CONTRACT DOCUMENTS

For the Construction of the

UTILITIES COMMISSION, CITY OF NEW SMYRNA BEACH
LIFT STATION #5 REPLACEMENT

PROCUREMENT REQUIREMENTS
CONTRACTING REQUIREMENTS
TECHNICAL SPECIFICATIONS

DIV 00-16

APRIL 2021

Prepared For: Prepared By:

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Tetra Tech #200-08460-20003
Bid Set
## DIVISION 0 – BIDDING AND CONTRACT REQUIREMENTS

INCLUDED AS A SEPARATE CONTRACT DOCUMENT

### DIVISION 1 - GENERAL REQUIREMENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>01005</td>
<td>Project Requirements</td>
</tr>
<tr>
<td>01010</td>
<td>Summary of Work</td>
</tr>
<tr>
<td>01014</td>
<td>Sequence of Construction</td>
</tr>
<tr>
<td>01025</td>
<td>Measurement and Payment</td>
</tr>
<tr>
<td>01041</td>
<td>Project Coordination</td>
</tr>
<tr>
<td>01050</td>
<td>Field Engineering and Surveying</td>
</tr>
<tr>
<td>01065</td>
<td>Permits and Fees</td>
</tr>
<tr>
<td>01070</td>
<td>Abbreviations and Symbols</td>
</tr>
<tr>
<td>01090</td>
<td>Reference Standards</td>
</tr>
<tr>
<td>01200</td>
<td>Project Meetings</td>
</tr>
<tr>
<td>01300</td>
<td>Contractor Submittals</td>
</tr>
<tr>
<td>01310</td>
<td>Construction Progress Schedules</td>
</tr>
<tr>
<td>01340</td>
<td>Shop Drawings, Working Drawings and Samples</td>
</tr>
<tr>
<td>01370</td>
<td>Schedule of Values</td>
</tr>
<tr>
<td>01380</td>
<td>Color Audio Video Taping of Construction Area</td>
</tr>
<tr>
<td>01400</td>
<td>Quality Control</td>
</tr>
<tr>
<td>01505</td>
<td>Mobilization</td>
</tr>
<tr>
<td>01510</td>
<td>Temporary Utilities</td>
</tr>
<tr>
<td>01530</td>
<td>Protection of Existing Facilities</td>
</tr>
<tr>
<td>01550</td>
<td>Site Access and Storage</td>
</tr>
<tr>
<td>01568</td>
<td>Temporary Erosion and Sedimentation Control</td>
</tr>
<tr>
<td>01570</td>
<td>Maintenance of Traffic</td>
</tr>
<tr>
<td>01580</td>
<td>Project Sign</td>
</tr>
<tr>
<td>01600</td>
<td>Products, Materials, Equipment, and Substitutions</td>
</tr>
<tr>
<td>01650</td>
<td>Start-Up and Check-Out</td>
</tr>
<tr>
<td>01700</td>
<td>Contract Closeout</td>
</tr>
<tr>
<td>01710</td>
<td>Cleaning</td>
</tr>
<tr>
<td>01720</td>
<td>Project Record Documents</td>
</tr>
<tr>
<td>01730</td>
<td>Operating and Maintenance Data</td>
</tr>
<tr>
<td>01740</td>
<td>Warranties and Bonds</td>
</tr>
</tbody>
</table>
UTILITIES COMMISSION, CITY OF NEW SMYRNA BEACH  
LIFT STATION NO. 5 REPLACEMENT  

TABLE OF CONTENTS  
(Continued)  

