way in strict conformity with applicable statutory requirements by the authority having jurisdiction.

1.6 FENCES

- A. Existing Fences: Obtain written permission from the OWNER prior to relocating or dismantling fences which interfere with construction operations. Reach agreements with the fence owner as to the period the fence may be left relocated or dismantled. Install adequate gates where fencing must be maintained. Keep gates closed and locked at all times when not in use.
- B. Restoration: Restore all fences to their original or better condition and to their original location on completion of the Work.

1.7 SECURITY

A. Preservation of Property:

1. Preserve from damage, all property along the line of the Work, in the vicinity of or in any way affected by the Work, the removal or destruction of which is not called for by the Drawings. Preserve from damage, public utilities, trees, lawn areas, building monuments, fences, pipe and underground structures, and public streets. Note: Normal wear and tear of streets resulting from legitimate use by the CONTRACTOR are not considered as damage. Whenever damages occur to such property, immediately restore to its original condition. Costs for such repairs are incidental to the Contract.
2. In case of failure on the part of the CONTRACTOR to restore property or make good on damage or injury, the OWNER may, upon 24 hours written notice, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary, and the cost thereof will be deducted from any moneys due or which may become due the CONTRACTOR under this Contract. If removal, repair or replacement of public or private property is made necessary by alteration of grade or alignment authorized by the OWNER and not contemplated by the Contract Documents, the CONTRACTOR will be compensated, in accordance with the General Conditions, provided that such property has not been damaged through fault of the CONTRACTOR or the CONTRACTOR's employees.

B. Public Utility Installations and Structures:

1. Public utility installations and structures include all poles, tracks, pipes, wires, conduits, vaults, manholes, and other appurtenances and facilities, whether owned or controlled by public bodies or privately owned individuals, firms or corporations, used to serve the public with transportation, gas, electricity, telephone, storm and sanitary sewers, water, or other public or private utility services. Facilities appurtenant to public or private property which may be affected by the Work are deemed included hereunder.
2. The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. Existing public utility installations and structures are indicated on the Drawings only to the extent such information was made available to, or found by, the ENGINEER in preparing the Drawings. These data are not guaranteed for completeness or accuracy, and the CONTRACTOR is responsible for making necessary investigations to become fully informed as to the character, condition, and extent of all public utility installations and structures that may be encountered and that may affect the construction operations.
3. Contact utility locating service sufficiently in advance of the start of construction to avoid damage to the utilities and delays to the completion date.
4. Remove, replace, relocate, repair, rebuild, and secure any public utility installations and structures damaged as a direct or indirect result of the Work under this Contract. Costs for such work are incidental to the Contract. Be responsible and liable for any consequential damages done to or suffered by any public utility installations or structures. Assume and accept responsibility for any injury, damage, or loss which may result from or be consequent to interference with, or interruption or discontinuance of, any public utility service.
5. Repair or replace any water, electric, sewer, gas, or other service connection damaged during the Work with no addition to the Contract price.
6. At all times in performance of the Work, employ proven methods and exercise reasonable care and skill to avoid unnecessary delay, injury, damage, or destruction to public utility installations and structures. Avoid unnecessary interference with, or interruption of, public utility services. Cooperate fully with the owners thereof to that end.
7. Give written notice to the owners of all public utility installations and structures affected by proposed construction operations, sufficiently in advance of breaking ground in any area or on any unit of the Work, to obtain their permission before disrupting the lines and to allow them to take measures necessary to protect their interests. Advise the Chiefs of Police, Fire and Rescue Services of any excavation in public streets or the temporary shut-off of any water main. Provide at least 24 hours notice to all affected property owners whenever service connections are taken out of service.

C. Work on Private Property: Work on this project will require operations on private property, rights of way or easements. The OWNER has secured the appropriate easements or rights of entry from the affected property owners. Comply with all easement or rights of entry provisions.

Conduct operations along rights-of-way and easements through private property to avoid damage to the property and to minimize interference with its ordinary use. Upon completion of the Work through such property, restore the surface and all fences or other structures disturbed by the construction as nearly as possible to the preconstruction conditions. Do not remove any material from private property without the consent of the property owner or responsible party in charge of such property. Save the OWNER harmless from any claim or damage arising out of or in connection with the performance of work across and through private property.

D. Miscellaneous Structures: Assume and accept responsibility for all injuries or damage to culverts, building foundations and walls, retaining walls, or other structures of any kind met with during the prosecution of the Work. Assume and accept liability for damages to public or private property resulting therefrom. Adequately protect against freezing all pipes carrying liquid.

E. Protection of Trees and Lawn Areas:

1. Protect with boxes, trees and shrubs, except those ordered to be removed. Do not place excavated material so as to cause injury to such trees or shrubs. Replace trees or shrubs destroyed by accident or negligence of the CONTRACTOR or CONTRACTOR's employees with new stock of similar size and age, at the proper season, at no additional cost to the OWNER.
2. Leave lawn areas in as good condition as before the start of the Work. Restore areas where sod has been removed by seeding or sodding.

1.8 TEMPORARY CONTROLS

A. During Construction:

1. Keep the site of the Work and adjacent premises free from construction materials, debris, and rubbish. Remove this material from any portion of the site if such material, debris, or rubbish constitutes a nuisance or is objectionable.
2. Remove from the site all surplus materials and temporary structures when they are no longer needed.
3. Neatly stack construction materials such as concrete forms and scaffolding when not in use. Promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.
4. Properly store volatile wastes in covered metal containers and remove from the site daily.
5. Do not bury or burn on the site or dispose of into storm drains, sanitary sewers, streams, or waterways, any waste material. Remove all wastes from the site and dispose of in a manner complying with applicable ordinances and laws.

B. Smoke Prevention:

1. Strictly observe all air pollution control regulations.
2. Open fires will be allowed only if permitted under current ordinances.

C. Noises:

1. Maintain acceptable noise levels in the vicinity of the Work. Limit noise production to acceptable levels by using special mufflers, barriers, enclosures, equipment positioning, and other approved methods.
2. Supply written notification to the OWNER sufficiently in advance of the start of any work which violates this provision. Proceed only when all applicable authorizations and variances have been obtained in writing.

D. Hours of Operation:

1. Operation of construction equipment between the hours of 7:00 p.m. and 6:00 a.m. the following day is prohibited. For operation of this equipment during this period obtain written consent from the OWNER.
2. Do not carry out nonemergency work, including equipment moves, on Sundays without prior written authorization by the OWNER.

E. Dust Control:

1. Take measures to prevent unnecessary dust. Keep earth surfaces exposed to dusting moist with water or a chemical dust suppressant. Cover materials in piles or while in transit to prevent blowing or spreading dust.
2. Adequately protect buildings or operating facilities which may be affected adversely by dust. Protect machinery, motors, instrument panels, or similar equipment by suitable dust screens. Include proper ventilation with dust screens.

F. Temporary Drainage Provisions:

1. Provide for the drainage of stormwater and any water applied or discharged on the site in performance of the Work. Provide adequate drainage facilities to prevent damage to the Work, the site, and adjacent property.
2. Supplement existing drainage channels and conduits as necessary to carry all increased runoff from construction operations. Construct dikes as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect the OWNER's facilities and the Work, and to direct water to drainage channels or conduits. Provide ponding as necessary to prevent downstream flooding.
3. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

G. Pollution: Prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris, and other substances resulting from construction activities. Do not permit sanitary

wastes to enter any drain or watercourse other than sanitary sewers. Do not permit sediment, debris, or other substances to enter sanitary sewers. Take reasonable measures to prevent such materials from entering any drain or watercourse.

1.9 TRAFFIC REGULATION

- A. **Parking:** Provide and maintain suitable parking areas for the use of all construction workers and others performing work or furnishing services in connection with the Contract, to avoid any need for parking personal vehicles where they may interfere with public traffic or construction activities.
- B. **Access:** Conduct Work to interfere as little as possible with public travel, whether vehicular or pedestrian. Provide and maintain suitable and safe bridges, detours, or other temporary expedients for the accommodation of public and private travel. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private, give reasonable notice to owners of private drives before interfering with them. Such maintenance of traffic will not be required when the CONTRACTOR has obtained permission from the owner or tenant of private property, or from the authority having jurisdiction over the public property involved, to obstruct traffic at the designated point.

1.10 FIELD OFFICES AND SHEDS

- A. **CONTRACTOR's Office:** Erect, furnish, and maintain a field office with a telephone. Have an authorized agent present at this office at all times while the Work is in progress. Keep readily accessible copies of the Contract Documents, required record documents, and the latest approved shop drawings at this field office.
- B. **Material Sheds and Temporary Structures:** Provide material sheds and other temporary structures of sturdy construction and neat appearance.
- C. **Location:** Coordinate location of field offices, material sheds and temporary structures with ENGINEER and OWNER.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01570

TRAFFIC REGULATION

PART 1 GENERAL

1.1 SECTION INCLUDES:

- A. General Requirements
- B. Traffic Control

1.2 RELATED SECTIONS

- A. Section 01041 – Project Coordination
- B. Section 02230 – Roadway Crossings by Open Cut

1.3 GENERAL REQUIREMENTS

- A. The CONTRACTOR shall be responsible for providing safe and expeditious movement of traffic through construction zones. A construction zone is defined as the immediate areas of actual construction and all abutting areas which are used by the CONTRACTOR and which interfere with the driving or walking public.
- B. Remove temporary equipment and facilities when no longer required, restore grounds to original, or to specified conditions.
- C. The requirements specified herein are in addition to the plan for Maintenance of Traffic as specified in Sections 01041 and 02230.

1.4 TRAFFIC CONTROL

- A. The necessary precautions shall include, but not be limited to, such items as proper construction warning signs, signals, lighting devices, marking, barricades, channelization, and hand signaling devices. The CONTRACTOR shall be responsible for installation and maintenance of all devices and requirements for the duration of the Construction period.
- B. The CONTRACTOR shall provide at least 72 hours notification to the State or County Department of Transportation of the necessity to close any portion of a roadway carrying vehicles or pedestrians so that the final approval of such closings can be obtained at least 48 hours in advanced. At no time will more than one (1) lane of roadway be closed to vehicles and pedestrians. With any such closings adequate provision shall be made for the safe expeditious movement of each.
- C. The CONTRACTOR shall also be responsible for notifying Police, Fire, and other Emergency Departments whenever construction is within roadways and of the alternate routes. Monthly status reports shall be provided to these Departments, as a minimum.
- D. The CONTRACTOR shall be responsible for removal, relocation, or replacement of any traffic control device in the construction area which exists as part of the normal pre-construction

traffic control scheme. Any such actions shall be performed by the CONTRACTOR under the supervision, and in accordance with the Specifications, of the Owner, unless otherwise specified.

- E. The CONTRACTOR shall immediately notify the Owner of any vehicular or pedestrian safety or efficiency problems incurred as a result of the construction of the project.
- F. The CONTRACTOR shall be responsible for notifying all residents of any road construction and limited access at least 72 hours in advance.

PART 2 PRODUCTS

NOT USED.

PART 3 EXECUTION

NOT USED.

END OF SECTION

SECTION 01600
MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Description
- B. Substitutions
- C. Manufacturer's Written Instructions
- D. Transportation and Handling
- E. Storage, Protection and Maintenance
- F. Manufacturer's Field Quality Control Services
- G. Post Startup Services
- H. Special Tools and Lubricating Equipment
- I. Lubrication

1.2 DESCRIPTION

- A. Proposed Manufacturers List: Within 15 calendar days of the date of the Notice to Proceed, submit to the ENGINEER a list of the names of proposed manufacturers, materialmen, suppliers and subcontractors, obtain approval of this list by OWNER prior to submission of any working drawings. Upon request submit evidence to ENGINEER that each proposed manufacturer has manufactured a similar product to the one specified and that it has previously been used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.
- B. Furnish and install Material and Equipment which meets the following:
 1. Conforms to applicable specifications and standards.
 2. Complies with size, make, type, and quality specified or as specifically approved, in writing, by ENGINEER.
 3. Will fit into the space provided with sufficient room for operation and maintenance access and for properly connecting piping, ducts and services, as applicable. Make the clear spaces that will be available for operation and maintenance access and connections equal to or greater than those shown and meeting all the manufacturers' requirements. Make all provisions for installing equipment furnished at no increase in Contract Price.

4. Manufactured and fabricated in accordance with the following:
 - a. Design, fabricate, and assemble in accordance with best engineering and shop practices.
 - b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
 - c. Provide two or more items of same kind identical, by same manufacturer.
 - d. Provide materials and equipment suitable for service conditions.
 - e. Adhere to equipment capabilities, sizes, and dimensions shown or specified unless variations are specifically approved, in writing, in accordance with the Contract Documents.
 - f. Adapt equipment to best economy in power consumption and maintenance. Proportion parts and components for stresses that may occur during continuous or intermittent operation, and for any additional stresses that may occur during fabrication or installation.
 - g. Working parts are readily accessible for inspection and repair, easily duplicated and replaced.
5. Use material or equipment only for the purpose for which it is designed or specified.

1.3 SUBSTITUTIONS

A. Substitutions:

1. CONTRACTOR's requests for changes in equipment and materials from those required by the Contract Documents are considered requests for substitutions and are subject to CONTRACTOR's representations and review provisions of the Contract Documents when one of following conditions are satisfied:
 - a. Where request is directly related to an "or equal" clause or other language of same effect in Specifications.
 - b. Where required equipment or material cannot be provided within Contract Time, but not as result of CONTRACTOR's failure to pursue Work promptly or to coordinate various activities properly.
 - c. Where required equipment or material cannot be provided in manner compatible with other materials of Work, or cannot be properly coordinated therewith.
2. CONTRACTOR'S Options:
 - a. Where more than one choice is available as options for CONTRACTOR's selection of equipment or material, select option compatible with other

equipment and materials already selected (which may have been from among options for other equipment and materials).

- b. Where compliance with specified standard, code or regulation is required, select from among products which comply with requirements of those standards, codes, and regulations.
- c. "Or Equal": For equipment or materials specified by naming one or more equipment manufacturer and "or equal", submit request for substitution for any equipment or manufacturer not specifically named.

B. Conditions Which are Not Substitution:

1. Requirements for substitutions do not apply to CONTRACTOR options on materials and equipment provided for in the Specifications.
2. Revisions to Contract Documents, where requested by OWNER or ENGINEER, are "changes" not "substitutions".
3. CONTRACTOR's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute substitutions and do not constitute basis for a Change Order, except as provided for in Contract Documents.

1.4 MANUFACTURER'S WRITTEN INSTRUCTIONS

A. Instruction Distribution: When the Contract Documents require that installation, storage, maintenance and handling of equipment and materials comply with manufacturer's written instructions, obtain and distribute printed copies of such instructions to parties involved in installation, including six copies to ENGINEER.

1. Maintain one set of complete instructions at jobsite during storage and installation, and until completion of work.

B. Manufacturer's Requirements: Store, maintain, handle, install, connect, clean, condition, and adjust products in accordance with manufacturer's written instructions and in conformity with Specifications.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult ENGINEER for further instructions.
2. Do not proceed with work without written instructions.

C. Performance Procedures: Perform work in accordance with manufacturer's written instructions. Do not omit preparatory steps or installation procedures, unless specifically modified or exempted by Contract Documents.

1.5 TRANSPORTATION AND HANDLING

- A. Coordination with Schedule: Arrange deliveries of materials and equipment in accordance with Construction Progress Schedules. Coordinate to avoid conflict with work and conditions at site.
 - 1. Deliver materials and equipment in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
 - 2. Protect bright machined surfaces, such as shafts and valve faces, with a heavy coat of grease prior to shipment.
 - 3. Immediately upon delivery, inspect shipments to determine compliance with requirements of Contract Documents and approved submittals and that material and equipment are protected and undamaged.
- B. Handling: Provide equipment and personnel to handle material and equipment by methods recommended by manufacturer to prevent soiling or damage to materials and equipment or packaging.

1.6 STORAGE, PROTECTION, AND MAINTENANCE

- A. On-site storage areas and buildings:
 - 1. Conform storage buildings to requirements of Section 01500.
 - 2. Coordinate location of storage areas with ENGINEER and OWNER.
 - 3. Arrange on site storage areas for proper protection and segregation of stored materials and equipment with proper drainage. Provide for safe travel around storage areas and safe access to stored materials and equipment.
 - 4. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
 - 5. Store materials such as pipe, reinforcing and structural steel, and equipment on pallets, blocks or racks, off ground.
 - 6. PVC Pipe may be damaged by prolonged exposure to direct sunlight and the CONTRACTOR shall take necessary precautions during storage and installation to avoid this damage. Pipe shall be stored under cover, and installed with sufficient backfill to shield it from the sun.
 - 7. Store fabricated materials and equipment above ground, on blocking or skids, to prevent soiling or staining. Cover materials and equipment which are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.
- B. Interior Storage:

1. Store materials and equipment in accordance with manufacturer's instructions, with seals and labels intact and legible.
2. Store materials and equipment, subject to damage by elements, in weather-tight enclosures.
3. Maintain temperature and humidity within ranges required by manufacturer's instructions.

C. Accessible Storage: Arrange storage in a manner to provide easy access for inspection and inventory. Make periodic inspections of stored materials or equipment to assure that materials or equipment are maintained under specified conditions and free from damage or deterioration.

1. Perform maintenance on stored materials or equipment in accordance with manufacturer's instructions, in presence of OWNER or ENGINEER.
2. Submit a report of completed maintenance to ENGINEER with each Application for Payment.
3. Failure to perform maintenance, to notify ENGINEER of intent to perform maintenance or to submit maintenance report may result in rejection of material or equipment.

D. OWNER's Responsibility: OWNER assumes no responsibility for materials or equipment stored in buildings or on-site. CONTRACTOR assumes full responsibility for damage due to storage of materials or equipment.

E. CONTRACTOR's Responsibility: CONTRACTOR assumes full responsibility for protection of completed construction. Repair and restore damage to completed Work equal to its original condition.

F. Special Equipment: Use only rubber tired wheelbarrows, buggies, trucks, or dollies to wheel loads over finished floors, regardless if the floor has been protected or not. This applies to finished floors and to exposed concrete floors as well as those covered with composition tile or other applied surfacing.

G. Surface Damage: Where structural concrete is also the finished surface, take care to avoid marking or damaging surface.

H. Inspection of materials stored offsite: Stored materials submitted for payment must be stored onsite unless an alternate location is approved by the Engineer and accepted by the Owner. The Owner reserves the right to inspect all items before releasing payment for stored materials. The Contractor will be responsible for transportation and other expenses related to the inspection should out of town travel be required.

1.7 MANUFACTURER'S FIELD QUALITY CONTROL SERVICES

A. General:

1. Provide manufacturer's field services in accordance with this subsection for those tasks specified in other sections.
2. Include and pay all costs for suppliers' and manufacturers' services, including, but not limited to, those specified.

B. Installation Instruction: Provide instruction by competent and experienced technical representatives of equipment manufacturers or system suppliers as necessary to resolve assembly or installation procedures which are attributable to, or associated with, the equipment furnished.

C. Installation Inspection, Adjustments and Startup Participation:

1. Provide competent and experienced technical representatives of equipment manufacturers or system suppliers to inspect the completed installation as follows:
 - a. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or for other conditions which may cause damage.
 - b. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
 - c. Verify that wiring and support components for equipment are complete.
 - d. Verify that equipment or system is installed in accordance with the manufacturer's recommendations, approved shop drawings and the Contract Documents.
 - e. Verify that nothing in the installation voids any warranty.
2. Provide manufacturer's representatives to perform initial equipment and system adjustment and calibration conforming to the manufacturer's recommendations and instructions, approved shop drawings and the Contract Documents.
3. Obtain ENGINEER's approval before start-up of equipment. Execute start-up under supervision of applicable manufacturer's representative in accordance with manufacturers' instructions.
4. Furnish ENGINEER with three copies of the following. When training is specified, furnish the copies at least 24 hours prior to training.
 - a. "Certificate of Installation, Inspection and Start-up Services" by manufacturers' representatives for each piece of equipment and each system specified, certifying:
 1. That equipment is installed in accordance with the manufacturers' recommendations, approved shop drawings and the Contract Documents.

2. That nothing in the installation voids any warranty.
3. That equipment has been operated in the presence of the manufacturer's representative.
4. That equipment, as installed, is ready to be operated by others.

b. Detailed report by manufacturers' representatives, for review by ENGINEER of the installation, inspection and start-up services performed, including:

1. Description of calibration and adjustments if made; if not in Operation and Maintenance Manuals, attach copy.
2. Description of any parts replaced and why replaced.
3. Type, brand name, and quantity of lubrication used, if any.
4. General condition of equipment.
5. Description of problems encountered, and corrective action taken.
6. Any special instructions left with CONTRACTOR or ENGINEER.

D. Field Test Participation: Provide competent and experienced technical representatives of all equipment manufacturers and system suppliers as necessary to participate in field testing of the equipment specified in Section 01400.

E. Trouble-Free Operation: Provide competent and experienced technical representatives of all equipment manufacturers and system suppliers as necessary to place the equipment in trouble-free operation after completion of start-up and field tests.

1.8 POST START-UP SERVICES

A. General: Provide Post Start-up Services in accordance with this subsection for equipment specified in other sections.

B. Site Visit: Provide the services of an authorized service representative for each equipment manufacturer or system supplier to make a final site visit after the equipment or system has been in operation for at least 6 months, but no longer than 11 months. Furnish assistance to OWNER's operating personnel in making adjustments and calibrations required to determine that the equipment and system is operating in conformance with design, manufacturer's, and specification requirements. Instruct the personnel in a review of proper operation and maintenance procedures.

C. Certificate: Furnish "Certificate of Post Start-up Services" cosigned by ENGINEER and the manufacturer's representative, certifying that this service has been performed. Use form provided in this section, and furnish OWNER with three copies.

1.9 SPECIAL TOOLS AND LUBRICATING EQUIPMENT

- A. General: Furnish, per manufacturer's recommendations, special tools required for checking, testing, parts replacement, and maintenance. (Special tools are those which have been specially designed or adapted for use on parts of the equipment, and which are not customarily and routinely carried by maintenance mechanics.)
- B. Time of Delivery: Deliver special tools and lubricating equipment to OWNER when unit is placed into operation and after operating personnel have been properly instructed in operation, repair, and maintenance of equipment.
- C. Quality: Provide tools and lubricating equipment of a quality meeting equipment manufacturer's requirements.

1.10 LUBRICATION

- A. General: Where lubrication is required for proper operation of equipment, incorporate in the equipment the necessary and proper provisions in accordance with manufacturer's requirements. Where possible, make lubrication automated and positive.
- B. Oil Reservoirs: Where oil is used, supply reservoir of sufficient capacity to lubricate unit for a 24-hour period.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

CERTIFICATE OF POST START-UP SERVICES

Project _____

Equipment _____

Specification Section _____

Contract _____

I hereby certify the Manufacturers' Representative has inspected this equipment, made adjustments and calibrations, and that it is operating in conformance with the design, specifications, and manufacturer's requirements. Detailed notation of improper operation with corresponding recommendations, if any, are made and attached to this form.

MANUFACTURERS' REPRESENTATIVE

Signature _____ Date _____

Name (print) _____

Title _____

Representing _____

CONTRACTOR

Signature _____ Date _____

Name (print) _____

Title _____

ENGINEER

Signature _____ Date _____

Name (print) _____

Title _____

Complete and submit three copies of this form to OWNER upon completion of 6 to 11 months re-inspection as required by Specification Section 01600.

(NO TEXT FOR THIS PAGE)

SECTION 01710

CLEANING

PART 1 GENERAL

1.1 SECTION INCLUDES:

- A. General Requirements
- B. Disposal Requirements

1.2 GENERAL REQUIREMENTS

- A. Execute cleaning during progress of the work and at completion of the work.

1.3 DISPOSAL REQUIREMENTS

- A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 DURING CONSTRUCTION

- A. Execute daily cleaning to keep the work, the site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris, resulting from construction operations.
- B. Provide onsite containers for the collection of waste materials, debris and rubbish. All waste materials including containers, food debris and other miscellaneous materials must be disposed of daily in onsite containers.
- C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

3.2 FINAL CLEANING

- A. Requirements: At the completion of work and immediately prior to final inspection, clean the entire project as follows:
 1. Thoroughly clean, sweep, wash, and polish all work and equipment provided under the Contract, including finishes. Leave the structures and site in a complete and finished condition to the satisfaction of the ENGINEER.

2. Direct all subcontractors to similarly perform, at the same time, an equivalent thorough cleaning of all work and equipment provided under their contracts.
3. Remove all temporary structures and all debris, including dirt, sand, gravel, rubbish and waste material.
4. Should the CONTRACTOR not remove rubbish or debris or not clean the buildings and site as specified above, the OWNER reserves the right to have the cleaning done at the expense of the CONTRACTOR.

B. Employ experienced workers, or professional cleaners, for final cleaning.

C. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

D. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.

E. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces. Polish surfaces so designated to shine finish.

F. Repair, patch, and touch up marred surfaces to specified finish, to match adjacent surfaces.

G. Replace air-handling filters if units were operated during construction.

H. Clean ducts, blowers, and coils, if air-handling units were operated without filters during construction.

I. Vacuum clean all interior spaces, including inside cabinets.

J. Handle materials in a controlled manner with as few handlings as possible. Do not drop or throw materials from heights.

K. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly-painted surfaces.

L. Clean interior of all panel cabinets, pull boxes, and other equipment enclosures.

M. Wash and wipe clean all lighting fixtures, lamps, and other electrical equipment which may have become soiled during installation.

N. Perform touch-up painting.

O. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.

P. Remove erection plant, tools, temporary structures and other materials.

Q. Remove and dispose of all water, dirt, rubbish or any other foreign substances.

3.3 FINAL INSPECTION

- A. After cleaning is complete the final inspection may be scheduled. The inspection will be done with the OWNER and ENGINEER.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01720

CONTRACT CLOSE OUT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Warranties and Bonds
- B. Record Drawings
- C. Special Tools

1.2 WARRANTIES AND BONDS

Prior to final payment deliver to the OWNER the original and one copy of all bonds, warranties, guarantees and similar documents, including those customarily provided by manufacturers and suppliers which cover a period greater than the one year correction period. Show OWNER as beneficiary of these documents.

1.3 RECORD DRAWINGS

At the site keep and maintain one record copy of all Contract Documents, reference documents and all technical documents submitted in good order. As the work progresses the CONTRACTOR shall record on one set of reproducible drawings all changes and deviations from the original Plans. He shall record the exact location of all changes in vertical and horizontal alignment by offsets and ties at each; sewer, water, electric, gas, communication and other services by off-set distance to permanent improvements such as building and curbs.

Prior to acceptance of the project and before final payment is made, the Engineer shall submit one (1) set of reproducible drawings, two (2) sets of blueline or blackline prints, all marked "Drawings of Record". These Record Drawings must be certified by the Florida Registered Professional Engineer, who prepared the plans and signs and seals these plan, and submits AutoCAD compatible diskette copy of the drawings, and other applicable related records to the Department of Lee County Utilities.

These Record Drawings must be certified by the Florida Registered Professional Engineer, who prepared the plans and signs and seals these plans. The Record Drawings shall include vertical and horizontal alignment of all water, sewer, and effluent reuse lines, valves, tees, bends, reducers, hydrants, pump stations, service connections, meter boxes and/or pads, and other pertinent structures. Pipeline runs in excess of 152.4m, (500'), without fittings shall include vertical alignment information at 152.4m, (500') intervals. Said alignment shall be tied to permanent improvements, such as roadway and/or railroad centerlines and rights-of-way, building and property corners, and shall be certified by a Professional Land Surveyor, licensed in the State of Florida. The Professional Land Surveyor can coordinate with the Contractor to install the necessary appurtenances on buried utilities to facilitate the survey after construction is completed. In addition, property strap numbers and street names shall be shown on the plan.

On a case by case basis, Lee County Utilities may waive the requirement for certification by a Professional Land Surveyor, licensed in the State of Florida. However, prior consent must first be obtained from Lee County Utilities. The County shall withhold final acceptance of the project until the requirement for record drawings and related records has been met. Record Drawings without detailed field verified horizontal and vertical locations of all facilities shown will be rejected.

1.4 SPECIAL TOOLS

Special tools are considered to be those tools which, because of their limited use, are not normally available but which are necessary for maintenance of particular equipment.

For each type of equipment provided under this CONTRACT, furnish a complete set of all special tools including grease guns and other lubricating devices, which may be needed for the adjustment, operation, maintenance, and disassembly of such equipment. Furnish only tools of high grade, smooth forged alloy tool steel. Manufacture grease guns of the lever type.

Furnish and erect one or more neat and substantial steel wall cases or cabinets with flat key locks and clips or hooks to hold each special tool in a convenient arrangement.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01740
WARRANTIES AND BONDS

PART 1 GENERAL

1.1 REQUIREMENTS INCLUDED

- A. Compile specified warranties and bonds, as in Articles 6 and 13 of the General Conditions.
- B. Co-execute submittals when so specified.
- C. Review submittals to verify compliance with Contract Documents.
- D. Submit to the ENGINEER for review and transmittal to OWNER.

1.2 SUBMITTAL REQUIREMENTS

- A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. Two original signed copies are required.
- C. Table of Contents. Neatly typed in orderly sequence. Provide complete information for each items.
 - 1. Product or work item.
 - 2. Firm, with name of principal, address and telephone number.
 - 3. Scope.
 - 4. Date of beginning warranty, bond or service and maintenance contract.
 - 5. Duration of warranty, bond or service maintenance contract.
 - 6. Provide information for OWNER's personnel:
 - a. Proper procedure in case of failure.
 - b. Instances which might affect the validity of warranty or bond.
 - 7. CONTRACTOR, name of responsible principal, address and telephone number.

1.3 FORM OF SUBMITTALS

- A. Prepare in duplicate packets.
- B. Format:
 - 1. Size 8-1/2" x 11", punch sheets for standard 3-post binder.
 - a. Fold larger sheets to fit into binders.
 - 2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS" list:
 - a. Title of Project
 - b. Name of CONTRACTOR

C. Binders: Commercial quality, three-post binder, with durable and cleanable plastic covers and maximum post width of 2 inches.

1.4 WARRANTY SUBMITTAL REQUIREMENTS

A. For all major pieces of equipment, submit a warranty from the equipment manufacturer. The manufacturer's warranty period shall be concurrent with the CONTRACTOR's for one (1) year, unless otherwise specified, commencing at the time of substantial completion.

B. The CONTRACTOR shall be responsible for obtaining certificates for equipment warranty for all major equipment specified under Division 11, 13, 14, 15, and 16 and which has a 1 HP motor or which lists for more than \$1,000. The ENGINEER reserves the right to request warranties for equipment not classified as major. The CONTRACTOR shall still warrant equipment not considered to be "major" in the CONTRACTOR's one-year warranty period even though certificates of warranty may not be required.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 02051
PIPELINE DEMOLITION AND ABANDONING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: All work necessary for the removal and disposal or abandoning in place of piping and appurtenances as indicated on the Drawings.
- B. Basic Procedures and Schedule: Carry out demolition so that adjacent facilities, which are to remain, are not endangered. Schedule the work so as not to interfere with the day to day operation of the existing facilities.
- C. Additional Requirements: Provide dust control and make provisions for safety.

1.2 SUBMITTALS

- A. Provide all submittals, including the following, as specified in Division 1.
- B. Site Inspection and recording: Visit the site and inspect existing facilities. Record existing visible facilities in accordance with Section 01390.

1.3 QUALITY ASSURANCE

- A. Limits: Exercise care to remove or abandon in place only piping as indicated on the Drawings. Where only parts of a pipeline are to be removed, cut lines with a suitable saw so that damage to the remaining pipe is held to a minimum.

PART 2 PRODUCTS

2.1 GROUT

- A. Pipes to be abandoned in place shall be filled with flowable fill as defined in FDOT Standard Specifications – Section 121.

PART 3 EXECUTION

3.1 EXAMINATION OF EXISTING FACILITIES

- A. The locations of facilities to be removed or abandoned in place are indicated on the Drawings. Other facilities to remain in service are shown based on information provided by others, and the accuracy of the locations cannot be guaranteed. The CONTRACTOR shall locate existing facilities, above and below ground, prior to commencing demolition work.

3.2 PROTECTION

- A. General Safety: Provide warning signs, protective barriers, and warning lights as necessary adjacent to the work as approved or required. Maintain these items during the demolition period.
- B. Existing Services: Cap, reroute or reconnect interconnecting piping that is to remain in service either permanently or temporarily in a manner that will not interfere with the operation of the remaining facilities. Protect all other facilities to prevent damage. Damage to facilities to remain in service shall be repaired by the CONTRACTOR at no additional cost to the OWNER.
- C. Hazards: Perform testing and air purging where the presence of hazardous chemicals, gases, flammable materials or other dangerous substances is apparent or suspected, and eliminate the hazard before demolition is started. Use proper personal protective equipment.

3.3 DEMOLITION REQUIREMENTS

- A. Explosives: The use of explosives will not be permitted.
- B. Removal: Remove all debris during demolition and do not allow debris to accumulate in piles.
- C. Access: Provide safe access to and egress from all working areas at all times with adequate protection.
- D. Lighting: Provide adequate lighting at all times during demolition.

3.4 DISPOSAL OF MATERIALS

- A. Final Removal: Remove all debris, rubbish, scrap pieces, equipment, and materials resulting from the demolition unless otherwise indicated. Take title to all demolished materials and remove such items from the site. Properly and legally dispose of materials removed from the site.
- B. Asbestos cement pipe shall be handled and disposed of by properly trained and qualified personnel, adhering to all safety and regulatory requirements. Disposal shall be at facilities permitted to receive such material. Handling and disposal methods shall be in conformance with all local, state and federal rules and regulations, including those of OSHA, EPA and FDOT Section 100-9.5 Hazardous Materials/Waste. The OWNER reserves the right to request manifest documentation.

3.5 ABANDONING IN PLACE

- A. Fill pipes to be abandoned in place with flowable fill, ensuring that the pipe is completely filled.
- B. Provide caps on ends of pipe being abandoned.
- C. Open or close valves to be abandoned as necessary for proper operation of the facilities remaining in service. Render the valves inoperable by removing the valve stem. Remove the valve box or fill with soil or flowable fill.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02110

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements for clearing of all areas within the Contract limits and other areas shown, including work designated in permits and other agreements, in accordance with the requirements of Division 1.
- B. Related Work Specified in Other Sections Includes:
 - 1. Section 02222 - Excavation - Earth and Rock
 - 2. Section 02223 - Backfilling
 - 3. Section 02400 – Lawn Restoration

1.2 DEFINITIONS

- A. Clearing: Clearing is the removal from the ground surface and disposal, within the designated areas, of trees, brush, shrubs, down timber, decayed wood, other vegetation, rubbish and debris as well as the removal of fences.
- B. Grubbing: Grubbing is the removal and disposal of all stumps, buried logs, roots larger than 1-1/2 inches, matted roots and organic materials.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 TREE REMOVAL

- A. Tree Removal Within Property Limits: Remove trees and shrubs within the limits of the right-of-way or easement unless otherwise indicated.
 - 1. Remove trees and shrubs to avoid damage to trees and shrubs designated to remain.
 - 2. Grub and remove tree stumps and shrubs felled within the right-of-way or easement to an authorized disposal site. Fill depressions created by such removal with material suitable for backfill as specified in Section 02223.
- B. Tree Removal Outside Property Limits: Do not cut or damage trees outside the right-of-way or easement unless shown to be removed or unless written permission has been obtained from the property owner. Furnish three copies of the written permission before removal operations commence.

C. If the land owner desires the timber or small trees, the CONTRACTOR shall cut and neatly pile it in 4 ft. lengths for removal by the OWNER; otherwise, the CONTRACTOR shall dispose of it by hauling it away from the project site.

3.2 TREES AND SHRUBS TO BE SAVED: N/A

A. Protection: Protect trees and shrubs within the (construction site) (right-of-way) (construction strip) that are so delineated or are marked in the field to be saved from defacement, injury and destruction.

1. Work within the limits of the tree drip line with extreme care using either hand tools or equipment that will not cause damage to trees.
 - a. Do not disturb or cut roots unnecessarily. Do not cut roots 1-1/2 inches and larger unless approved.
 - b. Immediately backfill around tree roots after completion of construction in the vicinity of trees.
 - c. Do not operate any wheeled or tracked equipment within drip line.
2. Protect vegetation from damage caused by emissions from engine-powered equipment.
3. During working operations, protect the trunk, foliage and root system of all trees to be saved with boards or other guards placed as shown and as required to prevent damage, injury and defacement.
 - a. Do not pile excavated materials within the drip line or adjacent to the trunk of trees.
 - b. Do not allow runoff to accumulate around trunk of trees.
 - c. Do not fasten or attach ropes, cables, or guy wires to trees without permission. When such permission is granted, protect the tree before making fastening or attachments by providing burlap wrapping and softwood cleats.
 - d. The use of axes or climbing spurs for trimming will not be permitted.
 - e. Provide climbing ropes during trimming.
4. Remove shrubs to be saved, taking a sufficient earth ball with the roots to maintain the shrub.
 - a. Temporarily replant if required, and replace at the completion of construction in a condition equaling that which existed prior to removal.
 - b. Replace in kind if the transplant fails.
5. Have any tree and shrub repair performed by a tree surgeon properly licensed by the State of Florida and within 24 hours after damage occurred.

3.3 CLEARING AND GRUBBING

- A. Clearing: Clear all items specified to the limits shown and remove cleared and grubbed materials from the site.
 - 1. Do not start earthwork operations in areas where clearing and grubbing is not complete, except that stumps and large roots may be removed concurrent with excavation.
 - 2. Comply with erosion, sediment control and storm management measures as specified in Division 1.
- B. Grubbing: Clear and grub areas to be excavated, areas receiving less than 3 feet of fill and areas upon which structures are to be constructed.
 - 1. Remove stumps and root mats in these areas to a depth of not less than 18 inches below the subgrade of sloped surfaces.
 - 2. Fill all depressions made by the removal of stumps or roots with material suitable for backfill as specified in Section 02223.
- C. Limited Clearing: Clear areas receiving more than 3 feet of fill by cutting trees and shrubs as close as practical to the existing ground. Grubbing will not be required.
- D. Dispose of all material and debris from the clearing and grubbing operation by hauling such material and debris away to an approved dump. The cost of disposal (including hauling) of cleared and grubbed material and debris shall be considered a subsidiary obligation of the Contractor; the cost of which shall be included in the prices bid for the various classes of work.

3.4 TOPSOIL

- A. Stripping: Strip existing topsoil from areas that will be excavated or graded prior to commencement of excavating or grading and place in well-drained stockpiles in approved locations.

3.5 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

- A. The CONTRACTOR shall exercise extreme care to avoid unnecessary disturbance of developed private property along the route of the construction. Trees, shrubbery, gardens, lawns, and other landscaping, which in the opinion of the ENGINEER must be removed, shall be replaced and replanted to restore the construction easement to the condition existing prior to construction.
- B. All soil preservation procedures and replanting operations shall be under the supervision of a nursery representative experienced in such operations.
- C. Improvements to the land such as fences, walls, outbuildings, and other structures which of necessity must be removed, shall be replaced with equal quality materials and workmanship.

- D. Clean up the construction site across developed private property directly after construction is completed upon approval of the ENGINEER.
- E. Any commercial signs, disturbed or removed, shall be restored to their original condition within 24 hours.

3.6 PRESERVATION OF PUBLIC PROPERTY

- A. The appropriate paragraphs of Articles 3.5 and 3.6 of these Specifications shall apply to the preservation and restoration of public lands, parks, rights-of-way, easements, and all other damaged areas.

END OF SECTION

SECTION 02151
SHORING, SHEETING AND BRACING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Work required for protection of an excavation or structure through shoring, sheeting, and bracing.
- B. Related Work Specified In Other Sections Includes:
 - 1. Section 02222 - Excavation - Earth and Rock
 - 2. Section 02223 - Backfilling

1.2 SUBMITTALS

- A. General: Provide all submittals, including the following, as specified in Division 1.
- B. CONTRACTOR's Submittals: All sheeting and bracing shall be the responsibility of the CONTRACTOR to retain qualified design services for these systems, and to be completed with strict adherence to OSHA Regulations. Submit complete design calculations and working drawings of proposed shoring, sheeting and bracing which have been prepared, signed and sealed by a Licensed Professional Engineer experienced in Structural Engineering and registered in the State of Florida, before starting excavation for jacking pits and structures. Use the soil pressure diagram shown for shoring, sheeting and bracing design. ENGINEER's review of calculations and working drawings will be limited to confirming that the design was prepared by a licensed professional engineer and that the soil pressure diagram shown was used.

1.3 REFERENCES

- A. Design: Comply with all Federal and State laws and regulations applying to the design and construction of shoring, sheeting and bracing.
- B. N.B.S. Building Science Series 127 "Recommended Technical Provisions for Construction Practice in Shoring and Sloping Trenches and Excavations.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Do work in accordance with the U.S. Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety Act of 1970 (PL 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54), and the Florida Trench Safety Act. The CONTRACTOR shall also observe 29 CFR 1910.46 OSHA's regulation for Confined Space Entry.

PART 2 PRODUCTS

2.1 MANUFACTURERS AND MATERIALS

- A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.
- B. Material Recommendations: Use manufacturers and materials for shoring, sheeting and bracing as recommended by the Licensed Professional Engineer who designed the shoring, sheeting, and bracing.
 - 1. Wood Materials: Oak, or treated fir or pine for wood lagging.

PART 3 EXECUTION

3.1 SHORING, SHEETING AND BRACING INSTALLATION

- A. General: Provide safe working conditions, to prevent shifting of material, to prevent damage to structures or other work, to avoid delay to the work, all in accordance with applicable safety and health regulations. Properly shore, sheet, and brace all excavations which are not cut back to the proper slope and where shown. Meet the general trenching requirements of the applicable safety and health regulations for the minimum shoring, sheeting and bracing for trench excavations.
 - 1. CONTRACTOR's Responsibility: Sole responsibility for the design, methods of installation, and adequacy of the shoring, sheeting and bracing.
- B. Arrange shoring, sheeting and bracing so as not to place any strain on portions of completed work until the general construction has proceeded far enough to provide ample strength.
- C. If ENGINEER is of the opinion that at any point the shoring, sheeting or bracing are inadequate or unsuited for the purpose, resubmission of design calculations and working drawings for that point may be ordered, taking into consideration the observed field conditions. If the new calculations show the need for additional shoring, sheeting and bracing, it should be installed immediately.
- D. Monitoring: Periodically monitor horizontal and vertical deflections of sheeting. Submit these measurements for review.
- E. Accurately locate all underground utilities and take the required measures necessary to protect them from damage. All underground utilities shall be kept in service at all times as specified in Division 1.
- F. Driven Sheeting: Drive tight sheet piling in that portion of any excavation in paved or surface streets City collector and arterial streets and in State and County highways below the intersection of a one-on-one slope line from the nearest face of the excavation to the edge of the existing pavement or surface.

- G. Sheeting Depth: In general drive or place sheeting for pipelines to a depth at elevation equal to the top of the pipe as approved.
 - 1. If it is necessary to drive sheeting below that elevation in order to obtain a dry trench or satisfactory working conditions, cut the sheeting off at the top of the pipe and leave in place sheeting below the top of the pipe.
- H. Sheeting Removal: In general, remove sheeting and bracing above the top of the pipe as the excavation is refilled in a manner to avoid the caving in of the bank or disturbance to adjacent areas or structures. Sheetng shall be removed as backfilling progresses so that the sides are always supported or when removal would not endanger the construction of adjacent structures. When required to eliminate excessive trench width or other damages, shoring or bracing shall be left in place and the top cut off at an elevation 2.5 feet below finished grade, unless otherwise directed.
 - 1. Carefully fill voids left by the withdrawal of the sheeting by jetting, ramming or otherwise.
 - 2. No separate payment will be made for filling of such voids.
- I. Permission for Removal: Obtain permission before the removal of any shoring, sheeting or bracing. Retain the responsibility for injury to structures or to other property or persons from failure to leave such shoring, sheeting and bracing in place even though permission for removal has been obtained.
- J. Preload internal braces to 50 percent of the design loads.
- K. Proof test tie backs to 133 percent of the design loads and lock off tie backs at 75 percent of the design loads.

3.2 SHEETING LEFT IN PLACE FOR PROTECTION

- A. Ordered Left in Place: In addition to sheeting specified or shown to be left in place, the ENGINEER may order, in writing, any or all other shoring, sheeting or bracing to be left in place for the purpose of preventing injury to the structures, pipelines or to other property or to persons.
 - 1. Cutoff sheeting left in place at the elevation shown or ordered, but, in general, at least 2.5 feet below the final ground surface.
 - 2. Drive up tight any bracing remaining in place.
- B. Right to Order: Do not construe the right to order shoring, sheeting and bracing left in place as creating any obligation to issue such orders.
- C. Payment: Shoring, sheeting and bracing left in place, by written order, will be paid for under the appropriate Contract Items or where no such items exist, as changes in the work.

END OF SECTION

SECTION 02222
EXCAVATION - EARTH AND ROCK

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements for performing opencut excavations to the widths and depths necessary for constructing structures, pipelines and conduits including excavation of any material necessary for any purpose pertinent to the construction of the Work.
- B. Related Work Specified In Other Sections Includes:
 1. Section 02110 - Site Clearing
 2. Section 02151 - Shoring, Sheetig and Bracing
 3. Section 02223 - Backfilling

1.2 DEFINITIONS

- A. Earth: "Earth" includes all materials which, in the opinion of the ENGINEER, do not require blasting, barring, wedging or special impact tools for their removal from their original beds, and removal of which can be completed using standard excavating equipment. Specifically excluded are all ledge and bedrock and boulders or pieces of masonry larger than one cubic yard in volume.
- B. Rock: "Rock" includes all materials which, in the opinion of the ENGINEER, require blasting, barring, wedging and/or special impact tools such as jack hammers, sledges, chisels, or similar devices specifically designed for use in cutting or breaking rock for removal from their original beds and which have compressive strengths in their natural undisturbed state in excess of 300 psi. Boulders or masonry larger than one cubic yard in volume are classed as rock excavation.

1.3 SUBMITTALS

- A. General: Provide all submittals, including the following, as specified in Division 1.
- B. Dewatering Excavation Plan: Develop an excavation dewatering plan that considers site ground and groundwater conditions, the type and arrangement of the equipment to be used and the proper method of groundwater disposal. Prepare the dewatering plan before beginning excavations below groundwater. Maintain one copy of the dewatering plan at the project site to be available for inspection while all dewatering operations are underway.

1.4 SITE CONDITIONS

- A. Geotechnical Investigation: No geotechnical investigation and report was performed in preparing the Contract Documents.
 - 1. The geotechnical investigation report may be examined for what ever value it may be considered to be worth. However, this information is not guaranteed as to its accuracy or completeness.
 - 2. The geotechnical investigation report is not part of the Contract Documents.
- B. Actual Conditions: Make any geotechnical investigations deemed necessary to determine actual site conditions.
- C. Underground Utilities: Locate and identify all existing underground utilities prior to the commencement of Work.
- D. Quality and Quantity: Make any other investigations and determinations necessary to determine the quality and quantities of earth and rock and the methods to be used to excavate these materials.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 GENERAL

- A. Clearing: Clear opencut excavation sites of obstructions preparatory to excavation. Clearing in accordance with Section 02110, includes removal and disposal of vegetation, trees, stumps, roots and bushes, except those specified to be protected during trench excavation.
- B. Banks: Shore or slope banks to the angle of repose to prevent slides or cave-ins in accordance with Section 02151.
- C. Safety: Whenever an excavation site or trench is left unattended by the CONTRACTOR or when an area is not within 100 feet of observation by the CONTRACTOR, the excavation site or trench shall be filled and/or, at the OWNER's discretion, protected by other means to prevent accidental or unauthorized entry. Such protection shall include barricades and other protection devices requested by the ENGINEER or OWNER, including temporary fencing, snow fencing, or temporary "structure" tape. Such safety items shall not relieve the CONTRACTOR of any site safety requirements or liabilities established by Federal, State and local laws and agencies, including OSHA, but is intended as additional safety measures to protect the general public.

- D. Hazardous Materials: If encountered, take care of hazardous materials not specifically shown or noted in accordance with Section 01500.
- E. During excavation and any site work, storm water pollution prevention measures shall be taken to ensure that water quality criteria are not violated in the receiving water body and all state and local regulatory requirements are met.

3.2 STRUCTURE EXCAVATION

- A. Excavation Size: Provide excavations of sufficient size and only of sufficient size to permit the Work to be economically and properly constructed in the manner and of the size specified.
- B. Excavation Shape: Shape and dimension the bottom of the excavation in earth or rock to the shape and dimensions of the underside of the structure or drainage blanket wherever the nature of the excavated material permits.
- C. Compaction: Before placing foundation slabs, footings or backfill, proof roll the bottom of the excavations to detect soft spots.
 1. For accessible areas, proof roll with a ten wheel tandem axle dump truck loaded to at least 15 tons or similarly loaded construction equipment.
 2. For small areas, proof roll with a smooth-faced steel roller filled with water or sand, or compact with a mechanical tamper.
 3. Make one complete coverage, with overlap, of the area.
 4. Overexcavate soft zones and replace with compacted select fill in accordance with Part 3, Section 3.9.

3.3 TRENCH EXCAVATION

- A. Preparation: Properly brace and protect trees, shrubs, poles and other structures which are to be preserved. Unless shown or specified otherwise, preserve all trees and large shrubs. Hold damage to the root structure to a minimum. Small shrubs may be preserved or replaced with equivalent specimens.
- B. Adequate Space: Keep the width of trenches to a minimum, however provide adequate space for workers to place, joint and backfill the pipe properly.
 1. The minimum width of the trench shall be equal to the outside diameter of the pipe at the joint plus 8-inches for unsheeted trench or 12 inches for sheeted trench. The maximum width of trench, measured at the top of the pipe, shall not exceed the outside pipe diameter plus 2 feet, unless otherwise shown on the drawing details or approved by the ENGINEER. Trench walls shall be maintained vertical from the bottom of the trench to a line measured one foot above the top of the pipe. From one

foot above the top of the pipe to the surface the trench walls shall conform with OSHA Regulations.

2. In sheeted trenches, measure the clear width of the trench at the level of the top of the pipe to the inside of the sheeting.
3. Should the maximum trench widths specified above be exceeded without written approval, provide concrete cradle or encasement for the pipe as directed. No separate payment will be made for such concrete cradle or encasement.

C. Depth:

1. Excavate trenches to a minimum depth of 8 inches below the bottom of the pipe or the bottom of encasement for electrical ducts, unless otherwise shown, specified or directed, so that bedding material can be placed in the bottom of the trench and shaped to provide a continuous, firm bearing for duct encasement, pipe barrels and bells.
2. Standard trench grade shall be defined as the bottom surface of the utility to be constructed or placed within the trench. Trench grade for utilities in rock or other non-cushioning material shall be defined as additional undercuts backfilled with #57 stone compacted in 6-inch lifts, below the standard 8-inches minimum trench undercut. Excavation below trench grade that is not ordered in writing by the ENGINEER shall be backfilled to trench grade and compacted.

D. Unstable or Unsuitable Materials: If unstable or unsuitable material is exposed at the level of the bottom of the trench excavation, excavate the material in accordance with the subsection headed "Authorized Additional Excavation".

1. Material shall be removed for the full width of the trench and to the depth required to reach suitable foundation material.
2. When in the judgment of the ENGINEER the unstable or unsuitable material extends to an excessive depth, the ENGINEER may advise, in writing, the need for stabilization of the trench bottom with additional select fill material, crushed stone, washed shell, gravel mat or the need to provide firm support for the pipe or electrical duct by other suitable methods.
3. Crushed stone, washed shell and gravel shall be as specified in Section 02223.
4. Payment for such trench stabilization will be made under the appropriate Contract Items or where no such items exist, as a change in the Work.

E. Length of Excavation: Keep the open excavated trench preceding the pipe or electrical duct laying operation and the unfilled trench, with pipe or duct in place, to a minimum length which causes the least disturbance. Provide ladders for a means of exit from the trench as required by applicable safety and health regulations.

- F. Excavated Material: Excavated material to be used for backfill shall be neatly deposited at the sides of the trenches where space is available. Where stockpiling of excavated material is required, the Contractor shall be responsible for obtaining the sites to be used and shall maintain his operations to provide for natural drainage and not present an unsightly appearance.
- G. Water: Allow no water to rise in the trench excavation until sufficient backfill has been placed to prevent pipe or duct flotation.

3.4 SHORT TUNNEL EXCAVATION

- A. Short Tunnel Requirements: In some instances, trees, shrubs, utilities, sidewalks and other obstructions may be encountered, the proximity of which may be a hindrance to opencut trench excavation. In such cases, excavate by means of short tunnels in order to protect such obstructions against damage.
 1. Construct the short tunnel by hand, auger or other approved method approximately 6 inches larger than the diameter of pipe bells or outer electrical duct encasement.
 2. Consider such short tunnel work incidental to the construction of pipelines or conduits and all appurtenances. The need for short tunnels will not be grounds for additional payment.

3.5 EXCAVATION FOR JACKING AND AUGERING

- A. Jacking and Augering Requirements: Allow adequate length in jacking pits to provide room for the jacking frame, the jacking head, the reaction blocks, the jacks, auger rig, and the jacking pipe. Provide sufficient pit width to allow ample working space on each side of the jacking frame. Allow sufficient pit depth such that the invert of the pipe, when placed on the guide frame, will be at the elevation desired for the completed line. Tightly sheet the pit and keep it dry at all times.

3.6 ROCK EXCAVATION

- A. Rock Excavation: Excavate rock within the boundary lines and grades as shown, specified or required.
 1. Rock removed from the excavation becomes the property of the CONTRACTOR. Transport and dispose of excavated rock at an off site disposal location. Obtain the off site disposal location.
 2. Remove all shattered rock and loose pieces.
- B. Structure Depths: For cast-in-place structures, excavate the rock only to the bottom of the structure, foundation slab, or drainage blanket.
- C. Trench Width: Maintain a minimum clear width of the trench at the level of the top of the pipe of the outside diameter of the pipe barrel plus 4 feet, unless otherwise approved.

- D. Trench Depth: For trench excavation in which pipelines or electrical ducts are to be placed, excavate the rock to a minimum depth of 8 inches below the bottom of the pipe or duct encasement. Provide a cushion of sand or suitable crushed rock. Refill the excavated space with pipe bedding material in accordance with Section 02223. Include placing, compacting and shaping pipe bedding material in the appropriate Contract Items.
- E. Manhole Depths: For manhole excavation, excavate the rock to a minimum depth of 8 inches below the bottom of the manhole base for pipelines 24 inches in diameter and larger and 6 inches below the bottom manhole base for pipelines less than 24 inches in diameter. Refill the excavated space with pipe bedding material in accordance with Section 02223. Include placing, compacting and shaping pipe bedding material for manhole bases in the appropriate Contract Items.
- F. Over-excavated Space: Refill the excavated space in rock below structures, pipelines, conduits and manholes, which exceeds the specified depths with 2,500 psi concrete, crushed stone, washed shell, or other material as directed. Include refilling of over-excavated space in rock as part of the rock excavation.
- G. Other Requirements: Follow, where applicable, the requirements of the subsections on "Trench Excavation" and "Structure Excavation".
- H. Payment: Rock excavation, including placing, compacting and shaping of the select fill material, will be paid for under the appropriate Contract Items or where no such items exist, as a change in the Work.
- I. Blasting: Perform authorized blasting by authorized and qualified workers as approved as to the number, length, placing and direction, and loading of holes. Do not use charges which will make the excavation unduly large or irregular, nor shatter the rock upon or against which masonry is to be built, nor injure masonry or existing structures at the site or in the vicinity.
 1. Cover each blast with a woven wire cable mat weighted with heavy timbers. Blasting will not be permitted within 25 feet of existing or of the completed pipeline or structure. Control blasts in tunnels so that the material surrounding the tunnel base proper is not loosened or displaced.
 2. Discontinue blasting whenever it is determined that further blasting may injure or damage adjacent rock, masonry, utility lines, or other structures. In such cases, excavate the remaining rock by barring, wedging, or other approved methods.
 3. Where sewers, gas, water, steam, or other utility ducts or lines, catch basin connections, or other structures have been exposed during excavation, adequately protect such structures from damage before proceeding with the blasting. Promptly repair any structure damaged by blasting at no addition to the Contract Price.

4. Take due precautions to prevent accidental discharge of electric blasting caps from current induced by radar, radio transmitters, lightning, adjacent powerlines, dust storms or other sources of extraneous electricity.
5. Keep a sufficient quantity of explosives on hand to avoid delay to the Work on the site when rock excavation is in progress. At no time keep a quantity in excess of that which will be required for use within the following 12 hours.
6. Store, handle and use such explosives in conformity with all laws, ordinances, and regulations of the County or governing body governing the storage and use of explosives at the construction site.
7. Provide a magazine keeper to keep accurate daily records and account for each piece of explosive, detonator and equipment from time of delivery at the magazine until used or removed from the site. Abandon no explosives or blasting agents.
8. Take sole responsibility for the methods of handling, use, and storage of explosives and any damage to persons or property resulting therefrom. Approval of these methods or failure to order that blasting be discontinued does not relieve the CONTRACTOR of any of this responsibility.

3.7 FINISHED EXCAVATION

- A. Finish: Provide a reasonably smooth finished surface for all excavations, which is uniformly compacted and free from irregular surface changes.
- B. Finish Methods: Provide a degree of finish which is ordinarily obtainable from blade-grade operations, except as otherwise specified in Section 02223.

3.8 PROTECTION

- A. Traffic and Erosion: Protect newly graded areas from traffic and from erosion.
- B. Repair: Repair any settlement or washing away that may occur from any cause, prior to acceptance. Re-establish grades to the required elevations and slopes.
- C. It shall be the CONTRACTOR's responsibility to acquaint himself with all existing conditions and to locate all structures and utilities along the proposed utility alignment in order to avoid conflicts. Where actual conflicts are unavoidable, work shall be coordinated with the facility owner and performed so as to cause as little interference as possible with the service rendered by the facility disturbed. Facilities or structures damaged in the prosecution of the work shall be repaired and/or replaced immediately, in conformance with current standard practices of the industry, or according to the direction of the owner of such facility, at the CONTRACTOR's expense.
- D. Other Requirements: Conduct all Work in accordance with the environmental protection requirements specified in Division 1.

3.9 AUTHORIZED ADDITIONAL EXCAVATION

- A. Additional Excavation: Carry the excavation to such additional depth and width as authorized in writing, for the following reasons:
 1. In case the materials encountered at the elevations shown are not suitable.
 2. In case it is found desirable or necessary to go to an additional depth, or to an additional depth and width.
- B. Refill Materials: Refill such excavated space with either authorized 2500 psi concrete or compacted select fill material, in compliance with the applicable provisions of Section 02223.
- C. Compaction: Where necessary, compact fill materials to avoid future settlement. As a minimum, unless otherwise specified or directed, backfill layers shall not exceed 6-inches in thickness for the full trench width and compaction shall equal 95% of maximum density, or 98% if under paved area of roadway, as determined by using ASTM D 1557. Compaction density tests shall be made at all such backfill areas with spacing not to exceed 100 feet apart and on each 6-inch compacted layer.
- D. Payment: Additional earth excavations so authorized and concrete or select fill materials authorized for filling such additional excavation and compaction of select fill materials will be paid for under the appropriate Contract Items or where no such items exist, as a change in the Work.

3.10 UNAUTHORIZED EXCAVATION

- A. Stability: Refill any excavation carried beyond or below the lines and grades shown, except as specified in the subsection headed "Authorized Additional Excavation", with such material and in such manner as may be approved in order to provide for the stability of the various structures.
- B. Refill Materials: Refill spaces beneath all manholes, structures, pipelines, or conduits excavated without authority with 2500 psi concrete or compacted select fill material, as approved.
- C. Payment: Refill for unauthorized excavation will not be measured and no payment will be made therefor.

3.11 SEGREGATION STORAGE AND DISPOSAL OF MATERIAL

- A. Stockpiling Suitable Materials: Stockpile topsoil suitable for final grading and landscaping and excavated material suitable for backfilling or embankments separately on the site in approved locations.

- B. Stockpile Locations: Store excavated and other material a sufficient distance away from the edge of any excavation to prevent its falling or sliding back into the excavation and to prevent collapse of the wall of the excavation. Provide not less than 2 feet clear space between the top of any stockpile and other material and the edge of any excavation.
- C. Excess Materials: CONTRACTOR shall be responsible to transport and dispose of surplus excavated material and excavated material unsuitable for backfilling or embankments at an off site disposal location secured by the CONTRACTOR.

3.12 REMOVAL OF WATER

- A. Water Removal: At all times during the excavation period and until completion and acceptance of the WORK at final inspection, provide ample means and equipment with which to remove promptly and dispose of properly all water entering any excavation or other parts of the WORK.
- B. Dry Excavations: Keep the excavation dry.
- C. Water Contact: Allow no water to rise over or come in contact with masonry and concrete until the concrete and mortar have attained a set and, in any event, not sooner than 12 hours after placing the masonry or concrete.
- D. Discharge of Water: Dispose of water pumped or drained from the Work in a safe and suitable manner without damage to adjacent property or streets or to other work under construction.
- E. Protection: Provide adequate protection for water discharged onto streets. Protect the street surface at the point of discharge.
- F. Sanitary Sewers: Discharge no water into sanitary sewers.
- G. Storm Sewers: Discharge no water containing settleable solids into storm sewers.
- H. Repair: Promptly repair any and all damage caused by dewatering the Work.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02223
BACKFILLING

PART 1 GENERAL

1.1 SUMMARY

- A. General Requirements: Backfill all excavation to the original surface of the ground or to such other grades as may be shown or required. For areas to be covered by topsoil, leave or stop backfill (12) inches below the finished grade or as shown. Obtain approval for the time elapsing before backfilling against masonry structures. Remove from all backfill, any compressible, putrescible, or destructible rubbish and refuse and all lumber and braces from the excavated space before backfilling is started. Leave sheeting and bracing in place or remove as the work progresses.
- B. Equipment Limitations: Do not permit construction equipment used to backfill to travel against and over cast-in-place concrete structures until the specified concrete strength has been obtained, as verified by concrete test cylinders. In special cases where conditions warrant, the above restriction may be modified providing the concrete has gained sufficient strength, as determined from test cylinders, to satisfy design requirements for the removal of forms and the application of load.
- C. Related Work Specified In Other Sections Includes:
 - 1. Section 02110 - Site Clearing
 - 2. Section 02222 – Excavation – Earth and Rock

1.2 REFERENCES

- A. Codes and standards referred to in this Section are:
 - 1. ASTM D 1557 - Standard Test Methods for Moisture-Density Relations of Soil and Soil-Aggregate Mixtures Using 10 lb Rammer and 18 in Drop

PART 2 PRODUCTS

2.1 BACKFILL MATERIAL - GENERAL

- A. General: Backfill with sound materials, free from waste, organic matter, rubbish, boggy or other unsuitable materials.
- B. General Materials Requirements: Conform materials used for backfilling to the requirements specified. Follow common fill requirements whenever drainage or select fill is not specified. Determine and obtain the approval of the appropriate test method where more than one compaction test method is specified.
- C. Frozen Materials: Do not use frozen material for backfilling.

2.2 DRAINAGE FILL: N/A

A. Materials for Drainage Fill: Use clean gravel, crushed stone, or other suitable material conforming to the gradation specified for drainage fill. Clay and fine particles are unacceptable in drainage fill. Provide drainage fill of a grade between the following limits:

U.S. Standard Sieve	Percent Passing By Weight
1-1/2 inch	100
1 inch	95-100
1/2 inch	45-65
#4	5-15
#16	0-4

2.3 SELECT FILL

A. Materials for Select Fill: Use clean gravel, crushed stone, washed shell, or other granular or similar material as approved which can be readily and thoroughly compacted to 95 percent of the maximum dry density obtainable by ASTM D 1557.

1. Allowed Materials: Grade select fill between the following limits:

U.S. Standard Sieve	Percent Passing By Weight
2 inch	100
1-1/2 inch	90-100
1 inch	75-95
1/2 inch	45-70
#4	25-50
#10	15-40
#200	5-15

2. Unallowed Materials: Very fine sand, uniformly graded sands and gravels, sand and silt, soft earth, or other materials that have a tendency to flow under pressure when wet are unacceptable as select fill.

2.4 COMMON FILL

A. Materials for Common Fill: Material from on-site excavation may be used as common fill provided that it can be readily compacted to 90 percent of the maximum dry density obtainable by ASTM D 1557, and does not contain unsuitable material. Select fill may be used as common fill at no change in the Contract Price.

B. Granular Materials On-Site: Granular on-site material, which is fairly well graded between the following limits may be used as granular common fill:

U.S. Standard Sieve	Percent Passing by Weight
3 inch	100
#10	50-100
#60	20-90
#200	0-20

C. Cohesive Materials On-Site: Cohesive site material may be used as common fill.

1. The gradation requirements do not apply to cohesive common fill.
2. Use material having a liquid limit less than or equal to 40 and a plasticity index less than or equal to 20.

D. Material Approval: All material used as common fill is subject to approval. If there is insufficient on-site material, import whatever additional off-site material is required which conforms to the specifications and at no additional cost.

2.5 UTILITY PIPE BEDDING

A. Class A (special utility bedding). Should special bedding be required due to depth of cover, impact loadings or other conditions, Class A bedding shall be installed, as shown in Section 9 of the Lee County Utilities Operations Manual.

B. Class B (minimum utility bedding). The bottom of the trench shall be shaped to provide a firm bedding for the utility pipe. The utility shall be firmly bedded in undisturbed firm soil or hand shaped unyielding material. The bedding shall be shaped so that the pipe will be in continuous contact therewith for its full length and shall provide a minimum bottom segment support for the pipe equal to 0.3 times the outside diameter of the barrel.

PART 3 EXECUTION

3.1 ELECTRICAL DUCT AND PRECAST MANHOLE BEDDING

A. Bedding Compaction: Bed all electrical ducts and precast manholes in well graded, compacted, select fill conforming to the requirements except as otherwise shown, specified, or required. Extend electrical duct bedding a minimum of 6 inches below the bottom of the duct encasement for the full trench width. Compact bedding thickness no less than 6 inches for precast concrete manhole bases.

B. Concrete Work Mats: Cast cast-in-place manhole bases and other foundations for structures against a 2500 psi concrete work mat in clean and dry excavations, unless otherwise shown, specified or required.

- C. Bedding Placement: Place select fill used for bedding beneath electrical ducts and precast manhole bases, in uniform layers not greater than 9 inches in loose thickness. Thoroughly compact in place with suitable mechanical or pneumatic tools to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.
- D. Use of Select Fill: Bed existing underground structures, tunnels, conduits and pipes crossing the excavation with compacted select fill material. Place bedding material under and around each existing underground structure, tunnel, conduit or pipe and extend underneath and on each side to a distance equal to the depth of the trench below the structure, tunnel, conduit or pipe.

3.2 PIPE BEDDING AND INITIAL BACKFILL

- A. Hand Placement: Place select fill by hand for initial pipe backfill from top of bedding to 1 foot over top of pipes in uniform layers not greater than 6 inches in loose thickness. Tamp under pipe haunches and thoroughly compact in place the select fill with suitable mechanical or pneumatic tools to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.
- B. Stone Placement: Do not place large stone fragments in the pipe bedding or backfill to 1 foot over the top of pipes, nor nearer than 2 feet at any point from any pipe, conduit or concrete wall.
- C. Unallowed Materials: Pipe bedding containing very fine sand, uniformly graded sands and gravels, sand and silt, soft earth, or other materials that have a tendency to flow under pressure when wet is unacceptable.

3.3 BEDDING PLACEMENT AND BACKFILL FOR PIPE IN SHORT TUNNEL

- A. Bed pipelines or electrical ducts placed in short tunnels in select fill or 2500 psi concrete. Completely fill the remainder of the annular space between the outside of the pipe wall and the tunnel wall with select fill, suitable job-excavated material, or 2500 psi concrete, as approved. Suitably support pipelines or ducts in short tunnels to permit placing of backfill suitably tamped in place.

3.4 TRENCH BACKFILL

- A. General: Backfill material shall be clean earth fill composed of sand, clay and sand, sand and stone, crushed stone, or an approved combination thereof. Backfilling shall be accomplished under two specified requirements: First Lift, from trench grade to a point 12 inches above the top of the utility, and, Second Lift, from the top of the First Lift to the ground surface. Where thrust blocks, encasements, or other below-grade concrete work have been installed, backfilling shall not proceed until the concrete has obtained sufficient strength to support the backfill load.
- B. First Lift: Fine material shall be carefully placed and tamped around the lower half of the utility. Backfilling shall be carefully continued in compacted and tested layers not exceeding 6 inches in thickness for the full trench width, until the fill is 12 inches above the top of the utility, using the best available material from the excavation, if approved. The material for

these first layers of backfill shall be lowered to within 2 feet above the top of pipes before it is allowed to fall, unless the material is placed with approved devices that protect the pipes from impact. The "First Lift" shall be thoroughly compacted and tested before the "Second Lift" is placed. Unless otherwise specified, compaction shall equal 98% of maximum density, as determined by ASTM D 1557. The "First Lift" backfill shall exclude stones, or rock fragments larger than the following:

<u>Pipe Type</u>	(Greatest Dimension-Inches) <u>Fragment Size (Inches)</u>
Steel	2
Concrete	2
Ductile Iron	2
Plastic	1
Fiberglass	1

C. Second Lift: The remainder of the trench, above the "First Lift", shall be backfilled and tested in layers not exceeding 6 inches. The maximum dimension of a stone, rock, or pavement fragment shall be 6 inches. When trenches are cut in pavements or areas to be paved, compaction, as determined by ASTM D 1557, shall be equal to 98% of maximum density, with compaction in other areas not less than 95% of maximum density in unpaved portions of the Rights-of-Way or 90% of maximum density in other areas.

As an alternative, or if required under roadways, Flowable Fill may be substituted. If Flowable Fill is to be used, a fabric mesh shall be installed between the "first lift" and the Flowable Fill. Flowable Fill shall be in accordance with Section 4.7.AH of the Lee County Utilities Operations Manual.

D. Compaction Methods: The above specified compaction shall be accomplished using accepted standard methods (powered tampers, vibrators, etc.), with exception that the first two feet of backfilling over the pipe shall be compacted by hand-operated tamping devices. Flooding or puddling with water to consolidate backfill is not acceptable, except where sand is the only material utilized and encountered and the operation has been approved by the OWNER.

E. Density Tests: Density tests for determination of the above specified compaction shall be made by an independent testing laboratory and certified by a Florida Registered, Professional ENGINEER at the expense of the Developer or CONTRACTOR. Test locations will be determined by the OWNER but in any case, shall be spaced not more than 100 feet apart where the trench cut is continuous. If any test results are unsatisfactory, the CONTRACTOR shall re-excavate and re-compact the backfill at his expense until the desired compaction is obtained. Additional compaction tests shall be made to each site of an unsatisfactory test, as directed, to determine the extent of re-excavation and re-compaction if necessary.

Copies of all density test results shall be furnished on a regular basis by the ENGINEER, to Lee County Utilities. Failure to furnish these results will result in the project not being recommended for acceptance by Lee County

F. Dropping of Material on Work: Do trench backfilling work in such a way as to prevent dropping material directly on top of any conduit or pipe through any great vertical distance. Do not allow backfilling material from a bucket to fall directly on a structure or pipe and, in all cases, lower the bucket so that the shock of falling earth will not cause damage.

G. Distribution of Large Materials: Break lumps up and distribute any stones, pieces of crushed rock or lumps which cannot be readily broken up, throughout the mass so that all interstices are solidly filled with fine material.

3.5 STRUCTURE BACKFILL

A. Use of Select Fill: Use select fill underneath all structures, and adjacent to structures where pipes, connections, electrical ducts and structural foundations are to be located within this fill. Use select fill beneath all pavements, walkways, and railroad tracks, and extend to the bottom of pavement base course or ballast.

1. Place backfill in uniform layers not greater than 8 inches in loose thickness and thoroughly compact in place with suitable approved mechanical or pneumatic equipment.
2. Compact backfill to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.

B. Use of Common Fill: Use common granular fill adjacent to structures in all areas not specified above, unless otherwise shown or specified. Select fill may be used in place of common granular fill at no additional cost.

1. Extend such backfill from the bottom of the excavation or top of bedding to the bottom of subgrade for lawns or lawn replacement, the top of previously existing ground surface or to such other grades as may be shown or required.
2. Place backfill in uniform layers not greater than 8 inches in loose thickness and thoroughly compact in place with suitable equipment, as specified above.
3. Compact backfill to not less than 90 percent of the maximum dry density as determined by ASTM D 1557.

C. Use of Clay: In unpaved areas adjacent to structures for the top 1 foot of fill directly under lawn subgrades use clay backfill placed in 6-inch lifts. Compact clay backfill to not less than 90 percent of the maximum dry density as determined by ASTM D 1557.

1. Use clay having a liquid limit less than or equal to 40 and a plasticity index less than or equal to 20.

3.6 DRAINAGE BLANKET: N/A

A. Drainage Fill Placement: Provide a drainage blanket where shown consisting of drainage fill.

1. Place drainage fill underneath all structures and adjacent to structures where pipes, connections, electrical ducts and structural foundations located within this fill, in uniform layers not greater than 8 inches in loose thickness. Compact drainage fill with suitable mechanical or pneumatic equipment to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.

2. Place drainage fill adjacent to structures in all areas not specified above in uniform layers not greater than 8 inches in loose thickness. Compact drainage fill with suitable mechanical or pneumatic equipment to not less than 90 percent of the maximum dry density as determined by ASTM D 1557.

3.7 EARTH EMBANKMENTS: N/A

A. Use of Cohesive Materials: Make all earth embankments of approved cohesive common fill material.

1. Place fill in uniform layers not greater than 10 inches in loose thickness. Compact in place with suitable approved mechanical equipment.
2. Compact earth embankments to not less than 90 percent of the maximum dry density as determined by ASTM D 1557.
3. Do not use cohesionless, granular material as earth embankment backfill, unless otherwise shown or required.

3.8 COMPACTION EQUIPMENT

A. Equipment and Methods: Carry out all compaction with suitable approved equipment and methods.

1. Compact clay and other cohesive material with sheep's-foot rollers or similar equipment where practicable. Use hand held pneumatic tampers elsewhere for compaction of cohesive fill material.
2. Compact low cohesive soils with pneumatic-tire rollers or large vibratory equipment where practicable. Use small vibratory equipment elsewhere for compaction of cohesionless fill material.
3. Do not use heavy compaction equipment over pipelines or other structures, unless the depth of fill is sufficient to adequately distribute the load.

3.9 BORROW

A. Should there be insufficient material from the excavations to meet the requirements for fill material, borrow shall be obtained from pits secured and tested by the CONTRACTOR and approved by the OWNER. Copies of all test results shall be submitted to Lee County Utilities.

3.10 FINISH GRADING

A. Final Contours: Perform finish grading in accordance with the completed contour elevations and grades shown and blend into conformation with remaining natural ground surfaces.

1. Leave all finished grading surfaces smooth and firm to drain.
2. Bring finish grades to elevations within plus or minus 0.10 foot of elevations or contours shown.

B. Surface Drainage: Perform grading outside of building or structure lines in a manner to prevent accumulation of water within the area. Where necessary or where shown, extend finish grading to ensure that water will be carried to drainage ditches, and the site area left smooth and free from depressions holding water.

3.11 RESPONSIBILITY FOR AFTER SETTLEMENT

A. After settlement Responsibility: Take responsibility for correcting any depression which may develop in backfilled areas from settlement within one year after the work is fully completed. Provide as needed, backfill material, pavement base replacement, permanent pavement, sidewalk, curb and driveway repair or replacement, and lawn replacement, and perform the necessary reconditioning and restoration work to bring such depressed areas to proper grade as approved.

3.12 INSPECTION AND TESTING OF BACKFILLING

A. Sampling and Testing: Provide sampling, testing, and laboratory methods in accordance with the appropriate ASTM Standard Specification. Subject all backfill to these tests.

B. Compaction density tests shall be made at all such backfill areas with spacing not to exceed 100 feet apart and on each 6-inch compacted layer.

C. Correction of Work: Correct any areas of unsatisfactory compaction by removal and replacement, or by scarifying, aerating or sprinkling as needed and recompaction in place prior to placement of a new lift.

END OF SECTION

SECTION 02226
JACKING, AUGERING AND MINING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Pipeline installation in casing pipe beneath highways, railroads and other structures may be installed by jacking and augering or by jacking and mining.
- B. Related Work Specified in Other Sections Includes:
 - 1. Section 02151 – Shoring, Sheetng and Bracing
 - 2. Section 02222 - Excavation - Earth and Rock
 - 3. Section 03311 – Concrete for Non-Plant Work

1.2 REFERENCES

- A. Codes and standards referred to in this Section are:
 - 1. ASTM C 76 - Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
 - 2. ASTM A 139 - Specification for Electric-Fusion (Arc) -Welded Steel Pipe (NPS in 4 in. and Over)
 - 3. OSHA PL-91-596- Occupational Safety Health Act of 1970 Public Law 91-596

1.3 SUBMITTALS

- A. Provide all submittals, including the following, as specified in Division 1.
 - 1. Working drawings of the jacking pipe, jacking frame, jacking head, reaction blocks, sheeting, including design calculations and the complete jacking installation.
 - 2. It shall be the responsibility of the CONTRACTOR to submit the necessary permit documents and data to the appropriate authority and receive approval thereof.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle all products and materials as specified in Division 1.

PART 2 PRODUCTS

2.1 MATERIALS

- A. General: Use one of the following for casing piping.
 - 1. New prime steel pipe, meeting the requirements of ASTM A 139, Grade B. The minimum casing pipe size and wall thickness shall be as shown in the following table, for the carrier

pipe size indicated. For sizes not included therein, or for special design considerations, approval shall be obtained from Lee County Utilities.

For PVC or DIP Pressure Carrier Pipes

<u>Carrier Pipe Nominal Size</u>	<u>Casing Pipe Nominal Diameter</u>	<u>Casing Pipe Wall Thickness</u>
<u>Inches</u>	<u>Inches</u>	<u>Inches</u>
4	12	0.250
6	16	0.250
8	18	0.250
10	20	0.250
12	24	0.312
14	28	0.312
16	30	0.312
18	30	0.312
20	36	0.375
24	42	0.500

For Gravity Sewer Carrier Pipes

<u>Carrier Pipe Nominal Size</u>	<u>Casing Pipe Nominal Diameter</u>	<u>Casing Pipe Wall Thickness</u>
<u>Inches</u>	<u>Inches</u>	<u>Inches</u>
8	14	0.250
10	16	0.250
12	20	0.250
15	24	0.312
18	26	0.312
21	30	0.312
24	32	0.375
27	36	0.375

2. HDPE may be used as the carrier pipe and casing pipe with approval from Lee County Utilities. The HDPE casing shall be SDR 11 and there shall be a minimum of 4 inches clearance between the interior of the casing pipe and the outside of the carrier pipe, unless otherwise approved by the OWNER.

B. Fill Material: Use fill material consisting of 1-1/4 pounds of Bentonite per gallon of water during jacking to fill any voids between pipe and the earth.

PART 3 EXECUTION

3.1 INSTALLATION

A. Casing Pipe:

1. Install all casing pipe in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.
2. The provisions of this section shall represent the minimum standards for the installation of casing pipe for sewer force main or water main pipeline.

3. Sewer force mains and water mains to be placed under all Lee County Department of Transportation & Engineering roadways shall be installed in a casing. The steel casing procedures shall conform to the requirements of Lee County DOT as outlined in "Administrative Code AC-11-12" and any supplements thereto. All work and materials shall be subject to inspection by DOT. The Department's property and surface conditions shall be restored to the original condition in keeping with the Department's specifications and standards.
4. In general, all underground sewer force mains and water mains crossing all existing Lee County roadways, Florida State Highways and railroads shall be installed under these traffic ways within steel casing pipe. Specific crossing requirements shall be obtained in advance from the authority having jurisdiction.
5. It shall be the sole responsibility of the CONTRACTOR to submit the necessary permit documents and data to the appropriate authority and receive approval thereof. The CONTRACTOR shall maintain traffic on the roadway and shall keep all workmen and equipment clear of the travelway during the work. All safety regulations of the Department and any permit(s) shall be complied with.
6. Casing pipes crossing under County roadways shall be located at suitable approved alignments in order to eliminate possible conflict with existing or future utilities and structures with a minimum 36 inches depth of cover between the top of the casing pipe and the surface of the roadway.
7. For casing pipe crossing under roadways, railroads, or other installations not within the jurisdiction of Lee County, the CONTRACTOR shall comply with the regulations of said authority in regard to design, specifications and construction. State Highway casing installations shall be as specified in the FDOT, "Utility Accommodation Guide", and for railroads, the American Railway Engineering Association, Part 5, Section 5.2, "Specifications for Pipelines Conveying Nonflammable Substances", shall be applicable. However, in no case shall the minimum casing pipe diameter and wall thickness, for a specific carrier pipe size, be less than that specified above.
8. Any boring and jacking operations shall be done simultaneously, with continuous installation until the casing pipe is in final position. Correct line and grade shall be carefully maintained. Add-on sections of casing pipe shall be full-ring welded to the preceding length, developing water-tight total pipe strength joints. The casing installation shall produce no upheaval, settlement, cracking, movement or distortion of the existing roadbed or other facilities. Following placement of the carrier pipe within the steel casing, masonry plugs are to be installed at each open end. Said plugs shall be suitable for restraining the external earth load, while allowing internal drainage.
9. Casing pipe holes shall be mechanically bored through the soil by a cutting head on a continuous auger mounted inside the pipe. The auger shall extend a minimum distance beyond the end of the casing pipe to preclude formation of voids outside the pipe shell.
10. The casing pipe shall be adequately protected to prevent crushing or other damage under jacking pressures. Backstops shall be provided for adequately distributing the jack thrust without causing deformation of the soil or other damage. Should the casing pipe be damaged, such damaged portion, if not in the hole, shall be replaced; however, if inserted,

the encasement pipe shall be abandoned in place, suitably plugged, and an alternate installation made, as directed by the OWNER.

11. Required boring or jacking pits or shafts shall be excavated and maintained to the minimum dimension. Said excavation shall be adequately barricaded, sheeted, braced and dewatered as required.
12. Directional boring may be used for the installation of HDPE pipe.

B. Casing Spacers:

1. Stainless steel carriers with Teflon skids, or The Booster Casing Spacers, being on center and restrained shall be the preferred method for installing the carrier pipe. Skids shall be installed 7 feet or less, on center. After the carrier pipe has been tested for leakage, the casing shall have the ends blocked with either a 8" wall of brick masonry with a weep hole installed near the bottom of each wall or Cascade Model CCES End Seals with stainless steel bands.
2. High density polyethylene Raci casing spacers or approved equal, can be used for all size PVC pipes and on DIP pipe with diameters 12 inches or less. The spacers shall be of a projection type with a minimum number of projections around the circumference totaling the number of carrier pipe diameter inches. Casing spacers shall be spaced per manufacturer's recommendation with double spacers on each end of the casing. The casing spacers shall provide a minimum safety factor of 2 to 1 to support the service load.

C. Augering: Conduct augering with the proper equipment and procedure such that the carrier pipe and the casing pipe can be installed to the grades specified without disturbing the adjacent earth. Submit all equipment and procedures for prior approval.

D. Hand Mining: Conduct hand mining only in casings that are sufficiently large enough to permit such operation. Provide adequate fresh air supply within the casing pipe and conduct all operations in accordance with the requirements of the U.S. Department of Labor Safety and Health Regulations for Construction promulgated under the Occupational Safety and Health Act of 1970 (PL-91-596).

E. Jacking Pit: Make the jacking pit of adequate length to provide room for the jacking frame, the jacking head, the reaction blocks, the jacks, auger rig, and the jacking pipe. Make the pit sufficiently wide to allow ample working space on each side of the jacking frame. Make the depth of the pit such that the invert of the pipe, when placed on the guide frame, is at the elevation desired for the completed line. Provide excavation in conformance with Section 02222.

F. Sheetig: Sheet the jacking pit tightly and keep it dry at all times. Conform sheeting to Section 02151. Have complete design calculation for sheeting the jacking pit sealed and submitted by a Professional Engineer registered in the State of Florida.

G. Jacking Frame: Use a jacking frame that applies a uniform pressure over the entire pipe wall area of the pipe to be jacked.

H. Reaction Blocks: Use reaction blocks designed to carry the thrust of the jacks to the soil without excessive soil deflection and in such a manner as to avoid any disturbance of adjacent structures or utilities.

- I. Operation: Use hydraulic jacks in the jacking operation. Use extreme care to hold the pipe to exact line and grade. Advance the excavation at the heading manually or with an auger. Do not allow the advance to exceed one foot ahead of the casing pipe. Make every effort to avoid loss of earth outside the casing.
- J. Safety Railing: Provide a safety railing all around the top of the pit at all times.
- K. Property and surface conditions shall be restored to the original condition in accordance with Lee County DOT specifications and standards.
- L. Carrier Pipe:
 - 1. Water Mains or Sewer Force Mains installed within casing pipes shall utilize joint restraining for the entire pipe length inside the casing. Special supporting of the carrier pipe within the casing shall be required with a design approved by Lee County Utilities.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02230
ROADWAY CROSSINGS BY OPEN CUT

PART 1 GENERAL

1.1 SCOPE OF WORK

The CONTRACTOR shall provide all labor, materials, equipment, supervision and incidentals required to install the pipeline as shown on the Drawings in Lee County Streets by method of open cut.

1.2 SUBMITTAL

- A. Submit shop drawings to the ENGINEER for review.
- B. Before starting work, the CONTRACTOR shall submit to the Lee County Department of Transportation, with copy to the ENGINEER, a detailed schedule of his operations a minimum of fourteen (14) days prior to beginning work for approval. This shall include, but not be limited to, type and extent of temporary paving, and drawings and lists describing materials and traffic control methods to be used. Approval shall not relieve the CONTRACTOR of his obligation to provide a safe and proper crossing.
- C. The CONTRACTOR shall engage the services of a Professional Engineer who is registered in the State of Florida to design all cofferdam and sheeting and bracing systems which the CONTRACTOR feels necessary for the execution of his work. The CONTRACTOR's Engineer shall submit to the ENGINEER a signed statement that he has been employed by the CONTRACTOR to design all sheeting and bracing systems. After the systems have been installed, the CONTRACTOR's Engineer shall furnish to the ENGINEER an additional signed statement that the cofferdams and sheeting and bracing systems have been installed in accordance with his design.
- D. If a detour is required, a traffic control plan shall be submitted for approval to Lee County and/or the Florida Department of Transportation.
- E. A plan for maintenance of traffic in accordance with Index 600 through 650 of the Florida Department of Transportation Specifications shall be submitted by the CONTRACTOR.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall meet those specified in other applicable portions of this Specification.

PART 3 EXECUTION

3.1 GENERAL

- A. Trench dimensions for open cutting of road crossings are shown on the Drawings.
- B. The CONTRACTOR will be limited to a 24-hour period to complete the open-cut crossing. The road surface shall be repaved, with temporary pavement, if necessary, at the end of the 24-hour period.
- C. The CONTRACTOR shall notify Lee County DOT forty-eight (48) hours in advance of starting construction.

3.2 INSTALLATION

A. Temporary Roadways

1. Temporary roadways required for traffic relocation shall be constructed of materials meeting the requirements of the FDOT. Temporary roadways shall be used when crossing a state highway right-of-way or at the direction of the ENGINEER.
2. Temporary roadways shall be maintained in good condition throughout their use.
3. Drainage shall be maintained through all existing ditches by the use of culvert pipe as necessary.
4. Drawings indicating the type and location of temporary roadways shall be submitted as discussed in Paragraph 1.04.C. for approval prior to beginning work.
5. Where detours are permitted, the CONTRACTOR shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured, the CONTRACTOR shall expedite construction operations and periods when traffic is being detoured will be strictly controlled by the ENGINEER.
6. Lee County DOT will inspect all work being done.
7. All work at the roadway crossing shall be performed and completed in a manner fully satisfactory to Lee County DOT.

B. Maintenance of Traffic

1. The requirements specified herein are in addition to the plan for Maintenance of Traffic as specified in Sections 01041 and 01570.

2. The CONTRACTOR shall furnish during construction and any subsequent maintenance within State secondary road right-of-ways and Lee County streets, proper signs, signal lights, flagmen, and other warning devices for the protection of traffic all in conformance with the latest Manual on Uniform Traffic Control and Safe Streets and Highways, and the Florida Manual of Traffic Control and Safe Practices for Street and Highway Construction, Maintenance and Utility Operations. Information as to the above may be obtained from FDOT Division engineers. The ENGINEER, County Engineer, or FDOT Manager of the right-of-way of their representatives reserves the right to stop any work for noncompliance.
3. The CONTRACTOR shall take precautions to prevent injury to the public due to open trenches. Night watchmen may be required where special hazards exist, or police protection provided for traffic while work is in progress. The CONTRACTOR shall be fully responsible for damage or injuries whether or not police protection has been provided.
4. Unless permission to close a County street is received in writing from the proper authority, all excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the CONTRACTOR's operations cause traffic hazards, he shall repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the ENGINEER.
5. The CONTRACTOR shall be fully responsible for the installation of adequate safety precautions, for maintenance of the channelization devices, and for the protection of the traveling public.
6. At all open cut crossings, a minimum of one-way traffic shall be maintained during the daylight hours, and two-way traffic at night.

C. Installation of Pipeline

1. Pavement removal, sheeting, shoring and bracing, excavation and backfill, and dewatering shall meet the requirements of the applicable portions of this Specification.
2. The pipe shall be installed in accordance with Division 2 of these Specifications.
3. The trench shall be backfilled in accordance with the requirements of Section 02221.
4. Pavement replacement shall be in accordance with Section 02575 of this Specification.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02276
TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work specified in this Section consists of designing, providing, maintaining and removing temporary erosion and sedimentation controls as necessary.
- B. Temporary erosion controls include, but are not limited to, grassing, mulching, setting, watering, and reseeding onsite surfaces and spoil and borrow area surfaces and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the OWNER.
- C. Temporary sedimentation controls include, but are not limited to, silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the OWNER.
- D. CONTRACTOR is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.

1.2 REFERENCE DOCUMENTS

- A. South Florida Building Code and Standard Building Code.

PART 2 PRODUCTS

2.1 EROSION CONTROL

- A. Seeding and Sodding is specified in Section 02400.
- B. Netting - fabricated of material acceptable to the OWNER.

2.2 SEDIMENTATION CONTROL

- A. Bales - clean, seed free cereal hay type.
- B. Netting - fabricated of material acceptable to the OWNER.
- C. Filter Stone - crushed stone conforming to Florida Department of Transportation specifications.
- D. Concrete Block - hollow, non-load-bearing type.
- E. Concrete - exterior grade not less than one inch thick.

PART 3 EXECUTION

3.1 EROSION CONTROL

A. Minimum procedures for grassing are:

1. Scarify slopes to a depth of not less than six inches and remove large clods, rock, stumps, roots larger than 1/2 inch in diameter and debris.
2. Sow seed within twenty-four (24) hours after the ground is scarified with either mechanical seed drills or rotary hand seeders.
3. Apply mulch loosely and to a thickness of between 3/4 inch and 1-1/2 inches.
4. Apply netting over mulched areas on sloped surfaces.
5. Roll and water seeded areas in a manner which will encourage sprouting of seeds and growing of grass. Reseed areas which exhibit unsatisfactory growth. Backfill and seed eroded areas.

3.2 SEDIMENTATION CONTROL

A. Install and maintain silt dams, traps, barriers, and appurtenances as shown on the approved descriptions and working drawings. Hay bales which deteriorate and filter stone which is dislodged shall be replaced.

3.3 PERFORMANCE

A. Should any of the temporary erosion and sediment control measures employed by the CONTRACTOR fail to produce results which comply with the requirements of the State of Florida, CONTRACTOR shall immediately take whatever steps are necessary to correct the deficiency at his own expense.

END OF SECTION

SECTION 02300

DIRECTIONAL DRILLING

PART 1 GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

- A. Provide all necessary tools, materials and equipment to successfully complete the installation of directionally drilled piping as specified herein and shown on the drawings. The CONTRACTOR shall be responsible for the final constructed product, and for furnishing the qualified labor and superintendence necessary for this method of construction.
- B. Furnish all items necessary to perform the horizontal directional drilling operation and construct the pipe to the lines and grade shown on the drawings.
- C. Boring must use techniques of creating or directing a borehole along a predetermined path to a specified target location. This must involve use of mechanical and hydraulic deviation equipment to change the boring course and must use instrumentation to monitor the location and orientation of the boring head assembly along a predetermined course.
- D. Drilling must be accomplished with fluid-assist mechanical cutting. Boring fluids shall be a mixture of bentonite and water or polymers and additives. Bentonite sealants and water will be used to lubricate and seal the mini-tunnel. It is mandatory that minimum pressures and flow rates be used during drilling operation as not to fracture the sub-grade material around and or above the bore.
- E. The mobile drilling system shall utilize small diameter fluid jets to fracture and mechanical cutters to cut and excavate the soil as the head advances forward.
- F. Steering shall be accomplished by the installation of an offset section of drill stem that causes the cutterhead to turn eccentrically about its centerline when it is rotating. When steering adjustments are required, the cutterhead offset section is rotated toward the desired direction of travel and the drill stem is advanced forward without rotation.
- G. The mobile drilling system must be capable of being launched from the surface at an inclined angle and drilling a 2 inch to 3 inch diameter pilot hole. The pilot hole will then be enlarged with reamers as required.

1.2 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials (AASHTO).
- B. Occupational Safety and Health Administration (OSHA).

1.3 DEFINITIONS

- A. CONTRACTOR's Construction Drawings shall be defined as drawings by which the CONTRACTOR proposes to construct, operate, build, etc., the referenced item. The submission of these drawings shall be required for the sole purpose of providing the sufficient details to verify that the CONTRACTOR's work in progress is in accordance with the intent of the design.

1.4 SUBMITTALS

- A. The ENGINEER will base the review of submitted details and data on the requirements of the completed work, safety of the work in regards to the public, potential for damage to public or private utilities and other existing structures and facilities, and the potential for unnecessary delay in the execution of the work. Such review shall not be construed to relieve the CONTRACTOR in any way of his responsibilities under the contract. CONTRACTOR shall not commence work on any items requiring CONTRACTOR's construction drawings or other submittals until the drawings and submittals are reviewed and accepted by the ENGINEER.
- B. The CONTRACTOR shall:
 - 1. Submit for review complete construction drawings and/or complete written description identifying details of the proposed method of construction and the sequence of operations to be performed during construction, as required by the method of tunnel excavation approved. The drawings and descriptions shall be sufficiently detailed to demonstrate to the ENGINEER whether the proposed materials and procedures will meet the requirements of this specification. CONTRACTOR shall submit arrangement drawings and technical specifications of the machine and trailing equipment (including any modifications), three-year experience record with this type of machine and a copy of the manufacturer's operation manual for the machine.
 - 2. CONTRACTOR's construction drawings shall be submitted on the following items.
 - a. Complete details of the equipment, methods and procedures to be used, including but not limited to primary lining installation, timing of installation in relation to the excavation plan and sequence, bulkheads, etc.
 - b. Grouting techniques, including equipment, pumping procedures, pressure grout types, mixtures and plug systems.
 - c. Method of controlling line and grade of excavation.
 - d. Details of muck removal, including equipment type, number, and disposal location.
 - e. Proposed contingency plans for critical phases and areas of directional drilling.
- C. Quality Control Methods. At least 10 days prior to the start of directional drilling, CONTRACTOR shall submit a description of his quality control methods he proposes to use in his operations to the ENGINEER. The submittal shall describe:
 - 1. Procedures for controlling and checking line and grade.
 - 2. Field forms for establishing and checking line and grade.
- D. Safety. Procedures including, but not limited to, monitoring for gases encountered shall be submitted.
- E. Hazardous chemical list as well as all MSDS and technical data sheets.

1.5 DESIGN CRITERIA

A. Compatibility of Methods.

1. The methods of excavation, lining, and groundwater control shall be compatible.

1.6 JOB CONDITIONS

A. Safety Requirements

1. Perform work in a manner to maximize safety and reduce exposure of men and equipment to hazardous and potentially hazardous conditions, in accordance with applicable safety standards.
2. Whenever there is an emergency or stoppage of work which is likely to endanger the excavation or adjacent structures, operate a full work force for 24 hours a day, including weekends and holidays, without intermission until the emergency or hazardous conditions no longer jeopardize the stability and safety of the work.