100% Submittal  

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DIVISION 2 - SITEWORK**

| 02050   | Demolition and Maintenance of Service During Construction |
| 02090   | Soil Borings                                           |
| 02100   | Site Preparation                                       |
| 02140   | Dewatering                                             |
| 02150   | Trench Safety                                          |
| 02200   | Earthwork                                              |
| 02510   | Pipeline Removal and Abandonment                       |
| 02574   | Pavement Removal and Replacement                       |
| 02595   | Polyethylene Pipe for Service Connections              |
| 02661   | Wastewater Force Mains                                 |
| 02666   | Pressure Testing of Piping                             |
| 02730   | Prefabricated Fiberglass Wetwell Liner                 |
| 02740   | Prefabricated Fiberglass Manhole Liner                 |
| 02822   | Solid Sodding                                          |
| 02920   | Restoration                                            |
| 02922   | Loaming, Seeding, and Mulching                         |
| 02995   | Flowable Fill of Abandoned Utilities                   |

**DIVISION 3 – CONCRETE**

| 03300   | Cast-in-Place Concrete                                 |
| 03350   | Concrete Finishes                                      |
| 03375   | Flowable Fill                                          |
| 03410   | Precast Concrete Structures                            |
| 03600   | Grout                                                  |

**DIVISIONS 4 – 8**  
NOT USED
UTILITIES COMMISSION, CITY OF NEW SMYRNA BEACH  
LIFT STATION NO. 5 REPLACEMENT  

TABLE OF CONTENTS  
(Continued)  

100% Submittal  

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DIVISION 9 – FINISHES</td>
</tr>
<tr>
<td>09900</td>
<td>Coatings</td>
</tr>
<tr>
<td>09905</td>
<td>Piping, Valve, and Equipment Identification System</td>
</tr>
<tr>
<td>09913</td>
<td>Epoxtec Concrete Rehabilitation and Structural Lining</td>
</tr>
<tr>
<td>09915</td>
<td>Green Monster Structural System</td>
</tr>
<tr>
<td></td>
<td>DIVISION 10 – SPECIALTIES</td>
</tr>
<tr>
<td></td>
<td>NOT USED</td>
</tr>
<tr>
<td></td>
<td>DIVISION 11 – EQUIPMENT</td>
</tr>
<tr>
<td>11208</td>
<td>Submersible Wastewater Pumps</td>
</tr>
<tr>
<td>11312</td>
<td>Collection System Bypass</td>
</tr>
<tr>
<td></td>
<td>DIVISION 12 – FURNISHINGS</td>
</tr>
<tr>
<td></td>
<td>NOT USED</td>
</tr>
<tr>
<td></td>
<td>DIVISION 13 – SPECIAL CONSTRUCTION</td>
</tr>
<tr>
<td>13410</td>
<td>Basic Instrumentation Requirements</td>
</tr>
<tr>
<td>13423</td>
<td>Level Measurement</td>
</tr>
<tr>
<td>13430</td>
<td>Control Panels and Consoles</td>
</tr>
<tr>
<td></td>
<td>DIVISION 14 – CONVEYING SYSTEMS</td>
</tr>
<tr>
<td></td>
<td>NOT USED</td>
</tr>
</tbody>
</table>
UTILITIES COMMISSION, CITY OF NEW SMYRNA BEACH
LIFT STATION NO. 5 REPLACEMENT

TABLE OF CONTENTS
(Continued)

100% Submittal

Section  Title

DIVISION 15 - MECHANICAL

15000  Mechanical – General Requirements
15044  Pressure Testing of Piping
15062  Ductile Iron Pipe and Fittings
15064  Polyvinyl Chloride (PVC) Pipe and Fittings
15070  Low Pressure Air Testing of Installed Sewer Pipe
15100  Ancillary Equipment
15207  Plug Valves
15208  Combination Air/Vacuum Release Valves
15209  Ball Valves

DIVISION 16 – ELECTRICAL

16050  Basic Electrical Requirements
16060  Grounding
16075  Electrical Identification
16120  Wires and Cables
16130  Raceways
16220  Motors
16410  Circuit and Motor Disconnects
16420  Motor Controllers

APPENDIX A

Geotechnical Report
DIVISION 0

BIDDING AND CONTRACT REQUIREMENTS
(INCLUDED AS A SEPARATE CONTRACT DOCUMENT)
PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. The Work to be done consists of the furnishing of all labor, materials, and equipment, and the performance of all Work included in this Contract. The summary of the Work is presented in Section 01010: Summary of Work.