B. Air Quality.

1. Conduct directional drilling operations by methods and with equipment, which will positively control dust, fumes, vapors, gases or other atmospheric impurities in accordance with applicable safety requirements.

1.7 PERMITS

A. Obtain any and all other permits required for prosecution of the work.

PART 2 PRODUCTS

2.1 GENERAL

A. Refer to Section 02620 for HDPE pipe material.

PART 3 EXECUTION

3.1 GENERAL

- A. The CONTRACTOR shall be responsible for his means and methods of directional drilling construction and shall ensure the safety of the work, the CONTRACTOR's employees, the public, and adjacent property, whether public or private.
- B. Anticipate that portions of the drilled excavation will be below the groundwater table.
- C. Comply with all local, state and federal laws, rules and regulations at all times to prevent pollution of the air, ground and water.

3.2 EQUIPMENT

- A. Diesel, electrical, or air-powered equipment will be acceptable, subject to applicable federal and state regulations.
- B. Any method or equipment that the CONTRACTOR can demonstrate will produce the specified results will be considered.
- C. Employ equipment that will be capable of handling the various anticipated ground conditions. In addition, the equipment shall:
 1. Be capable of minimizing loss of ground ahead of and around the machine and providing satisfactory support of the excavated face at all times.
 2. Provide a system to indicate whether the amount of earth material removed is equivalent to that displaced by the advance of the machine such that the advance rate may be controlled accordingly.
- D. Provide adequate secondary containment for any and all portable storage tanks.

3.3 DIRECTIONAL DRILLING DATA

- A. Daily logs of construction events and observations shall be submitted on at least the following:
 1. Location and elevation of significant soil strata boundaries and brief soil descriptions.
 2. Jacking pressures and torsional forces, if applicable.

3.4 CONTROL OF THE TUNNEL LINE AND GRADE

- A. Construction Control.
 1. Establish and be fully responsible for the accuracy of his own control for the construction of the entire project, including structures, tunnel line and grade.
 2. Establish control points sufficiently far from the tunnel operation not to be affected by construction operations.
 3. Maintain daily records of alignment and grade and shall submit three copies of these records to the ENGINEER. However, the CONTRACTOR remains fully responsible for the accuracy of his work and the correction of it, as required.
 4. Check control for the bore alignment against an above ground undisturbed reference at least once each hour and once for each 50 feet of tunnel constructed, or more often as needed or directed by the ENGINEER.

3.5 DISPOSAL OF EXCESS MATERIAL

- A. Where such effort is necessary, cost for groundwater control during the course of the tunnel work shall be included in the unit contract price for the work.

B. Dewatering required during the course of the project to lower water table, to remove standing water, surface drainage seepage, or to protect ongoing work against rising waters or floods shall be considered incidental to the work being performed.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02400

LAWN RESTORATION

PART 1 GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. The work in this section consists of furnishing all labor, material and equipment to replace and maintain all areas disturbed during construction by establishing a stand of grass, within the areas called for by the furnishing and placing grass sod, or seeding, or seeding and mulching.

1.2 REFERENCE DOCUMENTS

A. The materials used in this work shall conform to the requirements of Florida Department of Transportation Standard Specifications for Road and Bridge Construction as follows:

1. Sod - Section 981-2
2. Fertilizer - Section 982
3. Water - Section 983

1.3 SUBMITTALS

A. Submit certifications and identification labels for all sodding supplied as specified in Section 01300.

PART 2 PRODUCTS

2.1 SODDING

A. Types: Sod may be of either St. Augustine or Argentine Bahia grass or as that disturbed, as established prior to construction. It shall be well matted with roots. When replacing sod in areas that are already sodded, the sod shall be the same type as the existing sod.

B. Sod shall be provided as required in accordance with Florida Department of Transportation Specifications 575 and 981. The CONTRACTOR shall furnish sod equal to and similar in type as that disturbed. Placement and watering requirements shall be in accordance with FDOT Specifications Section 575.

C. The sod shall be taken up in commercial-size rectangles, preferably 12-inch by 24-inch or larger, except where 6-inch strip sodding is called for.

D. The sod shall be sufficiently thick to secure a dense stand of live grass. The sod shall be live, fresh and uninjured at the time of planting. It shall have a soil mat of sufficient thickness adhering firmly to the roots to withstand all necessary handling. It shall be reasonably free of weeds and other grasses. It shall be planted as soon as possible after being dug and shall be shaded and kept moist from the time it is dug until it is planted.

E. Sod should be handled in a manner to prevent breaking or other damage. Sod shall not be handled by pitch forks or by dumping from trucks or other vehicles. Care shall be taken at all

times to retain the native soil on the roots of each sod roll during stripping and handling. Sod that has been damaged by handling during delivery, storage or installation will be rejected.

2.2 FERTILIZER

- A. Chemical fertilizer shall be supplied in suitable bags with the net weight certification of the shipment. Fertilizer shall be 12-8-8 and comply with Section 982 of the FDOT Standard Specification for Road and Bridge Construction.
- B. The numerical designations for fertilizer indicate the minimum percentages (respectively) of (1) total nitrogen, (2) available phosphoric acid and (3) water soluble potash, contained in the fertilizer.
- C. The chemical designation of the fertilizer shall be 12-8-8, with at least 50 percent of the nitrogen from a nonwater-soluble organic source. The nitrogen source may be a ureaformaldehyde source provided it is not derived from a waste product of the plastic industry.

2.3 EQUIPMENT

- A. The device for spreading fertilizer shall be capable of uniformly distributing the material at the specified rate.

2.4 NETTING

- A. Netting is fabricated of material similar to Geoscope Landscape Fabric or approved equal.

2.5 GRASSING

- A. The CONTRACTOR shall grass all unpaved areas disturbed during construction which do not require sod. All grassing shall be completed in conformance with FDOT Specifications Sections 570 and 981. The grassed areas shall be mulched and fertilized in accordance with FDOT Specifications.
- B. Grass seed shall be Argentine Bahia, 60#/acre March 1 to November 1, 50#/acre with 20#/acre of rye grass seed November 1 to March 1. Argentine Bahia seed shall be a scarified seed having a minimum active germination of 40% and total of 85%.
- C. Mulch material shall be free of weeds and shall be oat straw or rye, Pangola, peanut, Coastal Bermuda, or Bahia grass hay.

2.6 TOPSOIL

- A. Topsoil stockpiled during excavation may be used. If additional topsoil is required to replace topsoil removed during construction, it shall be obtained off site at no additional cost to the OWNER. Topsoil shall be fertile, natural surface soil, capable of producing all trees, plants, and grassing specified herein.

2.7 MULCH

- A. Mulch shall be fresh cypress mulch. Rate of application specified herein shall correspond to depth not less than 1-inch or more than 3-inches according to texture and moisture content of mulch material.

2.8 WATER

- A. It is the CONTRACTOR'S responsibility to supply all water to the site, as required during seeding and sodding operations and through the maintenance period and until the work is accepted. The CONTRACTOR shall make whatever arrangements may be necessary to ensure an adequate supply of water to meet the needs for his work. He shall also furnish all necessary hose, equipment, attachments, and accessories for the adequate irrigation of lawns and planted areas as may be required. Water shall be suitable for irrigation and free from ingredients harmful to plant life.

PART 3 EXECUTION

3.1 SOD BED PREPARATION

- A. Areas to be sodded and/or seeded shall be cleared of all rough grass, weeds, and debris, and brought to an even grade.
- B. The soil shall then be thoroughly tilled to a minimum 8-inch depth.
- C. The areas shall then be brought to proper grade, free of sticks, stones, or other foreign matter over 1-inch in diameter or dimension. The surface shall conform to finish grade, less the thickness of sod, free of water-retaining depressions, the soil friable and of uniformly firm texture.

3.2 INSPECTION

- A. Verify that soil preparation and related preceding work has been completed.
- B. Do not start work until conditions are satisfactory.

3.3 SOD HANDLING AND INSTALLATION

- A. During delivery, prior to planting, and during the planting of sod areas, the sod panels shall at all times be protected from excessive drying and unnecessary exposure of the roots to the sun. All sod shall be stacked during construction and planting so as not to be damaged by sweating or excessive heat and moisture.
- B. After completion of soil conditioning as specified above, sod panels shall be laid tightly together so as to make a solid sodded lawn area. On mounds and other slopes, the long dimension of the sod shall be laid perpendicular to the slope. Immediately following sod laying the lawn areas shall be rolled with a lawn roller customarily used for such purposes, and then thoroughly watered.
- C. Sod shall be placed at all areas where sod existed prior to construction, on slopes of 3 horizontal on 1 vertical (3:1) or greater, in areas where erosion of soils will occur, and as

directed by the ENGINEER. On areas where the sod may slide, due to height and slope, the ENGINEER may direct that the sod be pegged, with pegs driven through the sod blocks into firm earth, at suitable intervals.

3.4 USE OF SOD ON ROADWAY PROJECTS

A. In accordance with the FDOT District One Standard Practice, permanent green grass shall be established at the completion of roadway construction and maintenance work. The following shall apply to all restoration involving State or County roadways:

1. Sod in lieu of seed and mulch shall be used on all roadways with urban (raised curb) typical sections.
2. One inch water per week shall be required for a minimum of four (4) consecutive weeks for the purpose of establishing sod. This can be waived during construction, if and only if there is a minimum of one inch of rain per week on all sod on the project.
3. Sod shall be placed on slopes 1:3 or greater. Staked sod shall be placed on slopes 1:2 or greater.
4. On all curves with super elevation, sod shall be placed from the edge of pavement to the toe of slope on the downhill side(s) for the entire length of the super elevated roadway. On multi-lane divided rural facilities, sod shall be placed in the median and on the inside of the curve in the super elevated areas. This does not apply to reverse crowns.
5. For all projects with less than 10,000 square yards grass area, sod shall be used.
6. On tangent sections and on outside of curves, sod shall be used between the edge of pavement and a point 4 feet beyond the shoulder break point.
7. The entire width of sod should not exceed 15 feet from the edge of pavement.
8. Sod is to be used to eliminate narrow seed and mulch areas. Areas less than 6 feet in width shall be sodded.
9. Sod shall be placed around drainage structures as per the standard Indexes and extended to the edge of pavement.

3.5 SOD MAINTENANCE

A. The sod shall produce a dense, well established growth. The CONTRACTOR shall be responsible for the repair and re-sodding of all eroded or bare spots until project acceptance. Repair to sodding shall be accomplished as in the original work.

B. Sufficient watering shall be done by the CONTRACTOR to maintain adequate moisture for optimum development of the seeded and sodded areas. Sodded areas shall receive no less than 1.5 inches of water per week for at least 2 weeks. Thereafter, the CONTRACTOR shall apply water for a minimum of 60 days as needed until the sod takes root and starts to grow or until final acceptance, whichever is latest.

3.6 CLEANING

- A. Remove debris and excess materials from the project site.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02485

SEEDING AND SODDING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, and equipment necessary to satisfactorily return all construction areas to their original conditions or better.
- B. Work includes furnishing and placing seed or sod, fertilizer, planting, watering, and maintenance until acceptance by the Owner.

1.02 QUALITY ASSURANCE

A. Requirements

It is the intent of this specification that the Contractor is obliged to deliver a satisfactory strand of grass as specified. If necessary, the Contractor shall repeat any or all of the work, including grading, fertilizing, watering, and seeding or sodding at no additional cost to the owner until a satisfactory strand is obtained.

B. Satisfactory Strand

For purposes of grassing, a satisfactory strand of grass is herein defined as a full lawn cover over areas to be seeded or sodded, with grass free of weeds, alive and growing, leaving no bare spots larger than 3/4 sq. yd. within a radius of 10 ft.

PART 2 - PRODUCTS

2.01 Materials

A. Fertilizer

Fertilizer shall be of the slow-release type meeting the following minimum requirements: 12 percent nitrogen, 3 percent phosphorus, 6 percent potassium; 40 percent other available materials derived from organic sources. Fertilizer shall be uniform in composition, dry and free flowing delivered to sites in original unopened containers bearing manufacturer's statement or guarantee.

B. Grassing

The Contractor shall grass all unpaved areas disturbed during construction which do not require sod. All grassing shall be completed in conformance with FDOT Specifications Sections 570 and 981. The grassed areas shall be mulched and fertilized in accordance with FDOT Specifications.

C. Sodding

Sod shall be provided as required in accordance with Florida Department of Transportation Specifications 575 and 981. The Contractor shall furnish sod equal to and similar in type as that disturbed. Placement and watering requirements shall be in accordance with FDOT Specifications Section 575.

D. Topsoil

Topsoil stockpiled during excavation may be used. If additional topsoil is required to replace topsoil removed during construction, it shall be obtained off site at no additional cost to the Owner. Topsoil shall be fertile, natural surface soil, capable of producing all trees, plants, and grassing specified herein.

E. Mulch

Mulch shall be fresh cypress mulch. Rate of application specified herein shall correspond to depth not less than 1" or more than 3" according to texture and moisture content of mulch material.

F. Water

It is the Contractor's responsibility to supply all water to the site, as required during seeding and sodding operations and through the maintenance period and until the work is accepted. The Contractor shall make whatever arrangements may be necessary to ensure an adequate supply of water to meet the needs for his work. He shall also furnish all necessary hose, equipment, attachments, and accessories for the adequate irrigation of lawns and planted areas as may be required. Water shall be suitable for irrigation and free from ingredients harmful to plant life.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Time of Seeding and Sodding

When the trench backfill has stabilized sufficiently, the Contractor shall commence work on lawns and grassed areas, including fine grading as required.

B. Finish Grading

Areas to be seeded or sodded shall be finish graded, raked, and debris removed. Soft spots and uneven grades shall be eliminated; the Engineer shall approve the finish grade of all areas to be seeded or sodded prior to application of seed or sod.

C. Protection

Seeded and sodded areas shall be protected against the traffic or other use by placing warning signs or erecting barricades as necessary. Any areas damaged prior to actual acceptance by the Owner shall be repaired by the Contractor as directed by the Engineer.

3.02 CLEANUP

- A. Soil, mulch, seed, or similar materials spilled onto paved areas shall be removed promptly, keeping those areas as clean as possible at all times. Upon completion of seeding and sodding operations, all excess soil, stones, and debris remaining shall be removed from the construction areas.

3.03 LANDSCAPE MAINTENANCE

- A. Any existing landscape items damaged or altered during construction by the Contractor shall be restored or replaced as directed by the Engineer.
- B. Maintain landscape work for a period of 90 days immediately following complete installation of work or until Owner accepts project. Watering, seeding, cultivating, restoration of grade, mowing and trimming grass, protection from insects and diseases, fertilizing and similar operations as needed to ensure normal growth and good health for live plant material shall be the responsibility of the Contractor and at no additional cost to the Owner.

3.04 REPAIRS TO LAWN AREAS DISTURBED BY CONTRACTOR'S OPERATIONS

- A. Lawn areas planted under this Contract and all lawn areas damaged by the Contractor's operation shall be repaired at once by proper soil preparation, fertilizing, and reseeding or sodding, in accordance with these Specifications.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02523
SIDEWALKS, DRIVEWAYS AND CURBS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Sidewalks, sidewalk ramps, driveways, curbs and drive approaches complete with concrete materials, concrete curing compounds, joint materials, field quality control and appurtenances.

1.2 REFERENCES

A. Reference Standards: Conform the work for this Section to the applicable portions of the following standard Specifications.

1. ASTM - American Society of Testing and Materials
2. AASHTO - American Association of State Highway and Transportation Officials
3. FDOT - Florida Department of Transportation - Standard Specifications for Road and Bridge Construction.
4. FAC - Florida Accessibility Code.
5. ADAAG - American with Disabilities Act Accessibility Guidelines
6. UFAS - Uniform Federal Accessibility Standards

1.3 SUBMITTALS

A. Reports: Written permission for the use of all local disposal sites. Furnish two (2) copies to the ENGINEER.

B. Test Reports:

1. Thickness and Compressive Strength: Provide the ENGINEER with two (2) certified copies of the test results. Perform the tests by a laboratory approved by the ENGINEER.

1.4 JOB CONDITIONS

A. Environmental Requirements:

1. Temperature: Comply with the requirements for concrete installation due to outside ambient air temperatures as specified under Article 3.3.I of this Section.

B. Protection:

1. Protection Against Rain: Comply with the requirements for protecting new work against damage from Rain, as specified under Article 3.3.I of this Section.
2. Protection Against Cold Weather: Comply with the requirements for protecting new work against damage from cold weather, as specified under Article 3.3.I of this Section.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Concrete: Use 2,500 psi concrete except as modified herein.
- B. Ready-Mixed Concrete: Use ready-mixed concrete which conforms to ASTM C94, Alternate 2.
- C. Water: Use water for mixing and curing concrete reasonably clean and free from oil, salt, acid, alkali, chlorides, sugar, vegetable, or other substances injurious to the finished product. Waters from sources approved by the local Health Department as potable may be used without test. Test water requiring testing in accordance with the current Method of Test for Quality of Water to be Used in Concrete, AASHTO T-26.
- D. Concrete Curing Compounds: Use white membrane curing compound for curing concrete which conforms to AASHTO M148, Type 1 clear, or Type 2 while per FDOT Section 925.
- E. Premolded Joint Filler: Use fiber joint filler which conforms to ASTM D1751. Use filler of the thickness, as specified herein, or as directed by the ENGINEER.
- F. Steel Hook Bolts: Use hook bolts which conform to ASTM A706, or for Grade 60 of ASTM A615, A616, or A617. Use 5/8-inch diameter hook bolts self tapping.
- G. Joint Sealant: Use hot-poured type joint sealant which conforms to ASTM D1190.

PART 3 EXECUTION

3.1 CONTRACTOR'S VERIFICATION

- A. Excavation and Forming: Prior to the installation of any concrete, examine the excavation and forms for the proper grades, lines, and levels required to receive the new work. Ascertain that all excavation and compacted subgrades are adequate to receive the concrete to be installed.
 - 1. Correct all defects and deficiencies before proceeding with the work.
- B. Existing Improvements: Investigate and verify location of existing improvements to which the new work is to be connected.
 - 1. Making necessary adjustment in line and grade to align the new work with the existing improvements must be approved by the ENGINEER prior to any change.

3.2 PREPARATION

- A. Forms: Use wood or metal forms, straight and free from warp, clean, and sufficient strength to resist springing during the process of depositing concrete against them.
 - 1. Use full depth of the concrete forms.

3.3 INSTALLATION

- A. Sidewalks, Sidewalk Ramps, Driveways and Driveway Approaches: Construct all sidewalks and sidewalk ramps four (4) inches thick except at driveways and alleys. Construct thickness of the sidewalks six (6) inches at driveways and alleys. Construct sidewalks five (5) feet wide unless otherwise noted on the Plans or directed by the ENGINEER, and slope 1/4-inch per foot towards the center of the road. Normally, sidewalks will be located within the right-of-way, parallel the property lines, at a distance of 1-foot from the property line.
 1. Construct alleys, driveways and approaches six (6) inches thick. Construct the width of the driveways and driveway approaches as shown on the Plans or as directed by the ENGINEER.
- B. Removal of Existing Curb for Sidewalk Ramps and Driveway Approaches: Conform construction of sidewalk ramps within street intersections where curbed pavement existing to the current FDOT Roadway and Traffic Design Standards.
 1. Saw cut, to full depth of pavement, and remove a minimum of an 18-inch wide curb and gutter section where there is no proper curb drop for the sidewalk ramp or driveway approach. When mountable curbs are present, remove a 24-inch wide curb and gutter section for the construction of sidewalk ramps, as specified above.
 2. Remove curb and gutter as determined by the ENGINEER in the field but remove curb and gutter at least as wide as the proposed sidewalk ramp plus 1-foot on each side.
 3. Replace the removed curb and gutter section with materials, equal to what was removed and seal joint with hot poured rubber asphalt.
- C. Install 5/8 inch diameter self tapping hook bolts, in the existing concrete pavement as indicated on the Plans prior to placing concrete for the removed curb and gutter section.
- D. Placement of Forms: Use wood forms, straight and free from warp, of nominal depth for sidewalk sections less than 25 feet in length.
 1. Stake forms to line and grade in a manner that will prevent deflection and settlement.
 2. When unit slab areas are to be poured, place slab division forms such that the slab division joints will be straight and continuous.
 3. Set forms for sidewalk ramps to provide a grade toward the centerline of the right-of-way in accordance with current standards. Use a uniform grade, except as may be necessary to eliminate short grade changes.
 4. Oil forms before placing concrete. Leave forms in place at least 12 hours after the concrete is placed. Place forms ahead of the pouring operations to maintain uninterrupted placement of concrete.
 5. The use of slip form pavers can be allowed when approved by the ENGINEER in lieu of the construction system described above.

E. Joints: Construct transverse and longitudinal expansion and plane-of-weakness joints at the locations specified herein, or as indicated on the Plans or as directed by the ENGINEER.

1. Place the transverse expansion joints for the full width and depth of the new work. Use transverse expansion joints placed against an existing pavement a minimum of six (6) inches deep but no less than the thickness of the concrete being placed.
2. Conform longitudinal expansion joints to the requirements as transverse expansion joints.
3. Construct joints true to line with their faces perpendicular to the surface of the sidewalk. Install the top slightly below the finished surface of the sidewalk. Construct transverse joints at right angles to the centerline of the sidewalk and construct longitudinal joints parallel to the centerline or as directed by the ENGINEER.
4. Place transverse expansion joints, 1/2-inch thick, through the sidewalk at uniform intervals of not more than 50 feet and elsewhere as shown on the Plans, or as directed by the ENGINEER.
5. Place expansion joints, 1/2-inch thick, between the sidewalk and back of abutting parallel curb, buildings or other rigid structures, concrete driveways and driveway approaches. When directed by the ENGINEER, place the expansion joint between sidewalks and buildings 1-foot from the property line and parallel to it.
6. Form plane-of-weakness joints every five (5) feet. Form joints by use of slab division's forms extending to the full depth of the concrete or by cutting joints in the concrete, after floating, to a depth equal to 1/4 the thickness on the sidewalk. Construct cut joints not less than 1/8-inch or more than 1/4-inch in width and finish smooth and at right angles to the centerline on the sidewalk.

F. Placing and Finishing Concrete: Place all concrete on a prepared unfrozen, smooth, leveled, rolled and properly compacted base. Place concrete on a moist surface with no visible water present.

1. Deposit the concrete, in a single layer to the depth specified. Spade or vibrate and compact the concrete to fill in all voids along the forms and joints. Strike off the concrete with a strike board until all voids are removed and the surface has the required grade and cross section as indicated on the Plans, or as directed by the ENGINEER.
2. Float the surface of the concrete just enough to produce a smooth surface free from irregularities. Round all edges and joints with an edger having a 1/4-inch radius.
3. Broom the surface of sidewalks, driveways and approaches to slightly roughen the surface.
4. Texture the surface of the sidewalk ramps with a coarse broom transversely to the ramp slope, and coarser roughen than the remainder of the sidewalk. Contrast the ramp slope in color (using a brick-red dye or approved equal) from the remainder of the sidewalk. Comply with minimum color contrast and slope requirements from FAC, UFAS, ADAAG, Local Government Standards, or as directed by the ENGINEER.

- G. Curing: After finishing operations have been completed and immediately after the free water has left the surface, completely coat and seal the surface of the concrete (and sides if slip-forming is used) with a uniform layer of white membrane curing compound. Do not thin the curing compound. Apply the curing compound at the rate of one gallon per 200 square feet of surface.
- H. Barricades: Place suitable barricades and lights around all newly poured sidewalks, sidewalk ramps, driveways, driveway approaches and curb and gutter sections in order to protect the new work from damage from pedestrians, vehicles and others until the concrete has hardened.
 - 1. Leave barricades in place for a minimum of two (2) days, except for driveway approaches and curb and gutter sections. Leave barricades in place for a minimum of three (3) days.
 - 2. Remove and replace any concrete that suffers surface or structural damage at no additional cost.
- I. Protection:
 - 1. Against Rain: Protect new concrete from the effects of rain before the concrete has sufficiently hardened. Have available on the job site at all times enough burlap or 6-mil thick polyurethane film to cover and protect one day's work. Stop work and cover completed work when rain appears eminent. As soon as the rain ceases, uncover the concrete and burlap drag the surface where necessary. Apply curing compound to any areas where the compound has been disturbed or washed away.
 - 2. Against Cold Weather: If concrete is placed between December 15 and February 15, have available on the site sufficient amount of clean, dry straw or hay to cover one (1) day's production. If the temperature reaches 40 degrees F and is falling, place the hay or straw 12 inches thick, immediately after the curing compound is applied.
 - 3. Concrete Temperature Limitations: Do not place concrete when the temperature of the concrete at the point of placement is above 90 degrees F.
- J. Cleanup: After the concrete has gained sufficient strength, but no sooner than within 12 hours, remove the fixed forms and backfill the spaces on both sides with sound earth of topsoil quality. Compact, level and leave backfill in a neat condition.
- K. Gutters and Curbs: Construct gutters and curbs in accordance with Section 520 FDOT Standard Specifications for Road and Bridge Construction, latest edition, including supplements.

3.4 FIELD QUALITY CONTROL

- A. Concrete Delivery Ticket: Use a ticket system for recording the transportation of concrete from the batching plant to point of delivery. Issue this ticket to the truck operator at the point of loading and give to the ENGINEER upon delivery.
- B. Concrete Delivery Rejection: Remove concrete not permitted for inclusion in the work by the ENGINEER from the site. Rejection of concrete will be determined through Field Quality Control and elapsed time from mixer charging to delivery.

C. Concrete Testing at Placement: Perform tests of each batch of concrete delivered, each 50 cubic yards, or whenever consistency appears to vary. The sampling and testing of slump, air content and strength shall be included in the cost of concrete work, and will be performed at no additional cost to the OWNER.

1. Sampling: Secure composite samples in accordance with the Method of Sampling Fresh Concrete, ASTM C172.
2. Slump Test: Test in accordance with ASTM C143. Use the least slump possible consistent with workability for proper placing of the various classifications of concrete.
 - a. Place structural concrete for walls and slabs, by means of vibratory equipment, with a slump of four (4) inches.
 - b. A tolerance of up to 1-inch above the indicated maximum will be allowed for individual batches provided the average for all batches or the most recent ten (10) batches tested, whichever is fewer, does not exceed the maximum limit.
3. Air Content: Determine air content of normal weight concrete in accordance with Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method, ASTM C23 1, or by the volumetric method, ASTM C 173, for each strength test.
4. Compressive Strength: Make two (2) strength tests of three (3) samples each for each 50 cubic yards, or fraction thereof, of each mix design of concrete placed in any one (1) day.
 - a. Handling Samples: Mold and cure three (3) specimens from each sample in accordance with Method of Making and Curing Concrete Test Specimens in the Field, ASTM C31. Record any deviations from the requirements of this Standard in the test report.
 - b. Testing: Test specimens in accordance with Method of Test for Compressive Strength of Cylindrical Concrete Specimens, ASTM C39. Test one (1) specimen at seven (7) days for information and test two (2) at 28 days for acceptance. Use the average of the strengths of the two (2) specimens tested at 28 days. Discard results if one (1) specimen in a test manifests evidence of improper sampling, molding or testing, and use the strength of the remaining cylinder. Should both specimens in test shown any of the above defects, discard the entire test.
 - c. Acceptance of Concrete: The strength level of the concrete will be considered satisfactory so long as the averages of all sets of three consecutive strength test results equal or exceed the specified 28-day strength and no individual strength test results falls below the specified 28-day strength by more than 500 psi. If the strength test is not acceptable, perform further testing to qualify the concrete.
 - d. Concrete Temperature: Determine the temperature of concrete sample for each strength test.

D. Reductions due to deficiencies in thickness or compressive strength are additive, that is, if an area is deficient by 3/8 inch and under strength by 200 psi, the total reduction is 20% plus 20% or 40% reduction.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02530

GROUNDWATER CONTROL FOR OPEN CUT EXCAVATION

PART 1 GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. This section provides for furnishing all labor, materials, equipment, power and incidentals for performing all operations necessary to dewater, depressurize, drain and maintain excavations as described herein and as necessary for installation of pipeline and appurtenances. Included are installing, maintaining, operating and removing dewatering systems and other approved devices for the control of surface and groundwater during the construction of open cut excavations, directional drilling, pipelines and appurtenances, and protecting work against rising waters and repair of any resulting damage.

1.2 CONTRACTOR'S RESPONSIBILITY

A. It is the sole responsibility of the CONTRACTOR to identify groundwater conditions and to provide any and all labor, material, equipment, techniques and methods to lower, control and handle the groundwater as necessary for his construction methods and to monitor the effectiveness of this installed system and its effect on adjacent facilities.

B. Operate, maintain and modify the system(s) as required to conform to these Specifications and federal, state and local regulatory requirements. Upon completion of the Construction, CONTRACTOR shall remove the system(s). The development, drilling and abandonment of all wells used in the dewatering system shall comply with regulations of the Florida Department of Environmental Protection and the governing Water Management District.

C. Assume sole responsibility for dewatering systems and for all loss or damage resulting from partial or complete failure of protective measures and any settlement or resultant damage caused by the dewatering operation.

1.3 PLANS AND OTHER DATA TO BE SUBMITTED

A. Prior to commencement of work, submit complete drawings, details and layouts showing the proposed dewatering plans in accordance with Section 01300. The submittals shall be sufficiently detailed (i.e., general arrangements, procedures to be used, etc.) to allow the ENGINEER to evaluate the proposed dewatering systems. Include the following, as required by the CONTRACTOR's proposed operation:

1. Names of equipment suppliers.
2. Names of installation subcontractors.
3. Plan for dewatering at access shafts and control of surface drainage.
4. Plan for dewatering for cut-and-cover excavations, or otherwise controlling groundwater.

5. Eductor system layout and details.
6. Deep well locations and details.
7. Well point system layout and details.
8. Installation reports for eductors, deep wells and well points.
9. Water level readings from piezometers or observation wells, and method of maintenance.
10. As part of his request for approval of a dewatering system, demonstrate the adequacy of the proposed system and well point filler sand by means of a test installation.
11. Water quality sample results as required by regulatory agencies.

PART 2 PRODUCTS

- A. Select equipment including but not limited to pumps, eductors, well points and piping and other material desired.

PART 3 EXECUTION

3.1 DEWATERING EXCAVATIONS

- A. Furnish, install, operate and maintain all necessary equipment for dewatering the various parts of the Work and for maintaining free of water the excavations and such other parts of the Work as required for Construction operations. Dewatering system should provide for continuous operation including nights, weekends, holidays, etc. Appropriate backup shall be provided if electrical power is primary energy source for dewatering system.
- B. Continue dewatering in all required areas, until the involved work is completed, including the placing and compaction of backfill materials in the dry.
- C. Provide a uniform diameter for each pipe drain run constructed for dewatering. Remove the pipe drain when it has served its purpose. If removal of the pipe is impractical, provide grout connections at 50-foot intervals, and fill the pipe with clay grout or cement and sand grout when the pipe has served its purpose.

3.2 DEWATERING TRENCH

- A. No pipeline shall be laid in a trench in the presence of water. All water shall be removed from the trench sufficiently ahead of the pipeline placing operation. The ENGINEER shall have full and final authority to require dewatering of the trench to ensure a dry, firm bed on which to place the pipeline. As a minimum, water levels shall be maintained at least 6 inches below the bottom of the trench. Trench shall continue to be dewatered until trench backfilling operations have been completed.

- B. Removal of water may be accomplished by pumping or pumping in connection with well point installation as the particular situation may warrant.
- C. If the soils encountered at the trench grade are suitable for the passage of water, without destroying the sides or utility foundation of the trench, sumps may be provided at intervals at the side of the main trench excavation. Pumps shall be used to lower the water level by taking their suction from said sumps.

3.3 REQUIREMENTS FOR EDUCTOR, WELL POINTS OR DEEP WELLS

- A. Eductor, well points or deep wells, where used, must be furnished, installed and operated by a reputable CONTRACTOR regularly engaged in this business, and approved.
- B. Submit the design criteria of the dewatering system and a certification that the system was designed according to that criteria.
- C. Install sufficient piezometers or observation wells to show that all trench excavation in sandy material is predrained prior to excavation. Install piezometers or observation wells not less than 1 week in advance of beginning of nearest excavation.
- D. Dewatering may be omitted for portions of underdrains or other trenches, only where auger borings and piezometers or observation wells show that the soil is predrained by an exterior system.

3.4 MAINTENANCE AND OBSERVATION

- A. Maintenance and observation of piezometers or observation wells is the responsibility of the CONTRACTOR and shall consist of keeping them in good condition and observing and recording the elevation of the water level daily, as long as the dewatering system is in operation, and weekly thereafter until the work is completed or the piezometers or wells are removed.
- B. Submit a record of the water level to the ENGINEER each day.
- C. Replace damaged and destroyed piezometers or observation wells, unless otherwise accepted by the ENGINEER, with new piezometers or wells within 48 hours, at no additional cost to the OWNER.
- D. Cut off piezometers or observation wells in excavation areas, where exposed, as excavation proceeds, and continue to maintain and make observations as specified.
- E. Remove, backfill or grout piezometers or observation wells inside or outside the excavation area, as approved by the ENGINEER.

3.5 DURATION OF DRAINAGE

- A. In areas where concrete is to be placed, carry out the foundation drainage so that the required lowering of the water table will be effected prior to placing reinforcing steel. Keep foundation beds free from water to the same levels for 3 days after placing concrete.

3.6 PROTECTION OF STRUCTURES

- A. Provide adequate protection for all structures to avoid damage to concrete.
- B. Operate construction equipment over completed concrete slabs or structures only with approval. Rubber tire equipment heavier than 5 tons and crawlers heavier than 7 tons will require adequate load spreading by sand fill or other means.

3.7 DISCHARGE OF WATER

- A. Do not discharge pumped drainage water into the sanitary sewer system or inhibit pedestrian or vehicular traffic with the groundwater control system.
- B. Discharge pumped drainage water into the storm sewer system or drainage ditch by direct means (i.e., discharge hose to inlet, burying header, etc.). Monitor the discharged water to determine that soil particles are not being removed.
- C. All discharge shall be in conformance with regulatory permits and if discharged into receiving waters, shall not exceed 29 N.T.U.s above background.

3.8 REPAIR OF DAMAGE

- A. Assume full responsibility for all loss and damage due to flooding, rising water or seepage resulting from dewatering operations in any part of the work. Repair any damage to partially completed work from these or other causes, including the removal of slides, repair of foundation beds and performance of any other work necessitated by lack of adequate dewatering or drainage facilities.

END OF SECTION

SECTION 02575

PAVEMENT REPAIR AND RESTORATION

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and remove and replace pavements over trenches excavated for installation of pipelines as shown on the drawings and/or specified herein.

1.2 GENERAL

- A. All damage, as a result of work under this project, done to existing pavement, driveways, paved areas, curbs and gutters, sidewalks, shrubbery, grass, trees, utility poles, utility pipe lines, conduits, drains, catch basins, or stabilized areas or driveways and including all obstructions not specifically named herein, shall be repaired in a manner satisfactory to the ENGINEER. Bid prices shall include the furnishing of all labor, materials, equipment, and incidentals necessary for the cutting, repair, and restoration of the damaged areas unless pay items for specific types of repair are included in the Bid Form.
- B. Keep the surface of the backfilled area of excavation in a safe condition and level with the remaining pavement until the pavement is restored in the manner specified herein. All surface irregularities that are dangerous or obstructive to traffic are to be removed. The repair shall conform to applicable OWNER or State requirements for pavement repair and as described herein.
- C. All materials and workmanship shall be first class and nothing herein shall be construed as to relieve the CONTRACTOR from this responsibility. The OWNER reserves the right to require soil bearing or loading tests or materials tests, should the adequacy of the foundation or the quality of materials used be questionable. Costs of these tests shall be borne by the OWNER, if found acceptable; the costs of all failed tests shall be borne by the CONTRACTOR.
- D. All street and road repair shall be made in accordance with the details indicated on the drawings and in accordance with the applicable requirements of these Specifications and meeting the permit requirements and approval of the governing Department of Transportation agencies.
- E. Pavement or roadway surfaces cut or damaged shall be replaced by the CONTRACTOR in equal or better condition than the original, including stabilization, base course, surface course, curb and gutter or other appurtenances. The CONTRACTOR shall obtain the necessary permits prior to any roadway work. Additionally, the CONTRACTOR shall provide advance notice to the appropriate authority, as required, prior to construction operations.
 - 1. Roadway Restoration (within Lee County Department of Transportation & Engineering jurisdiction): Restoration shall be in accordance with the requirements set forth in the "Right-of-Way Utility Construction Activities Policy" and these Standards. The materials of construction and method of installation, along with the proposed restoration

design for items not referred or specified herein, shall receive prior approval from Lee County DOT.

- a. Where existing pavement is to be removed, the surface shall be mechanical saw cut prior to trench excavation, leaving a uniform and straight edge parallel or perpendicular to the roadway centerline with minimum disturbance to the remaining adjacent surfacing. The width of cut for this phase of existing pavement removal shall be minimal.
- b. Immediately following the specified backfilling and compaction, a temporary sand seal coat surface shall be applied to the cut areas. This temporary surfacing shall provide a smooth traffic surface with the existing roadway and shall be maintained until final restoration. Said surfacing shall remain for a minimum of ten (10) days in order to assure the stability of the backfill under normal traffic conditions. Thirty (30) days following this period and prior to sixty (60) days after application, the temporary surfacing shall be removed and final roadway surface restoration accomplished.
- c. In advance of final restoration, the temporary surfacing shall be removed and the existing pavement mechanically sawed straight and clean to the stipulated dimensions, if needed. Following the above operation, the CONTRACTOR shall proceed immediately with final pavement restoration in accordance with the requirements set forth by Lee County Department of Transportation.

2. Roadway Restoration (outside Lee County Department of Transportation jurisdiction) – Work within the rights-of-way of public thoroughfares which are not under jurisdiction of Lee County, shall conform to the requirements of the Governmental agency having jurisdiction or the Florida Department of Transportation, if no governmental agencies have jurisdiction. Work within State Highway right-of-way shall be in full compliance with all requirements of the permit drawings, and to the satisfaction of the Florida Department of Transportation.

1.3 QUALITY ASSURANCE

- A. Applicable provisions of the latest version of the Florida Department of Transportation "Standard Specifications for Road and Bridge Construction", and Supplemental Specifications hereunder govern the work under this Section. The Florida Department of Transportation will hereafter be referred to as FDOT.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All materials utilized in flexible base pavement and base course shall be as specified in the latest version of the Florida Department of Transportation "Standard Specifications for Road and Bridge Construction".

PART 3 EXECUTION

3.1 CUTTING PAVEMENT

- A. Cut and remove pavement as necessary for installing the new pipelines and appurtenances and for making connections to existing pipelines.
- B. Before removing pavement, the pavement shall be marked for cuts nearly paralleling pipelines and existing street lines. Asphalt pavement shall be cut along the markings with a jackhammer, rotary saw, or other suitable tool, leaving a uniform and straight edge with minimum disturbance to the remaining adjacent surface.
- C. No pavement shall be machine pulled until completely broken and separated along the marked cuts.
- D. The pavement adjacent to pipeline trenches shall neither be disturbed nor damaged. If the adjacent pavement is disturbed or damaged, irrespective of cause, remove the damaged pavement and shall replace it at his own expense.

3.2 GENERAL RESTORATION

- A. The restoration of existing street paving, driveways, etc., shall be restored, replaced or rebuilt using the same type of construction as was in the original. Be responsible for restoring all such work, including sub-grade and base courses where present. Obtain and pay for such local or other governmental permits as may be necessary for the opening of streets. Meet any requirements other than those herein set forth which may affect the type, quality and manner of carrying on the restoration of surfaces by reason of jurisdiction of such governmental bodies.
- B. In all cases, maintain, without additional compensation, all permanent replacement of street paving, done by him under this Contract until accepted by the OWNER, including the removal and replacement of such work wherever surface depressions or underlying cavities result from settlement of trench backfill.
- C. Complete all the final resurfacing or re-paving of streets or roads, over the excavations and relay paving surfaces of roadbed that have failed or been damaged prior to acceptance by the OWNER. Backfilling of trenches and the preparation of sub-grades shall conform to the requirements of Section 02223.
- D. All re-paving or resurfacing shall be done in accordance with Florida Department of Transportation Specifications, to which the following requirement of trench backfill will be added: Where pipeline construction crossed paved areas such as streets, the top 24 inches of trench below the road bases or concrete slabs shall be backfilled with compacted A-4 or better matter that will provide a bearing value of not less than 75 when tested by the Florida Department of Transportation Soil Bearing Test Methods.

3.3 PRIME AND TACK COATS

- A. The work shall consist of the application of bituminous prime and tack coats on the previously prepared base course in accordance with Section 300 of the FDOT Specifications.

3.4 WEARING COURSE

- A. The work shall consist of the construction of plant-mixed hot bituminous pavement to the thickness indicated in the drawings conforming to Type III asphaltic concrete in accordance with Section 333 of the FDOT Specifications. The requirements for plant and equipment are specified in Section 320 and the general construction requirements for asphaltic concrete pavement are contained in Section 330 of the FDOT specifications.

3.5 TESTING

- A. All field testing shall be performed by an independent laboratory employed by the OWNER. All materials shall be tested and certified by the producer. Tests repeated because sub-grade or base does not meet specified compaction shall be at the CONTRACTOR's expense.

3.6 MISCELLANEOUS RESTORATION

- A. Sidewalks cut or damaged by construction shall be restored in full sections or blocks to a minimum thickness of four inches. Concrete curb or curb gutter shall be restored to the existing height and cross section in full sections or lengths between joints. Concrete shall be as specified on the drawings. Grassed yards, shoulders and parkways shall be restored to match the existing sections with grass seed or sod of a type matching the existing grass.

3.7 CLEANUP

- A. After all repair and restoration or paving has been completed, all excess asphalt, dirt, and other debris shall be removed from the roadways. All existing storm sewers and inlets shall be checked and cleaned of any construction debris.

END OF SECTION

SECTION 02620
HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS

GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required to install High Density Polyethylene (HDPE) pressure pipe, fittings, and appurtenances as shown on the Drawings and specified in the Contract Documents.
- B. High Density Polyethylene (HDPE) – Lee County Utilities has the option of approving the use of HDPE up to 12 inches in diameter for water main crossings of roadways, ditches, canals, and environmentally sensitive lands. HDPE water mains shall have the same equivalent internal diameter and equivalent pressure class rating as the corresponding PVC pipe, unless otherwise approved by Lee County Utilities. For all roadway crossings a steel or DR 11 HDPE casing pipe must be provided. The Department of Transportation having jurisdiction of said road and right-of-way must grant specific approval.

1.2 REFERENCED STANDARDS

- A. All standard specifications, i.e., Federal, ANSI, ASTM, etc., made a portion of these Specifications by reference, shall be the latest edition and revision thereof.

1.3 QUALIFICATIONS

- A. All HDPE pipe, fittings, and appurtenances shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the items to be furnished.

1.4 SUBMITTALS

- A. Submit to the ENGINEER, a list of materials to be furnished, the names of the suppliers, and the appropriate shop drawings for all HDPE pipe and fittings.
- B. Submit the pipe manufacturer's certification of compliance with the applicable sections of the Specifications.
- C. Submit shop drawings showing installation method and the proposed method and specialized equipment to be used.

1.5 INSPECTIONS AND TESTS

- A. All work shall be inspected by an Authorized Representative of the OWNER who shall have the authority to halt construction if, in his opinion, these specifications or standard construction practices are not being followed. Whenever any portion of these specifications is violated, the ENGINEER or his authorized representative, shall, by written notice, order further construction to cease until all deficiencies are corrected.

1.6 WARRANTY AND ACCEPTANCE

A. Warrant all work to be free from defects in workmanship and materials for a period of one year from the date of completion of all construction. If work meets these specifications, a letter of acceptance, subject to the one year warranty period, shall be given at the time of completion. A final acceptance letter shall be given upon final inspection at the end of the one year warranty period, provided the work still complies with these specifications. In the event deficiencies are discovered during the warranty period, they shall be corrected by the CONTRACTOR without additional charge to the OWNER before final acceptance. During the warranty period, the ENGINEER shall determine if warranty repairs or replacement work shall be performed by the CONTRACTOR. The decision of the ENGINEER shall be binding upon the CONTRACTOR.

PRODUCTS

1.7 POLYETHYLENE PIPE AND FITTINGS

A. Polyethylene pressure pipe shall be manufactured from PE4710 polyethylene and shall meet AWWA C906 standards. Polyethylene pipe in contact with potable water shall be listed and approved in accordance with NSF/ANSI 61. When specified by the ENGINEER on the construction drawings, as an alternate to PVC, HDPE, Ductile iron pipe sized (DIPS) piping can be used for buried applications. Iron pipe sized (IPS) HDPE piping can be used for above-ground applications. HDPE (IPS) SDR-11 Hydrostatic Design Basis (HDB) piping shall be used for the riser pipes from the pump discharge and manifold as shown on the drawings.

B. Where HDPE pipe is joined to HDPE pipe, it shall be by thermal butt fusion. Thermal fusion shall be accomplished in accordance with the pipe manufacturer and fusion equipment supplier specifications. The CONTRACTOR installing thermal butt fused HDPE pipe shall have a minimum of five years experience performing this type of work.

C. Qualification of Manufacturer: The Manufacturer shall have manufacturing and quality control facilities capable of producing and assuring the quality of the pipe and fittings required by these specifications. The Manufacturer's production facilities shall be open for inspection by the OWNER or his authorized representative. Qualified manufacturers shall be approved by the OWNER.

D. Approved Manufacturer: Manufacturers that are qualified and approved are listed below:

PLEXCO Division of Chevron Chemical Company
DriscoPipe, Phillips Petroleum Co.

E. Materials: Materials used for the manufacture of polyethylene pipe and fittings shall be PE3408 high density polyethylene meeting cell classification 345434C or 345434E per ASTM D 3350; and meeting Type III, Class B or Class C, Category 5, Grade P34 per ASTM D 1248; and shall be listed in the name of the pipe and fitting manufacturer in PPI (Plastics Pipe Institute) TR-4, Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds, with a standard grade rating of 1600 psi at 73°F. The Manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements.

- F. Interchangeability of Pipe and Fittings: Polyethylene pipe and fittings shall be produced by the same Approved Manufacturer. Products made by subcontractor's or Manufacturer's distributor are not acceptable. Pipe and fittings from different Approved Manufacturers shall not be interchanged.
- G. Polyethylene Pipe: Polyethylene pipe shall be manufactured in accordance with ASTM F 714, Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter or ASTM D 3035, Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter and shall be so marked. Each production lot of pipe shall be tested for (from material or pipe) melt index, density, % carbon, (from pipe) dimensions and either quick burst or ring tensile strength (equipment permitting).
- H. Color Identification: HDPE must have at least three equally spaced horizontal colored marking stripes. Permanent identification of piping service shall be provided by adhering to the following colors.
 - Blue – potable water
 - Green – wastewater, sewage
 - Pantone Purple – reuse or reclaimed water
- I. Polyethylene Fittings and Custom Fabrications: Polyethylene fittings and custom fabrications shall be molded or fabricated by the pipe manufacturer. Butt fusion outlets shall be made to the same outside diameter, wall thickness, and tolerances as the mating pipe. All fittings and custom fabrications shall be fully rated for the same internal pressure as the mating pipe. Pressure de-rated fabricated fittings are prohibited.
- J. Molded Fittings: Molded fittings shall be manufactured in accordance with ASTM D 3261, Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing, and shall be so marked. Each production lot of molded fittings shall be subjected to the tests required under ASTM D 3261.
- K. X-Ray Inspection: The Manufacturer shall submit samples from each molded fittings production lot to x-ray inspection for voids, and shall certify that voids were not found.
- L. Fabricated Fittings: Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service equivalent to the full service pressure rating of the mating pipe. Directional fittings 16" IPS and larger such as elbows, tees, crosses, etc., shall have a plain end inlet for butt fusion and flanged directional outlets. Part drawings shall be submitted for the approval of the ENGINEER.
- M. Polyethylene Flange Adapters: Flange adapters shall be made with sufficient through-bore length to be clamped in a butt fusion joining machine without the use of a stub-end holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves to provide gasketless sealing, or to restrain the gasket against blow-out.
- N. Back-up Rings and Flange Bolts: Flange adapters shall be fitted with lap joint flanges pressure rated equal to or greater than the mating pipe. The lap joint flange bore shall be chamfered or

radiused to provide clearance to the flange adapter radius. Flange bolts and nuts shall be Grade 2 or higher.