2. Work Included:

   a. The Contractor shall furnish all labor, superintendence, materials, power, light, heat, fuel, water, tools, appliances, equipment, supplies, and means of construction necessary for proper performance and completion of the Work. The Contractor shall obtain and pay for all necessary construction permits except as provided for in Section 01065 – Permits and Fees. The Contractor shall perform and complete the Work in the manner best calculated to promote rapid construction consistent with safety of life and property and to the satisfaction of the Engineer, and in strict accordance with the Contract Documents. The Contractor shall clean up the Work and maintain it during and after construction, until accepted, and shall do all Work and pay all costs incidental thereto. He shall repair or restore all structures and property that may be damaged or disturbed during performance of the Work.

   b. The cost of incidental work described in these Project Requirements, for which there are no specific Contract Items, shall be considered as part of the general cost of doing the Work and shall be included in the prices for the various Contract Items. No additional payment will be made therefore.

   c. The Contractor shall provide and maintain tools and equipment as may be necessary, in the opinion of the Engineer, to perform in a satisfactory and acceptable manner all the Work required by this Contract. Only equipment of established reputation and proven efficiency shall be used. The Contractor shall be solely responsible for the adequacy of his workmanship, materials, and equipment, prior approval of the Engineer notwithstanding.
3. Public Utility Installations and Structures:

a. Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, vaults, manholes, and all other appurtenances and facilities pertaining thereto whether owned or controlled by the Owner, other governmental bodies, or privately owned by individuals, firms, or corporations, used to serve the public with transportation, traffic control, gas, electricity, telephone, sewerage, drainage, water, or other public or private property which may be affected by the Work shall be deemed included hereunder.

b. The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. These data are not guaranteed as to their completeness or accuracy and it is the responsibility of the Contractor to make his own investigations to inform himself fully of the character, condition, and extent of all such installations and structures as may be encountered and as may affect the construction operations.

c. The Contractor shall protect all public utility installations and structures from damage during the Work. Access across any buried public utility installation or structure shall be made to avoid any damage to these facilities. All required protective devices and construction shall be provided by the Contractor at his expense. All existing public utilities damaged by the Contractor shall be repaired by the Contractor, at his expense. No separate payment shall be made for such protection or repairs to public utility installations or structures.

d. Public utility installations or structures owned or controlled by the Owner or other governmental body which are shown on the Drawings to be removed, relocated, replaced, or rebuilt by the Contractor shall be considered as a part of the general cost of doing the Work and shall be included in the prices bid for the various Contract Items. No separate payment shall be made therefore.

e. Where public utility installations of structures owned or controlled by the Owner or other governmental body are encountered during the course of the Work, and are not indicated on the Drawings or in the Specifications, and when, in the opinion of the Engineer, removal, relocation, replacement, or rebuilding is necessary to complete the Work under this Contract, such Work shall be accomplished by the utility having jurisdiction, or such Work may be ordered, in writing by the Engineer, for the Contractor to accomplish. If such work is accomplished by the utility having jurisdiction it will be carried out expeditiously, and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement, or rebuilding as required. If such work is accomplished by the Contractor, it will be paid for as extra work as provided in the Agreement.
f. The Contractor shall, at all times in performance of the Work, employ acceptable methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage, or destruction of public utility installations and structures; and shall, at all times in the performance of the Work, avoid unnecessary interference with, or interruption of, public utility services, and shall cooperate fully with the owners thereof to that end.

g. The maintenance, repair, removal, relocation, or rebuilding of public utility installations and structures, when accomplished by the Contractor as herein provided, shall be done by methods approved by the owners of such utilities.

1.02 DRAWINGS AND PROJECT MANUAL

A. Drawings: When obtaining data and information from the Drawings, figures shall be used in preference to scaled dimensions, and large-scale drawings in preference to small-scale drawings.