1.8 MANUFACTURER'S QUALITY CONTROL

A. The pipe and fitting manufacturer shall have an established quality control program responsible for inspecting incoming and outgoing materials. Incoming polyethylene materials shall be inspected for density, melt flow rate, and contamination. The cell classification properties of the material shall be certified by the supplier, and verified by Manufacturer's Quality Control. Incoming materials shall be approved by Quality Control before processing into finished goods. Outgoing materials shall be checked for:

- Outside diameter, wall thickness, and eccentricity as per ASTM D2122 at a frequency of at least once/hour or once/coil, whichever is less frequent.
- Out of Roundness at frequency of at least once/hour or once/coil, whichever is less frequent.
- Straightness, inside and outside surface finish, markings and end cuts shall be visually inspected as per ASTM F714 on every length of pipe.

Quality Control shall verify production checks and test for:

- Density as per ASTM D1505 at a frequency of at least once per extrusion lot.
- Melt Index as per ASTM D1238 at a frequency of at least once per extrusion lot.
- Carbon content as per ASTM D1603 at a frequency of at least once per day per extrusion line.
- Quick burst pressure (sizes thru 4-inch) as per ASTM D1599 at a frequency of at least once per day per line.
- Ring Tensile Strength (sizes above 4-inch equipment permitting) as per ASTM D2290 at a frequency of at least once per day per line.
- ESCR (size permitting) as per ASTM F1248 at a frequency of at least once per extrusion lot.

X-ray inspection shall be used to inspect molded fittings for voids, and knit line strength shall be tested. All fabricated fittings shall be inspected for joint quality and alignment.

1.9 COMPLIANCE TESTS

A. In case of conflict with Manufacturer's certifications, the CONTRACTOR, ENGINEER, or OWNER may request re-testing by the manufacturer or have re-tests performed by an outside testing service. All re-testing shall be at the requestor's expense, and shall be performed in accordance with the Specifications.

B. Installation shall be in accordance with Manufacturer's recommendations and this specification. All necessary precautions shall be taken to ensure a safe working environment in accordance with the applicable codes and standards.

EXECUTION

1.10 INSTALLATION OF HIGH DENSITY POLYETHYLENE PRESSURE PIPE AND FITTINGS

A. All high density polyethylene (HDPE) pressure pipe shall be installed by direct bury, directional bore, or a method approved by the OWNER/ENGINEER prior to construction. If directional bore is used, or if directed by the OWNER/ENGINEER, the entire area of construction shall be surrounded by silt barriers during construction.

Installation shall be in accordance with Manufacturer's recommendations, and this specification. All necessary precautions shall be taken to ensure a safe working environment in accordance with the applicable codes and standards.

1.11 HEAT FUSION JOINING

A. Joints between plain end pipes and fittings shall be made by butt fusion, and joints between the main and saddle branch fittings shall be made using saddle fusion using only procedures that are recommended by the pipe and fitting Manufacturer. Ensure that persons making heat fusion joints have received training and certification for heat fusion in the Manufacturer's recommended procedure. Maintain records of trained personnel, and shall certify that training was received not more than 12 months before commencing construction. External and internal beads shall not be removed.

1.12 MECHANICAL JOINING

A. Polyethylene pipe and fittings may be joined together or to other materials by means of flanged connections (flange adapters and back-up rings) or mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material. Mechanical couplings shall be fully pressure rated and fully thrust restrained such that when installed in accordance with manufacturer's recommendations, a longitudinal load applied to the mechanical coupling will cause the pipe to yield before the mechanical coupling disjoins. External joint restraints shall not be used in lieu of fully restrained mechanical couplings.

1.13 BRANCH CONNECTIONS

A. Branch connections to the main shall be made with saddle fittings or tees. Polyethylene saddle fittings shall be saddle fused to the main pipe.

1.14 EXCAVATION

A. Trench excavations shall conform to this specification, Section 02222, the plans and drawings, as otherwise authorized in writing by the ENGINEER or his approved representative, and in accordance with all applicable codes. Excess groundwater shall be removed by the CONTRACTOR. Where necessary, trench walls shall be shored or reinforced.

1.15 LARGE DIAMETER FABRICATED FITTINGS

A. Fabricated directional fittings 16" IPS and larger shall be butt fused to the end of a pipe. The flanged directional outlet connections shall be made up in the trench.

1.16 MECHANICAL JOINT AND FLANGE INSTALLATION

A. Mechanical joints and flange connections shall be installed in accordance with the Manufacturer's recommended procedure. Flange faces shall be centered and aligned to each other before assembling and tightening bolts. In no case shall the flange bolts be used to draw the flanges into alignment. Bolt threads shall be lubricated, and flat washers shall be fitted under the flange nuts. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the Manufacturer. At least one hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the Manufacturer. The final tightening torque shall be 100 ft-lbs or less as recommended by the Manufacturer.

1.17 FOUNDATION AND BEDDING

A. Pipe shall be laid on grade and on a stable foundation in accordance with Section 02223.

1.18 PIPE HANDLING

A. When lifting with slings, only wide fabric choker slings shall be used to lift, move, or lower pipe and fittings. Wire rope or chain shall not be used. Slings shall be of sufficient capacity for the load, and shall be inspected before use. Worn or defective equipment shall not be used.

1.19 TESTING

A. Butt Fusion Testing: On every day butt fusions are to be made, the first fusion of the day shall be a trial fusion. The trial fusion shall be allowed to cool completely, then fusion test straps shall be cut out. The test strap shall be 12 inches (min) or 30 times the wall thickness in length with the fusion in the center, and 1 inch (min) or 1.5 times the wall thickness in width. Bend the test strap until the ends of the strap touch. If the fusion fails at the joint, a new trial fusion shall be made, cooled completely, and tested. Butt fusion of pipe to be installed shall not commence until a trial fusion has passed the bent strap test.

Perform all butt fusion joints in the presence of the ENGINEER or his representative. Record the temperature and corresponding time for each fusion joint.

B. Hydrostatic Pressure Testing: HDPE pipes shall be pressure tested in a similar manner as for PVC force main in accordance with Section 02676.

END OF SECTION

SECTION 02623

POLYVINYL CHLORIDE (PVC) WATER MAIN PIPE

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required, and install polyvinyl chloride (PVC) waterline, fittings, service connections and appurtenances as shown on the Drawings and as specified herein.
- B. All water mains less than or equal to 12 inches in diameter shall be constructed of PVC, unless otherwise approved by Lee County Utilities.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. This standard references the documents listed below. They form a part of this standard to the extent specified herein. In any case of conflict, the requirements of this standard shall prevail.

1. ASTM D1598 - Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.
2. ASTM D1599 - Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings.
3. ASTM D1784 - Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
4. ASTM D2122 - Standard Method of Determining dimensions of Thermoplastic Pipe and Fittings.
5. ASTM D2152 - Standard Test Method for Degree of Fusion of Extruded Poly (Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion.
6. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series).
7. ASTM D2412 - Standard Test Method for Determination of External Loading characteristics of Plastic Pipe by Parallel-Plate Loading.
8. ASTM D2774 - Recommended Practice for underground Installation of Thermoplastic Pressure Piping.
9. ASTM D2837 - Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
10. ASTM D3139 - Specifications for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

11. ASTM F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
12. AWWA M23 - PVC Pipe - Design and Installation.
13. NSF 14 - Plastics Piping System Components and Related Materials.
14. PPI TR3 - Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials.

1.3 SUBMITTAL

- A. Submit to the Engineer within fourteen days after receipt of Notice-to-Proceed a list of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site.
- B. Submit for approval, as provided in the Supplement to the General Conditions, complete, detailed shop drawings of all PVC pipe and fittings.
- C. Submit and shall comply with pipe manufacturer's recommendations for handling, storing, and installing pipe and fittings.

PART 2 PRODUCTS

2.1 WATER MAIN

- A. Polyvinyl Chloride (PVC) Pipe
 1. All 4-inch through 12-inch diameter PVC pipe shall be rated per AWWA, C900, DR18, Class 150. Water mains larger than 12 inches shall be constructed of Ductile Iron Pipe.
 2. PVC pipe less than 4-inches in diameter shall be Schedule 80 with a pressure rating of 200 psi solvent welded, including blow-off assemblies. PVC pipe will be acceptable for pipe diameters of 12 inches or less.
 3. The potable water mains shall be blue in color.
 4. All pipe shall be manufactured in the United States.
- B. Steel Encasement Pipe: Conform to ASTM Designation A252, Grade 2. Joints shall be welded completely around the pipe by a certified welder. Pipe shall meet all AASHTO standards and Florida DOT requirements.
- C. Fittings:
 1. PVC Pipe: Fittings shall be ductile iron mechanical joint, with a working pressure of 250 psi and conforming to AWWA Specifications C110 or C153. For pipe 8 inches and smaller, fittings shall be C900 PVC rated fittings.

2. PVC fittings for 2-inch and smaller diameter pipe shall be threaded or glued and shall be Schedule 80 and conform to the requirements of ASTM D-2464. Threaded joints shall be used only with Schedule 80 pipe or stronger. At threaded joints between PVC and metal pipes, the metal shall contain a threaded socket and the PVC threaded spigot end. A metal spigot shall not, under any circumstances be screwed into a PVC socket.

PVC fittings 4 inches and larger in diameter shall meet the requirements of applicable AWWA C900 and C905 specifications. Fittings shall be manufactured entirely of PVC meeting ASTM D1784. Shall be formed by a thermal-form process and be of one-piece construction able to withstand 755 psi quick burst pressure-tested in accordance with ASTM D1599 and withstand 500psi for a minimum of 1,000 hours tested in accordance with ASTM D1598. Bells shall be gasketed push on type conforming to ASTM D3139 with gaskets conforming to ASTM F477. Fittings shall be as manufactured by the Harrington Corporation or approved equal. Cement lined ductile iron fittings with mechanical or push on joints conforming to AWWA C153 or C110 may be approved as alternative when PVC pressure fittings of the required sizes are not available.

Tapping Sleeves: Sleeve shall be stainless steel, mechanical joint type, with working pressure rating of 250 PSI, and conform to AWWA Standard C110.

3. All fittings shall be manufactured in the United States.

D. **Joint Restraining Devices:** Restraining joints shall be placed at all bends, tees, plugs, reducers, and other fittings to provide lateral support, and shall conform to the details shown on the drawings in Section 9 of the Lee County Utilities Operations Manual. Concrete thrust blocks may be utilized as additional restraint if approved by Lee County Utilities.

1. Joint restraint devices for C-900, C905 PVC pipe used with ductile iron mechanical joint fittings shall be EBAA Iron Sales, Inc., Series 2000 PV, Uni-Flange 1300, Star Pipe Product, L.P., or approved equal.
2. Bell joint restraint devices for PVC push joint pipe shall be EBAA Iron Inc., Series 1600 for C-900 PVC pipe, Series 2800 for bell restraint on C-905 PVC pipe or Uni-Flange Series 1300, 1360 or 1390 or ROMAC Series 600, Star Pipe Products L.P., or approved equal.
3. C-900 or C-905 PVC fittings shall be restrained with EBAA Iron Inc., Series 2500 bell restraint for PVC fittings, Star Pipe Products, L.P., or an approved equal.
4. Bolts and nuts shall be Ductile Iron, T-Head type with hexagonal nuts. Bolts and nuts shall be machined through and nuts shall be tapped at right angles to a smooth bearing surface.

E. **Joint Design:** PVC pipe 4 inches in diameter or larger shall have provisions for expansion and contraction provided in the joints. All joints shall be designed for push-on make-up connections. Push-on joint may be a coupling manufactured as an integral part of the pipe barrel consisting of a thickened section with an expanded bell with a groove to retain a rubber sealing ring of uniform cross section, similar and equal to John's Mannville ring-type and Ethyl Bell Ring or may be made with a separate twin gasketed coupling similar and equal to Certainteed Fluid-Type.

2.2 IDENTIFICATION

A. Pipe shall bear identification markings that will remain legible after normal handling, storage, and installation. Markings shall be applied in a manner that will not weaken or damage the pipe. Marking shall be applied at intervals of not more than 5 feet on the pipe. Marking on the pipe shall include the following:

1. Nominal size and OD base.
2. PVC
3. Dimension ratio
4. AWWA pressure rating.
5. AWWA designation.
6. Manufacturer's name and trademark.
7. Manufacturer's production code, including day, month, year, shift, plant, and extruder of manufacturer.
8. All PVC water pipe shall be color-coded blue and shall bear NSF approval.

PART 3 EXECUTION

3.1 WATER MAIN INSTALLATION

A. Polyvinyl Chloride (PVC) water pipe shall be installed in accordance with the manufacturer's recommendation, as shown on the drawings, and as specified herein.

B. The Contractor shall use care in handling, storage, and installation of pipe and fittings. Storage of pipe on the job site shall be done in accordance with the pipe manufacturer's recommendation. Under no circumstances shall pipe or fittings be dropped into the trench.

C. Pipe shall be laid to lines and grade shown on the drawings with bedding and backfill as shown on the drawings. Blocking under the pipe will not be permitted.

D. When laying is not in progress, or the potential exists for dirt or debris to enter the pipe, the open ends of the pipe shall be closed with plug or by other approved means.

3.2 SERVICE CONNECTIONS

A. All potable service taps shall be located in open/green areas unless specifically approved by Lee County Utilities. For service taps that are approved within a paved area, a 2-inch cast iron body gate valve shall be used in lieu of a corporation stop.

B. Service connections shall be installed at the locations and in the manner shown on the Drawings.

- C. Service clamps for PVC mains shall be full-circle bearing types as shown on the details in Section 9 of the Lee County Utilities Operations Manual.
- D. Corporation stops and curb stops shall be fitted with a compression connection outlet with split-lock devices for polyethylene or copper pipe.
- E. On curbed streets the exact location for each installed service shall be marked by etching or cutting a "W" in the concrete curb; where no curb exists or is planned, locations shall be adequately marked by a method approved by Lee County Utilities.
- F. Service connection shall not be installed on pipelines 16 inches and larger unless extenuating conditions exist and said connection is approved by Lee County Utilities.
- G. When practical, in new residential, commercial, or/and industrial subdivisions, the corporation stop shall be located at the intersecting property line or in the center of the lot.
 - 1. Copper Pipe Copper pipe for 3/4-inch to 1-inch service line installations shall be American manufactured, Type K, and conform to the requirements of ASTM designation B88. Brass compression couplings with screw-clamp fittings shall be used with copper pipe.
 - 2. Polytubing Polyethylene Tubing will be acceptable in sizes from 1-1/2 inches to 2 inches in diameter. Tubing for service lines shall be of a type approved by the National Sanitation Foundation for use in transmitting fluids for human consumption. The tubing shall be designed for a minimum burst pressure of 630 psi for water at 23°C, and shall be manufactured in accordance with the requirements of ASTM D2737 and shall be blue in color.

3.3 CLEANING

- A. At the conclusion of the work, the Contractor shall thoroughly clean all of the new pipe lines by flushing with water and pigged to remove all dirt, stones, pieces of wood, or other material which may have entered during the construction period. Debris cleaned from the lines shall be removed from the job site. If, after this cleaning, any obstructions remain, they shall be removed at the Contractor's expense.

3.4 TESTING AND DISINFECTION

- A. Test completed water pipeline in accordance with Section 02676. Disinfect completed water pipeline in accordance with Section 02675.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02630
DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required, and install ductile iron pipe, fittings and appurtenances as shown on the Drawings and as specified herein.
- B. NOTE: No buried ductile iron pipe shall be acceptable for sanitary force main construction. All water mains larger than 12 inches shall be constructed of Ductile Iron Pipe and shall be used for all vertical deflections ditch crossings, subaqueous crossings, and all paved surfaces unless otherwise approved by Lee County Utilities.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02650 - Laying and Jointing Buried Pipe

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Commercial Standards: (Latest Revision)

1. ANSI/AWWA C104/A21.4	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. ANSI/AWWA C105/A21.5	Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.
3. ANSI/AWWA C110/A21.10	Ductile-Iron Fittings, 3 in. Through 48 Inches, for Water and Other Liquids. (C110 2-48 inches).
4. ANSI/AWWA C111/A21.11	Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. ANSI/AWWA C115/A21.15	Flanged Ductile-Iron Pipe with Threaded Flanges.
6. ANSI/AWWA C150/A21.50	Thickness Design of Ductile-Iron Pipe.
7. ANSI/AWWA C151/A21.51	Ductile-Iron Pipe, Centrifugally Cast for Water or Other Liquids.
8. ANSI/AWWA C153/A21.53	Ductile-Iron Compact Fittings, 3 inches through 16 inches, for Water and Other Liquids.
9. AWWA C600	Installation of Ductile Iron Water Mains and Their Appurtenances.

10. AWWA F477

Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Material

1.4 CONTRACTOR SUBMITTALS

- A. Shop Drawings: Submit shop drawings of pipe and fittings in accordance with the requirements in the General Conditions, the requirements of the referenced standards and the following supplemental requirements as applicable:
 - 1. Certified dimensional drawings of all valves, fittings, and appurtenances.
 - 2. For pipe 48 inches in diameter and larger, a line layout and marking diagram shall indicate the specific number and location (station) of each fitting.
 - 3. In all cases, a line layout to indicate the limits of each reach of restrained joints, or of concrete encasement shall be supplied.
- B. Certifications: Furnish a certified affidavit of compliance for all pipe and other products or materials furnished under this Section of the Specifications, which indicates that all tests have been made and that all results comply with the requirements of AWWA C151, including but not necessarily limited to the following:
 - 1. Acceptance Tests.
 - 2. Hydrostatic Tests.
 - 3. Low Temperature Impact Tests.
- C. Additional Documentation: Foundry records shall be furnished in the form of written transcripts upon request.
- D. All expenses incurred for certification, testing, and data submittal shall be borne by the CONTRACTOR or the Supplier.

1.5 QUALITY ASSURANCE

- A. Inspection: All pipe shall be available for inspection at the place of manufacture prior to shipping in accordance with the provisions of the referenced standards. Notify the ENGINEER in writing not less than 10 calendar days prior to the shipping of the pipe.
- B. The ENGINEER shall be given access to all areas where manufacturing and testing is performed and shall be permitted to make all inspections necessary to confirm manufacturer compliance with these Specifications.
- C. Tests: Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of the referenced standards as applicable.
- D. Provide data on material tests at no additional cost to the OWNER.
- E. In addition to those tests specifically required, the ENGINEER may request additional samples of any material including lining and coating samples for testing by the OWNER. The additional samples shall be furnished at no additional cost to the OWNER.

1.6 CORROSION PROTECTION

- A. The allowed force main pipe materials are polyvinyl chloride (PVC) or high density polyethylene (HDPE) or fiberglass. Use of ductile iron pipe (DIP) and DIP fittings are not allowed without the specific approval of Lee County Utilities. Where a force main is expected to flow full pipe at all times, DIP may be used after specific approval by Lee County Utilities. The DIP pipe will be required to have a Protecto 401 lining or approved equal. The lining shall be applied in strict accordance with the manufacturer's written instructions. This lining must extend through the bell of the pipe to a point under the sealing gasket. To ensure a holiday-free lining, documentation must be provided, prior to shipment, showing each section of the lined pipe has passed the holiday testing at production per ASTM G62 with a minimum of 10,000 volt charge.
- B. If specifically approved by Lee County Utilities for use, exterior protection shall be provided for underground ductile iron pipe and fittings within areas of severe corrosive conditions. This shall be accomplished by the installation of polyethylene encasement through the area of concern. The soil test evaluation to determine the necessity for extra protection in suspect areas shall be those set forth in ANSI Standard A21.5. Additionally, where other existing utilities are known to be cathodically protected, ductile iron pipe crossing said utility shall be protected for a distance of 20 feet to each side. If ductile iron pipe is to be installed parallel to and within 10 feet of cathodically protected pipe, then protection shall be provided for the entire length. Steel pipe shall not be installed in severe corrosion areas.

PART 2 PRODUCTS

2.1 GENERAL

- A. Cement mortar lined ductile iron pipe shall conform to ANSI/AWWA C151 and C104, subject to the following supplemental requirements. The pipe shall be of the diameter and class shown, shall be furnished complete with rubber gaskets as indicated in the Contract Documents, and all specials and fittings shall be provided as required under the Contract Documents.
- B. Markings: Legibly mark specials 48 inches in diameter and larger in accordance with the laying schedule and marking diagram. All fittings shall be marked at each end with top field centerline.
- C. Handling and Storage: The pipe shall be handled by wide slings, padded cradles, or other devices designed and constructed to prevent damage to the pipe and its lining. The use of equipment or handling, which might injure the pipe and its lining, will not be permitted. Stockpiled pipe shall be suitably supported and shall be secured to prevent accidental rolling. All other pipe handling equipment and methods shall be acceptable to the ENGINEER.
- D. Laying lengths: Maximum pipe laying lengths shall be 20 feet.
- E. Finish: The pipe shall have smooth dense interior surfaces and shall be free from fractures, excessive interior surface crazing and roughness, in accordance with ANSI/AWWA C104.
- F. Closures and Correction Pieces: Closures and correction pieces shall be provided as required so that closures may be made due to different headings in the pipe laying operation and so that

correction may be made to adjust the pipe laying to conform to pipe stationing shown on the Drawings or line layouts where applicable.

2.2 PIPE DESIGN CRITERIA

- A. General: Ductile Iron pipe shall be designed in accordance with the requirements of ANSI/AWWA C150 as applicable and as modified in this Section.
- B. Pipe Wall Thickness for Internal Pressure: The pipe shall be designed with a net thickness to withstand the design internal pressure in accordance with the hoop stress formula. In addition to the requirements of the Section, the minimum wall thickness shall be in accordance with the minimum thickness wall depicted in table 50.5 of ANSI/AWWA C150.
- C. Ductile Iron Pipe shall be a minimum of Class 50 or pressure Class 250 and will be accepted in any diameter for use within the water distribution system. Flanged pipe shall be a minimum of Class 53.
- D. All aboveground water main pipe shall be painted blue. The pipe wall thickness shall not be less than that required by a working pressure of 250 psi in laying condition Type 4 "B" with 5-foot cover in conformance with ANSI Standard A21.50.

2.3 MATERIALS

- A. Ductile Iron Pipe: Pipe materials shall conform to the requirements of ANSI/AWWA C151.
- B. Cement: Cement for mortar lining shall conform to the requirements of ANSI/AWWA C104; provided that cement for mortar lining shall be Type II or V. A fly ash or pozzolan shall not be used.
- C. Adapters to connect ductile iron pipe or fittings to pipe or fittings of dissimilar materials shall be supplied by the CONTRACTOR in accordance with the pipe manufacturer recommendations, and as approved by the ENGINEER.
- D. Pipe materials and coatings in contact with potable water shall be approved by NSF.

2.4 SPECIALS AND FITTINGS

- A. Fittings for ductile iron pipe shall conform to the requirements of ANSI/AWWA C153/A21.53 or ANSI/AWWA C110/A21.10 for diameters 3 inches through 48 inches and shall have a minimum pressure rating of 250 psi. Ductile iron fittings shall be cement lined, seal coated and outside coated as specified. Ductile Iron fittings larger than 48 inches shall conform to the above referenced standard with the necessary modifications for the larger size manufacturer's standard.
- B. All above-ground fittings in direct contact with wastewater shall be HDPE or ductile iron flanged joints with a minimum pressure rating of 250 psi conforming to ANSI A21.10. If above-ground ductile iron fitting is used, the fitting shall be lined with Protecto 401 applied in strict accordance with the manufacturers specifications to a dry film thickness of 40 mils. All above-ground fittings shall have a factory applied exterior epoxy coating in accordance with AWWA C550.

2.5 DESIGN OF PIPE

- A. General: The pipe furnished shall be ductile iron pipe, mortar-lined, with rubber gasketed joints.
- B. The pipe shall be designed, manufactured, tested, inspected, and marked according to applicable requirements previously stated and except as hereinafter modified, shall conform to ANSI/AWWA C151.
- C. Pipe Dimensions: The pipe shall be of the diameter and class shown. The minimum wall thickness for each pipe size shall be as specified herein or shown on the Drawings.
- D. Fitting Dimensions: The fittings shall be of the diameter shown and class specified.
- E. Joint Design: Ductile Iron pipe and fittings shall be furnished with mechanical joints, push-on joints and flanged joints as follows:
 - 1. For buried pipe applications, unless otherwise indicated, mechanical and push-on joints shall conform to ANSI/AWWA C111/A21.11, with the minimum pressure rating of 250 psi.
 - 2. For above-ground or buried vault applications, unless otherwise indicated, flanged joints shall conform to ANSI/AWWA C115/A21.15, with the minimum pressure rating of 250 psi. All above-ground fittings shall be painted blue.
- F. Restraining Devices: Restraining joints shall be placed at all bends, tees, plugs, reducers, and other fittings to provide lateral support, and shall conform to the details shown on the drawings in Section 9 of the Lee County Utilities Operations Manual. Concrete thrust blocks may be utilized as additional restraint if approved by Lee County Utilities.
 - 1. Joint restraint devices for ductile iron mechanical joint pipe and ductile iron mechanical joint fittings to ductile iron pipe shall be EBAA Iron Inc., Series 1100 Megalug (R), Star Pipe Products, L.P., or approved equal.
 - 2. Bell joint restraint devices for ductile iron push joint pipe shall be EBAA Iron Inc., Series 1700 Megalug (R) for bell restraint, Star Pipe Products L.P., or approved equal.
- G. For bell-and-spigot ends with rubber gaskets, the clearance between the bells and spigots shall be such that when combined with the gasket groove configuration and the gasket itself will provide watertight joints under all operating conditions when properly installed. Require the pipe manufacturer to submit details complete with significant dimensions and tolerances and also to submit performance data indicating that the proposed joint has performed satisfactorily under similar conditions. In the absence of a history of field performance, the results of a test program shall be submitted.
- H. Gaskets shall be a Buna N, Neoprene, or a Nitryl-based rubber product approved by the County. Gaskets shall have clean tips unless otherwise specified. Elastomeric gaskets conforming to ASTM F-477 shall also be acceptable.

I. Shop-applied interior linings and exterior coatings shall be applied evenly to the nominal thickness specified. Holiday free cement is not possible to manufacture. Exterior coatings: asphalt coating for buried pipe or primed pipe cannot be furnished holiday free.

2.6 CEMENT-MORTAR LINING

A. Cement-Mortar Lining For Shop Application: Except as otherwise provided herein, interior surfaces of all ductile iron pipe shall be cleaned and lined in the shop with cement-mortar lining applied centrifugally in conformity with ANSI/AWWA C104. Ductile-Iron pipefittings need not have the cement-mortar lining applied centrifugally. The lining machines shall be of a type that has been used successfully for similar work. Every precaution shall be taken to prevent damage to the lining. If lining is damaged or found faulty at delivery site, the damaged or unsatisfactory portions shall be repaired in the field in accordance with ANSI/AWWA C104.

B. The nominal wet lining thickness shall be as follows:

Nominal Factory Nominal Replacement		
Nominal Pipe Diameter (in.)	Applied Lining Thickness (in.)	Lining Thickness (in.)
3-12	1/8	1/8
14-24	3/16	3/16
30-64	1/4	1/4

C. Protection of Pipe Lining/Interior: All shop-applied cement mortar lining shall be given a seal coat of asphaltic material in conformance with ANSI/AWWA C104.

2.7 EXTERIOR COATING OF PIPE

A. Exterior Coating of Exposed Piping: The exterior surfaces of pipe which will be exposed to the atmosphere inside structures or above ground shall be thoroughly cleaned and then given a shop coat of rust-inhibitive primer conforming to the requirements of Section 09900, "Painting and Coating". All above-ground pipe shall be painted blue.

B. Exterior Coating of Buried Piping: The exterior coating shall be an asphaltic coating approximately 1 mil thick, conforming to ANSI/AWWA C151.

2.8 CORROSION PROTECTION

A. The allowed force main pipe materials are polyvinyl chloride (PVC) or high density polyethylene (HDPE) or fiberglass. Use of ductile iron pipe (DIP) and DIP fittings are not allowed without the specific approval of Lee County Utilities. Where a force main is expected to flow full pipe at all times, DIP may be used after specific approval by Lee County Utilities. The DIP pipe will be required to have a Protecto 401 lining or approved equal. The lining shall be applied in strict accordance with the manufacturer's written instructions. This lining must extend through the bell of the pipe to a point under the sealing gasket. To ensure a holiday-free lining, documentation must be provided, prior to shipment, showing each section of the lined pipe has passed the holiday testing at production per ASTM G62 with a minimum of 10,000 volt charge.

B. If specifically approved by Lee County Utilities for use, exterior protection shall be provided for underground ductile iron pipe and fittings within areas of severe corrosive conditions. This shall be accomplished by the installation of polyethylene encasement through the area of concern. The soil test evaluation to determine the necessity for extra protection in suspect areas shall be those set forth in ANSI Standard A21.5. Additionally, where other existing utilities are known to be cathodically protected, ductile iron pipe crossing said utility shall be protected for a distance of 20 feet to each side. If ductile iron pipe is to be installed parallel to and within 10 feet of cathodically protected pipe, then protection shall be provided for the entire length. Steel pipe shall not be installed in severe corrosion areas.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPE

A. Handling and Storage: All pipe, fittings, etc., shall be carefully handled and protected against damage, impact shocks, and free fall and in accordance with ANSI/AWWA C600. Pipe shall not be placed directly on rough rocky ground but in such instances shall be supported in a manner which will protect the pipe against injury whenever stored at such trench site or elsewhere. No pipe shall be installed where the lining or coating show defects that may be harmful as determined by the ENGINEER. Such damaged lining or coating shall be repaired, or a new undamaged pipe shall be furnished and installed.

B. All pipe damaged prior to Substantial Completion or during warranty period shall be repaired or replaced by the CONTRACTOR.

C. Inspect each pipe and fitting prior to installation to insure that no damaged portions of the pipe get installed.

D. Before placement of pipe in the trench, each pipe or fitting shall be thoroughly cleaned of any foreign substance, which may have collected therein and shall be kept clean at all times thereafter. For this purpose, the openings of all pipes and fittings in the trench shall be closed during any interruption to the work.

E. Pipe Laying: The pipe shall be installed in accordance with ANSI/AWWA C600.

F. Pipe shall be laid directly on the bedding material. No blocking will be permitted, and the bedding shall be such that it forms a continuous, solid bearing for the full length of the pipe. Excavations shall be made as needed to facilitate removal of handling devices after the pipe is laid. Bell holes shall be formed at the ends of the pipe to prevent point loading at the bells or couplings. Excavation shall be made as needed outside the normal trench section at field joints to permit adequate access to the joints for field connection operations and for application of coating on field joints.

G. Where necessary to raise or lower the pipe due to unforeseen obstructions or other causes, the ENGINEER may change the alignment and/or the grades. Such change shall be made by the deflection of joints, by the use of bevel adapters, or by the use of additional fittings. However, in no case shall the deflection in the joint exceed 70 percent of the maximum deflection recommended by the pipe manufacturer. No joint shall be misfit any amount which will be detrimental to the strength and water tightness of the finished joint.

- H. Pipe and Specials Protection: The openings of all pipe and specials shall be protected with suitable bulkheads to prevent unauthorized access by persons, animals, water, or any undesirable substance. At all times, means shall be provided to prevent the pipe from floating.
- I. Pipe Cleanup: As pipe laying progresses, keep the pipe interior free of all debris. Completely clean the interior of the pipe of all sand, dirt, mortar splatter and any other debris following completion of pipe laying, pointing of joints, and any necessary interior repairs per ANSI/AWWA C600 and C602 prior to testing and disinfecting the completed pipeline. Pipe larger than 12" diameter will utilize a polyurethane foam plug "Poly Pig" to remove all debris from main.

3.2 RUBBER GASKETED JOINTS

- A. Rubber Gasketed Joints: Immediately before jointing pipe, the bell end of the pipe shall be thoroughly cleaned, and a clean rubber gasket shall be placed in the bell groove. The bell and spigot end of push-on joint pipe shall be carefully cleaned and lubricated with a vegetable-based lubricant or per manufacturer's recommendation. The spigot end of the pipe section shall then be inserted into the bell of the previously laid joint and telescoped into its proper position. Tilting of the pipe to insert the spigot into the bell will not be permitted.

3.3 INSTALLATION OF PIPE APPURTENANCES

- A. Installation of Valves: All valves shall be handled in a manner to prevent any injury or damage to any part of the valve. All joints shall be thoroughly cleaned and prepared prior to installation. Adjust all stem packing and operate each valve prior to installation to insure proper operation.
- B. All valves shall be installed so that the valve stems are plumb and in the location shown on the Drawings.
- C. Mechanical joints consisting of bell, socket, gland, gasket, bolts, and nuts shall conform to ANSI Standard A21.11. Bolts and nuts shall be high strength, low alloy, Cor-Ten, T-Head Type having hexagonal nuts. Bolts and nuts shall be machined through and nuts shall be tapped at right angles to a smooth bearing surface. Single sealed gasket push-on type joints shall conform to the requirements of ANSI A21.11 and shall be Tyton, Fastite, Superbelltite, Alltite, or approved equal.
- D. Mechanical joint retainer glands may be used to restrain mechanical joint pipe and fittings to the plain end of ductile iron pipe and fittings when used in conjunction with thrust blocks of reduced size. The Utilities ENGINEER must approve thrust block size. Joint flexibility shall be maintained.

3.4 TESTING AND DISINFECTION

- A. Test completed water pipeline in accordance with Section 02676. Disinfect completed water pipeline in accordance with Section 2675.

END OF SECTION

SECTION 02645

HYDRANTS

PART 1 GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

- A. Furnish and install fire hydrants where shown on the Drawings or directed by the ENGINEER.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Section 15100 – Water Valves and Appurtenances
- B. Section 03311 – Concrete for Non-Plant Work
- C. Section 09900 – Painting and Coating

1.3 QUALITY ASSURANCE

- A. Install hydrants to meet current requirements of Lee County Utilities.
- B. Provide manufacturer's certificate those products meet or exceed minimum requirements as specified.

1.4 SUBMITTALS

- A. Submit manufacturer's certificates on conformance.
- B. Shop Drawings: Submit manufacturer's drawings and data sheets for material to be supplied under this Section. Indicate sizes and types to be installed.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. During loading, transportation and unloading, exercise care to prevent damage to materials.
- B. Handling: Fire hydrants should be unloaded carefully. The hydrant should be carefully lowered from the truck to the ground, not dropped. Only hoists and slings with adequate load capacity to handle the weight of the hydrant shall be used.
- C. Storage: Should be stored in the fully closed position to prevent entry of foreign material that could cause damage to the seating surfaces. Whenever practical, hydrants should be stored indoors. If outside storage is required, means should be provided to protect the operating mechanism. In outside storage, parts and flanges should be protected from the weather and foreign materials.

PART 2 PRODUCTS

2.1 FIRE HYDRANTS

- A. Fire hydrants shall be of the compression type with break away upper sections capable of ready replacement without loss in the event of traffic damage. Each hydrant shall have a 6" bottom inlet connection and valve opening at least 5-1/4 inches in diameter. Hydrants shall turn to the left (counter clockwise) to open. Each hydrant shall be fitted with one 4-1/2-inch pumper connection and two 2-1/2 inch hose connections, both having threads that conform to the Fire Division Standard for the area. Hose caps shall be chained to the hydrant barrel and fitted with nuts similar to the hydrant operating nuts. Each hydrant shall have a barrel of sufficient length to bring the bottom of the 6" pipe connection 3 feet below the surface of the finished ground. Each hydrant shall be made in at least two sections bolted together. All interior working parts of the hydrant shall be removable from the top of the hydrant to allow repairs without removing the hydrant barrel after it has been installed. Hydrants shall have renewable O-ring stem seals. Hydrant barrels shall be painted AWWA Safety Yellow. They shall be designed for a working pressure of 150 psi and will conform to AWWA Standard C502, "Fire Hydrants for Ordinary Water Works Service".
- B. Hydrant shall have no drain parts. If parts exist, they shall be plugged with a threaded plug.
- C. Operating stem shall be equipped with anti-friction thrust bearing to reduce operating torque and assure easy opening. Stops shall be provided to limit stem travel. Stem threads shall be enclosed in a permanently sealed lubricant reservoir with O-ring seals.
- D. Hydrants shall be designated for 150 psi working pressure and shop tested to 300 psi pressure with main valve both opened and closed. Under test the valve shall not leak, the automatic drain shall function and there shall be no leakage into the bonnet.
- E. Hydrant guard posts (bollards) shall be 6-inch diameter Class 50 ductile iron pipe.
- F. Acceptable models include:
 - 1. Mueller Centurion A-423
 - 2. Kennedy K-81A
 - 3. American Darling LCU B84B
 - 4. Clow Medallion
 - 5. U. S. Pipe Metropolitan 250 Model 94

PART 3 EXECUTION

3.1 INSTALLATION

- A. Hydrants shall be set plumb and in true alignment with mains. They shall utilize concrete thrust blocks or restrained joints and Grade-Lok adapters as shown in details in Section 9 of the Lee County Utilities Operations Manual. Backfilling around hydrants shall be carefully done so as not to disturb the hydrant and shall be thoroughly compacted so as to support the hydrant securely. The hydrants shall have between 18" and 24" clearance measured from finish grade to the center of pumper connection.

B. Hydrant guard posts (bollards) shall be 6 feet long, buried 3 feet below finished grade, filled with 2500 psi concrete and painted AWWA safety yellow as shown on the Lee County Standard Details.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02650
LAYING AND JOINTING BURIED PIPELINES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Installation of all underground pipelines. Provide pipeline materials, coatings and linings as specified and pipe of the types, sizes and classes shown or specified.

1. Use proper and suitable tools and appliances for the safe and convenient cutting, handling, and laying of the pipe and fittings.
2. Use suitable fittings where shown and at connections or where grade or alignment changes require offsets greater than those recommended and approved.
3. Lay all underground pipelines not supported on piles or concrete cradle in select fill bedding material.
4. Close off all lines with bulkheads when pipe laying is not in progress.

B. Related Work Specified in Other Sections Includes:

1. Section 02222 - Excavation - Earth and Rock
2. Section 02223 – Backfilling
3. Section 02620 – High Density Polyethylene (HDPE) Pipe and Fittings
4. Section 02623 – Polyvinyl Chloride (PVC) Water Main Pipe
5. Section 02630 – Ductile Iron Pipe and Fittings
6. Section 02676 - Leakage Tests
7. Section 02675 - Disinfection

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM D 2774 - Practice for Underground Installation of Thermoplastic Pressure Piping
2. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances
3. ASTM A 307 - Specification for Carbon Steel Bolts and Studs, 60000 psi Tensile
4. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, C25, 125, 250, 800
5. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges

6. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
7. AWWA C115/A21.15 - Flanged Ductile-Iron Pipe With Threaded Flanges
8. ASTM E 165- Practice for Liquid Penetrant Examination
9. ASTM E 709- Practice for Magnetic Particle Examination

1.3 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:
 - B. Transportation and Delivery: Take every precaution to prevent injury to the pipe during transportation and delivery to the site.
 - C. Loading and Unloading: Take extreme care in loading and unloading the pipe and fittings.
 1. Work slowly with skids or suitable power equipment, and keep pipe under perfect control at all times.
 2. Under no condition is the pipe to be dropped, bumped, dragged, pushed, or moved in any way that will cause damage to the pipe or coating.
 - D. Sling: When handling the pipe with a crane, use a suitable sling around the pipe.
 1. Under no condition pass the sling through the pipe.
 2. Use a nylon canvas type sling or other material designed to prevent damage to the pipe and coating.
 3. When handling reinforced concrete pipe or uncoated steel or ductile iron pipe, steel cables, chain or like slings are acceptable.
 - E. Damaged Piping: If in the process of transportation, handling, or laying, any pipe or fitting is damaged, replace or repair such pipe or pipes.
 - F. Blocking and Stakes: Provide suitable blocking and stakes installed to prevent pipe from rolling.
 1. Obtain approval for the type of blocking and stakes, and the method of installation.
 - G. Storage for Gaskets: Store gaskets for pipe joints in a cool place and protect gaskets from light, sunlight, heat, oil, or grease until installed.
 1. Do not use any gaskets showing signs of checking, weathering or other deterioration.
 2. Do not use gasket material stored in excess of six months without approval.

1.4 FIELD CONDITIONS

A. Repair of Sanitary Sewers and Services: Rebed, in compacted select fill material, sanitary sewers which cross over the new pipe or which cross under the new pipe with less than 12 inches clear vertical separation. Compact the bedding to densities required for new pipeline construction and extend bedding below the sewer to undisturbed earth. Reconstruct sewers damaged by pipeline construction.

1. Furnish and install all materials and do all work necessary for the reconstruction or repairs of sanitary sewers and services.
2. Provide pipe for reconstruction of sanitary sewers and services meeting the appropriate specification requirements.
3. Provide pipe of the same size as the existing sewer or when the same size is not available, use the next larger size of pipe. Obtain approval of joints made between new pipe and existing pipe.

PART 2 PRODUCTS

A. The materials allowed for buried sewer pipes are PVC, HDPE or fiberglass. Use of ductile iron pipe is not allowed for sewer construction without specific approval of Lee County Utilities.

PART 3 EXECUTION

3.1 PREPARATION

A. Dry Trench Bottoms: Lay pipe only in dry trenches having a stable bottom.

1. Where groundwater is encountered, make every effort to obtain a dry trench bottom.
2. If a dry trench bottom has not been obtained due to improper or insufficient use of all known methods of trench dewatering, then the order to excavate below grade and place sufficient select fill material, crushed stone, or 2500 psi concrete over the trench bottom may be given.
3. If all efforts fail to obtain a stable dry trench bottom and it is determined that the trench bottom is unsuitable for pipe foundation, obtain an order, in writing, for the kind of stabilization to be constructed.
4. Perform trench excavation and backfill in accordance with Sections 02222 and 02223.

3.2 INSTALLATION

A. General: Install all piping in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1. Where pipe deflections are used, do not exceed 80 percent of the maximum deflection limits shown in AWWA C600.

1. Arrange miscellaneous pipelines, which are shown in diagram form on the Plans, clear of other pipelines and equipment.
- B. Code Requirements: Provide pipeline installations complying with AWWA C600 for iron pipe, AWWA Manual M11 for steel pipe, ASTM D 2774 for thermoplastic pressure piping, and as modified or supplemented by the Specifications.
- C. Pipe Laying - General:
 1. For pipelines intended for gravity flow, begin pipeline laying at the low end of a run and proceed upgrade.
 2. Generally, lay all pipe with bells pointing ahead.
 3. Carefully place each pipe and check for alignment and grade.
 4. Make adjustments to bring pipe to line and grade by scraping away or filling in select fill material under the body of the pipe.
 5. Wedging or blocking up the pipe barrel is not permitted.
 6. Bring the faces of the spigot ends and the bells of pipes into fair contact and firmly and completely shove the pipe home.
 7. As the work progresses, clean the interior of pipelines of all dirt and superfluous materials of every description.
 8. Keep all lines absolutely clean during construction.
 9. Lay pipelines accurately to line and grade.
 10. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other material from entering the pipe.
- D. Pipe Laying - Trenches:
 1. Lay all pipelines in trench excavations on select fill bedding, concrete cradle or other foundations as shown, specified or ordered in writing.
 2. Properly secure the pipe against movement and make the pipe joints in the excavation as required.
 3. Carefully grade and compact pipe bedding.
 4. Bell Holes:
 - a. Cut out bell holes for each joint as required to permit the joint to be properly made and allow the barrel of the pipe to have full bearing throughout its length.
 - b. Thoroughly tamp bell holes full of select fill material following the making of each joint.

E. Other Foundations: Install pipelines laid on other types of foundations as specified for such other foundations or as ordered in writing.

F. Ductile Iron Pipe Mechanical Joints:

1. Assembly: In making up mechanical joints, center the spigot in the bell.
 - a. Thoroughly brush the surfaces with which the rubber gasket comes in contact with a wire brush just prior to assembly of the joint.
 - b. Brush lubricant over the gasket just prior to installation.
 - c. Place the gasket and gland in position, bolts inserted, and the nuts tightened fingertight.
 - d. Tighten the nuts with a torque wrench so that the gland is brought up toward the pipe evenly. Torque wrenches shall be set as specified in AWWA C111. Spanner type wrenches not longer than specified in AWWA C111 may be used with the permission of Lee County Utilities.
 - e. Prime all bolts by dipping with a bituminous coating, except the threads. Coat threads immediately prior to installation of nuts.

2. Torques: Apply the following range of bolt torques:

Size Inches	Range of Torque - ft. lbs
5/8	45 - 60
3/4	75 - 90
1	85 - 100
1-1/4	105 - 120

3. Remaking of Joints: If effective sealing is not obtained at the maximum torque listed above, disassemble and reassemble the joint after thorough cleaning.

G. Ductile Iron Pipe Rubber Gasket Joints:

1. Assembly: In making up the rubber gasket joint, brush the gasket seat in the socket thoroughly with a wire brush and wipe the gasket with a cloth.
 - a. Place the gasket in the socket with the large round end entering first so that the groove fits over the bead in the seat.
 - b. Apply a thin film of lubricant to the inside surface of the gasket that will come in contact with the entering pipe.
 - c. Brush the plain end of the pipe to be entered thoroughly with a wire brush and place it in alignment with the bell of the pipe to which it is to be joined.

- d. Exert sufficient force on the entering pipe so that its plain end is moved past the gasket until it makes contact with the base of the socket to make the joint.
2. Positioning: Before proceeding with backfilling, feel completely around the joint using a feeler gauge to confirm that the gasket is in its proper position.
 - a. If the gasket can be felt out of position, withdraw the pipe and examine the gasket for cuts or breaks.
 - b. If the gasket has been damaged, replace it with a new one before re-installing the pipe.
3. Optional Mechanical Joints: Use mechanical joint fittings that meet the requirements of Section 02630 with the rubber gasket joint pipe when specified or when rubber gasket fittings are not available.

H. Temporary Bulkheads: Provide temporary bulkheads at the ends of sections where adjoining pipelines have not been completed, and in connections built into pipelines where adjoining pipelines or structures have not been completed and are not ready to be connected.

1. Remove bulkheads encountered in connecting sewers or structures included in this Contract, or in pipelines or structures previously built, when they are no longer needed or when ordered.

I. Sleeve Type Couplings: For sleeve type couplings, equally tighten diametrically opposite bolts on the connection so that the gaskets will be brought up evenly all around the pipe.

1. Torque Wrenches: Do the final tightening with torque wrenches set for the torque recommended by the coupling manufacturer.

J. Concrete Encasement: Concrete encasement shall be constructed in accordance with Lee County standard details when:

1. A waterline crosses at a depth which provides less than 18 inches clear distance from sewer lines. Encasement shall extend a minimum 10 feet on each side of the point of crossing. Encase the sewer main unless specifically approved by Lee County Utilities.
2. A waterline running parallel to a sewer line provides less than 10 feet separation. Encase the sewer main unless specifically approved by Lee County Utilities.
3. The Engineer has ordered the line encased.

The points of beginning and ending of pipe encasement shall be not more than 6 inches from a pipe joint to protect the pipe from cracking due to uneven settlement of its foundation or the effects of superimposed live loads.

K. Valve Box Setting: Install valve boxes vertical and concentric with the valve stem.

1. Satisfactorily reset any valve box which is moved from its original position, preventing the operation of the extension valve stem.
2. Replace any extension valve stem which has been damaged so that it can be operated.

L. Jacking:

1. General: Perform jacking as shown. After jacking is completed, seal the ends of the casing pipe with brick masonry.
 - a. Jacking pit: Provide jacking pit of adequate length to provide room for the jacking frame, the jacking head, reaction block, the jacks, rig, and jacking pipe.
 - b. Construct the pit to be sufficiently wide to allow ample working space on each side of the jacking frame and sufficiently deep so that the invert of the pipe will be at the elevation desired for the completed line when placed on the guide frame.
 - c. Tightly sheet the pit and keep it dry at all times.
 - d. Provide adequate protective railings at the top of the pit at all times.
2. Jacking Frame: Design the jacking frame so that it applies a uniform pressure over the entire pipe wall area of the pipe to be jacked.
3. Reaction Blocks: Adequately design the reaction blocks to carry the thrust of the jacks to the soil without excessive soil deflection in a manner which avoids any disturbance of adjacent structures or utilities.
4. Hydraulic Jacks: Use hydraulic jacks in the jacking operation, and take extreme care to hold the casing pipe to exact line and grade.
5. Advance Excavation: Advance excavation by augering.
6. Casing pipe: Furnish steel casing pipe, unless otherwise specified, conforming to ASTM A 139 with wall thicknesses and pipe diameters shown on the Plans. Provide full penetration butt welded pipe joints.
7. Fill Material: Use fill material, consisting of 1-1/4 pounds of Bentonite per gallon of water, during jacking to fill any voids between the casing pipe and the earth.