B. Supplementary Drawings:

1. When, in the opinion of the Engineer, it becomes necessary to explain more fully the Work to be done or to illustrate the Work further or to show any changes which may be required, drawings known as Supplementary Drawings, with specifications pertaining thereto, will be prepared by the Engineer, and the Contractor will be furnished one (1) complete set of reproducible drawings (22 inches by 34 inches) and one (1) reproducible copy of the specifications.

2. The Supplementary Drawings shall be binding upon the Contractor with the same force as the Contract Drawings. Where such Supplementary Drawings require either less or more than the estimated quantities of Work, credit to the Owner or compensation therefore to the Contractor shall be subject to the terms of the Agreement.

C. Contractor to Check Drawings and Data:

1. The Contractor shall verify all dimensions, quantities, and details shown on the Drawings, Supplementary Drawings, Schedules, Specifications, or other data received from the Engineer, and shall notify him of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts, or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty construction, or improper operation resulting therefrom, nor from rectifying such conditions at his own expense. He will not be allowed to take advantage of any errors or omissions, as full instructions will be furnished by the Engineer, should such errors or omissions be discovered.
2. All schedules are given for the convenience of the Engineer and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quality of materials and equipment included in work to be done under the Contract.

D. Specifications: The Technical Specifications consist of three (3) parts: General, Products, and Execution. The General part of a Specification contains General Requirements which govern the Work. The Products and Execution parts modify and supplement the General Requirements by detailed requirements for the Work and shall always govern whenever there appears to be a conflict.

E. Intent:

1. All Work called for in the Specifications applicable to this Contract, but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Drawings or in the Specifications, but involved in carrying out their intent or in the complete and proper execution of the Work, is required and shall be performed by the Contractor as though it were specifically delineated or described.

2. The apparent silence of the Specifications 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, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, the interpretation of these Specifications shall be made upon that basis.

1.03 MATERIALS AND EQUIPMENT

A. Manufacturer:

1. All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request and at the Engineer's option, that the manufacturer or subcontractor deal directly with the Engineer. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.

2. Any two (2) or more pieces of material or equipment of the same kind, type, or classification, and being used for identical types of service, shall be made by the same manufacturer.
B. Delivery:

1. The Contractor shall deliver materials in ample quantities to ensure the most speedy and uninterrupted progress of the Work so as to complete the Work within the allotted time.

2. The Contractor shall also coordinate deliveries in order to avoid delay in, or impediment of, the progress of the work of any related Contractor.

C. Tools and Accessories:

1. The Contractor shall, unless otherwise stated in the Contract Documents, furnish with each type, kind, or size of equipment, one (1) complete set of suitably marked high grade special tools and appliances which may be needed to adjust, operate, maintain, or repair the equipment. Such tools and appliances shall be furnished in approved painted steel cases, properly labeled and equipped with good grade cylinder locks and duplicate keys.

2. Spare parts shall be furnished as specified herein and as recommended by the manufacturer necessary for the operation of the equipment, not including materials required for routine maintenance.

3. Each piece of equipment shall be provided with a substantial nameplate, securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, serial number, weight, and principal rate data.

D. Service of Manufacturer's Engineer:

1. The Contract Prices for equipment shall include the cost of furnishing a competent and experienced engineer or superintendent who shall represent the manufacturer and shall assist the Contractor, when required, to install, adjust, test, and place in operation, the equipment in conformity with the Contract Documents.

2. After the equipment is placed in permanent operation by the Owner, such engineer or superintendent shall make all adjustments and tests required by the Engineer to prove that such equipment is in proper and satisfactory operating condition, and shall instruct such personnel as may be designated by the Owner in the proper operation and maintenance of such equipment.

1.04 INSPECTION AND TESTING

A. General:

1. For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests, and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Contract Documents. Five (5) copies of the reports shall be submitted, and authoritative
certification thereof must be furnished to the Engineer as a prerequisite for the acceptance of any material or equipment.

2. If, in the making of any test of any material or equipment, it is ascertained by the Engineer that the material or equipment does not comply with the Contract Documents, the Contractor will be notified thereof, and he will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the Work and replace it with acceptable material, without cost to the Owner.

3. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with the recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.

4. The Contractor shall be fully responsible for the proper operation of equipment during testing and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner formally takes over the operation thereof.

B. Costs:

1. All costs for inspections required under the Building Permit shall be provided by the Contractor, unless otherwise expressly specified.

2. The cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents shall be borne by the Contractor, and such costs shall be deemed to be included in the Contract Price.

3. 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. The Contractor shall reimburse the Owner for the expenditures incurred in making such tests of materials and equipment which are rejected for non-compliance.

C. Certificate of Manufacturer:

1. Contractor shall furnish to Engineer authoritative evidence in the form of a certificate of manufacture that the materials to be used in the Work have been manufactured and tested in conformity with the Contract Documents.

2. These certificates shall be notarized and shall 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.
D. Shop Tests:

1. Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function, or special requirements are specified shall be tested in the shop of the maker in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents. Shop tests where specified shall be witnessed by the Engineer.

2. Five (5) copies of the manufacturer's actual test data and interpreted results thereof, accompanied by a certificate of authenticity sworn to by a responsible official of the manufacturing company and/or independent laboratory, shall be submitted to the Engineer for approval.

3. The cost of shop tests, travel expenses of the Engineer, and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor.

E. Start-up Tests:

1. As soon as conditions permit, the Contractor shall furnish all labor, materials, and instruments and shall make start-up tests of equipment.

2. If the start-up tests disclose any equipment furnished under this Contract which does not comply with the requirements of the Contract Documents, the Contractor shall, prior to demonstration tests, make all changes, adjustments, and replacements required. The furnishing Contractor shall assist in the start-up tests as applicable.

F. Demonstration Tests:

1. Prior to Contractor's request for a Substantial Completion inspection, all equipment and piping installed under this Contract shall be subjected to demonstration tests as specified or required to prove compliance with the Contract Documents.

2. The Contractor shall furnish labor, fuel, energy, water, and all other materials, equipment, and instruments necessary for all demonstration tests, at no additional cost to the Owner. Contractor shall assist in the demonstration tests as applicable.

1.05 LINES AND GRADES

A. Grade:

1. All work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings, or as given by the Engineer. The full responsibility for keeping alignment and grade shall rest upon the Contractor.
2. The Engineer will establish benchmarks and baseline controlling points. Reference marks for lines and grades as the Work progresses will be located by the Contractor to cause as little inconvenience to the prosecution of the Work as possible. The Contractor shall so place excavation and other materials as to cause no inconvenience in the use of the reference marks provided. He shall remove any obstructions placed by him contrary to this provision.

B. Surveys:

1. The Contractor shall furnish and maintain, at his own expense, stakes and other such materials.

2. The Contractor shall check such reference marks by such means as he may deem necessary and, before using them, shall call the Engineer's attention to any inaccuracies.

3. The Contractor shall, at his own expense, establish all working or construction lines and grades as required from the reference marks set by the Engineer, and shall be solely responsible for the accuracy thereof. He shall, however, be subject to the check and review by the Engineer.

C. Safeguarding Marks:

1. The Contractor shall safeguard all points, stakes, grade marks, monuments, and bench marks made or established on the Work, bear the cost of re-establishing them if disturbed, and bear the entire expense of rectifying work improperly installed due to not maintaining or protecting or to removing without authorization such established points, stakes, and marks.