M. Identification:

1. Identification Tape: For all types of pipe to be installed, 3-inch detectable marking tape, of appropriate color, shall be placed along the entire pipe length. In all cases, marking tape shall be installed 12 inches to 18 inches below the finished grade during backfill operations. All PVC pipe, PVC fittings, and identification tape shall be color-coded per standards outlined in the Utility Location and Coordinating Council's Uniform Color Code as specified in Section 4 of the Lee County Utilities Operations Manual.

2. Direct Bury Locating Wire: A locating tracing wire shall also be installed with PVC, HDPE and fiberglass pipes and shall be a continuous No. 12 insulated copper tracing wire laid in the trench on top of the utility pipe and attached to the pipe at ten (10) foot intervals. This continuous tracing wire shall run along the entire pipe and be stubbed out at valves, pressure clean-outs and air release valves.
3. Directional Drill Locating Wire: Pipe installed by directional drill shall have a composite tracing wire installed as per part 2 above with a resistance per 1000 feet of 5.3 Ohms and a tensile breaking load of 1150 lbs as manufactured by Copperhead Industries, LLC or approved equal.

3.3 FIELD QUALITY CONTROL

- A. Testing: Test pipelines in accordance with Section 02676.
 1. Test valves in place, as far as practicable, and correct any defects in valves or connections.
- B. Inspection: Clean, inspect, and examine each piece of pipe and each fitting and special for defects before it is installed.
 1. Cut away any lumps or projections on the face of the spigot end or the shoulder.
 2. Do not use any cracked, broken, or defective pieces in the work.
 3. If any defective piece should be discovered after having been installed, remove and replace this piece with a sound piece in a satisfactory manner at no increase in Contract Amount.

3.4 CLEANING

- A. General: Thoroughly clean all pipe before it is laid and keep it clean until it is accepted in the completed work.
- B. Removal of Materials: Exercise special care to avoid leaving bits of wood, dirt, and other foreign particles in the pipe. If any particles are discovered before the final acceptance of the work, remove and clean the pipe.

3.5 DISINFECTION

- A. General: Disinfect all pipelines that are to carry potable water in accordance with Section 02675.

END OF SECTION

SECTION 02675
DISINFECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Disinfection of all pipelines, tanks, structures, conduits and equipment which are to store, handle or carry potable water. Furnish all labor, water, chemicals and equipment, including taps, corporation stops, temporary pumps and other items necessary to perform the Work, except as otherwise specified.

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. AWWA C651 - Disinfecting Water Mains
2. AWWA C652 - Disinfection of Water-Storage Facilities

1.3 QUALITY ASSURANCE

A. Disinfection Standards: Disinfect in accordance with AWWA C651 for water mains and AWWA C652 for water storage facilities and equipment.

B. Chlorinated Water Disposal: Dispose of old highly chlorinated water in accordance with applicable regulations.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 WATER MAIN DISINFECTION

A. Following acceptable pressure testing, disinfect all sections of the water distribution system and receive approval thereof from the appropriate agencies, prior to placing in service. Advance notice of 24 hours shall be provided to the County before disinfecting procedures start. The disinfection shall be accomplished in accordance with the applicable provisions of AWWA Standard C651, "Disinfecting Water Mains" and all appropriate approval agencies.

B. The disinfecting agent shall be free chlorine in aqueous solution with sustained concentration for 12 hours or more of not less than 50 parts per million. Chlorine may be derived from Chlorine gas, or 70% (high test) calcium hypochlorite (HTH or Perchloron, or equal). Administration may be by any of the several methods described in AWWA Standard C651 as proposed by the CONTRACTOR and approved by the ENGINEER. Proposals as to method must be made prior to commencement of the disinfection process.

- C. Following contact with chlorine solution, the system shall be thoroughly flushed out. Samples shall then be taken using sterile containers obtained from the County Health Department. Samples shall be taken by the CONTRACTOR and delivered by him to the County Health Department or approved laboratory for analysis.
- D. If samples do not demonstrate satisfactory results, the disinfection procedure shall be repeated until two series of satisfactory samples are obtained, the period between such series of samples to be a minimum of 24 hours.

3.2 DISINFECTION PROCEDURES FOR TANKS

- A. Disinfect potable water storage tanks and equipment in accordance with AWWA C652, Method 2 or 3, using sodium hypochlorite.
 - 1. In Method 2, spray method, spray the entire interior surface of the tank with chlorinated water containing 200 mg/l of available chlorine. After spraying, allow the tank to stand at least two hours before filling with fresh water.
- B. After disinfection, allow the tanks and equipment to overflow until the chlorine residual is approximately 2 mg/l.

END OF SECTION

SECTION 02676

LEAKAGE TESTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Testing for any signs of leakage in all pipelines and structures required to be watertight.
 - 1. Test gravity sewers and drain lines by low pressure air testing.
 - 2. Test all other pipelines with water under the specified pressures.
- B. Operation of Existing Facilities: Conduct all tests in a manner to minimize as much as possible any interference with the day-to-day operations of existing facilities or other contractors working on the site.

1.2 PERFORMANCE REQUIREMENTS

- A. Written Notification of Testing: Provide written notice when the work is ready for testing, and make the tests as soon thereafter as possible.
 - 1. Personnel for reading meters, gauges, or other measuring devices, will be furnished.
 - 2. Furnish all other labor, equipment, air, water and materials, including meters, gauges, smoke producers, blower, pumps, compressors, fuel, water, bulkheads and accessory equipment.

1.3 REFERENCES

- A. Codes and standards referred to in this Section are:
 - 1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances
 - 2. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water

1.4 SUBMITTALS

- A. General: Provide all submittals, including the following, as specified in Division 1.
- B. Testing Report: Prior to placing the water or sewer system in service submit for review and approval a detailed bound report summarizing the leakage test data, describing the test procedure and showing the calculations on which the leakage test data is based. The test report shall include, at a minimum:

1. Reference Pipeline Data

a. For Hydrostatic Testing

1. The length and diameter of the line tested.
2. A complete description of the test procedures and methods, including:
 - a. Test pressure
 - b. Test start time
 - c. Test end time
 - d. Pressure readings at start, intervals, and end
 - e. Leakage test results

b. For Low Pressure Air Testing

1. The length and diameter of the section of line tested (MH to MH) including any laterals.
2. A complete description of test procedures and methods, including:
 - a. Trench backfilling and sewer cleaning status
 - b. Type of plugs used and where
 - c. Depth of sewer, and ground water pressure over sewer pipe
 - d. Stabilization time period and air pressure
 - e. Actual air test pressures used if ground water is present
 - f. The allowed time by specifications
 - g. The actual test time
 - h. The air pressure at beginning and end of test
3. The name of the inspector/tester and the date(s) and time(s) of all testing, including any retesting.
3. A description of any repairs made.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 LEAKAGE TESTING

A. All new sewer and water pipelines installed shall be tested for leakage. The test used will be Hydrostatic Testing for pressure lines and Low Pressure Air Testing for gravity lines. Tests to be performed will be indicated by the ENGINEER and witnessed by the ENGINEER and the Lee County Utilities representatives.

1. Flushing

- a. All mains shall be flushed to remove all sand and other foreign matter. The velocity of the flushing water shall be at least 4 fps. Flushing shall be terminated at the direction of the ENGINEER. dispose of the flushing water without causing a nuisance or property damage.
- b. Temporary flush out connections shall be installed on all dead end water mains at the locations shown on the Drawings and in accordance with the detail shown in Section 9 of the Lee County Utilities Operations Manual.

2. Hydrostatic Testing

Perform hydrostatic testing of the system as set forth in the following, and shall conduct said tests in the presence of representatives from the COUNTY and other authorized agencies, with 48 hours advance notice provided.

Piping and appurtenances to be tested shall be within sections between valves unless alternate methods have received prior approval from the COUNTY. Testing shall not proceed until concrete thrust blocks are in place and cured, or other restraining devices installed. All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of all foreign matter. While the piping is being filled with water, care shall be exercised to permit the escape of air from extremities of the test section, with additional release cocks provided if required.

Hydrostatic testing shall be performed with a sustained pressure for a minimum of two (2) hours at 150 psi pressure or 2-1/2 times working pressure, whichever is higher, unless otherwise approved by Lee County Utilities. However, in no case shall the test pressure exceed the pressure rating of the lowest pressure rated component in the system being tested. Ductile iron pipe shall be tested in accordance with the applicable provisions as set forth in the most recent edition of AWWA Standard C600. PVC pipe shall be tested in accordance with the applicable provisions as set forth in the most recent edition of AWWA Standard C605. The allowable rate of leakage for ductile iron or PVC pipes shall be less than the number of gallons per hour determined by the following formula:

$$L = \frac{SD(P)^{1/2}}{133,200}$$

Where,

L = Allowable leakage in gallons per hour;

S = Length of pipe tested in feet;

D = Nominal diameter of the pipe in inches;

P = Average test pressure maintained during the leakage
test in pounds per square inch

For 150 psi, $L = (9.195 \times 10^{-5}) SD$

The testing procedure shall include the continued application of the specified pressure to the test system, for the one hour period, by way of a pump taking supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume displaced in said container.

Should the test fail, necessary repairs shall be accomplished by the CONTRACTOR and the test repeated until results are within the established limits. The CONTRACTOR shall furnish the necessary labor, water, pumps, and gauges at specified location(s) and all other items required to conduct the required testing and perform necessary repairs.

General. All sanitary sewers and associated service lines shall be constructed watertight to prevent infiltration and/or exfiltration. All new sanitary sewer systems will be subject to low pressure air testing.

3. Low Pressure Air Test

After completing backfill of a section of gravity sewer line, conduct a Line Acceptance Test using low pressure air. The test shall be performed using the below stated equipment, according to state procedures and under the supervision of the ENGINEER and in the presence of a Lee County Utilities representative, with 48 hours advanced notice provided.

a. Equipment:

1. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
2. Pneumatic plugs shall resist internal bracing or blocking.

3. All air used shall pass through a single control panel.
4. Three individual hoses shall be used for the following connections:
 - a. From control panel to pneumatic plugs for inflation.
 - b. From control panel to sealed line for introducing the low pressure air.
 - c. From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

b. Procedures:

All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psi. The sealed pipe shall be pressurized to 5 psi. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.

After a manhole to manhole reach of pipe has been backfilled and cleaned and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psi. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psi greater than the average back pressure of any ground water that may be over the pipe. At least two (2) minutes shall be allowed for the air pressure to stabilize. After the stabilization period (3.5 psi minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "Acceptable", if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psi (greater than the average back pressure of any ground water that may be over the pipe) is greater than the time shown for the given diameters in the following table:

Pipe Diameter <u>In Inches</u>	<u>Minutes</u>
8	4.0
10	5.0
12	5.5
16	7.5
18	8.5
24	11.5

Time in minutes = $0.472 D$
D = Diameter of pipe in inches.

In areas where ground water is known to exist, the CONTRACTOR shall install capped pipe adjacent to the top of one of the sewer lines. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the ground water shall be determined by removing the pipe cap, and a measurement of the height in feet of water over the invert of the pipe shall be taken. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings. (For example, if the height of water is 11-1/2 feet, then the added pressure will be 5 psi. This increases the 3.5 psi to 8.5 psi, and the 2.5 psi to 7.5 psi. The allowable drop of one pound and the timing remain the same).

If the installation fails to meet this requirement, the CONTRACTOR shall, at his own expense, determine the source of leakage. He shall then repair or replace all defective materials and/or workmanship.

3.2 LEAKAGE TESTS FOR STRUCTURES

- A. Structure Leakage Testing: Perform leakage tests of wet wells, tanks, vaults and similar purpose structures before backfilling, by filling the structure with water to the overflow water level and observing the water surface level for the following 24 hours.
 1. Make an inspection for leakage of the exterior surface of the structure, especially in areas around construction joints.
 2. Leakage will be accepted as within the allowable limits for structures from which there are no visible leaks.
 3. If visible leaks appear, repair the structure by removing and replacing the leaking portions of the structure, waterproofing the inside, or by other methods approved.
 4. Water for testing will be provided by the OWNER at the CONTRACTOR's expense.

END OF SECTION

SECTION 02999

MISCELLANEOUS WORK AND CLEANUP

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. This Section includes operations which cannot be specified in detail as separate items but can be sufficiently described as to the kind and extent of work involved. Furnish all labor, materials, equipment and incidentals to complete the work under this Section.
- B. The work of this Section includes, but is not limited to, the following:
 - 1. Restoring of sidewalks, driveways, curbing and gutters.
 - 2. Crossing utilities.
 - 3. Relocation of existing water lines, low pressure, gas lines, telephone lines, electric lines, cable TV lines and storm drains as necessary, all as shown on the drawings.
 - 4. Restoring easements and rights-of-ways.
 - 5. Cleaning up.
 - 6. Incidental work.

1.2 WORK SPECIFIED UNDER OTHER SECTIONS

- A. All work shall be completed in a workmanlike manner by competent workmen in full compliance with all applicable sections of these Specifications.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Materials required for this Section shall be of at least the same type and quality as materials that are to be restored. Where possible, reuse existing materials that are removed and then replaced, with the exception of paving.

PART 3 EXECUTION

3.1 RESTORING OF CURBING, FENCES, AND GUARD RAILS

- A. Existing curbing shall be protected. If necessary, curbing shall be removed from joint to joint and replaced after backfilling. Curbing which is damaged during construction shall be replaced with curbing of equal quality and dimension.

3.2 CROSSING UTILITIES

- A. This item shall include any extra work required in crossing culverts, water courses, drains, water mains, and other utilities, including all sheeting and bracing, extra excavation and backfill, or any other work required for the crossing, whether or not shown on the drawings.

3.3 RELOCATIONS OF EXISTING GAS LINES, TELEPHONE LINES, ELECTRIC LINES, AND CABLE TV LINES

A. Notify the proper authority of the utility involved when relocation of these lines is required. Coordinate all work by the utility so that the progress of construction will not be hampered.

3.4 PROTECTION AND RESTORATION OF PROPERTY

A. Protection and Restoration of Property: During the course of construction, take special care and provide adequate protection in order to minimize damage to vegetation, surfaced areas, and structures within the construction right-of-way, easement or site, and take full responsibility for the replacement or repair thereof. Immediately repair any damage to private property created by encroachment thereon. Should the removal or trimming of valuable trees, shrubs, or grass be required to facilitate the installation within the designated construction area, this work shall be done in cooperation with the County and/or local communities which the work takes place. Said valuable vegetation, removed or damaged, shall be replanted, if possible, or replaced by items of equal quality, and maintained until growth is re-established. Top soil damaged in the course of work shall be replaced in kind with suitable material, graded to match existing grade. Following construction completion, the work area along the route of the installation shall be finish grade to elevations compatible with the adjacent surface, with grassing or hand raking required within developed areas.

B. Existing lawn surfaces damaged by construction shall be re-graded and re-sodded or re-seeded. These areas shall be maintained until all work under this Contract has been completed and accepted.

3.5 CLEANING UP

A. Remove all construction material, excess excavation, buildings, equipment and other debris remaining on the job as a result of construction operations and shall render the site of the work in a neat and orderly condition.

B. Work site clean-up shall follow construction operations without delay and in accordance with Section 01710.

3.6 INCIDENTAL WORK

A. Do all incidental work not otherwise specified, but obviously necessary for the proper completion of the Contract as specified and as shown on the drawings.

END OF SECTION

SECTION 03311
CONCRETE FOR NON-PLANT WORK

PART 1 GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

- A. The extent of concrete work is shown on the drawings.

1.2 CODES AND STANDARDS

- A. ACI 347 "Recommended Practice for Concrete Formwork"; ACI 304 "Recommended Practice for measuring, Mixing, Transporting, and Placing Concrete"; comply with applicable provisions.
- B. Reference to standard specifications herein shall be construed as to be in reference to the latest revision or edition.

1.3 STORAGE

- A. Immediately upon receipt at the site, cement that is to be site mixed shall be stored in a dry, weather tight building, properly ventilated and with provisions for prevention of moisture absorption.
- B. Reinforcing shall be protected from the weather.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: Cement shall conform to standard specifications for "Portland Cement", ASTM C150, Type I for concrete not exposed to sewage and ASTM C150, Type II or ASTM C150, Type I with sulfide resistant properties equal to Type II for concrete exposed to sewage.
- B. Aggregate: Concrete aggregate shall conform to the current specifications for "Concrete Aggregate", ASTM Designation C33.
- C. Water: Water used in mixing concrete shall be fresh, clean, and free from injurious amounts of oil, acid, alkali or organic matter.
- D. Ready-Mix Concrete: Ready-mixed concrete may be used at the option of the CONTRACTOR provided that such concrete meets the requirements of these specifications and of ASTM Designation C94 for "Ready-Mixed Concrete".
- E. High-Early-Strength Concrete: Concrete made with high-early-strength Portland cement shall be used only when specifically authorized by the ENGINEER. The 7-day compressive strength of concrete made with high-early-strength cement shall be at least equal to the minimum 28-day compressive strength specified. All provisions of these specifications shall

be applicable to high-early-strength concrete except the cement shall conform to ASTM Designation C150, Type III.

2.2 RELATED MATERIALS

- A. Reinforcing: Deformed Reinforcing Bars, ASTM A615; Grade 60 unless otherwise indicated.
- B. Welded Wire Fabric: ASTM A185.
- C. Liquid Membrane-Forming Curing Compound: ASTM C309, Type I.
- D. Form Materials:
 - 1. Provide form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection.
 - 2. Exposed Concrete Surfaces: Suitable material to suit project conditions.
- E. Waterstops: To be used in joints shall be #10 gage steel sheet, 4" wide, welded continuous through the joint, unless detailed otherwise.
- F. Chemical Floor Hardener: Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent, containing not less than 2 lbs. of fluosilicates per gallon.
 - 1. Apply to exposed concrete slabs not indicated or scheduled to receive subsequent finishes.

2.3 QUALITY

- A. Strength: The minimum 28-day compressive strength of reinforced concrete shall be 4,000 psi, unless shown otherwise on the drawings.
 - 1. Each cubic yard of 4,000 psi concrete shall contain no less than 517 lbs. of cement. The total water content per bag of cement shall not exceed 6.0 gallons.
- B. Strength: The minimum 28-day compressive strength of non-reinforced concrete shall be 2,500 psi, unless shown otherwise on the drawings.

Each cubic yard of 2,500 psi concrete shall contain no less than 440 lbs. of cement. The total water content per bag shall not exceed 7.5 gallons.
- C. Mix Proportions: All concrete materials shall be proportioned so as to produce a workable mixture with a slump between 2" and 4".
- D. Tests:
 - 1. The CONTRACTOR shall provide, for test purposes, one set of three cylinders taken from each day's pour or each 50 cubic yards placed, whichever is least or as directed by the ENGINEER. The CONTRACTOR at his expense shall supply test samples and an

independent testing laboratory at the CONTRACTOR's expense will make tests. Sampling and testing of concrete shall be made in accordance with ASTM C-143 and ASTM C-31. The standard age of test shall be at 7 days and 28 days; and, when approved by the ENGINEER, a 45 day test may be used. If the test strength of the cylinders falls below the minimum allowable compressive strength, the ENGINEER shall have the right to order the CONTRACTOR to remove and renew that day's pour of concrete or the CONTRACTOR shall accept such deductions in the final payment as the OWNER may deem reasonable.

2. Sampling and testing of concrete materials shall be made in accordance with ASTM Designations. The CONTRACTOR at his expense shall supply test samples, and an independent testing laboratory at the CONTRACTOR's expense shall make tests. The source from which concrete aggregates are to be obtained shall be selected by the CONTRACTOR well in advance of the time when they will be required in the work; and suitable samples, as they are to be used in the concrete, shall be furnished in advance of the time when the placing of the concrete is expected to begin.

PART 3 EXECUTION

3.1 FORMING AND PLACING CONCRETE

- A. Formwork: Construct so that concrete members and structures are of correct size, shape, alignment, elevation and position, complying with ACI 347.

Clean and adjust forms prior to concrete placement. Apply form release agents for wet forms, as required. Retighten forms during and after concrete placement if required to eliminate mortar leaks.

3.2 REINFORCEMENT

- A. Position, support and secure reinforcement against displacement. Locate and support with metal chairs, runners, bolsters, spacers and hangers, as required. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- B. Install welded wire fabric in lengths as long as possible, lapping at least one mesh.
- C. Installation of Embedded Items: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by cast-in-place concrete. Use setting diagrams, templates and instructions provided by others for locating and setting.

3.3 CONCRETE PLACEMENT

- A. Comply with ACI 304, placing concrete in a continuous operation within planned joints or sections. Do not begin placement until work of other trades affecting concrete is completed.
- B. Consolidate placed concrete using mechanical vibrating equipment with hand rodding and tamping, so that concrete is worked around reinforcement and other embedded items and into all parts of the forms.

- C. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placement and curing. Concrete shall not be placed when the surrounding air temperature is below 40°F. and dropping.
 - 1. In cold weather comply with ACI 306.
 - 2. In hot weather comply with ACI 305.

3.4 CONCRETE FINISHES

- A. Nonslip Broom Finish: Apply nonslip broom finish to exterior concrete and sidewalks.
 - 1. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with the ENGINEER before application.

3.5 BONDING AND GROUTING

- A. Before depositing new concrete on or against concrete that has set, existing surfaces shall be thoroughly roughened and cleaned of glaze, foreign matter, and loose particles. An epoxy coating shall be applied for bonding the new concrete to the old.

3.6 CURING

- A. Concrete shall be kept continuously (not periodically) wet for a period of at least five consecutive days by covering with water or with an approved water saturated covering. Water for curing shall be clean and free from any elements, which might cause staining, or discoloration of the concrete surface.
- B. Sidewalks and floor slabs may be cured by spraying with a Membrane-Forming curing compound, applied as per manufacturer's recommendations. This material shall not be used on any interior slabs to which an applied finish is to be bonded.

3.7 PATCHING

- A. Any concrete which is not formed as shown on the drawings, or is out of alignment or level or shows a defective surface, shall be considered as not conforming with the intent of these specifications and shall be removed from the job by the CONTRACTOR at his expense, unless the ENGINEER grants permission to patch the defective area. This shall be done in accordance with the procedures above. Honeycomb consisting of 1/2" diameter holes or greater shall be considered a defective surface. Permission to patch any such area shall not be considered a waiver of the ENGINEER's right to require complete removal of the defective work if the patching does not, in his opinion, satisfactorily restore the quality of the concrete and appearance of the surface.
- B. As the forms are removed, fins, rough edges, and offsets shall be ground smooth. Holes to 1/2", slight honeycomb, and minor defects shall be wet and filled with a 1:2 mix of cement mortar, matching color of surrounding concrete, and then troweled to a uniform plane. As soon as they have been troweled, the patched areas shall be sprayed with a curing compound,

which will not destroy future bonding properties. Three days after application of curing compound, the entire surface shall be finished by wetting and applying a 1:2 mix of cement mortar with a cement brick. Using the brick, mortar shall be rubbed into pits or indentations and excess mortar rubbed off to provide a uniformly textured surface. When the surface has dried, all loose sand and dust shall be removed and the surface then hosed down with water.

3.8 TOLERANCES

A. Tolerances for concrete work shall be in accordance with ACI 347.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 05540
METAL CASTINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Miscellaneous ferrous and nonferrous castings.

1. This classification includes wheel guards, valve boxes, manhole frames and covers, manhole steps, stop plank grooves, brackets and supports for piping and gutter inlets, floor drains, cleanouts and special malleable iron castings and inserts.

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM A 27/A27M - Specification for Steel Castings, Carbon for General Applications
2. ASTM A 47 - Specification for Ferric Malleable Iron Castings
3. ASTM A 48 - Specifications for Gray Cast Iron Castings
4. ASTM A 148/A148M - Specifications for Steel Castings
5. ASTM A 536 - Specifications for Ductile Iron Castings
6. ASTM B 26/B26M - Aluminum
7. ASTM B 148 - Aluminum Bronze Sand Castings
8. ASTM B 584 - Manganese Bronze

PART 2 PRODUCTS

2.1 WORKMANSHIP

A. Provide castings accurately made to the approved dimensions, and plane or grind castings where marked or where otherwise necessary to secure flat and true surfaces. Make allowance in the patterns so that the specified thickness is not reduced. Provide manhole covers which conform to the details shown and which are true and seat at all points. Supply castings showing the name of the manufacturer and the country of manufacture. No plugging or welding of defective castings will be permitted.

2.2 WEIGHTS

- A. Reject castings with a weight which is less than the theoretical weight based on required dimensions by more than 5 percent. Provide facilities at the site for weighing castings in the presence of the ENGINEER, or furnish invoices showing true weights, certified by the supplier.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Erect all castings to accurate grades and alignment, and when placing in concrete carefully support castings to prevent movement during concreting.

3.2 PAINTING

- A. Clean metal castings thoroughly before painting. Give manhole frames and covers and valve boxes one coat of primer and two coats of an approved asphaltum varnish or other approved coating at the point of manufacture. Deliver all other castings to the job site unpainted. Paint all other castings as specified in Section 09900.

END OF SECTION

SECTION 15100

WATER VALVES AND APPURTENANCES

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required and install complete and ready for operation all valves and appurtenances as shown on the Drawings and as specified herein.

1.2 REFERENCES

A. Codes, specifications, and standards referred to by number or title form a part of this Section to the extent required by the references to codes, specifications, and standards. Latest revisions, as of the date of bid opening, apply, unless otherwise noted on the Drawings or specified in this Section.

B. Standards

Designation	Title
ANSI/AWWA C111/A21.11	Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
ANSI/AWWA C500	Gate Valves
ANSI/AWWA C509	Resilient-Seated Gate Valves 3 through 12 NPS, for Water and Sewage Systems
ANSI/B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 125
ANSI/B16.3	Malleable Iron Threaded Fittings, Class 150 and 300
ANSI/B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys
ASTM A276	Specification for Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A231	Specification for Steel Casting, Austenitic, for High-Temperature Service
ASTM A743	Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, and Nickel-Base Corrosion-Resistant for General Application
MSS SP-60	Connecting Flange Joint Between Tapping Sleeves and Tapping Valves

1.3 DEFINITIONS

A. References to valve sizes on the Drawings and in the Specifications are intended to be nominal size, and shall be interpreted as nominal size.

1.4 SUBMITTALS

A. General: as specified in:

1. General Conditions;
2. Supplementary General Conditions;

1.5 QUALITY ASSURANCE

A. Testing: Test valves as specified in this Section.

PART 2 PRODUCTS

2.1 GENERAL:

A. All valves and appurtenances shall be of the size shown on the Drawings and as far as possible all equipment of the same type shall be from one manufacturer.

B. All valves and appurtenances shall have the name of the maker and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

2.2 MANUFACTURERS

A. U.S. Pipe Metroseal 250, McWayne, American or equal by U.S. manufacturer.

2.3 DESIGN

A. Resilient, Wedge or Gate Valves and Boxes

1. Valves for pipe less than 2" in diameter shall conform to the requirements of AWWA C509 (latest revision) and shall be cast iron, single wedge, non-rising stem, screwed bonnet, 125 pounds S.P., 200 pounds W.O.G with stuffing box repackable under pressure and all parts renewable. Ends shall be as shown or indicated on the drawings.

2. Resilient, wedge or gate valves 2" in diameter and larger shall be cast or ductile iron body, non-rising stem, bronze mounted gate valves, mechanical joint conforming to requirements of the AWWA Standard C509 and shall be provided with a 2" square operating nut. Valves shall be resilient, wedge, or gate type and shall turn to the left (counter clockwise) to open. The wedge or gate shall be cast iron or ductile iron per

ASTM A536, minimum 65,000 psi strength and, completely encapsulated with urethane rubber, permanently bonded to the wedge or gate to meet ASTM test for rubber metal bond, ASTM D429. The valve stems for non-rising stem assemblies shall be cast bronze with integral collars in full compliance with AWWA. The NRS stem stuffing box shall be the O-ring seal type with two rings located above thrust collar; the two

rings shall be replaceable with valve fully open and subjected to full rated working pressure.

3. There shall be two low torque thrust bearings located above and below the stem collar. The stem nut shall be independent of wedge and shall be made of solid bronze. There shall be a smooth unobstructed waterway free of all pockets, cavities and depressions in the seat area. The body and bonnet shall be coated with fusion bonded epoxy both interior and exterior. The valve shall be designed and tested to be opened and closed under a differential pressure of 150 psi or greater.

B. Valves for Buried Service

1. Valves for buried service shall meet all the requirements as specified herein for interior except that buried valves shall have mechanical joint ends.
2. All buried valves shall have cast-iron three piece valve boxes, valve boxes shall be provided with suitable heavy bonnets to extend to such elevation at the finished grade surface as directed by the ENGINEER. The barrel shall be two-piece, screw type, having 53" shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling, shall be designed so as to prevent the transmission of surface loads directly to the valve or piping, and shall be complete with cast iron covers. Covers shall have "WATER" cast into the top. The covers shall be so constructed as to prevent tipping or rattling. Valve boxes shall be manufactured by OPELICA FOUNDRY COMPANY, Opelika, Alabama or TYLER PIPE DIVISION, Tyler, Texas or approved equal.
3. One tee-handled wrench of suitable length shall be furnished to operate each valve with a valve box.
4. Where valves are located out of pavement, the boxes shall be adjusted to finished grade and a concrete slab two feet square and six inches thick shall be poured around the box.
5. Valve boxes shall be of the heavy duty, traffic bearing cast iron, adjustable screw type with a drop cover. The valve box assembly shall consist of a bottom section, top section and cover which is cast from gray iron, formulated to ASTM specification A-48 latest revision, class 30 minimum and shall be free from blowholes, shrinkage or other imperfections not true to pattern. The shaft size shall be 5 1/4" and the adjustable length shall be from 18" to 24". The wall thickness shall be 3/16" \pm 1/16". The weight of the assembly shall be 61 pounds \pm 2 pounds, with the cover weight being a minimum of 12 pounds.
6. The name of the manufacturer and foundry of origin shall be cast into each of the components of the assembly in legible form. The assembly shall be suitable for highway traffic wheel loads of 16,000 pounds and shall withstand a proof load test of 25,000 pounds without failure or permanent deflection, as per Federal Specification RR-F-621-C, latest revision. The valve box shall be cast, machined, assembled, and packaged within the United States and shall fully comply with the Buy American provisions of Public Law 102-240, enacted 12/18/91.

C. Gate Valves Greater Than 20 Inches

1. Valves larger than 20" in diameter and larger shall be approved by the County and shall be epoxy-coated, cast or ductile iron body mechanical joint type conforming to requirements of the AWWA Standards and shall be provided with a 2" square operating nut.
2. 20" or larger resilient gate valve must have a 4" bypass line and 4" gate valve. If a Metroseal 250 or approved equal resilient gate valve is used, the 4" bypass line and 4" gate valve is not required. Butterfly valves may be used for valves greater than 24" without the 4" bypass line and 4" gate valve.

D. Check Valves

1. Check valves smaller than 4" shall have a bronze body with a bronze disk. Check valves shall absolutely prevent the return of water back through the valve when the inlet pressure decreases below the delivery pressure.
2. The valve must be full opening, tight seating and its seat right shall be renewable and must be securely held in place by a threaded joint; the valve disc shall be bronze and shall be suspended from a non-corrosive shaft which will pass through a stuffing box.
3. The check valve 4" and larger shall be a rubber flapper type swing check valve and the body and cover shall be cast iron construction meeting ASTM A126 Class B or Ductile Iron construction. The flapper shall be Buna-N having an "O" ring seating edge and be internally reinforced with steel.
4. Flapper to be captured between the body and the body cover in a manner to permit the flapper to flex from closed to full open position during flow through the valve. Flapper shall be easily removed without need to remove valve from line. Check Valves to have full pipe size flow area. Seating surface to be on a 45° angle requiring the flapper to travel only 35° from closed to full open position, for minimum head loss and non-slam closure.
5. Non-slam closing characteristic shall be provided through a short 35° disc stroke and a memory flex disc return action.
6. When essential to create backflow thru the check valve, i.e.; to prime or backflush a clogged pump, an external backflow device shall be included.
7. Valve exterior to be painted Phenolic Primer Red Oxide for high resistance to corrosion.
8. Materials of construction shall be certified in writing to conform to A.S.T.M. specified above.
9. Valve shall be APCO Series 100 Rubber Flapper Swing Check Valve, as manufactured by Valve & Primer Corporation, Schaumburg, Illinois, U.S.A or Series 500 swing flex valve as manufactured by Val-Matic Valve and Manufacturing Corporation or approved equal.

E. Backflow Prevention Devices

1. Backflow prevention devices for fire protection systems which do not utilize chemical additives or an auxiliary water supply shall be double detector check valve assemblies, shall be USC approved, painted red, and meet all requirements of ANSI/AWWA C510

For all other applications, backflow prevention devices shall be reduced pressure principle assemblies and shall be USC approved, and shall meet all requirements of ANSI/AWWA C511 and the Southern Standard Plumbing Code. Refer to Section 9 of the Lee County Utilities Operations Manual for details and Section 17196.

F. Air Release Valves

1. Air release valves shall be of the short body, automatic type as shown on the Lee County Standard Detail No. 9.27 in the Operations Manual. The valve body shall be cast iron construction, ASTM A126, Class B, and all internal working parts shall be 300 Series stainless steel, and BUNA-N orifice button. The inlet openings shall be 1" NPT screwed connection. The venting orifice shall be 3/16" in diameter and shall be installed to vent a minimum of 1 foot above the flood elevation. Air release valves shall be the 400 series SARV as manufactured by Apcov Valve and Primer Corporation, Schaumburg, Illinois, or approved equal.

G. Tapping Valves and Sleeves

1. Tapping valves shall be of non-rising stem type of O-Ring seals and conform to the applicable requirement as specified above for valves and shall have one flange joint end and mechanical joint end.
2. Valve end connecting to tapping sleeve shall have a flange for bolting to the sleeve. The flange shall have a tongue which fits a recess in sleeve. Tongues shall meet the requirements of MSS SP-60. Resilient-seated gate valves having a port diameter equal to or exceeding 1/4 inch over nominal diameter shall not require a tongue. Flange dimensions and drilling shall meet the requirements of ANSI B16.1. Mechanical joints shall meet the requirements of ANSI/AWWA C111/A21.11. A full nominal diameter cutter shall be used for tapping.
3. Tapping valves 16" and smaller, shall be installed vertically. Tapping valves larger than 16" shall be installed horizontally and shall have bypass valves. Tapping valves installed horizontally shall have rollers and tracks. Valves 16" and larger, shall have gear operators with enclosed gear cases suitable for buried service. Gear cases shall be extended type or totally enclosed type. Extended type gear cases shall have bolted side plates to cover stem and stuffing box.

H. Meter Boxes

1. Meters less than 1" shall be installed in a Quazite PG1118BB12 box with Quazite PG1118WAP1 cover, or CDR WB00-1118-12 box with CDR WC00-1118-2C cover.
2. Meters 1" through 2" shall be installed in a Quazite PG1730BB12 box with Quazite PG1730WAP1 cover, or CDR WB-1730-12 box with CDR WC00-1730-2C cover.
3. Meters larger than 2" shall be installed above ground and approved by Lee County Utilities. Refer to Lee County standard details.

Meter boxes, which need to be replaced, shall be Quazite PG1015WAR.1 or CDR R-1071-2C. Should just the cover need to be replaced it shall be Quazite PG1730WAP1, or CDR WC00-1730-2C.

PART 3 EXECUTION

3.1 INSTALLATION

- A. All valves and appurtenances shall be installed in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the ENGINEER before they are installed.
- B. After installation, all valves and appurtenances shall be tested at least one hour at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired to the satisfaction of the ENGINEER.
- C. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the CONTRACTOR shall check all plans and figures which have a direct bearing on their location and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.
- D. Flanged joints shall be made with Series 300, stainless steel bolts. All exposed bolts shall be made with Series 300 stainless steel bolts.
- E. Prior to assembly of split couplings, the grooves as well as other parts shall be thoroughly cleaned. The ends of the pipes and outside of the gaskets shall be moderately coated with petroleum jelly, cup grease, soft soap or graphite paste, and the gasket shall be slipped over one pipe end. After the other pipe has been brought to the correct position, the gasket shall be centered properly over the pipe ends with the lips against the pipes. The housing sections then shall be placed. After the bolts have been inserted, the nuts shall be tightened until the housing sections are firmly in contact, metal-to-metal, without excessive bolt tension.
- F. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of 8". Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6" from the end, and the middle ring shall be placed on the already laid pipe end until it is properly centered over the joint. The other pipe end shall be inserted into the middle ring and brought to proper position in relation to the pipe already laid. The gaskets and followers shall then be pressed evenly and firmly into the middle ring flares. After the bolts have been inserted and all nuts have been made up finger-tight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint, preferably by use of a torque wrench of the appropriate size and torque for the bolts.
- G. Valves shall be carefully inspected, opened wide and then tightly closed and the various nuts and bolts shall be tested for tightness. Special care shall be taken to prevent any foreign matter from becoming lodged in the valve seat. Gate valves, unless shown otherwise, shall be set with their stems vertically above the center line of the pipe. Any valve that does not operate correctly shall be removed and replaced.
- H. Valve boxes shall be carefully centered over the operating nuts of the valves so as to permit a valve wrench or key to be fitted easily to the operating nut. Valve boxes shall be set to conform to the level of the finished surface and held in position by a ring of concrete placed under the support flange as shown on the details in Section 9 of the Lee County Utilities Operations Manual. The valve box shall not transmit surface loads to the pipe or valve. Care shall be taken to prevent earth and other material from entering the valve box.

Any valve box which is out of alignment or whose top does not conform to the finished ground surface shall be dug and reset. Before final acceptance of the work, all valve boxes shall be adjusted to finish grade. Valve operating risers shall be installed with any valves required to ensure that the operating nut is 30 inches or less from the ground surface.

3.2 SHOP PAINTING

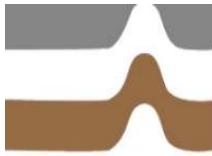
- A. Ferrous surfaces of valves and appurtenances shall receive a coating of epoxy in accordance with AWWA Standard C550 that meets or exceeds all test requirements including the Food and Drug Administration Document Title 21 of the Federal Regulations on Food Additives, Section 175.000 entitled "Resinous and Polymeric Coating"; Impact Test Requirement in accordance with the ASTM D2794.

END OF SECTION

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APPENDIX A
GEOTECHNICAL REPORT

**SUBSURFACE SOIL EXPLORATION
FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT - PHASE 2, AREA A
FIDDLESTICKS COUNTRY CLUB
FORT MYERS, LEE COUNTY, FLORIDA**



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Society of American Military Engineers
American Council of Engineering Companies



Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

Ardaman Project No. 17-33-4601
September 19, 2018

WESTON & SAMPSON ENGINEERING, INC.
1520 Royal Palm Square Boulevard, Suite 260
Fort Myers, FL 33919

Attention: Mr. Jeffrey A. Wilson, P.E. PWLF

SUBJECT: Subsurface Soil Exploration
Fiddlesticks Water Main Replacement Project – Phase 2, Area A
Fiddlesticks Country Club
Fort Myers, Lee County, Florida

Gentlemen:

As requested and authorized by **Weston & Sampson Engineers, Inc.**, Ardaman & Associates, Inc. (Ardaman) has completed the subsurface soil exploration program for the subject project. The purposes of this program were to evaluate the general subsurface conditions in the project study area and discuss our findings.

This report documents our findings and conclusions. It has been prepared for the exclusive use of **Weston & Sampson Engineers, Inc.** for specific application to the subject project in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

SCOPE

The scope of our services was limited to the following items:

1. Conducting 21 Standard Penetration Test (SPT) borings to 15 feet to determine the nature and condition of the subsurface soils along the route of the proposed water main.
2. Reviewing each soil sample obtained in our field exploration program by a geotechnical engineer in our laboratory for further identification and assignment of laboratory tests.
3. Performing the appropriate laboratory tests on selected samples.
4. Analyzing the existing soil conditions with respect to the proposed construction.

5. Preparing this report to document the results of our field exploration and laboratory testing programs, and discuss our findings.

SITE LOCATION AND PROJECT DESCRIPTION

The Fiddlesticks Water Main Replacement project includes design, permitting and installation of a new water main in the right-of-way of all streets within the Fiddlesticks Country Club development in Fort Myers, Lee County, Florida. The proposed project has been split up into two phases. This report is only for Phase 2, Area A, which encompasses Lockmaben Avenue, Kinross Circle, Carriedale Lane, Tweedale Circle and Cannongate Drive. Phase 2, Area A includes an estimated total of 10,800 lineal feet of water main installation. Most of the water main replacement will be installed by directional drill. In general, the soil borings along the water main route were performed on approximately 500-foot centers. Due to access limitations all borings were performed on the existing road surface.

FIELD EXPLORATION PROGRAM

Our field exploration consisted of performing 21 Standard Penetration Test (SPT) borings. The SPT borings were drilled to a depth of 15 feet below the existing ground surface. The SPT borings were conducted using methods consistent with ASTM D-1586. The equipment and procedures used in the SPT borings are described in detail in the **Appendix**.

The locations of the borings are shown on the attached **Figure 1–Boring Location Plan**. They were located by measurement from the site features shown on an aerial photograph of the site shown on the preliminary subsurface utility engineering and geotechnical investigation sheet G-1 provided by Weston & Sampson Engineers, Inc. Therefore, the locations indicated should be considered accurate only to the degree implied by the method of measurement used. If a more precise location of the borings is desired, then we recommend that a registered land surveyor be employed to locate the borings on site. GPS coordinates of each boring location are provided on the boring logs.

GENERAL SUBSURFACE CONDITIONS

The general subsurface conditions encountered during the field exploration are shown on the attached soil boring logs. Soil stratification is based on examination of recovered soil samples and interpretation of the field boring logs. The stratification lines represent the approximate boundaries between the soil types, the actual transitions may be gradual.



The borings were performed in the asphalt pavement. In general, below the asphalt and base, the borings typically encountered very loose to very dense fine sands (SP and SP-SM) extending to depths ranging from 9 feet to the termination of the borings at 15 feet below the existing ground surface. Nine of the 21 borings encountered very loose to dense slightly silty and silty sands (SM) with varying amounts (if any) of gravel consisting of rock fragments or cemented sands at depths ranging from 4.5 to 13.5 extending to depths of 6 feet to the termination of the borings at 15 feet below the existing ground surface. Two of the borings encountered a 1.5-foot thick stratum of loose clayey fine sands (SC) at depths of 10.5 and 13.5 feet. Also, 13 borings encountered soft weathered to hard limestone at depths ranging from 4 to 13.5 feet extending to depth ranging from 7.5 to the termination of the borings. In addition, boring SPT-105 encountered medium dense slightly organic slightly silty fine sands at a depth of 3 feet extending to a depth of about 4.5 feet below the existing ground surface.

Groundwater was encountered in the boreholes at depths ranging from 3.5 to 5.5 feet below the existing ground surface at the time of our field exploration (August 1 through August 3, 2018). The groundwater depths shown on the boring logs represent the groundwater surface encountered on the dates shown. Fluctuations in groundwater level should be anticipated throughout the year due to seasonal variations in rainfall, and other factors.

LABORATORY TESTING PROGRAM

Representative soil samples obtained during our field sampling operation were packaged and transferred to our office and, thereafter, examined by a geotechnical engineer to obtain more accurate descriptions of the existing soil strata. Laboratory testing was performed on selected samples as deemed necessary to aid in soil classification and to further define the engineering properties of the soils. The laboratory tests included Natural Moisture Content, Organic Content and Percent Finer than the U.S. No. 200 Sieve (percent silt and clay).

The test results are presented on the attached soil boring logs at the depths from which the samples were recovered. The soil descriptions shown on the logs are based upon visual-manual procedures in accordance with local practice. Soil classification is in general accordance with the Unified Soil Classification System (ASTM D-2487) and is also based on visual-manual procedures.

In addition, soil samples from the borings were obtained on approximately 1,500-foot centers for environmental corrosion tests and conducted in accordance with Florida test methods FM 5-550, FM 5-551, FM 5-552 and FM 5-553. The environmental corrosion test parameters include pH, resistivity, sulfate content and chloride content. The summarized results are presented below.



Boring No.	Depth (ft.)	pH	Resistivity (ohms-cm)	Chlorides (ppm)	Sulfates (ppm)	Environmental Classification ¹	
						Steel	Concrete
SPT-90	3 – 4.5	8.6	7,000	60	129	Slightly Agg.	Slightly Agg.
SPT-94	3 – 4.5	8.8	3,400	60	39	Moderately Agg.	Slightly Agg.
SPT-97	3 – 4.5	8.3	2,500	45	138	Moderately Agg.	Moderately Agg.
SPT-101	3 – 4.5	8.3	5,500	45	72	Slightly Agg.	Slightly Agg.
SPT-103	3 – 4.5	8.3	7,000	45	18	Slightly Agg.	Slightly Agg.
SPT-106	1.5 – 6	6.4	18,000	90	9	Moderately Agg.	Slightly Agg.
SPT-109	3 – 7.5	5.7	17,000	45	27	Extremely Agg.	Moderately Agg.

¹Based on Florida Department of Transportation (FDOT) Structures Manual, Volume 1, Section 1.3 (Jan. 2018).

DISCUSSION

The borings performed along the proposed route encountered fine sands (SP and SP-SM) from directly below the pavement section extending to depths ranging from 9 feet to the termination of the borings at 15 feet below the existing ground surface. The fine sands were typically underlain by either silty sands (SM), clayey sands (SC) and/or soft weathered to hard limestone typically extending to the termination of the soil borings at a depth of 15 feet. Boring SPT-96 encountered slightly silty fine sands (SM) at a depth of 4.5 feet extending to approximately 6 feet. Typically limestone, if encountered in the borings, was encountered at depths between 9 and 13.5; however, boring SPT-95 encountered limestone at a depth of 4 feet extending to a depth of about 7.5 feet below the existing ground surface.

The fine sands (SP/SP-SM) are suitable for use as backfill materials and suitable for pipe bedding. However, the pipe should be bedded in gravel such as FDOT No. 89 stone if rock occurs within 6 inches of the pipe bottom, or if unsuitable silty sands (SM) or clayey sands (SC) are encountered at pipe invert.

Typically, heavy excavators can remove soft limestone and boulders; however, dynamic methods using hydraulic hammers or hoes will be needed to remove hard limestone or large boulders where they occur. Use of excavated rock as a fill material will require further processing (crushing and screening) to reduce particle size to mostly sand and gravel size.



GENERAL COMMENTS

While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of the region are anticipated and may be encountered. The boring profiles and related information are based on the driller's logs and visual examination of selected sample in the laboratory. The delineation between soil types shown on the profiles is approximate and the description represents our interpretation of subsurface conditions at the designated boring locations and on the particular date drilled.

If you have any questions about this report, please contact this office.

Very truly yours,

Ardaman & Associates, Inc.
Florida Certificate of Authorization No. 00005950



Matthew R. Elmore, E.I.
Project Engineer



This document has been digitally signed and sealed by

on the date adjacent to the seal.

Printed copies of this document are not considered signed and sealed and the signature must be verified on the electronic copies.

Gary A. Drew, P.E. No. 35504
Vice President/Branch Manager

MRE/GAD:mre



Ardaman & Associates, Inc.