2. The Contractor shall safeguard all existing and known property corners, monuments, and marks adjacent to but not related to the Work and shall bear the cost of re-establishing them if disturbed or destroyed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The Work to be performed shall consist of furnishing parts, tools, equipment, materials, supplies, and manufactured articles, and furnishing all labor, transportation, and services, including but not limited to fuel, power, water, essential communications, and performing all Work or other operations required in strict accordance with the Drawings and these specifications. The Work shall be complete, and all Work, materials, and services not expressly indicated or called for in the Contract Documents which may be necessary for the complete and proper construction of the Work in good faith shall be provided by the Contractor as though originally so indicated, at no increase in cost to the Utilities Commission of New Smyrna Beach (UCNSB).

1.02 THE WORK

A. This Contract is for the construction of modifications to Lift Station Nos. 5 and 35 and associated gravity sewer pipe and force main pipe, as shown on the Drawings and specified herein. Also included are miscellaneous sanitary sewer improvements along 5th Street and 6th Street as depicted in attachment 4. The Work consist of furnishing all labor, equipment, and materials for the construction of the facilities consisting of, but limited to, the following:

Lift Station No. 5

- Remove all existing internal wet well and valve vault components, fill existing wet well, and remove existing valve vault.
- Install new wet well, submersible pumps, discharge piping, valves, and appurtenances.
- Relocate existing water service.
- Install new control panel with SCADA system.
- Miscellaneous site improvements including installation of fencing, slide gate, concrete site curb, and landscaping.

Lift Station No. 35

- Remove all existing internal dry well, wet well, and valve vault components, fill existing dry well and wet well, and remove existing valve vault.
- Remove existing control panel, antenna, and water service.
Collection System

- Cut and cap existing Lift Station No. 5 force main on each side of the 8-inch force main.
- Cut and cap existing 6-inch force main from lift station No. 35 to upstream of discharge manhole.
- Connect to existing gravity system.
- Install approximately 2,400 LF of 10-inch SDR 26 PVC sanitary sewer connecting flow from existing lift station No. 35 to new lift station No. 5.
- Connect to existing wastewater collection pressure system.
- Install approximately 400 LF of 6-inch DR 18 PVC force main from new lift station No. 5 to existing wastewater collection pressure system.
- Install ten (10) new 4-ft diameter sanitary manholes.
- Install fifty (50) new wastewater service connections.

1.03 CONTRACT METHOD

A. The Work hereunder will be constructed under a Contract Agreement between the UCNSB and Contractor, with unit and lump sum prices for the elements of the Work.

1.04 WORK BY OTHERS

A. Interference With Work On Utilities: The Contractors shall cooperate fully with all utility forces of the UCNSB or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the Work, and shall schedule the Work so as to minimize interference with said relocation, altering, or other rearranging of facilities.

1.05 SUBCONTRACTOR USE OF SITE

A. The Contractor's use of the site shall be limited to its construction operations, including on-site storage of materials, on-site fabrication facilities, and field offices.

B. The Contractor shall continuously remove from the project excess fill, rock and construction debris regularly and shall remove it within 48 hours when directed to do so by the UCNSB. All removed corrugated metal pipe, storm drain structures, and other demolished items shall be removed from the site or placed in dumpster within 24 hours of removal.

C. The Contractor shall obtain all required municipal or other governmental permits for any offsite storage yards, processing areas, or other operations.
1.06 UCNSB USE OF THE SITE

B. The Utilities Commission of New Smyrna Beach may utilize all or part of the existing facilities during the entire period of construction for the conduct of the UCNSB’s normal operations. The Contractor shall cooperate and coordinate with UCNSB to facilitate the UCNSB’s operations and to minimize interference with the Contractor's operations at the same time. In any event, UCNSB shall be allowed access to the site at all times during the period of construction.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

END OF SECTION
SECTION 01014
SEQUENCE OF CONSTRUCTION

PART 1 - GENERAL

1.01 PUBLIC NUISANCE
   A. The Contractor shall not create a public nuisance including, but not limited to, encroachment on adjacent lands, flooding of adjacent lands, excessive back-up or blockage of sewer, excessive noise, or undue traffic disruption.