ATTACHMENTS

- **BORING LOCATION PLAN (FIGURE 1)**
- **BORING LOGS – SPT-90 THROUGH SPT-110**



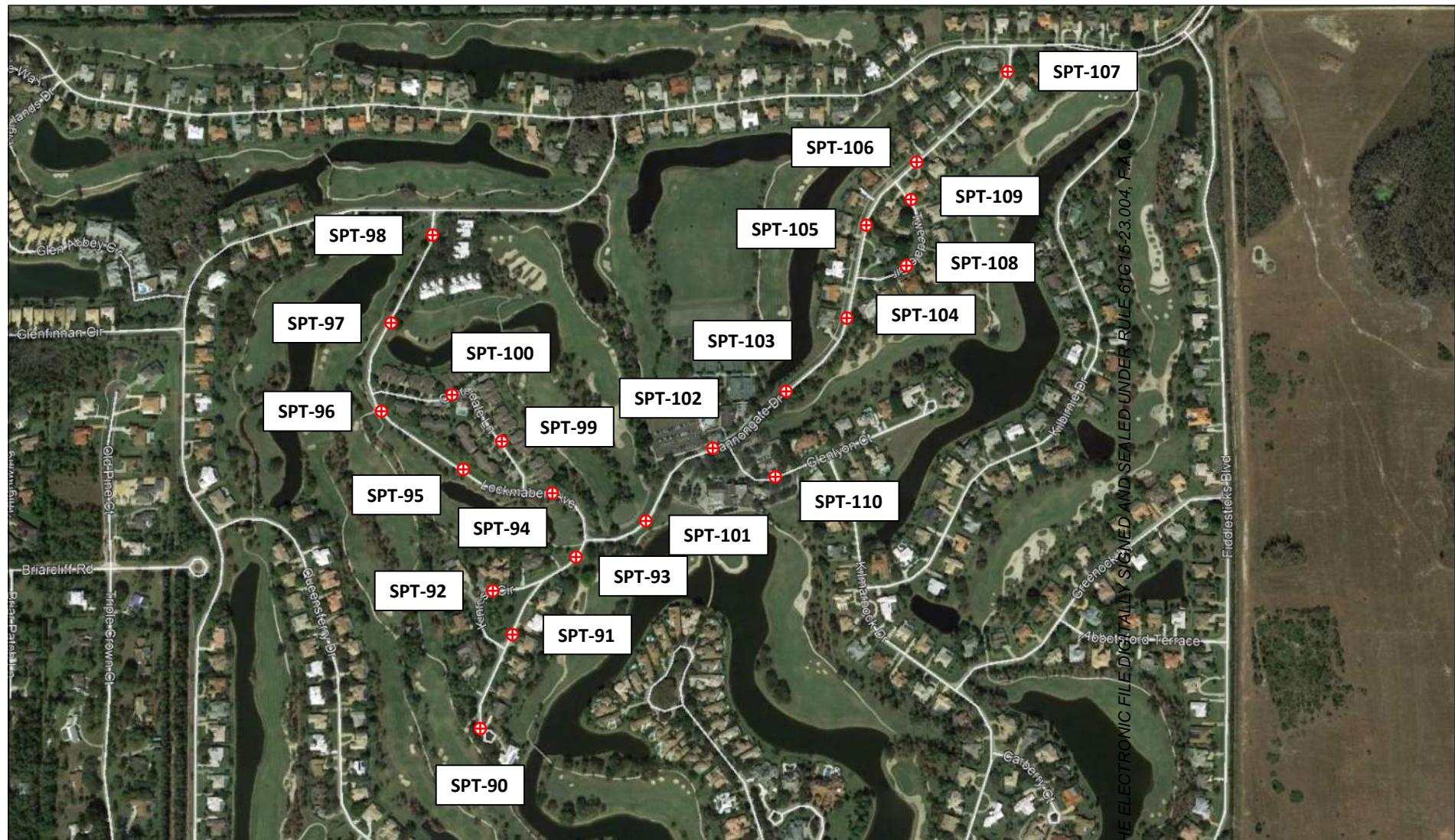
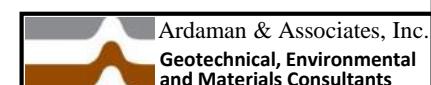
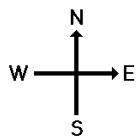


FIGURE 1
BORING LOCATION PLAN

SOURCE: GOOGLE EARTH PRO®



Proposed Fiddlesticks Water Main Replacement
Project – Phase 2, Area A
Fiddlesticks Country Club
Fort Myers, Lee County, FL

Drawn By: ME Checked By: GD Date: 8/23/18

File No.: 17-33-4601 Approved By: Gary Drew, P.E. Figure No: 1

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'59.51" DATE DRILLED: 01-AUG-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC Page 250 of 385 PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA A LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: CLOUDS / RAIN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	40- 15- 14	29	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments). Poorly Graded Sand - Brown fine sand.						
11- 11- 11	22	2			SP							
4- 3- 2	5	3			SP-SM							
5	1- 1- 1	2	4		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
1- 2- 4	6	5			SP							
5- 6- 6	12	6			SP	Poorly Graded Sand - Brown fine sand.						
3- 4- 4	8	7			SP							
1- 1- 3	4	8			SP							
8- 5- 5	10	9			SL	Soft Weathered Limestone.						
2- 4- 5	9	10			SL							
						TERMINATED AT 15.0'						
20												
25												
30												
35												

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BORING LOCATION: SEE BORING LOCATION PLAN

LATITUDE: N 26°31'1.74"

DATE DRILLED: 01-AUG-18

GROUND SURFACE ELEVATION:

WATER TABLE DEPTH (ft): 4.0

LONGITUDE: W 81°49'2.74"

STA: OFF:

TIME:

DATE: 01-AUG-18

Fiddlesticks Water Main Replacement - Phase 2

CLIENT: WESTON & SAMPSON ENGINEERS, INC. Page 251 of 385

**PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
PHASE 2, AREA A**

LOCATION: FORT MYERS, LEE COUNTY, FLORIDA

DRILL CREW: LOCKLEY / BENAVIDES

LOGGED BY: M. ELMORE E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO

BIT: 2-15/16" DIA. TRICONE ROLLER

DRILLING RODS: AW

DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID

WEATHER CONDITIONS: SUN / CLOUDS / RAIN

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEATED UNDER RULE 67(G) 5-23-004, F.A.C.
PLAST. INDEX



Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

REVIEWED BY

SARAH TAYLOR

FILE NO. 17-00-1004

BOILING SPRINGS

250

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'3.06" DATE DRILLED: 01-AUG-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 252 of 385 PHASE 2, AREA A LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	23- 11- 7	18	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	9- 11- 13	24	2		SP	Poorly Graded Sand - Light brown fine sand.						
5	8- 8- 7	15	3		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	6- 5- 6	11	4		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	6- 6- 7	13	5		SP	Poorly Graded Sand - Brown fine sand.						
	3- 5- 4	9	6		SP	Poorly Graded Sand - Brown fine sand.		25.5	3.4			
10	2- 2- 1	3	7		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	5- 11- 10	21	8			Soft Weathered Limestone.						
	9- 17- 5	22	9									
15	2- 1- 0	1	10		SP-SM	TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'16.37" DATE DRILLED: 01-AUG-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 253 of 385 OFF: TIME: DATE: 01-AUG-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO	BIT: 2-15/16" DIA. TRICONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	43- 14- 8	22	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	8- 10- 10	20	2		SP	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
8- 8- 8	16	3				Poorly Graded Sand - Brown fine sand.						
5	3- 4- 6	10	4		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
4- 4- 5	9	5				Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
2- 1- 1	2	6				Hard Limestone.						
10	50/2" - -	50/2"	7			Hard Limestone. Soft Weathered Limestone.		22.8	6.2			
15	1- 1- 1	2	8			TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'7.82" LONGITUDE: W 81°49'5.10"						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA A
DATE DRILLED: 01-AUG-18 STA: OFF: TIME: DATE: 01-AUG-18						Page 254 of 385
GROUND SURFACE ELEVATION: DRILL CREW: LOCATION: FORT MYERS, LEE COUNTY, FLORIDA						
WATER TABLE DEPTH (ft): 4.0' DRILL CREW: LOCKLEY / BENAVIDES LOGGED BY: M. ELMORE, E.I.						

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO	BIT: 2-15/16" DIA. TRICONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	39- 22- 22	44	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	20- 17- 14	31	2		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	7- 7- 4	11	3			Soft Weathered Limestone.						
5	2- 1- 12	13	4									
	16- 3- 1	4	5									
	3- 2- 13	15	6		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
10	3- 1- 0	1	7									
	1- 0- 1	1	8		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	1- 0- 0	0	9									
15	1- 0- 0	0	10			TERMINATED AT 15.0'						
20												
25												
30												
35												

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'9.75" DATE DRILLED: 01-AUG-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 3.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 255 of 385 OFF: TIME: DATE: 01-AUG-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	BIT: 2-15/16" DIA. TRICONE ROLLER	WEATHER CONDITIONS: SUN	DRILLING RODS: AW
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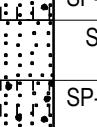
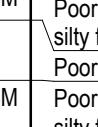
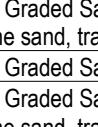
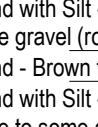
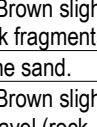
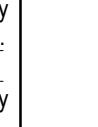
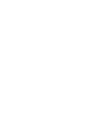
DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	36- 24- 19	43	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments). Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	16- 17- 21	38	2		SP-SM							
	12- 13- 14	27	3									
5	10- 7- 8	15	4		SM	Silty Sand - Brown slightly silty fine sand.		16.1	14.3			
	9- 9- 10	19	5		SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand.						
	9- 7- 9	16	6									
10	6- 3- 3	6	7			Soft Weathered Limestone.						
	1- 2- 7	9	8									
	20- 16- 13	29	9									
15	2- 3- 6	9	10			TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'15.05" DATE DRILLED: 01-AUG-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 256 of 385 PHASE 2, AREA A
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	26- 24- 20	44	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments). Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
19- 20- 23	43	2			SP-SM							
16- 17- 20	37	3										
5	13- 14- 9	23	4									
9- 11- 11	22	5			SP	Poorly Graded Sand - Brown fine sand.		19.4	3.4			
8- 7- 7	14	6										
7- 5- 6	11	7										
10- 50/0"-	50/0"	8				Hard Limestone.						
50/0" -	50/0"	9				TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'18.63" DATE DRILLED: 01-AUG-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 3.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 257 of 385 PHASE 2, AREA A LOGGED BY: M. ELMORE, E.I.
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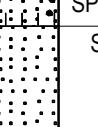
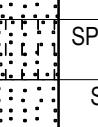
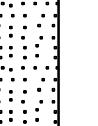
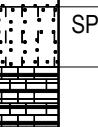
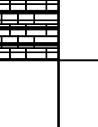
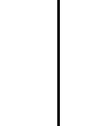
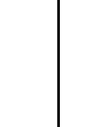
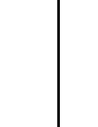
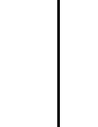
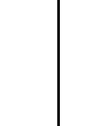
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	28- 16- 14	30	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	14- 17- 18	35	2		SP	Poorly Graded Sand - Brown fine sand.						
	13- 24- 47	71	3		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments and shell fragments).						
5	29- 13- 14	27	4		SP-SM	Poorly Graded Sand with Silt - Brown to light brown slightly silty fine sand.						
	13- 11- 10	21	5									
	3- 5- 6	11	6									
10	3- 50/0"-	50/0"	7			Hard Limestone.						
			8			Soft Weathered Limestone.						
15	4- 2- 1	3				TERMINATED AT 15.0'						
20												
25												
30												
35												

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'8.90" DATE DRILLED: 03-AUG-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 258 of 385 PHASE 2, AREA A LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO	BIT: 2-15/16" DIA. TRICONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	15- 11- 5	16	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments). Poorly Graded Sand - Gray to brown fine sand.						
	5- 5- 5	10	2		SP							
	3- 4- 6	10	3		SP-SM							
5	6- 6- 9	15	4		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	8- 8- 8	16	5		SP	Poorly Graded Sand - Light brown fine sand.		24.3	0.8			
	3- 6- 6	12	6									
10	1- 2- 3	5	7		SP-SM							
	4- 4- 3	7	8		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	4- 3- 12	15	9			Soft Weathered Limestone.						
15	3- 3- 1	4	10			TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'11.22" DATE DRILLED: 03-AUG-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 259 of 385 OFF: TIME: DATE: 03-AUG-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO	BIT: 2-15/16" DIA. TRICONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	22- 11- 10	21	1	██████████	SP-SM	Pavement and Rock Base.						
	11- 14- 13	27	2	██████████	SP	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	7- 7- 6	13	3	██████████	SP-SM	Poorly Graded Sand - Brown fine sand.						
5	7- 7- 10	17	4	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	12- 12- 13	25	5	██████████	SP	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	10- 11- 11	22	6	██████████		Poorly Graded Sand - Light brown fine sand.						
10	10- 8- 8	16	7	██████████								
	6- 4- 3	7	8	██████████								
	12- 9- 18	27	9	██████████	SM	Silty Sand - Brown silty fine sand.						
15	18- 50/0"-	50/0"	10	██████████		Hard Limestone.						
						TERMINATED AT 14.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'4.79" DATE DRILLED: 02-AUG-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 260 of 385 PHASE 2, AREA A LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO	BIT: 2-15/16" DIA. TRICONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	31- 21- 18	39	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	12- 17- 17	34	2		SP-SM	Poorly Graded Sand with Silt - Brown to gray slightly silty fine sand.						
5	11- 14- 18	32	3									
9	9- 11- 16	27	4		SP	Poorly Graded Sand - Light gray fine sand.						
12	12- 13- 16	29	5									
7	7- 5- 6	11	6		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.		21.4	1.0			
10	2- 3- 2	5	7		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	31- 15- 9	24	8		SM	Silty Sand - Brown silty fine sand, trace to some gravel (rock fragments and cemented sands).						
11	11- 13- 17	30	9			Soft Weathered Limestone.						
20	20- 41- 37	78	10			Hard Limestone.						
8	8- 33- 50/0"	50/0"	11			TERMINATED AT 16.0'						
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'11.62" DATE DRILLED: 02-AUG-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 262 of 385 PHASE 2, AREA A
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	37- 28- 25	53	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	35- 17- 17	34	2		SP	Poorly Graded Sand - Brown fine sand.						
	11- 12- 12	24	3		SP	Poorly Graded Sand - Brown fine sand.						
5	5- 6- 6	12	4		SP	Poorly Graded Sand - Brown fine sand.						
	5- 6- 6	12	5		SP	Poorly Graded Sand - Brown fine sand.						
	5- 5- 6	11	6		SP	Poorly Graded Sand - Brown fine sand.						
10	6- 4- 4	8	7		SC	Clayey Sand - Gray clayey fine sand.						
	4- 4- 4	8	8		SC	Clayey Sand - Gray clayey fine sand.						
	2- 1- 1	2	9		SM	Silty Sand - Light gray silty fine sand, trace to some gravel (rock fragments and cemented sands).						
15	1- 0- 0	0	10		SM	Silty Sand - Light gray silty fine sand, trace to some gravel (rock fragments and cemented sands).	TERMINATED AT 15.0'					
20												
25												
30												
35												

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'14.24" DATE DRILLED: 02-AUG-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 263 of 385 OFF: TIME: DATE: 02-AUG-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO	BIT: 2-15/16" DIA. TRICONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	29- 21- 11	32	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	10- 12- 11	23	2		SP	Poorly Graded Sand - Gray to brown fine sand.						
5	7- 7- 8	15	3									
	4- 5- 6	11	4									
	3- 3- 3	6	5		SP-SM	Poorly Graded Sand with Silt - Dark brown to brown slightly silty fine sand.		25.3		1.2		
	2- 2- 3	5	6									
10	1- 1- 1	2	7		SP	Poorly Graded Sand - Brown fine sand.						
	1- 1- 2	3	8		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	1- 0- 1	1	9		SM	Silty Sand - Light gray silty fine sand, trace to some gravel (rock fragments and cemented sands).						
15	1- 1- 10	11	10			Soft Weathered Limestone.						
						TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'20.03" DATE DRILLED: 02-AUG-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 264 of 385 OFF: TIME: DATE: 02-AUG-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	BIT: 2-15/16" DIA. TRICONE ROLLER	WEATHER CONDITIONS: SUN	DRILLING RODS: AW
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DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	39- 40- 32	72	1		SP-SM	Pavement and Rock Base.						
	15- 15- 16	31	2		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	8- 8- 10	18	3		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	7- 7- 8	15	4		SP-SM	Poorly Graded Sand with Silt - Dark brown slightly organic slightly silty fine sand.						
	5- 5- 5	10	5			Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	2- 1- 1	2	6									
10	1- 0- 0	0	7									
	0- 0- 0	0	8									
	0- 0- 1	1	9			Soft Weathered Limestone.						
15	1- 2- 8	10	10			TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: _____ LONGITUDE: _____ DATE DRILLED: 02-AUG-18 STA: _____ OFF: _____ GROUND SURFACE ELEVATION: _____ TIME: _____ WATER TABLE DEPTH (ft): _____ DATE: 02-AUG-18						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC. Page 265 of 385 PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA A LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES LOGGED BY: M. ELMORE, E.I.			
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN			
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DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	31- 30- 25	55	1	██████████	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments). Poorly Graded Sand - Brown fine sand.						
	18- 13- 14	27	2	██████████	SP							
	7- 8- 9	17	3	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	6- 7- 8	15	4	██████████								
	6- 7- 6	13	5	██████████	SP	Poorly Graded Sand - Dark brown fine sand.		22.9	2.2			
	5- 4- 3	7	6	██████████								
10	1- 1- 1	2	7	██████████								
0- 0- 0	0											
0- 0- 0	0		8	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
1- 0- 0	0		9	██████████		TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'27.43" DATE DRILLED: 07-AUG-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN / CLOUDS / RAIN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	45- 37- 33	70	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	22- 18- 14	32	2									
	9- 7- 7	14	3		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	4- 2- 1	3	4									
0	0- 0- 0	0	5									
0	0- 0- 0	0	6									
10	1- 0- 5	5	7		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments and shell fragments).						
	3- 3- 3	6	8		SM	Silty Sand - Light gray silty fine sand, trace to some gravel (rock fragments and cemented sands).						
	5- 7- 2	9	9									
15	2- 4- 2	6	10			Soft Weathered Limestone.						
						TERMINATED AT 15.0'						
20												
25												
30												
35												

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'17.77" DATE DRILLED: 07-AUG-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 267 of 385 OFF: TIME: DATE: 07-AUG-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO	BIT: 2-15/16" DIA. TRICONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	21- 15- 6	21	1	██████████	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	6- 7- 6	13	2	██████████	SP	Poorly Graded Sand - Light brown fine sand.						
3- 4- 4	8	3		██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	3- 4- 6	10	4	██████████	SP	Poorly Graded Sand - Brown to light brown fine sand.		17.8	1.6			
4- 5- 8	13	5		██████████								
8- 10- 12	22	6		██████████								
8- 8- 10	18	7		██████████								
5- 3- 1	4	8		██████████								
1- 0- 0	0	9		██████████								
1- 1- 2	3	10		██████████	SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand.						
						TERMINATED AT 15.0'						
20												
25												
30												
35												

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'20.10" DATE DRILLED: 07-AUG-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 268 of 385 PHASE 2, AREA A LOGGED BY: M. ELMORE, E.I.
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN / CLOUDS / RAIN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	31- 16- 14	30	1	██████████	SP-SM	Pavement and Rock Base.						
	12- 11- 10	21	2	██████████	SP	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	9- 10- 9	19	3	██████████	SP-SM	Poorly Graded Sand - Gray to brown fine sand.						
5	7- 7- 8	15	4	██████████		Poorly Graded Sand with Silt - Dark brown to gray slightly silty fine sand.						
	7- 8- 9	17	5	██████████								
	6- 7- 7	14	6	██████████								
10	4- 5- 10	15	7	██████████								
	6- 5- 5	10	8	██████████								
	4- 3- 2	5	9	██████████								
15	1- 0- 1	1	10	██████████	SM	Silty Sand - Gray silty fine sand, trace to some gravel (rock fragments and cemented sands).						
						TERMINATED AT 15.0'						
20								20.6	6.2			
25												
30												
35												

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'20.10" DATE DRILLED: 03-AUG-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 269 of 385 PHASE 2, AREA A LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO	BIT: 2-15/16" DIA. TRICONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	16- 20- 12	32	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	8- 10- 12	22	2									
	5- 5- 7	12	3		SP-SM	Poorly Graded Sand with Silt - Gray to brown slightly silty fine sand.						
5	5- 5- 5	10	4									
	6- 7- 7	14	5		SP	Poorly Graded Sand - Brown to light brown fine sand.						
	7- 8- 10	18	6									
10	3- 4- 4	8	7									
	2- 1- 1	2	8									
	0- 0- 0	0	9		SM	Silty Sand - Gray silty fine sand, trace to some gravel (rock fragments and cemented sands).						
15	1- 0- 1	1	10			TERMINATED AT 15.0'						
20												
25												
30												
35												

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

APPENDIX

- **SOIL BORING, SAMPLING AND TESTING METHODS
PROJECT SOIL DESCRIPTION PROCEDURE – UNIFIED**



SOIL BORING, SAMPLING AND TESTING METHODS

STANDARD PENETRATION TEST

The Standard Penetration Test (SPT) is a widely accepted method of in-situ testing of foundation soils (ASTM D-1586). A 2-foot (0.6 m) long, 2-inch (50 mm) O.D. split-barrel sampler attached to the end of a string of drilling rods is driven 18 inches (0.45 m) into the ground by successive blows of a 140-pound (63.5 Kg) hammer freely dropping 30 inches (0.76 m). The number of blows needed for each 6 inches (0.15 m) of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch (0.15 m) increments penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual description of the retained soil sample. The N-value has been empirically correlated with various soil properties allowing a conservative estimate of the behavior of soils under load. The following tables relate N-values to a qualitative description of soil density and, for cohesive soils, an approximate unconfined compressive strength (Qu):

Cohesionless Soils:	N-Value	N-Value	Description	Relative Density
	Safety Hammer	Auto Hammer		
	< 4	< 3	Very loose	0 - 15%
	4 - 10	3 - 8	Loose	15 - 35%
	10 - 30	8 - 24	Medium dense	35 - 65%
	30 - 50	24 - 40	Dense	65 - 85%
	> 50	> 40	Very dense	85 - 100%

Cohesive Soils:	N-Value	N-Value	Description	Unconfined Compressive Strength, Qu
	Safety Hammer	Auto Hammer		
	< 2	< 1	Very soft	< 0.25 tsf (25 kPa)
	2 - 4	1 - 3	Soft	0.25 - 0.50 tsf (25 - 50 kPa)
	4 - 8	3 - 6	Firm	0.50 - 1.0 tsf (50 - 100 kPa)
	8 - 15	6 - 12	Stiff	1.0 - 2.0 tsf (100 - 200 kPa)
	15 - 30	12 - 24	Very stiff	2.0 - 4.0 tsf (200 - 400 kPa)
	> 30	> 24	Hard	> 4.0 tsf (400 kPa)

The tests are usually performed at 5-foot (1.5 m) intervals. However, more frequent or continuous testing is done by our firm through depths where a more accurate definition of the soils is required. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. The circulating fluid, which is bentonitic drilling mud, is also used to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or prevent the loss of circulating fluid. After completion of a test boring, the hole is kept open until a steady state groundwater level is recorded. The hole is then sealed by backfilling with neat cement.

Representative split-spoon samples from each sampling interval and from different strata are brought to our laboratory in air-tight jars for classification and testing, if necessary. Afterwards, the samples are discarded unless prior arrangements have been made.

POWER AUGER BORINGS

Auger borings are used when a relatively large, continuous sampling of soil strata close to the ground surface is desired. A 4-inch (100 mm) diameter, continuous flight, helical auger with a cutting head at its end is screwed into the ground in 5-foot (1.5 m) sections. It is powered by the rotary drill rig. The sample is recovered by withdrawing the auger out of the ground without rotating it. The soil sample so obtained, is described and representative samples put in bags or jars and returned to the laboratory for classification and testing, if necessary.

HAND AUGER BORINGS

Hand auger borings are used, if soil conditions are favorable, when the soil strata are to be determined within a shallow (approximately 5-foot [1.5 m]) depth or when access is not available to power drilling equipment. A 3-inch (75 mm) diameter hand bucket auger with a cutting head is simultaneously turned and pressed into the ground. The bucket auger is retrieved at approximately 6-inch (0.15 m) intervals and its contents emptied for inspection. Sometimes post-hole diggers are used, especially in the upper 3 feet (1 m) or so. The soil sample obtained is described and representative samples put in bags or jars and transported to the laboratory for classification and testing, if necessary.

UNDISTURBED SAMPLING

Undisturbed sampling implies the recovery of soil samples in a state as close to their natural condition as possible. Complete preservation of in-situ conditions cannot be realized; however, with careful handling and proper sampling techniques, disturbance during sampling can be minimized for most geotechnical engineering purposes. Testing of undisturbed samples gives a more accurate estimate of in-situ behavior than is possible with disturbed samples.

Normally, we obtain undisturbed samples by pushing a 2.875-inch (73 mm) I.D., thin wall seamless steel tube 24 inches (0.6 m) into the soil with a single stroke of a hydraulic ram. The sampler, which is a Shelby tube, is 30 (0.8 m) inches long. After the sampler is retrieved, the ends are sealed in the field and it is transported to our laboratory for visual description and testing, as needed. Undisturbed sampling is noted on the boring logs as thus "U-".

LABORATORY TEST METHODS

Soil samples returned to our laboratory are looked at again by a geotechnical engineer or geotechnician to obtain more accurate descriptions of the soil strata. Laboratory testing is performed on selected samples as deemed necessary to aid in soil classification and to help define engineering properties of the soils. The test results are presented on the soil boring logs at the depths at which the respective sample was recovered, except that grain-size distributions or selected other test results may be presented on separate tables, figures or plates as discussed in this report, the results of which will be located in an Appendix. The soil descriptions shown on the logs are based upon visual-manual procedures in accordance with local practice. Soil classification is in general accordance with the Unified Soil Classification System (ASTM D-2487) and is also based on visual-manual procedures. Following is a list of abbreviations that may appear in the Remarks column on the boring logs indicating additional laboratory testing was performed, the results of which will usually be located in an Appendix.

- DD:** Unit Weight/Classification of Undisturbed "Shelby Tube" samples
- PP:** Pocket Penetrometer reading on cohesive samples in tons per sq. ft. (tsf)
- k:** Hydraulic Conductivity
- Qu:** Unconfined Compression Strength; ASTM D-2166
- UU:** Unconsolidated-Undrained Triaxial Test; ASTM D 2850
- Consol:** One-Dimensional Consolidation test performed on subsample from undisturbed sample; ASTM D-2435

THE PROJECT SOIL DESCRIPTION PROCEDURE FOR SOUTHWEST FLORIDA⁽¹⁾
For use with the ASTM D 2487 Unified Soil Classification System
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

BOULDERS (>12" [300 mm]) and COBBLES (3" [75 mm] TO 12" [300 mm]):

GRAVEL: Coarse Gravel: 3/4" (19 mm) to 3" (75 mm)
Fine Gravel: No. 4 (4.75 mm) Sieve to 3/4" (19 mm)

Descriptive adjectives:

0 – 5%	---	no mention of gravel in description
5 – 15%	---	trace
15 – 29%	---	some
30 – 49%	---	gravelly (shell, limerock, cemented sands)

SANDS

COARSE SAND: No. 10 (2 mm) Sieve to No. 4 (4.75 mm) Sieve
MEDIUM SAND: No. 40 (425 μm) Sieve to No. 10 (2 mm) Sieve
FINE SAND: No. 200 (75 μm) Sieve to No. 40 (425 μm) Sieve

Descriptive adjectives:

0 – 5%	---	no mention of sand in description
5 – 15%	---	trace
15 – 29%	---	some
30 – 49%	---	sandy

SILT/CLAY: < #200 (75 μm) sieve

SILTY OR SILT: PI < 4

SILTY CLAYEY OR SILTY CLAY: 4 \leq PI \leq 7

CLAYEY OR CLAY: PI > 7

Descriptive adjectives:

0 – 5%	---	clean (no mention of silt or clay in description)
5 – 12% to 15%	---	slightly
16 – 35%	---	clayey, silty, or silty clayey
36 – 49%	---	very

ORGANIC SOILS

<u>Organic Content</u>	<u>Descriptive adjectives</u>	<u>Classification</u>
0 – 2.5%	no mention of organics in description	See above
2.6 – 5%	slightly organic	See above
5 – 20%	organic	Add "with organic fines" to group name

THE PROJECT SOIL DESCRIPTION PROCEDURE FOR SOUTHWEST FLORIDA⁽¹⁾
For use with the ASTM D 2487 Unified Soil Classification System
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

HIGHLY ORGANIC SOILS AND MATTER

<u>Organic Content</u>	<u>Description</u>	<u>Classification</u>
20-75%	highly organic sand or muck sandy peat	Peat (PT) Peat (PT)
>75%	amorphous or fibrous peat	Peat (PT)

STRATIFICATION AND STRUCTURE

<u>Descriptive Term</u>	<u>Thickness</u>
with interbedded	
seam:	less than 1/2-inch (13 mm) thick
layer:	1/2 to 12-inches (13 to 300 mm) thick
stratum:	more than 12-inches (300 mm) thick
pocket:	small, erratic deposit, usually less than 1-foot
occasional:	one or less per foot of thickness
frequent:	more than one per foot of thickness
calcareous:	containing calcium carbonate (reaction to diluted HCL)
hardpan:	spodic horizon usually medium dense
marl:	mixture of carbonate clays, silts, shells and sands.

ROCK CLASSIFICATION

<u>Description</u>
Hard Limestone or Caprock – N-values >50 bpf
Soft Weathered Limestone – N values <50 bpf

(1) This soil description procedure was developed specifically for projects in southwest Florida because it is believed that the terminology will be better understood as a result of local practice. It is not intended to supplant other visual-manual classification procedures for description and identification of soils such as ASTM D 2488. BY: G.A. DREW, P.E. (1995) (Revised 2016).

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A			Soil Classification	
			Group Symbol	Group Name ^B
Coarse Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	Cu ≥ 4 and $1 \leq Cc \leq 3$ ^E	GW Well-graded gravel ^F
		Gravels with Fines: More than 12% fines ^C	Cu < 4 and/or $1 > Cc > 3$ ^E Fines classify as ML or MH	GP Poorly graded gravel ^{F,G,H}
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	Cu ≥ 6 and $1 \leq Cc \leq 3$ ^E	SW Well-graded sand ^I
		Sands with Fines: More than 12% fines ^D	Cu < 6 and/or $1 > Cc > 3$ ^E Fines classify as ML or MH	SP Poorly graded sand ^I
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic: Organic:	PI > 7 and plots on or above "A" line ^J PI < 4 or plots below "A" line ^J	CL Lean clay ^{K,L,M}
			Liquid limit - oven dried Liquid limit - not dried < 0.75	ML Silt ^{K,L,M}
	Silts and Clays: Liquid limit 50 or more	Inorganic: Organic:	PI plots on or above "A" line PI plots below "A" line	CH Fat clay ^{K,L,M}
			Liquid limit - oven dried Liquid limit - not dried < 0.75	MH Elastic Silt ^{K,L,M}
Highly organic soils:		Primarily organic matter, dark in color, and organic odor		OH Organic clay ^{K,L,M,P} Organic silt ^{K,L,M,Q}
				PT Peat

^A Based on the material passing the 3-in. (75-mm) sieve

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

$$E \quad Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant.

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" group name.

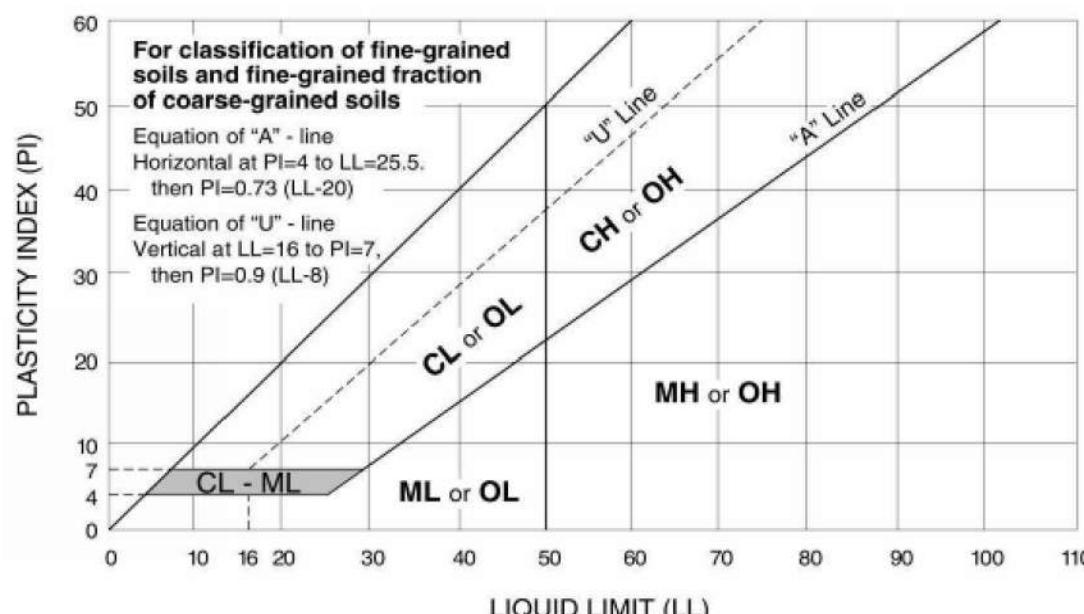
^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N PI ≥ 4 and plots on or above "A" line.

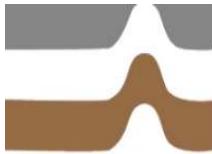
^O PI < 4 or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.



**SUBSURFACE SOIL EXPLORATION
FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT - PHASE 2, AREA B
FIDDLESTICKS COUNTRY CLUB
FORT MYERS, LEE COUNTY, FLORIDA**



Ardaman & Associates, Inc.

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Louisiana: Baton Rouge, Monroe, New Orleans, Shreveport

MEMBERS:

ASTM International
American Concrete Institute
Geoprofessional Business Association
Society of American Military Engineers
American Council of Engineering Companies



Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

Ardaman Project No. 17-33-4601
August 28, 2018

WESTON & SAMPSON ENGINEERING, INC.
1520 Royal Palm Square Boulevard, Suite 260
Fort Myers, FL 33919

Attention: Mr. Jeffrey A. Wilson, P.E. PWLF

SUBJECT: Subsurface Soil Exploration
Fiddlesticks Water Main Replacement Project – Phase 2, Area B
Fiddlesticks Country Club
Fort Myers, Lee County, Florida

Gentlemen:

As requested and authorized by **Weston & Sampson Engineers, Inc.**, Ardaman & Associates, Inc. (Ardaman) has completed the subsurface soil exploration program for the subject project. The purposes of this program were to evaluate the general subsurface conditions in the project study area and discuss our findings.

This report documents our findings and conclusions. It has been prepared for the exclusive use of **Weston & Sampson Engineers, Inc.** for specific application to the subject project in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

SCOPE

The scope of our services was limited to the following items:

1. Conducting 22 Standard Penetration Test (SPT) borings to 15 feet to determine the nature and condition of the subsurface soils along the route of the proposed water main.
2. Reviewing each soil sample obtained in our field exploration program by a geotechnical engineer in our laboratory for further identification and assignment of laboratory tests.
3. Performing the appropriate laboratory tests on selected samples.
4. Analyzing the existing soil conditions with respect to the proposed construction.

5. Preparing this report to document the results of our field exploration and laboratory testing programs, and discuss our findings.

SITE LOCATION AND PROJECT DESCRIPTION

The Fiddlesticks Water Main Replacement project includes design, permitting and installation of a new water main in the right-of-way of all streets within the Fiddlesticks Country Club development in Fort Myers, Lee County, Florida. The proposed project has been split up into two phases. This report is only for Phase 2, Area B, which encompasses Glenfinnan Circle, Glen Abbey Circle, Bagpipe Way and Fiddlesticks Boulevard from Glenfinnan Circle (south intersection) to Glenfinnan Circle (north intersection). Phase 2, Area B includes an estimated total of 11,450 lineal feet of water main installation. Most of the water main replacement will be installed by directional drill. In general, the soil borings along the water main route were performed on approximately 500-foot centers. Due to access limitations all borings were performed on the existing road surface.

FIELD EXPLORATION PROGRAM

Our field exploration consisted of performing 22 Standard Penetration Test (SPT) borings. The SPT borings were drilled to a depth of 15 feet below the existing ground surface. The SPT borings were conducted using methods consistent with ASTM D-1586. The equipment and procedures used in the SPT borings are described in detail in the **Appendix**.

The locations of the borings are shown on the attached **Figure 1–Boring Location Plan**. They were located by measurement from the site features shown on an aerial photograph of the site shown on the preliminary subsurface utility engineering and geotechnical investigation sheet G-1 provided by Weston & Sampson Engineers, Inc. Therefore, the locations indicated should be considered accurate only to the degree implied by the method of measurement used. If a more precise location of the borings is desired, then we recommend that a registered land surveyor be employed to locate the borings on site. GPS coordinates of each boring location are provided on the boring logs.

GENERAL SUBSURFACE CONDITIONS

The general subsurface conditions encountered during the field exploration are shown on the attached soil boring logs. Soil stratification is based on examination of recovered soil samples and interpretation of the field boring logs. The stratification lines represent the approximate boundaries between the soil types, the actual transitions may be gradual.



The borings were performed in the asphalt pavement. In general, below the asphalt and base, the borings typically encountered very loose to very dense fine sands (SP and SP-SM) extending to depths ranging from 9 feet to the termination of the borings at 15 feet below the existing ground surface. Nine of the 22 borings encountered loose to dense slightly silty and silty sands (SM) with varying amounts (if any) of gravel consisting of rock fragments or cemented sands at depths ranging from 4.5 to 13.5 extending to depths of 6 feet to the termination of the borings at 15 feet below the existing ground surface. Also, ten borings encountered soft weathered to hard limestone at depths ranging from 3.5 to 13.5 feet extending to depth ranging from 5 to the termination of the borings.

Groundwater was encountered in the boreholes at depths ranging from 4 to 5 feet below the existing ground surface at the time of our field exploration (July 19 through July 30, 2018). The groundwater depths shown on the boring logs represent the groundwater surface encountered on the dates shown. Fluctuations in groundwater level should be anticipated throughout the year due to seasonal variations in rainfall, and other factors.

LABORATORY TESTING PROGRAM

Representative soil samples obtained during our field sampling operation were packaged and transferred to our office and, thereafter, examined by a geotechnical engineer to obtain more accurate descriptions of the existing soil strata. Laboratory testing was performed on selected samples as deemed necessary to aid in soil classification and to further define the engineering properties of the soils. The laboratory tests included Natural Moisture Content, Organic Content and Percent Finer than the U.S. No. 200 Sieve (percent silt and clay).

The test results are presented on the attached soil boring logs at the depths from which the samples were recovered. The soil descriptions shown on the logs are based upon visual-manual procedures in accordance with local practice. Soil classification is in general accordance with the Unified Soil Classification System (ASTM D-2487) and is also based on visual-manual procedures.

In addition, soil samples from the borings were obtained on approximately 1,500-foot centers for environmental corosions tests and conducted in accordance with Florida test methods FM 5-550, FM 5-551, FM 5-552 and FM 5-553. The environmental corrosion test parameters include pH, resistivity, sulfate content and chloride content. The summarized results are presented below.



Boring No.	Depth (ft.)	pH	Resistivity (ohms-cm)	Chlorides (ppm)	Sulfates (ppm)	Environmental Classification ¹	
						Steel	Concrete
SPT-69	3 – 4.5	8.9	9,000	30	60	Slightly Agg.	Slightly Agg.
SPT-72	3 – 4.5	8.7	7,000	30	27	Slightly Agg.	Slightly Agg.
SPT-75	3 – 4.5	8.7	3,700	75	36	Moderately Agg.	Slightly Agg.
SPT-78	3 – 4.5	8.8	8,000	30	12	Slightly Agg.	Slightly Agg.
SPT-81	3 – 4.5	8.5	4,500	30	66	Slightly Agg.	Slightly Agg.
SPT-84	3 – 4.5	8.4	1,900	165	90	Moderately Agg.	Moderately Agg.
SPT-87	3 – 4.5	8.4	3,300	90	81	Moderately Agg.	Slightly Agg.

¹Based on Florida Department of Transportation (FDOT) Structures Manual, Volume 1, Section 1.3 (Jan. 2018).

DISCUSSION

The borings performed along the proposed route encountered fine sands (SP and SP-SM) from directly below the pavement section extending to depths ranging from 9 feet to the termination of the borings at 15 feet below the existing ground surface. The fine sands were typically underlain by either silty sands (SM) and/or soft weathered to hard limestone typically extending to the termination of the soil borings at a depth of 15 feet. Borings SPT-68, SPT-82, SPT-85 and SPT-86 encountered slightly silty to silty fine sands (SM) at depths of 4.5 to 6 feet extending to depths of 6 to 7.5 feet. Typically limestone, if encountered in the borings, was encountered at depths between 9 and 13.5; however, borings SPT-73 and SPT-89 encountered limestone at depths of 3.5 and 6 feet extending to depths of 5 and 7.5 feet below the existing ground surface.

The fine sands (SP/SP-SM) are suitable for use as backfill materials and suitable for pipe bedding. However, the pipe should be bedded in gravel such as FDOT No. 89 stone if rock occurs within 6 inches of the pipe bottom, or if unsuitable silty sands (SM) are encountered at pipe invert.

Typically, heavy excavators can remove soft limestone and boulders; however, dynamic methods using hydraulic hammers or hoes will be needed to remove hard limestone or large boulders where they occur. Use of excavated rock as a fill material will require further processing (crushing and screening) to reduce particle size to mostly sand and gravel size.



GENERAL COMMENTS

While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of the region are anticipated and may be encountered. The boring profiles and related information are based on the driller's logs and visual examination of selected sample in the laboratory. The delineation between soil types shown on the profiles is approximate and the description represents our interpretation of subsurface conditions at the designated boring locations and on the particular date drilled.

If you have any questions about this report, please contact this office.

Very truly yours,

Ardaman & Associates, Inc.
Florida Certificate of Authorization No. 00005950



Matthew R. Elmore, E.I.
Project Engineer



This document has been digitally signed and sealed by

on the date adjacent to the seal.

Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Gary A. Drew, P.E. No. 35504
Vice President/Branch Manager

MRE/GAD:mre



Ardaman & Associates, Inc.

ATTACHMENTS

- **BORING LOCATION PLAN (FIGURE 1)**
- **BORING LOGS – SPT-68 THROUGH SPT-89**



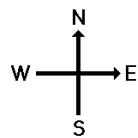
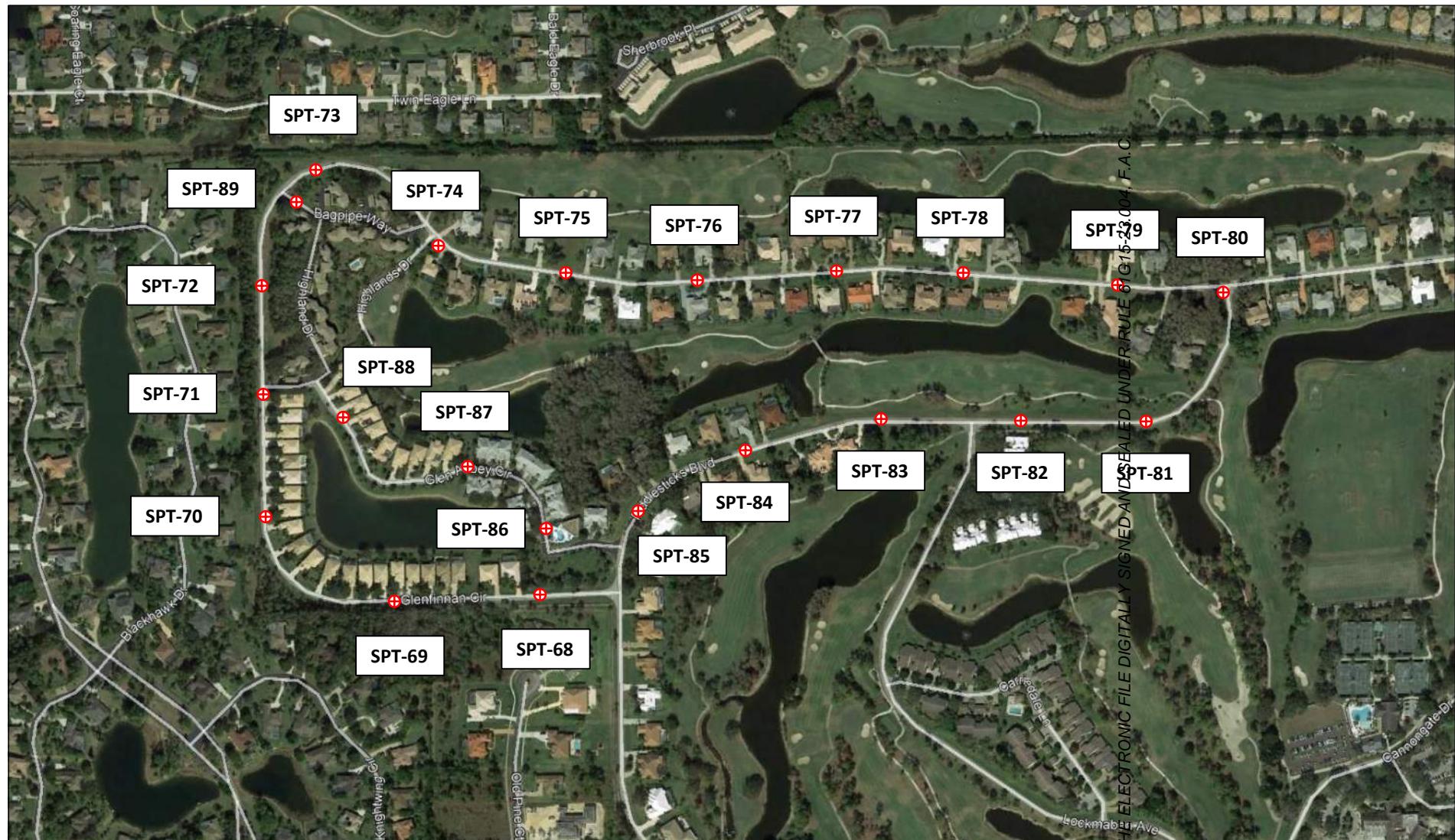
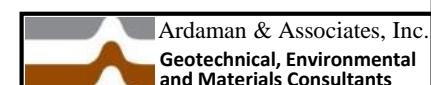


FIGURE 1
BORING LOCATION PLAN

SOURCE: GOOGLE EARTH PRO®



Proposed Fiddlesticks Water Main Replacement
Project – Phase 2, Area B
Fiddlesticks Country Club
Fort Myers, Lee County, FL

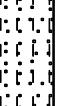
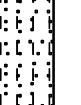
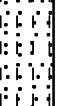
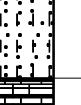
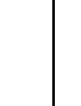
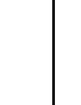
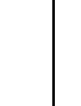
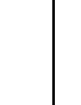
Drawn By: ME Checked By: GD Date: 8/22/18

File No.: 17-33-4601 Approved By: Gary Drew, P.E. Figure No: 1

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'14.56" DATE DRILLED: 19-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	24- 8- 6	14	1	██████████	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments). Poorly Graded Sand - Brown fine sand.						
9- 12- 13	25	2		██████████	SP							
8- 9- 9	18	3		██████████								
5	8- 11- 11	22	4	██████████	SM	Silty Sand - Gray slightly silty fine sand.		18.4	12.4			
11- 12- 15	27	5		██████████	SP-SM	Poorly Graded Sand with Silt - Brown and gray to light gray slightly silty fine sand.						
10- 12- 14	26	6		██████████								
10	11- 9- 10	19	7	██████████								
10- 10- 7	17	8		██████████								
4- 8- 8	16	9		██████████								
5- 5- 5	10	10		██████████	SP	Poorly Graded Sand - Light gray fine sand.						
15						TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'14.46" DATE DRILLED: 19-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	44- 18- 14	32	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments). Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	10- 12- 16	28	2		SP-SM							
10	10- 14- 11	25	3		SP-SM							
15	9- 8- 8	16	4		SP-SM							
20	6- 6- 4	10	5		SP-SM							
25	4- 4- 3	7	6		SP-SM							
30	3- 1- 1	2	7		SP-SM							
35	3- 2- 1	3	8		SP-SM							
	1- 0- 1	1	9		SP-SM							
	9- 15- 3	18	10		SP-SM	Soft Weathered Limestone.	TERMINATED AT 15.0'					

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'17.14" DATE DRILLED: 19-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 286 of 385 PHASE 2, AREA B
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	41- 16- 11	27	1	██████████	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments). Poorly Graded Sand - Brown fine sand.						
	10- 14- 14	28	2	██████████	SP							
	9- 9- 12	21	3	██████████								
5	12- 15- 18	33	4	██████████								
	13- 8- 5	13	5	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	3- 1- 0	1	6	██████████								
10	1- 2- 2	4	7	██████████								
	4- 4- 7	11	8	██████████	SP	Poorly Graded Sand - Light gray fine sand.		24.4	6.5			
	5- 6- 5	11	9	██████████								
15	8- 3- 1	4	10	██████████		TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'21.49" DATE DRILLED: 19-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	28- 19- 15	34	1	██████████	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	14- 16- 14	30	2	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	9- 10- 13	23	3	██████████								
5	8- 8- 10	18	4	██████████				14.1	6.0			
	6- 7- 11	18	5	██████████								
	8- 6- 6	12	6	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
10	4- 5- 6	11	7	██████████	SP-SM	Poorly Graded Sand with Silt - Brown to gray slightly silty fine sand.						
	6- 5- 5	10	8	██████████								
	4- 5- 6	11	9	██████████	SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand, trace gravel (rock fragments).						
15	8- 8- 7	15	10	██████████		TERMINATED AT 15.0'						
20												
25												
30												
35												

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'29.81" DATE DRILLED: 19-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 289 of 385 OFF: TIME: DATE: 19-JUL-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO	BIT: 2-15/16" DIA. TRICONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	54- 49- 30	79	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	23- 17- 6	23	2									
	7- 5- 6	11	3		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	5- 7- 10	17	4					17.6	9.6			
	13- 30- 15	45	5			Soft Weathered Limestone.						
	10- 7- 6	13	6		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
10	6- 11- 13	24	7		SP	Poorly Graded Sand - Brown to gray fine sand.						
	6- 9- 10	19	8									
	8- 6- 6	12	9									
15	5- 6- 8	14	10			TERMINATED AT 15.0'						
20												
25												
30												
35												

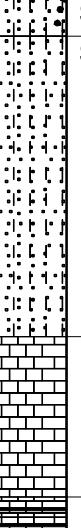
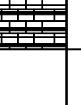
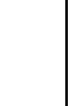
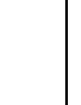
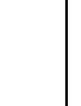
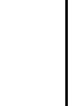
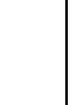
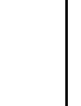
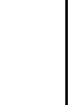
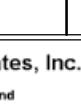
BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'27.25" DATE DRILLED: 20-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 290 of 385 PHASE 2, AREA B LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	25- 15- 8	23	1	██████████	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	7- 6- 7	13	2	██████████	SP	Poorly Graded Sand - Brown fine sand.						
	3- 3- 3	6	3	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	3- 2- 1	3	4	██████████				19.9	6.9			
	2- 1- 2	3	5	██████████								
	1- 2- 3	5	6	██████████								
10	3- 5- 9	14	7	██████████	SP	Poorly Graded Sand - Light gray fine sand.						
	6- 5- 6	11	8	██████████								
	1- 4- 1	5	9	██████████	SM	Silty Sand - Gray silty fine sand.						
15	4- 4- 6	10	10	██████████	SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand.						
						TERMINATED AT 15.0'						
20												
25												
30												
35												

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'25.87" DATE DRILLED: 20-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 292 of 385 PHASE 2, AREA B
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	21- 14- 13	27	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments). Poorly Graded Sand with Silt - Brown to light gray slightly silty fine sand.						
5	13- 13- 14	27	2		SP-SM							
10	10- 14- 16	30	3									
10	10- 6- 7	13	4			Hard Limestone.						
10	6- 9- 10	19	5									
10	6- 5- 5	10	6									
10	19- 50/0"-	50/0"	7			Hard Limestone.						
10	- 50/0"-	50/0"										
10	- 50/0"-	50/0"										
15	1- 4- 20	24	8			Soft Weathered Limestone.						
15						TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'26.5" DATE DRILLED: 20-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	21- 13- 9	22	1	██████████	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	9- 10- 14	24	2	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	10- 12- 20	32	3	██████████								
5	14- 15- 16	31	4	██████████				33.3	10.8			
	9- 10- 11	21	5	██████████								
	5- 6- 8	14	6	██████████								
10	10- 10- 10	20	7	██████████	SP	Poorly Graded Sand - Light gray fine sand.						
	8- 7- 7	14	8	██████████								
	2- 2- 2	4										
15	1- 0- 1	1				TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'26.01" DATE DRILLED: 20-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 294 of 385 PHASE 2, AREA B LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO	BIT: 2-15/16" DIA. TRICONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	26- 12- 10	22	1	██████████	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	8- 11- 12	23	2	██████████	SP	Poorly Graded Sand - Brown fine sand.						
5	10- 9- 9	18	4	██████████								
	5- 8- 9	17	5	██████████								
	5- 6- 6	12	6	██████████								
10	3- 2- 1	3	7	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	3- 1- 0	1	8	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	2- 7- 5	12	9	██████████	SM	Silty Sand - Light gray silty fine sand, trace to some gravel (rock fragments and cemented sands).						
15	4- 5- 10	15	10	██████████		TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'25.50" DATE DRILLED: 23-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 295 of 385 PHASE 2, AREA B
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	33- 10- 11	21	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments). Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	10- 12- 14	26	2		SP-SM							
12	12- 15- 18	33	3		SP-SM							
11	11- 8- 8	16	4		SP-SM							
7	7- 9- 11	20	5		SP-SM							
3	3- 4- 4	8	6		SP-SM							
28	28- 23- 10	33	7		SP-SM	Soft Weathered Limestone.						
50/2"	50/2"		8		SP-SM	Hard Limestone.						
50/0"	50/0"		9		SP-SM							
50/1"	50/1"		10		SP-SM	TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'25.09" DATE DRILLED: 23-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA B LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN / CLOUDS			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	46- 14- 12	26	1	██████████	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	18- 21- 22	43	2	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	14- 12- 14	26	3	██████████								
5	10- 11- 11	22	4	██████████								
	10- 11- 12	23	5	██████████	SP-SM	Poorly Graded Sand with Silt - Dark brown slightly silty slightly organic fine sand.		25.2		2.8		
	9- 9- 12	21	6	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
10	7- 10- 11	21	7	██████████								
	8- 6- 12	18	8	██████████								
	6- 7- 3	10	9	██████████								
15	5- 3- 3	6	10	██████████	SM	Silty Sand - Brown to gray silty fine sand.						
						TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'20.83" DATE DRILLED: 23-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 297 of 385 PHASE 2, AREA B LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO	BIT: 2-15/16" DIA. TRICONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	WEATHER CONDITIONS: CLOUDS / RAIN	

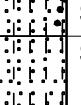
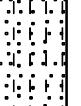
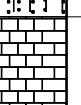
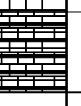
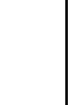
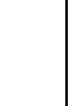
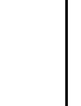
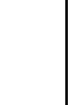
DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	41- 24- 17	41	1	██████████	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	20- 19- 16	35	2	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	13- 14- 16	30	3	██████████	SP	Poorly Graded Sand - Brown fine sand.						
5	8- 10- 10	20	4	██████████								
	8- 8- 7	15	5	██████████								
	3- 4- 4	8	6	██████████								
10	3- 6- 7	13	7	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	4- 6- 7	13	8	██████████								
	4- 5- 3	8	9	██████████	SM	Silty Sand - Brown to gray silty fine sand, trace to some gravel (rock fragments and cemented sands).						
15	1- 11- 4	15	10	██████████		Soft Weathered Limestone.						
						TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'20.70" DATE DRILLED: 23-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC Page 298 of 385 PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA B LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN / CLOUDS			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	38- 28- 19	47	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	15- 21- 23	44	2									
	18- 23- 28	51	3		SP	Poorly Graded Sand - Brown fine sand.						
5	20- 17- 15	32	4		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.		17.9	21.8			
	7- 7- 5	12	5		SM	Silty Sand - Brown silty fine sand.						
	6- 6- 5	11	6		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
10	2- 1- 0	1	7									
	1- 0- 0	0	8									
	2- 2- 2	4	9									
15	2- 3- 3	6	10		SM	Silty Sand - Light gray silty fine sand, trace to some gravel (rock fragments and cemented sands). TERMINATED AT 15.0'						
20												
25												
30												
35												

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'20.97" DATE DRILLED: 23-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN / CLOUDS			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	16- 18- 13	31	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments). Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	16- 17- 24	41	2		SP-SM							
10	19- 29- 38	67	3		SP-SM							
15	35- 28- 24	52	4		SP-SM							
20	15- 10- 11	21	5		SP-SM							
25	10- 10- 10	20	6		SP-SM							
30	10- 9- 8	17	7		SP-SM							
35	50/0"- -	50/0"	8		SP-SM	Hard Limestone.						
40	5- 4- 5	9	9		SP-SM	Soft Weathered Limestone.						
45			10		SP-SM	TERMINATED AT 15.0'						

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'19.65" DATE DRILLED: 27-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA B LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	46- 40- 25	65	1	██████████	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	21- 25- 28	53	2	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	20- 23- 28	51	3	██████████		Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	19- 22- 22	44	4	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	16- 16- 14	30	5	██████████	SP	Poorly Graded Sand - Light brown fine sand.						
	12- 10- 12	22	6	██████████								
10	9- 10- 12	22	7	██████████								
	9- 8- 10	18	8	██████████								
	6- 9- 9	18	9	██████████								
15	9- 8- 8	16	10	██████████	SM	Silty Sand - Gray silty fine sand.						
						TERMINATED AT 15.0'						
20												
25												
30												
35												

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'17.86" DATE DRILLED: 27-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 301 of 385 OFF: TIME: DATE: 27-JUL-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO	BIT: 2-15/16" DIA. TRICONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	34- 11- 7	18	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	12- 16- 26	42	2		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	15- 14- 13	27	3		SM	Silty Sand - Brown silty fine sand.						
5	13- 14- 13	27	4		SP-SM	Poorly Graded Sand with Silt - Brown to light brown slightly silty fine sand.		17.6	27.3			
	12- 10- 6	16	5		SP-SM	Hard Limestone.						
	5- 5- 6	11	6			Soft Weathered Limestone.						
10	4- 6- 50/0"	50/0"	7									
	13- 13- 6	19	8				TERMINATED AT 15.0'					
15												
20												
25												
30												
35												

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'19.27" DATE DRILLED: 30-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES	Page 303 of 385 OFF: TIME: DATE: 30-JUL-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO	BIT: 2-15/16" DIA. TRICONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	27- 13- 7	20	1	SP-SP	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	6- 6- 10	16	2	SP-SP		Poorly Graded Sand with Silt - Brown to gray slightly silty fine sand.						
6	6- 9- 11	20	3									
5	8- 8- 10	18	4									
	9- 6- 6	12	5									
	7- 8- 9	17	6									
10	6- 5- 5	10	7									
	4- 10- 7	17	8									
	5- 6- 6	12	9	SP-SP	SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand, trace gravel (rock fragments).						
15	5- 4- 2	6	19			TERMINATED AT 15.0'						
20												
25												
30												
35												

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APPENDIX

- **SOIL BORING, SAMPLING AND TESTING METHODS
PROJECT SOIL DESCRIPTION PROCEDURE – UNIFIED**



SOIL BORING, SAMPLING AND TESTING METHODS

STANDARD PENETRATION TEST

The Standard Penetration Test (SPT) is a widely accepted method of in-situ testing of foundation soils (ASTM D-1586). A 2-foot (0.6 m) long, 2-inch (50 mm) O.D. split-barrel sampler attached to the end of a string of drilling rods is driven 18 inches (0.45 m) into the ground by successive blows of a 140-pound (63.5 Kg) hammer freely dropping 30 inches (0.76 m). The number of blows needed for each 6 inches (0.15 m) of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch (0.15 m) increments penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual description of the retained soil sample. The N-value has been empirically correlated with various soil properties allowing a conservative estimate of the behavior of soils under load. The following tables relate N-values to a qualitative description of soil density and, for cohesive soils, an approximate unconfined compressive strength (Qu):

Cohesionless Soils:	N-Value	N-Value	Description	Relative Density
	Safety Hammer	Auto Hammer		
	< 4	< 3	Very loose	0 - 15%
	4 - 10	3 - 8	Loose	15 - 35%
	10 - 30	8 - 24	Medium dense	35 - 65%
	30 - 50	24 - 40	Dense	65 - 85%
	> 50	> 40	Very dense	85 - 100%

Cohesive Soils:	N-Value	N-Value	Description	Unconfined Compressive Strength, Qu
	Safety Hammer	Auto Hammer		
	< 2	< 1	Very soft	< 0.25 tsf (25 kPa)
	2 - 4	1 - 3	Soft	0.25 - 0.50 tsf (25 - 50 kPa)
	4 - 8	3 - 6	Firm	0.50 - 1.0 tsf (50 - 100 kPa)
	8 - 15	6 - 12	Stiff	1.0 - 2.0 tsf (100 - 200 kPa)
	15 - 30	12 - 24	Very stiff	2.0 - 4.0 tsf (200 - 400 kPa)
	> 30	> 24	Hard	> 4.0 tsf (400 kPa)

The tests are usually performed at 5-foot (1.5 m) intervals. However, more frequent or continuous testing is done by our firm through depths where a more accurate definition of the soils is required. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. The circulating fluid, which is bentonitic drilling mud, is also used to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or prevent the loss of circulating fluid. After completion of a test boring, the hole is kept open until a steady state groundwater level is recorded. The hole is then sealed by backfilling with neat cement.

Representative split-spoon samples from each sampling interval and from different strata are brought to our laboratory in air-tight jars for classification and testing, if necessary. Afterwards, the samples are discarded unless prior arrangements have been made.

POWER AUGER BORINGS

Auger borings are used when a relatively large, continuous sampling of soil strata close to the ground surface is desired. A 4-inch (100 mm) diameter, continuous flight, helical auger with a cutting head at its end is screwed into the ground in 5-foot (1.5 m) sections. It is powered by the rotary drill rig. The sample is recovered by withdrawing the auger out of the ground without rotating it. The soil sample so obtained, is described and representative samples put in bags or jars and returned to the laboratory for classification and testing, if necessary.

HAND AUGER BORINGS

Hand auger borings are used, if soil conditions are favorable, when the soil strata are to be determined within a shallow (approximately 5-foot [1.5 m]) depth or when access is not available to power drilling equipment. A 3-inch (75 mm) diameter hand bucket auger with a cutting head is simultaneously turned and pressed into the ground. The bucket auger is retrieved at approximately 6-inch (0.15 m) intervals and its contents emptied for inspection. Sometimes post-hole diggers are used, especially in the upper 3 feet (1 m) or so. The soil sample obtained is described and representative samples put in bags or jars and transported to the laboratory for classification and testing, if necessary.

UNDISTURBED SAMPLING

Undisturbed sampling implies the recovery of soil samples in a state as close to their natural condition as possible. Complete preservation of in-situ conditions cannot be realized; however, with careful handling and proper sampling techniques, disturbance during sampling can be minimized for most geotechnical engineering purposes. Testing of undisturbed samples gives a more accurate estimate of in-situ behavior than is possible with disturbed samples.

Normally, we obtain undisturbed samples by pushing a 2.875-inch (73 mm) I.D., thin wall seamless steel tube 24 inches (0.6 m) into the soil with a single stroke of a hydraulic ram. The sampler, which is a Shelby tube, is 30 (0.8 m) inches long. After the sampler is retrieved, the ends are sealed in the field and it is transported to our laboratory for visual description and testing, as needed. Undisturbed sampling is noted on the boring logs as thus "U-".

LABORATORY TEST METHODS

Soil samples returned to our laboratory are looked at again by a geotechnical engineer or geotechnician to obtain more accurate descriptions of the soil strata. Laboratory testing is performed on selected samples as deemed necessary to aid in soil classification and to help define engineering properties of the soils. The test results are presented on the soil boring logs at the depths at which the respective sample was recovered, except that grain-size distributions or selected other test results may be presented on separate tables, figures or plates as discussed in this report, the results of which will be located in an Appendix. The soil descriptions shown on the logs are based upon visual-manual procedures in accordance with local practice. Soil classification is in general accordance with the Unified Soil Classification System (ASTM D-2487) and is also based on visual-manual procedures. Following is a list of abbreviations that may appear in the Remarks column on the boring logs indicating additional laboratory testing was performed, the results of which will usually be located in an Appendix.

DD: Unit Weight/Classification of Undisturbed "Shelby Tube" samples

PP: Pocket Penetrometer reading on cohesive samples in tons per sq. ft. (tsf)

k: Hydraulic Conductivity

Qu: Unconfined Compression Strength; ASTM D-2166

UU: Unconsolidated-Undrained Triaxial Test; ASTM D 2850

Consol: One-Dimensional Consolidation test performed on subsample from undisturbed sample; ASTM D-2435

THE PROJECT SOIL DESCRIPTION PROCEDURE FOR SOUTHWEST FLORIDA⁽¹⁾
For use with the ASTM D 2487 Unified Soil Classification System
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

BOULDERS (>12" [300 mm]) and COBBLES (3" [75 mm] TO 12" [300 mm]):

GRAVEL: Coarse Gravel: 3/4" (19 mm) to 3" (75 mm)
Fine Gravel: No. 4 (4.75 mm) Sieve to 3/4" (19 mm)

Descriptive adjectives:

0 – 5%	---	no mention of gravel in description
5 – 15%	---	trace
15 – 29%	---	some
30 – 49%	---	gravelly (shell, limerock, cemented sands)

SANDS

COARSE SAND: No. 10 (2 mm) Sieve to No. 4 (4.75 mm) Sieve
MEDIUM SAND: No. 40 (425 μm) Sieve to No. 10 (2 mm) Sieve
FINE SAND: No. 200 (75 μm) Sieve to No. 40 (425 μm) Sieve

Descriptive adjectives:

0 – 5%	---	no mention of sand in description
5 – 15%	---	trace
15 – 29%	---	some
30 – 49%	---	sandy

SILT/CLAY: < #200 (75 μm) sieve

SILTY OR SILT: PI < 4

SILTY CLAYEY OR SILTY CLAY: 4 \leq PI \leq 7

CLAYEY OR CLAY: PI > 7

Descriptive adjectives:

0 – 5%	---	clean (no mention of silt or clay in description)
5 – 12% to 15%	---	slightly
16 – 35%	---	clayey, silty, or silty clayey
36 – 49%	---	very

ORGANIC SOILS

<u>Organic Content</u>	<u>Descriptive adjectives</u>	<u>Classification</u>
0 – 2.5%	no mention of organics in description	See above
2.6 – 5%	slightly organic	See above
5 – 20%	organic	Add "with organic fines" to group name

THE PROJECT SOIL DESCRIPTION PROCEDURE FOR SOUTHWEST FLORIDA⁽¹⁾
For use with the ASTM D 2487 Unified Soil Classification System
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

HIGHLY ORGANIC SOILS AND MATTER

<u>Organic Content</u>	<u>Description</u>	<u>Classification</u>
20-75%	highly organic sand or muck sandy peat	Peat (PT) Peat (PT)
>75%	amorphous or fibrous peat	Peat (PT)

STRATIFICATION AND STRUCTURE

<u>Descriptive Term</u>	<u>Thickness</u>
with interbedded	
seam:	less than 1/2-inch (13 mm) thick
layer:	1/2 to 12-inches (13 to 300 mm) thick
stratum:	more than 12-inches (300 mm) thick
pocket:	small, erratic deposit, usually less than 1-foot
occasional:	one or less per foot of thickness
frequent:	more than one per foot of thickness
calcareous:	containing calcium carbonate (reaction to diluted HCL)
hardpan:	spodic horizon usually medium dense
marl:	mixture of carbonate clays, silts, shells and sands.

ROCK CLASSIFICATION

<u>Description</u>
Hard Limestone or Caprock – N-values >50 bpf
Soft Weathered Limestone – N values <50 bpf

(1) This soil description procedure was developed specifically for projects in southwest Florida because it is believed that the terminology will be better understood as a result of local practice. It is not intended to supplant other visual-manual classification procedures for description and identification of soils such as ASTM D 2488. BY: G.A. DREW, P.E. (1995) (Revised 2016).

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A			Soil Classification	
			Group Symbol	Group Name ^B
Coarse Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	Cu ≥ 4 and $1 \leq Cc \leq 3$ ^E	GW Well-graded gravel ^F
		Gravels with Fines: More than 12% fines ^C	Cu < 4 and/or $1 > Cc > 3$ ^E Fines classify as ML or MH	GP Poorly graded gravel ^{F,G,H}
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	Cu ≥ 6 and $1 \leq Cc \leq 3$ ^E	SW Well-graded sand ^I
		Sands with Fines: More than 12% fines ^D	Cu < 6 and/or $1 > Cc > 3$ ^E Fines classify as ML or MH	SP Poorly graded sand ^I
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic: Organic:	PI > 7 and plots on or above "A" line ^J PI < 4 or plots below "A" line ^J	CL Lean clay ^{K,L,M}
			Liquid limit - oven dried Liquid limit - not dried < 0.75	ML Silt ^{K,L,M}
	Silts and Clays: Liquid limit 50 or more	Inorganic: Organic:	PI plots on or above "A" line PI plots below "A" line	CH Fat clay ^{K,L,M}
			Liquid limit - oven dried Liquid limit - not dried < 0.75	MH Elastic Silt ^{K,L,M}
Highly organic soils:			Primarily organic matter, dark in color, and organic odor	PT Peat

^A Based on the material passing the 3-in. (75-mm) sieve

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

$$E \quad Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant.

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" group name.

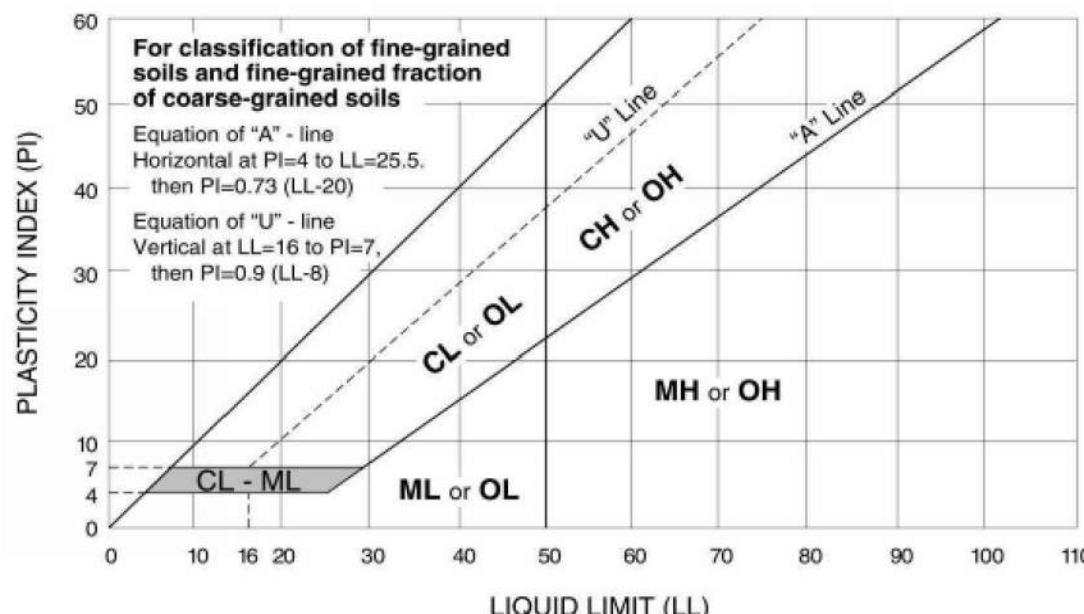
^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N PI ≥ 4 and plots on or above "A" line.

^O PI < 4 or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.



**SUBSURFACE SOIL EXPLORATION
FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT - PHASE 2, AREA C
FIDDLESTICKS COUNTRY CLUB
FORT MYERS, LEE COUNTY, FLORIDA**



Ardaman & Associates, Inc.

OFFICES

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Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

Ardaman Project No. 17-33-4601
July 18, 2018

WESTON & SAMPSON ENGINEERING, INC.
1520 Royal Palm Square Boulevard, Suite 260
Fort Myers, FL 33919

Attention: Mr. Jeffrey A. Wilson, P.E. PWLF

SUBJECT: Subsurface Soil Exploration
Fiddlesticks Water Main Replacement Project – Phase 2, Area C
Fiddlesticks Country Club
Fort Myers, Lee County, Florida

Gentlemen:

As requested and authorized by **Weston & Sampson Engineers, Inc.**, Ardaman & Associates, Inc. (Ardaman) has completed the subsurface soil exploration program for the subject project. The purposes of this program were to evaluate the general subsurface conditions in the project study area and discuss our findings.

This report documents our findings and conclusions. It has been prepared for the exclusive use of **Weston & Sampson Engineers, Inc.** for specific application to the subject project in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

SCOPE

The scope of our services was limited to the following items:

1. Conducting 25 Standard Penetration Test (SPT) borings to 15 feet to determine the nature and condition of the subsurface soils along the route of the proposed water main.
2. Reviewing each soil sample obtained in our field exploration program by a geotechnical engineer in our laboratory for further identification and assignment of laboratory tests.
3. Performing the appropriate laboratory tests on selected samples.
4. Analyzing the existing soil conditions with respect to the proposed construction.

5. Preparing this report to document the results of our field exploration and laboratory testing programs, and discuss our findings.

SITE LOCATION AND PROJECT DESCRIPTION

The Fiddlesticks Water Main Replacement project includes design, permitting and installation of a new water main in the right-of-way of all streets within the Fiddlesticks Country Club development in Fort Myers, Lee County, Florida. The proposed project has been split up into two phases. This report is only for Phase 2, Area C, which encompasses Glenisle Way, Grey Friars Court, Abbotsford Terrace, Greenock Lane and Fiddlesticks Boulevard from the entrance to Glenisle Way. Phase 2, Area C includes an estimated total of 14,100 lineal feet of water main installation. Most of the water main replacement will be installed by directional drill. In general, the soil borings along the water main route were performed on approximately 500-foot centers. Due to access limitations all borings were performed on the existing road surface.

FIELD EXPLORATION PROGRAM

Our field exploration consisted of performing 25 Standard Penetration Test (SPT) borings. The SPT borings were drilled to a depth of 15 feet below the existing ground surface. The SPT borings were conducted using methods consistent with ASTM D-1586. The equipment and procedures used in the SPT borings are described in detail in the **Appendix**.

The locations of the borings are shown on the attached **Figure 1–Boring Location Plan**. They were located by measurement from the site features shown on an aerial photograph of the site shown on the preliminary subsurface utility engineering and geotechnical investigation sheet G-1 provided by Weston & Sampson Engineers, Inc. Therefore, the locations indicated should be considered accurate only to the degree implied by the method of measurement used. If a more precise location of the borings is desired, then we recommend that a registered land surveyor be employed to locate the borings on site. GPS coordinates of each boring location are provided on the boring logs.

GENERAL SUBSURFACE CONDITIONS

The general subsurface conditions encountered during the field exploration are shown on the attached soil boring logs. Soil stratification is based on examination of recovered soil samples and interpretation of the field boring logs. The stratification lines represent the approximate boundaries between the soil types, the actual transitions may be gradual.



The borings were performed in the asphalt pavement. In general, below the asphalt and base, the borings typically encountered very loose to very dense fine sands (SP and SP-SM) extending to depths ranging from 9 to the termination of the borings at 15 feet below the existing ground surface. Below the fine sands, four of the 21 borings encountered loose to dense silty sands (SM) with varying amounts (if any) of gravel consisting of rock fragments or cemented sands typically extending to the termination of the borings at a depth of 15 feet below the existing ground surface. Boring SPT-44 encountered loose sandy silt at a depth of about 13 feet extending to the termination of the boring at a depth of 15 feet. Also, nine borings encountered soft weathered to hard limestone at depths ranging from 9 to 13 feet typically extending to the termination of the borings.

Groundwater was encountered in the boreholes at depths ranging from 5.5 to 6.5 feet below the existing ground surface at the time of our field exploration (June 8 through 14, 2018). The groundwater depths shown on the boring logs represent the groundwater surface encountered on the dates shown. Fluctuations in groundwater level should be anticipated throughout the year due to seasonal variations in rainfall, and other factors.

LABORATORY TESTING PROGRAM

Representative soil samples obtained during our field sampling operation were packaged and transferred to our office and, thereafter, examined by a geotechnical engineer to obtain more accurate descriptions of the existing soil strata. Laboratory testing was performed on selected samples as deemed necessary to aid in soil classification and to further define the engineering properties of the soils. The laboratory tests included Natural Moisture Content, Organic Content and Percent Finer than the U.S. No. 200 Sieve (percent silt and clay).

The test results are presented on the attached soil boring logs at the depths from which the samples were recovered. The soil descriptions shown on the logs are based upon visual-manual procedures in accordance with local practice. Soil classification is in general accordance with the Unified Soil Classification System (ASTM D-2487) and is also based on visual-manual procedures.

In addition, soil samples from the borings were obtained on approximately 1,500-foot centers for environmental corrosion tests and conducted in accordance with Florida test methods FM 5-550, FM 5-551, FM 5-552 and FM 5-553. The environmental corrosion test parameters include pH, resistivity, sulfate content and chloride content. The summarized results are presented below.



Boring No.	Depth (ft.)	pH	Resistivity (ohms-cm)	Chlorides (ppm)	Sulfates (ppm)	Environmental Classification ¹	
						Steel	Concrete
SPT-23	3 – 4.5	8.2	6,200	15	15	Slightly Agg.	Slightly Agg.
SPT-26	3 – 4.5	8.3	3,300	20	114	Moderately Agg.	Slightly Agg.
SPT-29	3 – 4.5	7.1	6,000	10	87	Slightly Agg.	Slightly Agg.
SPT-33	3 – 4.5	8.5	3,700	140	120	Moderately Agg.	Slightly Agg.
SPT-36	3 – 7.5	8.4	4,400	25	231	Moderately Agg.	Slightly Agg.
SPT-39	3 – 7.5	8.1	3,400	200	231	Moderately Agg.	Slightly Agg.
SPT-42	3 – 4.5	8.0	2,900	180	231	Moderately Agg.	Moderately Agg.
SPT-43	3 – 4.5	8.8	7,500	20	51	Slightly Agg.	Slightly Agg.
SPT-46	3 – 4.5	8.3	3,700	10	96	Moderately Agg.	Slightly Agg.

¹Based on Florida Department of Transportation (FDOT) Structures Manual, Volume 1, Section 1.3 (Jan. 2018).

DISCUSSION

The borings performed along the proposed route encountered fine sands (SP and SP-SM) from the directly below the pavement section extending to depths ranging from 9 feet to the termination of the borings at 15 feet below the existing ground surface. The fine sands were generally underlain by either silty sands (SM) and/or soft weathered limestone typically extending to the termination of the soil borings at a depth of 15 feet. Note that boring SPT-38 encountered hard limestone at a depth of 13 feet extending to the termination of the boring at a depth of 15 feet below the existing ground surface.

The fine sands (SP/SP-SM) are suitable for use as backfill materials and suitable for pipe bedding. However, the pipe should be bedded in gravel such as FDOT No. 89 stone if rock occurs within 6 inches of the pipe bottom, or if unsuitable silty sands (SM) are encountered at pipe invert.

Typically, heavy excavators can remove soft limestone and boulders; however, dynamic methods using hydraulic hammers or hoes will be needed to remove hard limestone or large boulders where they occur. Use of excavated rock as a fill material will require further processing (crushing and screening) to reduce particle size to mostly sand and gravel size.



GENERAL COMMENTS

While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of the region are anticipated and may be encountered. The boring profiles and related information are based on the driller's logs and visual examination of selected sample in the laboratory. The delineation between soil types shown on the profiles is approximate and the description represents our interpretation of subsurface conditions at the designated boring locations and on the particular date drilled.

If you have any questions about this report, please contact this office.

Very truly yours,

Ardaman & Associates, Inc.
Florida Certificate of Authorization No. 00005950



Matthew R. Elmore, E.I.
Project Engineer



This document has been digitally signed and sealed by:

*Printed copies of this document are not considered signed and sealed.
The signature must be verified on the electronic documents.*

Gary A. Drew, P.E. No. 35504
Vice President/Branch Manager

MRE/GAD:mre



Ardaman & Associates, Inc.

ATTACHMENTS

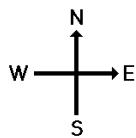
- **BORING LOCATION PLAN (FIGURE 1)**
- **BORING LOGS – SPT-22 THROUGH SPT- 46**





FIGURE 1
BORING LOCATION PLAN

SOURCE: GOOGLE EARTH PRO®



Proposed Fiddlesticks Water Main Replacement
Project – Phase 2, Area C
Fiddlesticks Country Club
Fort Myers, Lee County, FL

Drawn By: ME Checked By: GD Date: 7/5/18

File No.: 17-33-4601 Approved By: Gary Drew, P.E. Figure No: 1

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'28.82" DATE DRILLED: 8-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC Page 320 of 385 PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA C LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
	48- 38- 17	55	1	SP-SP		Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	12- 15- 20	35	2	SP		Poorly Graded Sand - Brown to light brown fine sand.						
3	11- 12- 17	29	3									
	14- 15- 19	34	4									
6	11- 15- 16	31	5									
9	10- 4- 9	13	6									
12	2- 1- 4	5	7									
15	4- 5- 7	12	8			TERMINATED AT 15.5'						
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'24.78" DATE DRILLED: 8-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA C LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN			
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DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	39- 28- 23	51	1	SP-SP		Pavement and Rock Base.						
						Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	12- 20- 22	42	2	SP-SP		Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
3	15- 16- 19	35	3	SP		Poorly Graded Sand - Brown to light brown fine sand.						
6	18- 22- 17	39	4									
11	11- 13- 11	24	5									
19	19- 8- 7	15	6									
6	6- 7- 7	14	7	SP-SP		Poorly Graded Sand with Silt - Gray slightly silty fine sand.						
12												
15	1- 2- 4	6	8			TERMINATED AT 15.5'		22.4	7.5			
18												
21												

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'20.92" DATE DRILLED: 11-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS	Page 322 of 385 OFF: TIME: DATE: 11-JUN-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO	BIT: 2-15/16" DIA. TRICONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	WEATHER CONDITIONS: SUN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	43- 36- 19	55	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
3	16- 19- 17	36	2		SP-SM	Poorly Graded Sand with Silt - Dark brown slightly silty fine sand.						
6	10- 13- 15	28	3		SP	Poorly Graded Sand - Brown fine sand.						
9	10- 9- 11	20	4									
12	10- 12- 12	24	5		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
15	9- 11- 10	21	6		SP	Poorly Graded Sand - Brown to light brown fine sand.						
18	10- 9- 6	15	7									
21	6- 6- 5	11	8			TERMINATED AT 15.5'						

BORING LOCATION: SEE BORING LOCATION PLAN

LATITUDE: N 26°31'14.42"

DATE DRILLED: 11-JUN-18

GROUND SURFACE ELEVATION:

WATER TABLE DEPTH (ft): 6.0

LONGITUDE: W 81°48'21.87"

STA: OFF:

TIME:

DATE: 11-JUN-18

Fiddlesticks Water Main Replacement - Phase 2

CLIENT: WESTON & SAMPSON ENGINEERS, INC. Page 323 of 385

**PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
PHASE 2, AREA C**

LOCATION: FORT MYERS, LEE COUNTY, FLORIDA

DRILL CREW: LOCKEY / BENAVIDES / SKEWIS

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO

BIT: 2-15/16" DIA. TRICONE ROLLER

DRILLING RODS: AW

DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID

WEATHER CONDITIONS: SUN

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PLAST. INDEX



Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

REVIEWED BY

SARVĀ DDEWĀ R.F.

FILE NO. 17-22-4224

BOILING NO.

2015

PAGE 1 OF 1

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'10.29" DATE DRILLED: 11-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC Page 324 of 385 PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA C LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
4.9- 25- 13	38	1	1	SP-SP		Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
12- 13- 14	27	2	2	SP-SP		Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
3												
9- 8- 9	17	3	3									
5- 4- 4	8	4	4									
3- 2- 2	4	5	5									
1- 2- 1	3	6	6	SP		Poorly Graded Sand - Brown fine sand.						
9												
1- 1- 1	2	7	7	SP-SP		Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
12												
15.5	14	8	8			Soft Weathered Limestone.						
18												
21						TERMINATED AT 15.5'						

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'6.09" DATE DRILLED: 11-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN / CLOUDS			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	38- 18- 16	34	1	SP-SP	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
3	12- 13- 15	28	2	SP		Poorly Graded Sand - Light brown fine sand.						
10	10- 10- 11	21	3	SP-SM		Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
18	8- 7- 7	14	4	SP-SM		Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
21	5- 5- 6	11	5	SP		Poorly Graded Sand - Brown fine sand.						
24	10- 8- 8	16	6	SP-SM		Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
27	4- 1- 2	3	7	SP-SM		Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
30	1- 1- 4	5	8	SP		Soft Weathered Limestone.						
33						TERMINATED AT 15.5'						

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'3.46" DATE DRILLED: 11-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: RAIN / SUN / CLOUDS			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	35- 9- 9	18	1	SP-SP		Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
3	9- 13- 13	26	2	SP		Poorly Graded Sand - Brown fine sand.						
6	7- 6- 6	12	3	SP-SP								
9	2- 2- 5	7	4	SP-SP		Poorly Graded Sand with Silt - Dark brown slightly organic slightly silty fine sand.		23.1	4.2			
12	5- 6- 7	13	5	SP-SP								
15	3- 3- 3	6	6	SP-SP		Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
18	2- 1- 1	2	7	SP-SP								
21	1- 0- 6	6	8			TERMINATED AT 15.5'						

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'55" DATE DRILLED: 11-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS	Page 327 of 385 OFF: TIME: DATE: 11-JUN-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO	BIT: 2-15/16" DIA. TRICONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	WEATHER CONDITIONS: CLOUDS	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
	39- 12- 11	23	1	SP-SP		Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	10- 13- 17	30	2	SP		Poorly Graded Sand - Brown to brown and gray fine sand.						
3	10- 12- 13	25	3	SP-SP		Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	7- 7- 7	14	4	SP-SP		Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
6												
	5- 3- 3	6	5	SP		Poorly Graded Sand - Brown fine sand.						
	1- 3- 3	6	6	SP-SP		Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
9	3- 4- 4	8	7	SP-SP		Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
						Soft Weathered Limestone.						
12												
	9- 3- 6	9	8	SP		TERMINATED AT 15.5'						
15												
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'57.09" DATE DRILLED: 12-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	48- 22- 14	36	1	SP-SP	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
3	8- 8- 8	16	2	SP-SP	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	5- 6- 8	14	3									
7	7- 10- 11	21	4									
6												
9	9- 8- 7	15	5	SP	SP	Poorly Graded Sand - Light brown fine sand.						
12	4- 6- 7	13	6									
15	7- 8- 9	17	7									
18												
21	5- 4- 2	6	8	SP-SP	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.	TERMINATED AT 15.5'					

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004 F.A.C.

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'59.22" DATE DRILLED: 12-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	33- 20- 16	36	1	SP-SP		Pavement and Rock Base.						
	9- 9- 11	20	2	SP		Poorly Graded Sand - Brown to gray to Brown fine sand.						
3	5- 6- 6	12	3	SP-SP		Poorly Graded Sand with Silt - Dark brown to brown slightly silty fine sand.						
5- 6- 5	11	4		SP-SP								
6	5- 4- 6	10	5									
9	3- 1- 0	1	6									
12	1- 3- 2	5	7			Soft Weathered Limestone.						
15	6- 4- 4	8	8			TERMINATED AT 15.5'						
18												
21												

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'3.30" DATE DRILLED: 12-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC Page 330 of 385 PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA C LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	41- 32- 15	47	1	SP-SP		Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
3	16- 17- 14	31	2	SP		Poorly Graded Sand - Brown to light brown fine sand.						
10	10- 8- 7	15	3									
15	5- 5- 6	11	4									
18	3- 5- 7	12	5									
21	4- 5- 5	10	6									
	5- 5- 6	11	7									
	6- 7- 6	13	8			TERMINATED AT 15.5'						

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: **LONGITUDE**
DATE DRILLED: 12-JUN-18 **STA:**
GROUND SURFACE ELEVATION:
WATER TABLE DEPTH (ft): 6.5'

CLIENT: WESTON & SAMPSON ENGINEERS, INC. page 331 of 385
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
PHASE 2, AREA C

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER

DRILLING RODS: AW

DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID

WEATHER CONDITIONS: SUN

WATER TABLE DEPTH (ft): 6.5' DATE: 12-JUN-18

LOCATION: FORT MYERS, LEE COUNTY, FLORIDA

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23-004, F.A.C.
PLAST. INDEX



Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

PAGE 1 OF 1

REVIEWED BY: GARY A. BREW, R.F. FILE NO: 17-22-4601 BORING NO.: GPT-22

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'52.96" DATE DRILLED: 12-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS:			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
	34- 18- 11	29	1	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	9- 14- 30	44	2	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
3	15- 13- 24	37	3	██████████	SP	Poorly Graded Sand - Brown fine sand.						
	18- 25- 22	47	4	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
6	15- 15- 12	27	5	██████████	SP	Poorly Graded Sand - Light brown fine sand.						
	10- 11- 12	23	6	██████████	SP	Poorly Graded Sand - Light brown fine sand.						
9	10- 9- 5	14	7	██████████	SP	Poorly Graded Sand - Light brown fine sand.						
12												
15	7- 8- 7	15	8	██████████		TERMINATED AT 15.5'						
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'48.00" DATE DRILLED: 12-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS	Page 333 of 385 OFF: TIME: DATE: 12-JUN-18 LOGGED BY: M. ELMORE, E.I.
--	--	--	--	--	--	--	--

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN / CLOUDS

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
	35- 15- 10	25	1	SP-SM		Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	14- 25- 22	47	2	SP		Poorly Graded Sand - Brown to light brown fine sand.						
3	11- 15- 20	35	3									
	14- 20- 16	36	4									
6	15- 14- 13	27	5									
	10- 8- 6	14	6									
9	7- 8- 9	17	7									
12												
15	7- 4- 4	8	8			TERMINATED AT 15.5'						
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'44.19" DATE DRILLED: 13-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC Page 334 of 385 PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA C LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN / CLOUDS			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
	52- 23- 16	39	1	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	18- 20- 24	44	2	██████████	SP	Poorly Graded Sand - brown fine sand.						
3	20- 18- 17	35	3	██████████								
	18- 16- 12	28	4	██████████								
6												
	8- 8- 10	18	5	██████████	SP-SM	Poorly Graded Sand with Silt - Brown to dark brown slightly silty fine sand.		21.2	6.1			
	8- 7- 5	12	6	██████████								
9	6- 5- 5	10	7	██████████								
12												
15	4- 5- 1	6	8	██████████		TERMINATED AT 15.5'						
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'39.51" DATE DRILLED: 13-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
52-27-13	40	1	1	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
8-10-13	23	2	2	██████████	SP	Poorly Graded Sand - Brown fine sand.						
10-7-5	12	3	3	██████████	SP	Poorly Graded Sand - Brown fine sand.						
3-2-1	3	4	4	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
1-0-0	0	5	5	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
1-2-3	5	6	6	██████████	SP	Poorly Graded Sand - Brown fine sand.						
4-4-5	9	7	7	██████████	SP-SM	Poorly Graded Sand - Brown fine sand.						
1-1-1	2	8	8	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
						TERMINATED AT 15.5'						
21												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'39.26" DATE DRILLED: 13-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC Page 336 of 385 PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA C LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS:			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	43- 38- 17	55	1	SP- SM		Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	20- 22- 23	45	2	SP- SM		Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
3	14- 16- 24	40	3	SP		Poorly Graded Sand - Brown fine sand.						
	19- 19- 15	34	4	SP- SM		Poorly Graded Sand with Silt - Dark brown to brown slightly silty fine sand.						
6	9- 13- 15	28	5									
	8- 7- 6	13	6									
9	7- 6- 7	13	7									
12												
15	48- 51- 29	80	8			Hard Limestone.		20.4	5.8			
						TERMINATED AT 15.5'						
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'39.38" DATE DRILLED: 13-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC Page 337 of 385 PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA C LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN / CLOUDS			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	49- 20- 9	29	1	SP-SP		Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
3	11- 12- 13	25	2	SP		Poorly Graded Sand - Brown fine sand.						
7	7- 10- 12	22	3									
7	7- 7- 6	13	4	SP-SP		Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
6	5- 6- 7	13	5									
9	5- 5- 4	9	6	SP		Poorly Graded Sand - Light brown fine sand.						
12	2- 3- 3	6	7	SP								
15	5- 7- 3	10	8	SM		Silty Sand - Light brown silty fine sand, trace to some gravel (cemented sands and rock fragments).						
18						TERMINATED AT 15.5'						
21												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'39.38" DATE DRILLED: 13-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN / CLOUDS			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	19- 8- 7	15	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
3	6- 7- 6	13	2		SP	Poorly Graded Sand - Brown fine sand.						
4- 4- 4	8	3	3									
3- 2- 2	4	4	4									
6	2- 1- 1	2	5		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.		20.6	7.6			
9	1- 1- 2	3	6		SP	Poorly Graded Sand - Light brown fine sand.						
20- 11- 2	13	7	7			Soft Weathered Limestone.						
15	3- 1- 1	2	8			TERMINATED AT 15.5'						
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'46.60" DATE DRILLED: 14-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC Page 339 of 385 PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA C LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS:			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	37-13-7	20	1	SP-SP	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
3	8-8-9	17	2		SP	Poorly Graded Sand - Brown fine sand.						
6	6-5-4	9	3									
9	5-5-5	10	4		SP-SM	Poorly Graded Sand with Silt - Dark brown to brown slightly silty fine sand.		26.1	1.5			
12	2-4-6	10	5									
15	4-4-6	10	6									
18	4-6-6	12	7		SP	Poorly Graded Sand - Brown fine sand.						
21	6-12-12	24	8			Soft Weathered Limestone.						
						TERMINATED AT 15.5'						

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'50.10" DATE DRILLED: 14-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	44- 20- 7	27	1	SP-SP	SP-SM	Pavement and Rock Base.						
	4- 3- 3	6	2		SP	Poorly Graded Sand - Brown slightly silty fine sand.						
3	2- 2- 2	4	3		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	3- 6- 6	12	4		SP	Poorly Graded Sand - Brown fine sand.						
6	6- 7- 7	14	5		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	8- 7- 5	12	6		SP	Poorly Graded Sand - Brown fine sand.						
9	3- 2- 1	3	7		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
12												
15	1- 0- 9	9	8		SM	Silty Sand - Gray silty fine sand, trace to some gravel (cemented sands and rock fragments).						
						TERMINATED AT 15.5'						
18												
21												

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'47.78" DATE DRILLED: 14-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC Page 341 of 385 PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA C LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN / CLOUDS			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	29- 16- 7	23	1	SP-SP		Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
3	6- 7- 5	12	2	SP		Poorly Graded Sand - Brown to light brown fine sand.						
5- 4- 5	9	3										
5- 5- 6	11	4										
6												
4- 5- 4	9	5										
5- 5- 6	11	6										
9	4- 3- 1	4	7									
12						Soft Weathered Limestone.						
15	8- 10- 6	16	8			TERMINATED AT 15.5'		20.5	2.7			
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'53.82" DATE DRILLED: 14-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	29- 12- 5	17	1	SP-SP	SP-SM	Pavement and Rock Base.						
	7- 9- 7	16	2	SP-SP	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
3	4- 5- 3	8	3	SP-SP	SP	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	5- 5- 3	8	4	SP-SP	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
6	3- 3- 2	5	5	SP-SP	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
8	3- 2- 2	4	6	SP-SP	SP	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
9	1- 2- 1	3	7	SP-SP	SP	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
12				ML-ML	ML	Sandy Silty - Light brown sandy silt, trace to some gravel (cemented sands and rock fragments).						
15	5- 5- 2	7	8	ML-ML	ML	TERMINATED AT 15.5'		21.4	59.9			
18												
21												

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'55.82" DATE DRILLED: 14-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN / CLOUDS			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	22- 11- 9	20	1	SP- SM	Pavement and Rock Base.							
	10- 11- 12	23	2	SP- SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).							
3	8- 8- 8	16	3	SP	Poorly Graded Sand - Brown fine sand.							
	7- 5- 5	10	4	SP- SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.							
6	3- 2- 2	4	5	SP	Poorly Graded Sand - Brown fine sand.							
	1- 1- 1	2	6	SP- SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.			14.4	11.5			
9	1- 3- 4	7	7									
12	3- 6- 3	9	8									
15						TERMINATED AT 15.5'						
18												
21												

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'58.30" DATE DRILLED: 14-JUN-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 6.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN / CLOUDS			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	38- 12- 7	19	1	SP-SP		Pavement and Rock Base.						
	4- 4- 4	8	2	SP-SP		Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
3	3- 5- 6	11	3			Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
6	4- 6- 6	12	4									
	4- 5- 5	10	5									
	4- 4- 5	9	6									
9	4- 5- 5	10	7									
12				SP		Poorly Graded Sand - Brown fine sand.						
15	1- 0- 0	0	8			TERMINATED AT 15.5'		30.3	1.1			
18												
21												

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APPENDIX

- **SOIL BORING, SAMPLING AND TESTING METHODS
PROJECT SOIL DESCRIPTION PROCEDURE – UNIFIED**



Ardaman & Associates, Inc.

SOIL BORING, SAMPLING AND TESTING METHODS

STANDARD PENETRATION TEST

The Standard Penetration Test (SPT) is a widely accepted method of in-situ testing of foundation soils (ASTM D-1586). A 2-foot (0.6 m) long, 2-inch (50 mm) O.D. split-barrel sampler attached to the end of a string of drilling rods is driven 18 inches (0.45 m) into the ground by successive blows of a 140-pound (63.5 Kg) hammer freely dropping 30 inches (0.76 m). The number of blows needed for each 6 inches (0.15 m) of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch (0.15 m) increments penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual description of the retained soil sample. The N-value has been empirically correlated with various soil properties allowing a conservative estimate of the behavior of soils under load. The following tables relate N-values to a qualitative description of soil density and, for cohesive soils, an approximate unconfined compressive strength (Qu):

Cohesionless Soils:	N-Value	N-Value	Description	Relative Density
	Safety Hammer	Auto Hammer		
	< 4	< 3	Very loose	0 - 15%
	4 - 10	3 - 8	Loose	15 - 35%
	10 - 30	8 - 24	Medium dense	35 - 65%
	30 - 50	24 - 40	Dense	65 - 85%
	> 50	> 40	Very dense	85 - 100%

Cohesive Soils:	N-Value	N-Value	Description	Unconfined Compressive Strength, Qu
	Safety Hammer	Auto Hammer		
	< 2	< 1	Very soft	< 0.25 tsf (25 kPa)
	2 - 4	1 - 3	Soft	0.25 - 0.50 tsf (25 - 50 kPa)
	4 - 8	3 - 6	Firm	0.50 - 1.0 tsf (50 - 100 kPa)
	8 - 15	6 - 12	Stiff	1.0 - 2.0 tsf (100 - 200 kPa)
	15 - 30	12 - 24	Very stiff	2.0 - 4.0 tsf (200 - 400 kPa)
	> 30	> 24	Hard	> 4.0 tsf (400 kPa)

The tests are usually performed at 5-foot (1.5 m) intervals. However, more frequent or continuous testing is done by our firm through depths where a more accurate definition of the soils is required. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. The circulating fluid, which is bentonitic drilling mud, is also used to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or prevent the loss of circulating fluid. After completion of a test boring, the hole is kept open until a steady state groundwater level is recorded. The hole is then sealed by backfilling with neat cement.

Representative split-spoon samples from each sampling interval and from different strata are brought to our laboratory in air-tight jars for classification and testing, if necessary. Afterwards, the samples are discarded unless prior arrangements have been made.

POWER AUGER BORINGS

Auger borings are used when a relatively large, continuous sampling of soil strata close to the ground surface is desired. A 4-inch (100 mm) diameter, continuous flight, helical auger with a cutting head at its end is screwed into the ground in 5-foot (1.5 m) sections. It is powered by the rotary drill rig. The sample is recovered by withdrawing the auger out of the ground without rotating it. The soil sample so obtained, is described and representative samples put in bags or jars and returned to the laboratory for classification and testing, if necessary.

HAND AUGER BORINGS

Hand auger borings are used, if soil conditions are favorable, when the soil strata are to be determined within a shallow (approximately 5-foot [1.5 m]) depth or when access is not available to power drilling equipment. A 3-inch (75 mm) diameter hand bucket auger with a cutting head is simultaneously turned and pressed into the ground. The bucket auger is retrieved at approximately 6-inch (0.15 m) intervals and its contents emptied for inspection. Sometimes post-hole diggers are used, especially in the upper 3 feet (1 m) or so. The soil sample obtained is described and representative samples put in bags or jars and transported to the laboratory for classification and testing, if necessary.

UNDISTURBED SAMPLING

Undisturbed sampling implies the recovery of soil samples in a state as close to their natural condition as possible. Complete preservation of in-situ conditions cannot be realized; however, with careful handling and proper sampling techniques, disturbance during sampling can be minimized for most geotechnical engineering purposes. Testing of undisturbed samples gives a more accurate estimate of in-situ behavior than is possible with disturbed samples.

Normally, we obtain undisturbed samples by pushing a 2.875-inch (73 mm) I.D., thin wall seamless steel tube 24 inches (0.6 m) into the soil with a single stroke of a hydraulic ram. The sampler, which is a Shelby tube, is 30 (0.8 m) inches long. After the sampler is retrieved, the ends are sealed in the field and it is transported to our laboratory for visual description and testing, as needed. Undisturbed sampling is noted on the boring logs as thus "U-".

LABORATORY TEST METHODS

Soil samples returned to our laboratory are looked at again by a geotechnical engineer or geotechnician to obtain more accurate descriptions of the soil strata. Laboratory testing is performed on selected samples as deemed necessary to aid in soil classification and to help define engineering properties of the soils. The test results are presented on the soil boring logs at the depths at which the respective sample was recovered, except that grain-size distributions or selected other test results may be presented on separate tables, figures or plates as discussed in this report, the results of which will be located in an Appendix. The soil descriptions shown on the logs are based upon visual-manual procedures in accordance with local practice. Soil classification is in general accordance with the Unified Soil Classification System (ASTM D-2487) and is also based on visual-manual procedures. Following is a list of abbreviations that may appear in the Remarks column on the boring logs indicating additional laboratory testing was performed, the results of which will usually be located in an Appendix.

- DD:** Unit Weight/Classification of Undisturbed "Shelby Tube" samples
- PP:** Pocket Penetrometer reading on cohesive samples in tons per sq. ft. (tsf)
- k:** Hydraulic Conductivity
- Qu:** Unconfined Compression Strength; ASTM D-2166
- UU:** Unconsolidated-Undrained Triaxial Test; ASTM D 2850
- Consol:** One-Dimensional Consolidation test performed on subsample from undisturbed sample; ASTM D-2435

THE PROJECT SOIL DESCRIPTION PROCEDURE FOR SOUTHWEST FLORIDA⁽¹⁾
For use with the ASTM D 2487 Unified Soil Classification System
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

BOULDERS (>12" [300 mm]) and COBBLES (3" [75 mm] TO 12" [300 mm]):

GRAVEL: Coarse Gravel: 3/4" (19 mm) to 3" (75 mm)
Fine Gravel: No. 4 (4.75 mm) Sieve to 3/4" (19 mm)

Descriptive adjectives:

0 – 5%	---	no mention of gravel in description
5 – 15%	---	trace
15 – 29%	---	some
30 – 49%	---	gravelly (shell, limerock, cemented sands)

SANDS

COARSE SAND: No. 10 (2 mm) Sieve to No. 4 (4.75 mm) Sieve
MEDIUM SAND: No. 40 (425 μm) Sieve to No. 10 (2 mm) Sieve
FINE SAND: No. 200 (75 μm) Sieve to No. 40 (425 μm) Sieve

Descriptive adjectives:

0 – 5%	---	no mention of sand in description
5 – 15%	---	trace
15 – 29%	---	some
30 – 49%	---	sandy

SILT/CLAY: < #200 (75 μm) sieve

SILTY OR SILT: PI < 4

SILTY CLAYEY OR SILTY CLAY: 4 \leq PI \leq 7

CLAYEY OR CLAY: PI > 7

Descriptive adjectives:

0 – 5%	---	clean (no mention of silt or clay in description)
5 – 12% to 15%	---	slightly
16 – 35%	---	clayey, silty, or silty clayey
36 – 49%	---	very

ORGANIC SOILS

<u>Organic Content</u>	<u>Descriptive adjectives</u>	<u>Classification</u>
0 – 2.5%	no mention of organics in description	See above
2.6 – 5%	slightly organic	See above
5 – 20%	organic	Add "with organic fines" to group name

THE PROJECT SOIL DESCRIPTION PROCEDURE FOR SOUTHWEST FLORIDA⁽¹⁾
For use with the ASTM D 2487 Unified Soil Classification System
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

HIGHLY ORGANIC SOILS AND MATTER

<u>Organic Content</u>	<u>Description</u>	<u>Classification</u>
20-75%	highly organic sand or muck sandy peat	Peat (PT) Peat (PT)
>75%	amorphous or fibrous peat	Peat (PT)

STRATIFICATION AND STRUCTURE

<u>Descriptive Term</u>	<u>Thickness</u>
with interbedded	
seam:	less than 1/2-inch (13 mm) thick
layer:	1/2 to 12-inches (13 to 300 mm) thick
stratum:	more than 12-inches (300 mm) thick
pocket:	small, erratic deposit, usually less than 1-foot
occasional:	one or less per foot of thickness
frequent:	more than one per foot of thickness
calcareous:	containing calcium carbonate (reaction to diluted HCL)
hardpan:	spodic horizon usually medium dense
marl:	mixture of carbonate clays, silts, shells and sands.

ROCK CLASSIFICATION

<u>Description</u>
Hard Limestone or Caprock – N-values >50 bpf
Soft Weathered Limestone – N values <50 bpf

(1) This soil description procedure was developed specifically for projects in southwest Florida because it is believed that the terminology will be better understood as a result of local practice. It is not intended to supplant other visual-manual classification procedures for description and identification of soils such as ASTM D 2488. BY: G.A. DREW, P.E. (1995) (Revised 2016).

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A			Soil Classification	
			Group Symbol	Group Name ^B
Coarse Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	Cu ≥ 4 and $1 \leq Cc \leq 3$ ^E	GW Well-graded gravel ^F
		Gravels with Fines: More than 12% fines ^C	Cu < 4 and/or $1 > Cc > 3$ ^E Fines classify as ML or MH	GP Poorly graded gravel ^{F,G,H}
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	Cu ≥ 6 and $1 \leq Cc \leq 3$ ^E	SW Well-graded sand ^I
		Sands with Fines: More than 12% fines ^D	Cu < 6 and/or $1 > Cc > 3$ ^E Fines classify as ML or MH	SP Poorly graded sand ^I
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic: Organic:	PI > 7 and plots on or above "A" line ^J PI < 4 or plots below "A" line ^J	CL Lean clay ^{K,L,M}
			Liquid limit - oven dried Liquid limit - not dried < 0.75	ML Silt ^{K,L,M}
	Silts and Clays: Liquid limit 50 or more	Inorganic: Organic:	PI plots on or above "A" line PI plots below "A" line	CH Fat clay ^{K,L,M}
			Liquid limit - oven dried Liquid limit - not dried < 0.75	MH Elastic Silt ^{K,L,M}
Highly organic soils:			Primarily organic matter, dark in color, and organic odor	PT Peat

^A Based on the material passing the 3-in. (75-mm) sieve

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

$$E \quad Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant.

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" group name.

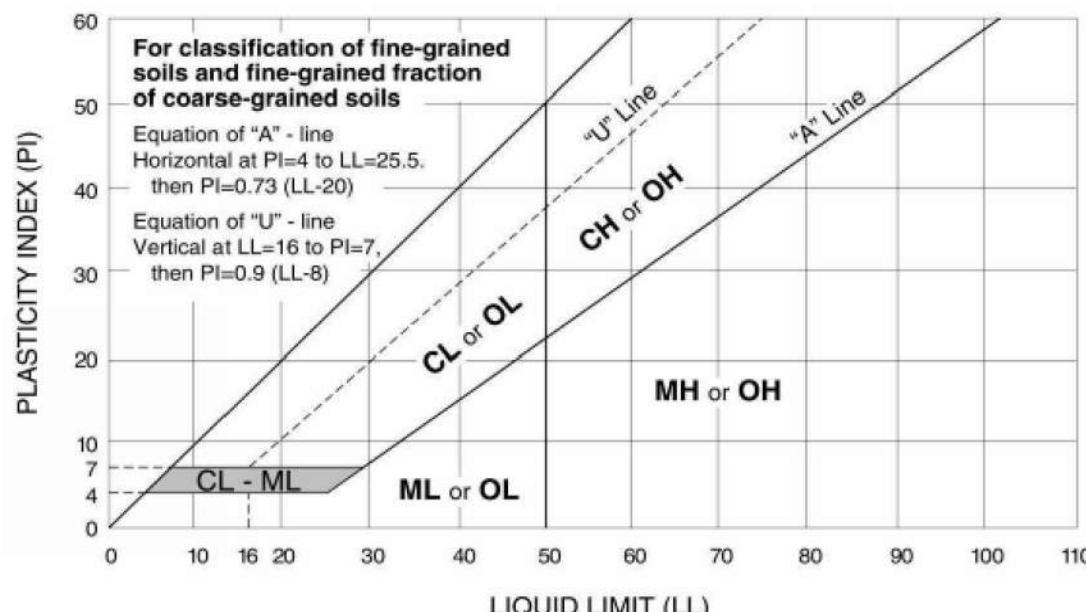
^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N PI ≥ 4 and plots on or above "A" line.

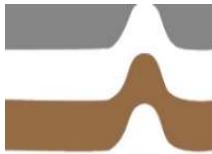
^O PI < 4 or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.



**SUBSURFACE SOIL EXPLORATION
FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT - PHASE 2, AREA D
FIDDLESTICKS COUNTRY CLUB
FORT MYERS, LEE COUNTY, FLORIDA**



Ardaman & Associates, Inc.

CORPORATE HEADQUARTERS

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Louisiana: Baton Rouge, Monroe, New Orleans, Shreveport

MEMBERS:

ASTM International
American Concrete Institute
Geoprofessional Business Association
Society of American Military Engineers
American Council of Engineering Companies



Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

Ardaman Project No. 17-33-4601
August 14, 2018

WESTON & SAMPSON ENGINEERING, INC.
1520 Royal Palm Square Boulevard, Suite 260
Fort Myers, FL 33919

Attention: Mr. Jeffrey A. Wilson, P.E. PWLF

SUBJECT: Subsurface Soil Exploration
Fiddlesticks Water Main Replacement Project – Phase 2, Area D
Fiddlesticks Country Club
Fort Myers, Lee County, Florida

Gentlemen:

As requested and authorized by **Weston & Sampson Engineers, Inc.**, Ardaman & Associates, Inc. (Ardaman) has completed the subsurface soil exploration program for the subject project. The purposes of this program were to evaluate the general subsurface conditions in the project study area and discuss our findings.

This report documents our findings and conclusions. It has been prepared for the exclusive use of **Weston & Sampson Engineers, Inc.** for specific application to the subject project in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

SCOPE

The scope of our services was limited to the following items:

1. Conducting 21 Standard Penetration Test (SPT) borings to 15 feet to determine the nature and condition of the subsurface soils along the route of the proposed water main.
2. Reviewing each soil sample obtained in our field exploration program by a geotechnical engineer in our laboratory for further identification and assignment of laboratory tests.
3. Performing the appropriate laboratory tests on selected samples.
4. Analyzing the existing soil conditions with respect to the proposed construction.

5. Preparing this report to document the results of our field exploration and laboratory testing programs, and discuss our findings.

SITE LOCATION AND PROJECT DESCRIPTION

The Fiddlesticks Water Main Replacement project includes design, permitting and installation of a new water main in the right-of-way of all streets within the Fiddlesticks Country Club development in Fort Myers, Lee County, Florida. The proposed project has been split up into two phases. This report is only for Phase 2, Area D, which encompasses Queensferry Drive, Gullane Court, Pipers Glen and Fiddlesticks Boulevard from Glenisle Way to Glenfinnan Circle (south intersection). Phase 2, Area D includes an estimated total of 12,000 lineal feet of water main installation. Most of the water main replacement will be installed by directional drill. In general, the soil borings along the water main route were performed on approximately 500-foot centers. Due to access limitations all borings were performed on the existing road surface.

FIELD EXPLORATION PROGRAM

Our field exploration consisted of performing 21 Standard Penetration Test (SPT) borings. The SPT borings were drilled to a depth of 15 feet below the existing ground surface. The SPT borings were conducted using methods consistent with ASTM D-1586. The equipment and procedures used in the SPT borings are described in detail in the **Appendix**.

The locations of the borings are shown on the attached **Figure 1–Boring Location Plan**. They were located by measurement from the site features shown on an aerial photograph of the site shown on the preliminary subsurface utility engineering and geotechnical investigation sheet G-1 provided by Weston & Sampson Engineers, Inc. Therefore, the locations indicated should be considered accurate only to the degree implied by the method of measurement used. If a more precise location of the borings is desired, then we recommend that a registered land surveyor be employed to locate the borings on site. GPS coordinates of each boring location are provided on the boring logs.

GENERAL SUBSURFACE CONDITIONS

The general subsurface conditions encountered during the field exploration are shown on the attached soil boring logs. Soil stratification is based on examination of recovered soil samples and interpretation of the field boring logs. The stratification lines represent the approximate boundaries between the soil types, the actual transitions may be gradual.



The borings were performed in the asphalt pavement. In general, below the asphalt and base, the borings typically encountered very loose to very dense fine sands (SP and SP-SM) extending to depths ranging from 9 feet to the termination of the borings at 15 feet below the existing ground surface. Below the fine sands, six of the 21 borings encountered very loose to very dense silty sands (SM) or silty clayey fine sands (SC-SM) with varying amounts (if any) of gravel consisting of rock fragments or cemented sands typically extending to depths of 11 feet to the termination of the borings at 15 feet below the existing ground surface. Also, seven borings encountered soft weathered to hard limestone at depths ranging from 11 to 13.5 feet typically extending to the termination of the borings.

Groundwater was encountered in the boreholes at depths ranging from 5.5 to 6.5 feet below the existing ground surface at the time of our field exploration (June 8 through 14, 2018). The groundwater depths shown on the boring logs represent the groundwater surface encountered on the dates shown. Fluctuations in groundwater level should be anticipated throughout the year due to seasonal variations in rainfall, and other factors.

LABORATORY TESTING PROGRAM

Representative soil samples obtained during our field sampling operation were packaged and transferred to our office and, thereafter, examined by a geotechnical engineer to obtain more accurate descriptions of the existing soil strata. Laboratory testing was performed on selected samples as deemed necessary to aid in soil classification and to further define the engineering properties of the soils. The laboratory tests included Natural Moisture Content and Percent Finer than the U.S. No. 200 Sieve (percent silt and clay).

The test results are presented on the attached soil boring logs at the depths from which the samples were recovered. The soil descriptions shown on the logs are based upon visual-manual procedures in accordance with local practice. Soil classification is in general accordance with the Unified Soil Classification System (ASTM D-2487) and is also based on visual-manual procedures.

In addition, soil samples from the borings were obtained on approximately 1,500-foot centers for environmental corosions tests and conducted in accordance with Florida test methods FM 5-550, FM 5-551, FM 5-552 and FM 5-553. The environmental corrosion test parameters include pH, resistivity, sulfate content and chloride content. The summarized results are presented below.



Boring No.	Depth (ft.)	pH	Resistivity (ohms-cm)	Chlorides (ppm)	Sulfates (ppm)	Environmental Classification ¹	
						Steel	Concrete
SPT-49	3 – 4.5	8.6	3,700	60	54	Moderately Agg.	Slightly Agg.
SPT-52	3 – 4.5	8.8	9,000	30	45	Slightly Agg.	Slightly Agg.
SPT-55	3 – 4.5	8.7	7,000	45	165	Slightly Agg.	Slightly Agg.
SPT-59	3 – 4.5	8.4	4,700	45	75	Moderately Agg.	Slightly Agg.
SPT-61	3 – 4.5	8.9	4,400	105	66	Moderately Agg.	Slightly Agg.
SPT-64	3 – 4.5	8.7	5,500	120	30	Slightly Agg.	Slightly Agg.
SPT-66	3 – 4.5	8.8	8,500	90	27	Slightly Agg.	Slightly Agg.

¹Based on Florida Department of Transportation (FDOT) Structures Manual, Volume 1, Section 1.3 (Jan. 2018).

DISCUSSION

The borings performed along the proposed route encountered fine sands (SP and SP-SM) from directly below the pavement section extending to depths ranging from 9 feet to the termination of the borings at 15 feet below the existing ground surface. The fine sands were typically underlain by either silty sands (SM), silty clayey fine sands (SC-SM) and/or soft weathered limestone typically extending to the termination of the soil borings at a depth of 15 feet. Note that borings SPT-59 and SPT-67 encountered hard limestone at depths of 11 and 13.5 feet extending to the termination of the boring at a depth of 15 feet below the existing ground surface.

The fine sands (SP/SP-SM) are suitable for use as backfill materials and suitable for pipe bedding. However, the pipe should be bedded in gravel such as FDOT No. 89 stone if rock occurs within 6 inches of the pipe bottom, or if unsuitable silty sands (SM) or silty clayey fine sands (SC-SM) are encountered at pipe invert.

Typically, heavy excavators can remove soft limestone and boulders; however, dynamic methods using hydraulic hammers or hoes will be needed to remove hard limestone or large boulders where they occur. Use of excavated rock as a fill material will require further processing (crushing and screening) to reduce particle size to mostly sand and gravel size.



GENERAL COMMENTS

While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of the region are anticipated and may be encountered. The boring profiles and related information are based on the driller's logs and visual examination of selected sample in the laboratory. The delineation between soil types shown on the profiles is approximate and the description represents our interpretation of subsurface conditions at the designated boring locations and on the particular date drilled.

If you have any questions about this report, please contact this office.

Very truly yours,

Ardaman & Associates, Inc.
Florida Certificate of Authorization No. 00005950



Matthew R. Elmore, E.I.
Project Engineer



This document has been digitally signed and sealed by:

*Printed copies of this document are not considered signed and sealed.
The signature must be verified on the electronic documents.*

Gary A. Drew, P.E. No. 35504
Vice President/Branch Manager

MRE/GAD:mre



Ardaman & Associates, Inc.

ATTACHMENTS

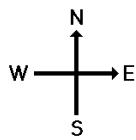
- **BORING LOCATION PLAN (FIGURE 1)**
- **BORING LOGS – SPT-47 THROUGH SPT-67**





FIGURE 1
BORING LOCATION PLAN

SOURCE: GOOGLE EARTH PRO®



Proposed Fiddlesticks Water Main Replacement
Project – Phase 2, Area D
Fiddlesticks Country Club
Fort Myers, Lee County, FL

Drawn By: ME Checked By: GD Date: 8/13/18

File No.: 17-33-4601 Approved By: Gary Drew, P.E. Figure No: 1

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'39.42" DATE DRILLED: 11-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / SKEWIS	Page 359 of 385 OFF: TIME: DATE: 11-JUL-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN / OPPRESSIVE HEAT

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	48- 23- 14	37	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	17- 15- 17	32	2									
	11- 11- 10	21	3		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	7- 8- 8	16	4		SP	Poorly Graded Sand - Brown fine sand.						
	6- 4- 4	8	5									
	4- 5- 4	9	6		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.		16.7	9.4			
10	2- 2- 2	4	7									
	0- 0- 0	0	8									
	0- 0- 0	0	9									
15	0- 0- 0	0	10			TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'39.07" DATE DRILLED: 11-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / SKEWIS	Page 360 of 385 OFF: TIME: DATE: 11-JUL-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN / OPPRESSIVE HEAT

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINEs	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	41- 17- 12	29	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	17- 15- 19	34	2		SP	Poorly Graded Sand - Brown fine sand.						
	12- 15- 14	29	3		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	8- 9- 8	17	4		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	4- 4- 5	9	5		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	2- 2- 1	3	6		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
10	2- 1- 1	2	7		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	3- 3- 3	6	8		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	3- 2- 2	4	9		SM	Silty Sand - Gray silty fine sand.						
15	1- 1- 1	2	10			TERMINATED AT 15.0'		18.1	13.4			
20												
25												
30												
35												

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'39.14" DATE DRILLED: 11-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / SKEWIS	Page 361 of 385 OFF: TIME: DATE: 11-JUL-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN / CLOUDS / RAIN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	30- 17- 16	33	1	██████████	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	19- 15- 24	39	2	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	20- 21- 16	37	3	██████████								
5	11- 10- 9	19	4	██████████				13.3	7.0			
	5- 4- 3	7	5	██████████								
	2- 1- 1	2	6	██████████								
10	1- 1- 1	2	7	██████████								
	1- 0- 1	1	8	██████████	SM	Silty Sand - Brown silty fine sand.						
	1- 2- 1	3	9	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
15	1- 2- 2	4	10	██████████		TERMINATED AT 15.0'						
20												
25												
30												
35												

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'38.89" DATE DRILLED: 11-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / SKEWIS	Page 362 of 385 OFF: TIME: DATE: 11-JUL-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO	BIT: 2-15/16" DIA. TRICONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID	WEATHER CONDITIONS: SUN / CLOUDS / RAIN	

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	40- 18- 10	28	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	14- 22- 15	37	2									
	14- 11- 12	23	3		SP	Poorly Graded Sand - Brown fine sand.						
5	8- 6- 4	10	4									
	3- 3- 2	5	5		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	3- 2- 3	5	6									
10	2- 2- 2	4	7		SP	Poorly Graded Sand - Brown fine sand.						
	1- 2- 3	5	8									
	4- 7- 8	15	9		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
15	6- 6- 7	13	10			TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'38.65" DATE DRILLED: 16-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC Page 363 of 385 PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN / OPPRESSIVE HEAT			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	47- 26- 16	42	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	12- 17- 25	42	2									
	11- 14- 15	29	3		SP	Poorly Graded Sand - Brown to light brown fine sand.						
5	7- 4- 6	10	4									
	8- 8- 8	16	5									
	5- 5- 6	11	6									
10	5- 4- 4	8	7									
	4- 5- 6	11	8									
	5- 6- 8	14	9									
15	5- 3- 2	5	10			TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'38.68" DATE DRILLED: 16-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC Page 364 of 385 PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA D LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN / CLOUDS / OPPRESSIVE HEAT			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	25- 19- 14	33	1	██████████	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	12- 16- 16	32	2	██████████	SP	Poorly Graded Sand - Brown to light brown fine sand.						
5	7- 9- 9	18	4	██████████								
	7- 8- 9	17	5	██████████								
	5- 4- 5	9	6	██████████								
10	6- 7- 8	15	7	██████████								
	9- 9- 10	19	8	██████████								
	11- 12- 7	19	9	██████████								
15	6- 4- 5	9	10	██████████		TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'43.59" DATE DRILLED: 16-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	21- 18- 12	30	1	SP- SM	SP	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments). Poorly Graded Sand - Brown to light brown fine sand.						
5	14- 17- 18	35	2									
10	13- 14- 16	30	3									
12	12- 15- 20	35	4									
14	14- 10- 9	19	5									
16	8- 7- 9	16	6									
18	7- 4- 4	8	7									
20	6- 6- 4	10	8									
22	4- 5- 5	10	9									
24	4- 7- 10	17	10			TERMINATED AT 15.0'						
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'46.55" DATE DRILLED: 16-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC Page 366 of 385 PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA D LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN / CLOUDS			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	24- 14- 12	26	1	██████████	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments). Poorly Graded Sand - Brown to light brown fine sand.						
5	9- 10- 14	24	2	██████████	SP							
7- 9- 10	19	3										
10	10- 11- 9	20	4	██████████								
10	9- 10- 12	22	5	██████████								
10	10- 10- 7	17	6	██████████								
10	10- 11- 11	22	7	██████████								
10	9- 15- 19	34	8	██████████								
10	20- 17- 11	28	9	██████████								
15	8- 4- 2	6	10	██████████		TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'55.74" DATE DRILLED: 16-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC Page 368 of 385 PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN / CLOUDS / RAIN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	35- 16- 10	26	1	SP- SM	SP	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments). Poorly Graded Sand - Brown to light brown fine sand.						
5	2- 1- 2	3	4									
10	1- 1- 2	3	5									
15	1- 2- 3	5	6									
20	4- 7- 8	15	7									
25	6- 8- 9	17	8									
30	6- 7- 8	15	9									
35	6- 10- 10	20	10			TERMINATED AT 15.0'						

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'11.36" DATE DRILLED: 1-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	24- 13- 17	30	1	SP-SP	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments). Poorly Graded Sand - Brown to light brown fine sand.						
5	25- 17- 14	31	2		SP							
10	10- 11- 15	26	3									
13	13- 14- 16	30	4									
14	14- 14- 13	27	5									
10	10- 7- 7	14	6									
6	6- 7- 9	16	7									
8	8- 10- 5	15	8									
5	5- 5- 3	8	9									
3	3- 1- 1	2	10			TERMINATED AT 15.0'						
15												
20												
25												
30												
35												

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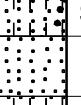
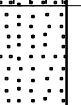
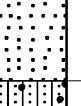
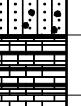
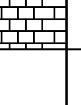
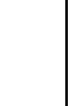
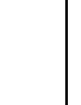
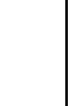
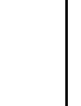
BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'42.31" DATE DRILLED: 17-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS	Page 370 of 385 OFF: TIME: DATE: 17-JUL-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO	BIT: 2-15/16" DIA. TRICONE ROLLER	DRILLING RODS: AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID		WEATHER CONDITIONS: SUN / OPPRESSIVE HEAT

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	21- 17- 20	37	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	13- 14- 13	27	2		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	9- 7- 7	14	3		SP	Poorly Graded Sand - Brown fine sand.						
5	3- 2- 2	4	4									
	1- 1- 2	3	5									
	1- 2- 3	5	6									
10	2- 2- 2	4	7		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.		24.5	3.7			
	2- 3- 3	6	8									
	2- 2- 3	5	9		SC-SM	Silty Clayey Sand - Gray silty clayey fine sand.						
15	1- 2- 2	4	10		SM	Silty Sand - Gray silty fine sand, trace to some gravel (rock fragments and cemented sands).	TERMINATED AT 15.0'					
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'43.91" DATE DRILLED: 17-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN / HOT

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	31- 15- 14	29	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	12- 14- 14	28	2		SP	Poorly Graded Sand - Gray fine sand.						
	8- 9- 8	17	3		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	8- 10- 9	19	4									
	7- 8- 8	16	5		SP	Poorly Graded Sand - Brown to light brown fine sand.		22.2	4.1			
	6- 7- 8	15	6									
10	6- 4- 10	14	7									
	7- 10- 10	20	8		SM	Silty Sand - Light gray silty fine sand, trace to some gravel (rock fragments and cemented sands).						
	17- 9- 14	23	9			Soft Weathered Limestone.						
15	39- 11- 40	51	10			Hard Limestone.	TERMINATED AT 15.0'					
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'45.39" DATE DRILLED: 17-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS	Page 372 of 385 OFF: TIME: DATE: 17-JUL-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN / BREEZY

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	42- 20- 12	32	1	██████████	SP-SM	Pavement and Rock Base.						
	10- 13- 14	27	2	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	10- 10- 11	21	3	██████████	SP	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	6- 7- 8	15	4	██████████		Poorly Graded Sand - Brown fine sand.						
	5- 7- 8	15	5	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	8- 7- 8	15	6	██████████								
10	6- 7- 7	14	7	██████████	SP	Poorly Graded Sand - Light brown fine sand.						
	5- 6- 8	14	8	██████████								
	3- 4- 3	7	9	██████████								
15	1- 1- 1	2	10	██████████		TERMINATED AT 15.0'						
20												
25												
30												
35												

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'47.93" DATE DRILLED: 17-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS	Page 373 of 385 OFF: TIME: DATE: 17-JUL-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN / CLOUDS / HOT

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	36- 18- 16	34	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments). Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	17- 19- 18	37	2		SP-SM							
10	10- 11- 14	25	3		SP-SM							
15	9- 10- 10	20	4		SP	Poorly Graded Sand - Brown fine sand.						
20	9- 8- 8	16	5		SP	Poorly Graded Sand - Brown fine sand.						
25	4- 3- 4	7	6		SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand.						
30	1- 0- 0	0	7		SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand.						
35	42- 32- 17	49	8		SP-SM	Soft Weathered Limestone.		23.0	6.5			
	5- 3- 9	12	9		SP-SM							
	10- 15- 8	23	10		SP-SM	TERMINATED AT 15.0'						

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'53.36" DATE DRILLED: 17-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS	Page 374 of 385 OFF: TIME: DATE: 17-JUL-18 LOGGED BY: M. ELMORE, E.I.
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN / CLOUDS

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINEs	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	47- 31- 21	52	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	19- 24- 21	45	2									
	8- 10- 10	20	3		SP-SM	Poorly Graded Sand with Silt - Brown to gray slightly silty fine sand.						
5	5- 4- 3	7	4									
	2- 1- 1	2	5									
	1- 0- 1	1	6									
10	1- 0- 1	1	7									
	1- 3- 2	5	8									
	6- 28- 44	72	9		SM	Silty Sand - Gray silty fine sand, trace to some gravel (rock fragments and cemented sands).						
15	53- 12- 8	20	10			Soft Weathered Limestone.						
						TERMINATED AT 15.0'						
20												
25												
30												
35												

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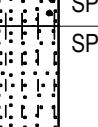
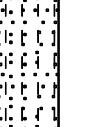
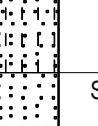
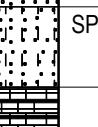
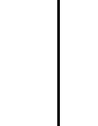
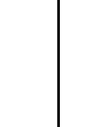
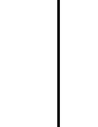
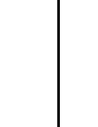
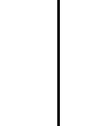
BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°30'57.75" DATE DRILLED: 17-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN / CLOUDS / RAIN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	36- 21- 15	36	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	15- 16- 17	33	2									
	12- 10- 13	23	3		SP	Poorly Graded Sand - Brown to light brown fine sand.						
5	10- 9- 9	18	4									
	5- 7- 8	15	5									
	7- 8- 13	21	6									
10	6- 5- 5	10	7									
	3- 3- 3	6	8									
	6- 3- 4	7	9		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
15	36- 16- 11	27	10			Soft Weathered Limestone.						
						TERMINATED AT 15.0'						
20												
25												
30												
35												

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'2.72" DATE DRILLED: 18-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA D LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						WEATHER CONDITIONS: SUN DRILLING RODS: AW			
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DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	32- 17- 17	34	1		SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments). Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
13- 15- 23	38	2			SP-SM							
13- 14- 13	27	3										
5	15- 20- 12	32	4									
3- 2- 2	4	5										
1- 0- 0	0	6										
10	1- 0- 1	1	7		SP	Poorly Graded Sand - Brown fine sand.						
1- 1- 2	3	8			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
1- 7- 11	18	9				Soft Weathered Limestone.						
10- 10- 16	26	10				TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'5.72" DATE DRILLED: 18-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 5.0'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	31- 15- 13	28	1	██████████	SP-SM	Pavement and Rock Base.						
	15- 15- 17	32	2	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	11- 15- 15	30	3	██████████	SP	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	13- 13- 10	23	4	██████████		Poorly Graded Sand - Brown to light brown fine sand.						
	8- 9- 8	17	5	██████████								
	9- 9- 9	18	6	██████████								
10	8- 6- 4	10	7	██████████								
	3- 16- 15	31	8	██████████		Soft Weathered Limestone.						
	5- 1- 3	4	9	██████████								
15	4- 5- 5	10	10	██████████		TERMINATED AT 15.0'						
20												
25												
30												
35												

BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'01" LONGITUDE: W 81°49'56" DATE DRILLED: 18-JUL-18 STA: OFF GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.5'						CLIENT: WESTON & SAMPSON ENGINEERS, INC. Page 378 of 385 PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA D LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
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DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	55- 24- 15	39	1	██████████	SP-SM	Pavement and Rock Base.						
	18- 17- 18	35	2	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	14- 14- 13	27	3	██████████		Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
5	12- 11- 10	21	4	██████████								
	3- 2- 2	4	5	██████████								
	8- 2- 3	5	6	██████████								
10	2- 1- 1	2	7	██████████								
	2- 3- 3	6	8	██████████				22.6	7.0			
	1- 0- 0	0	9	██████████								
15	1- 0- 3	3	10	██████████	SP	Poorly Graded Sand - Brown fine sand.						
						TERMINATED AT 15.0'						
20												
25												
30												
35												

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BORING LOCATION: SEE BORING LOCATION PLAN LATITUDE: N 26°31'12.99" DATE DRILLED: 18-JUL-18 GROUND SURFACE ELEVATION: WATER TABLE DEPTH (ft): 4.5'						Fiddlesticks Water Main Replacement - Phase 2 CLIENT: WESTON & SAMPSON ENGINEERS, INC PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT PHASE 2, AREA D LOCATION: FORT MYERS, LEE COUNTY, FLORIDA DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS LOGGED BY: M. ELMORE, E.I.			
DRILL MAKE & MODEL: MOBILE B-57 W/AUTO BIT: 2-15/16" DIA. TRICONE ROLLER DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID						DRILLING RODS: AW WEATHER CONDITIONS: SUN			

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINE	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	35- 13- 11	24	1	██████████	SP-SM	Pavement and Rock Base. Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
	11- 14- 21	35	2	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	17- 18- 23	41	3	██████████	SP	Poorly Graded Sand - Light brown fine sand.						
5	20- 18- 16	34	4	██████████	SP	Poorly Graded Sand with Silt - Brown slightly silty fine sand.		14.4	1.3			
	9- 9- 8	17	5	██████████	SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	4- 3- 7	10	6	██████████	SM	Silty Sand - Light gray silty fine sand, trace to some gravel (rock fragments and cemented sands).						
10	3- 1- 2	3	7	██████████		Hard Limestone.						
	18- 50/0"-	50/0"	8	██████████		TERMINATED AT 15.0'						
	- 50/0"-	50/0"		██████████								
15	36- 43- 15	58	9	██████████								
20												
25												
30												
35												

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APPENDIX

- **SOIL BORING, SAMPLING AND TESTING METHODS
PROJECT SOIL DESCRIPTION PROCEDURE – UNIFIED**



SOIL BORING, SAMPLING AND TESTING METHODS

STANDARD PENETRATION TEST

The Standard Penetration Test (SPT) is a widely accepted method of in-situ testing of foundation soils (ASTM D-1586). A 2-foot (0.6 m) long, 2-inch (50 mm) O.D. split-barrel sampler attached to the end of a string of drilling rods is driven 18 inches (0.45 m) into the ground by successive blows of a 140-pound (63.5 Kg) hammer freely dropping 30 inches (0.76 m). The number of blows needed for each 6 inches (0.15 m) of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch (0.15 m) increments penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual description of the retained soil sample. The N-value has been empirically correlated with various soil properties allowing a conservative estimate of the behavior of soils under load. The following tables relate N-values to a qualitative description of soil density and, for cohesive soils, an approximate unconfined compressive strength (Qu):

Cohesionless Soils:	N-Value	N-Value	Description	Relative Density
	Safety Hammer	Auto Hammer		
	< 4	< 3	Very loose	0 - 15%
	4 - 10	3 - 8	Loose	15 - 35%
	10 - 30	8 - 24	Medium dense	35 - 65%
	30 - 50	24 - 40	Dense	65 - 85%
	> 50	> 40	Very dense	85 - 100%

Cohesive Soils:	N-Value	N-Value	Description	Unconfined Compressive Strength, Qu
	Safety Hammer	Auto Hammer		
	< 2	< 1	Very soft	< 0.25 tsf (25 kPa)
	2 - 4	1 - 3	Soft	0.25 - 0.50 tsf (25 - 50 kPa)
	4 - 8	3 - 6	Firm	0.50 - 1.0 tsf (50 - 100 kPa)
	8 - 15	6 - 12	Stiff	1.0 - 2.0 tsf (100 - 200 kPa)
	15 - 30	12 - 24	Very stiff	2.0 - 4.0 tsf (200 - 400 kPa)
	> 30	> 24	Hard	> 4.0 tsf (400 kPa)

The tests are usually performed at 5-foot (1.5 m) intervals. However, more frequent or continuous testing is done by our firm through depths where a more accurate definition of the soils is required. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. The circulating fluid, which is bentonitic drilling mud, is also used to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or prevent the loss of circulating fluid. After completion of a test boring, the hole is kept open until a steady state groundwater level is recorded. The hole is then sealed by backfilling with neat cement.

Representative split-spoon samples from each sampling interval and from different strata are brought to our laboratory in air-tight jars for classification and testing, if necessary. Afterwards, the samples are discarded unless prior arrangements have been made.

POWER AUGER BORINGS

Auger borings are used when a relatively large, continuous sampling of soil strata close to the ground surface is desired. A 4-inch (100 mm) diameter, continuous flight, helical auger with a cutting head at its end is screwed into the ground in 5-foot (1.5 m) sections. It is powered by the rotary drill rig. The sample is recovered by withdrawing the auger out of the ground without rotating it. The soil sample so obtained, is described and representative samples put in bags or jars and returned to the laboratory for classification and testing, if necessary.

HAND AUGER BORINGS

Hand auger borings are used, if soil conditions are favorable, when the soil strata are to be determined within a shallow (approximately 5-foot [1.5 m]) depth or when access is not available to power drilling equipment. A 3-inch (75 mm) diameter hand bucket auger with a cutting head is simultaneously turned and pressed into the ground. The bucket auger is retrieved at approximately 6-inch (0.15 m) intervals and its contents emptied for inspection. Sometimes post-hole diggers are used, especially in the upper 3 feet (1 m) or so. The soil sample obtained is described and representative samples put in bags or jars and transported to the laboratory for classification and testing, if necessary.

UNDISTURBED SAMPLING

Undisturbed sampling implies the recovery of soil samples in a state as close to their natural condition as possible. Complete preservation of in-situ conditions cannot be realized; however, with careful handling and proper sampling techniques, disturbance during sampling can be minimized for most geotechnical engineering purposes. Testing of undisturbed samples gives a more accurate estimate of in-situ behavior than is possible with disturbed samples.

Normally, we obtain undisturbed samples by pushing a 2.875-inch (73 mm) I.D., thin wall seamless steel tube 24 inches (0.6 m) into the soil with a single stroke of a hydraulic ram. The sampler, which is a Shelby tube, is 30 (0.8 m) inches long. After the sampler is retrieved, the ends are sealed in the field and it is transported to our laboratory for visual description and testing, as needed. Undisturbed sampling is noted on the boring logs as thus "U-".

LABORATORY TEST METHODS

Soil samples returned to our laboratory are looked at again by a geotechnical engineer or geotechnician to obtain more accurate descriptions of the soil strata. Laboratory testing is performed on selected samples as deemed necessary to aid in soil classification and to help define engineering properties of the soils. The test results are presented on the soil boring logs at the depths at which the respective sample was recovered, except that grain-size distributions or selected other test results may be presented on separate tables, figures or plates as discussed in this report, the results of which will be located in an Appendix. The soil descriptions shown on the logs are based upon visual-manual procedures in accordance with local practice. Soil classification is in general accordance with the Unified Soil Classification System (ASTM D-2487) and is also based on visual-manual procedures. Following is a list of abbreviations that may appear in the Remarks column on the boring logs indicating additional laboratory testing was performed, the results of which will usually be located in an Appendix.

- DD:** Unit Weight/Classification of Undisturbed "Shelby Tube" samples
- PP:** Pocket Penetrometer reading on cohesive samples in tons per sq. ft. (tsf)
- k:** Hydraulic Conductivity
- Qu:** Unconfined Compression Strength; ASTM D-2166
- UU:** Unconsolidated-Undrained Triaxial Test; ASTM D 2850
- Consol:** One-Dimensional Consolidation test performed on subsample from undisturbed sample; ASTM D-2435

THE PROJECT SOIL DESCRIPTION PROCEDURE FOR SOUTHWEST FLORIDA⁽¹⁾
For use with the ASTM D 2487 Unified Soil Classification System
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

BOULDERS (>12" [300 mm]) and COBBLES (3" [75 mm] TO 12" [300 mm]):

GRAVEL: Coarse Gravel: 3/4" (19 mm) to 3" (75 mm)
Fine Gravel: No. 4 (4.75 mm) Sieve to 3/4" (19 mm)

Descriptive adjectives:

0 – 5%	---	no mention of gravel in description
5 – 15%	---	trace
15 – 29%	---	some
30 – 49%	---	gravelly (shell, limerock, cemented sands)

SANDS

COARSE SAND: No. 10 (2 mm) Sieve to No. 4 (4.75 mm) Sieve
MEDIUM SAND: No. 40 (425 μm) Sieve to No. 10 (2 mm) Sieve
FINE SAND: No. 200 (75 μm) Sieve to No. 40 (425 μm) Sieve

Descriptive adjectives:

0 – 5%	---	no mention of sand in description
5 – 15%	---	trace
15 – 29%	---	some
30 – 49%	---	sandy

SILT/CLAY: < #200 (75 μm) sieve

SILTY OR SILT: PI < 4

SILTY CLAYEY OR SILTY CLAY: 4 \leq PI \leq 7

CLAYEY OR CLAY: PI > 7

Descriptive adjectives:

0 – 5%	---	clean (no mention of silt or clay in description)
5 – 12% to 15%	---	slightly
16 – 35%	---	clayey, silty, or silty clayey
36 – 49%	---	very

ORGANIC SOILS

<u>Organic Content</u>	<u>Descriptive adjectives</u>	<u>Classification</u>
0 – 2.5%	no mention of organics in description	See above
2.6 – 5%	slightly organic	See above
5 – 20%	organic	Add "with organic fines" to group name

THE PROJECT SOIL DESCRIPTION PROCEDURE FOR SOUTHWEST FLORIDA⁽¹⁾
For use with the ASTM D 2487 Unified Soil Classification System
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

HIGHLY ORGANIC SOILS AND MATTER

<u>Organic Content</u>	<u>Description</u>	<u>Classification</u>
20-75%	highly organic sand or muck sandy peat	Peat (PT) Peat (PT)
>75%	amorphous or fibrous peat	Peat (PT)

STRATIFICATION AND STRUCTURE

<u>Descriptive Term</u>	<u>Thickness</u>
with interbedded	
seam:	less than 1/2-inch (13 mm) thick
layer:	1/2 to 12-inches (13 to 300 mm) thick
stratum:	more than 12-inches (300 mm) thick
pocket:	small, erratic deposit, usually less than 1-foot
occasional:	one or less per foot of thickness
frequent:	more than one per foot of thickness
calcareous:	containing calcium carbonate (reaction to diluted HCL)
hardpan:	spodic horizon usually medium dense
marl:	mixture of carbonate clays, silts, shells and sands.

ROCK CLASSIFICATION

<u>Description</u>
Hard Limestone or Caprock – N-values >50 bpf
Soft Weathered Limestone – N values <50 bpf

(1) This soil description procedure was developed specifically for projects in southwest Florida because it is believed that the terminology will be better understood as a result of local practice. It is not intended to supplant other visual-manual classification procedures for description and identification of soils such as ASTM D 2488. BY: G.A. DREW, P.E. (1995) (Revised 2016).

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A			Soil Classification	
			Group Symbol	Group Name ^B
Coarse Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	Cu ≥ 4 and $1 \leq Cc \leq 3$ ^E	GW Well-graded gravel ^F
		Gravels with Fines: More than 12% fines ^C	Cu < 4 and/or $1 > Cc > 3$ ^E Fines classify as ML or MH	GP Poorly graded gravel ^{F,G,H}
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	Cu ≥ 6 and $1 \leq Cc \leq 3$ ^E	SW Well-graded sand ^I
		Sands with Fines: More than 12% fines ^D	Cu < 6 and/or $1 > Cc > 3$ ^E Fines classify as ML or MH	SP Poorly graded sand ^I
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic: Organic:	PI > 7 and plots on or above "A" line ^J PI < 4 or plots below "A" line ^J	CL Lean clay ^{K,L,M}
			Liquid limit - oven dried Liquid limit - not dried < 0.75	ML Silt ^{K,L,M}
	Silts and Clays: Liquid limit 50 or more	Inorganic: Organic:	PI plots on or above "A" line PI plots below "A" line	CH Fat clay ^{K,L,M}
			Liquid limit - oven dried Liquid limit - not dried < 0.75	MH Elastic Silt ^{K,L,M}
Highly organic soils:			Primarily organic matter, dark in color, and organic odor	PT Peat

^A Based on the material passing the 3-in. (75-mm) sieve

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

$$E \quad Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant.

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" group name.

^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N PI ≥ 4 and plots on or above "A" line.

^O PI < 4 or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.