   B. All roadway open cuts shall be backfilled and compacted the same working day as trenching operations are undertaken. Pavement restoration of roadway open cuts are to be in accordance with local authorities or no later than seventy-two (72) hours after utility installation is completed.

   C. No extra charge may be made for time lost due to work stoppage resulting from the creation or avoidance of a public nuisance.

1.02 JURISDICTIONAL DISPUTES
   A. It shall be the responsibility of the Contractor to pay all costs that may be required to perform any of the work shown on the Drawings or specified herein in order to avoid any work stoppages due to jurisdictional disputes. The basis for subletting work in question, if any, shall conform with precedent agreements and decisions on record with the Building and Construction Trades Department, AFL-CIO, dated June 1973, including any amendments thereto.

1.03 SEQUENCE OF WORK
   A. The Contractor shall establish his work sequence based on the use of crews to facilitate completion of construction and testing within the specified contract time. Table 01014-A is provided as a basic reference for proposed sequence of construction. Contractor shall submit detailed sequence and schedule as required in Section 01310 – Construction Progress Schedules and Section 02050 – Demolition and Maintenance of Service during Construction.

   B. Prior to commencement of work on-site, Contractor shall furnish sequence of work to City for review.

   C. Contractor shall backfill utility trenches each evening and shall lay no more than one section of sewer, structure to structure (including service connections), before returning to backfill, compact the subgrade and install drivable surface.
1.04 CONTRACTOR’S USE OF PREMISES

A. The Contractor shall assume full responsibility for the protection and safekeeping of products and materials at the job site. If additional storage or work areas are required, Contractor shall obtain at no additional cost to the Owner.

TABLE 01014-A

PROPOSED SEQUENCE OF CONSTRUCTION

1. Construction shall proceed as identified in the approved Maintenance of Traffic (MOT) plan.

2. In general, perform the Work in the following sequential tasks:

Lift Station No. 5

a. Construct proposed wet well, discharge piping, valves, and appurtenances.
b. Install pumps, control panel, SCADA components, RTU, and additional electrical upgrades.
c. Connect proposed discharge piping to new force main.
d. Install temporary bypass from existing wet well to bypass connection.
e. Demolish existing facilities.
f. Perform preliminary equipment testing and inspection on installed pumps.
g. Construct proposed gravity sewers and manholes.
h. Install new water service piping, backflow preventer, and hose bib.
i. After successful completion of testing, place lift station in service and discontinue bypass operations.
j. Decommission existing wet well.
k. Construct new driveway, fence, and access gate.
l. Perform site work including gravel and landscaping restoration.
m. Start-Up testing.
n. Substantial completion.
o. Final completion.

Collection System: Force Main

a. MOT facilities.
b. Erosion and sedimentation control.
c. Location and protection of existing utilities and other facilities.
d. Dewatering operations.
e. Clearing and grubbing; saw cut, removal, and replacement of pavement.
f. Install new force mains, including all testing.
g. Final pavement restoration.
h. Bypass facilities and pumping including testing and verification of the reliability of the installed bypass facilities.
i. Connect to existing force mains.

Collection System: Gravity Main

a. MOT facilities.
b. Erosion and sedimentation control.
c. Location and protection of existing utilities and other facilities.
d. Dewatering operations.
e. Clearing and grubbing; saw cut, removal, and replacement of pavement.
f. Install new gravity mains and sanitary manholes, including all testing.
g. Final pavement restoration.
h. Lift Station No. 35 will continue in operation until construction of gravity sewer main is finalized. No bypass operations shall be required.
i. Connect to existing gravity system.

Lift Station No. 35

a. After successful installation of gravity sewer main, remove all internal dry well, wet well, valve vault components. Fill existing dry well and wet well in accordance with instructions. Remove existing valve vault.
b. Remove existing control panel, antenna, and water service.
SECTION 01025

MEASUREMENT AND PAYMENT

1.01 GENERAL

A. The Contractor shall receive and accept the compensation provided in the Proposal and the Contract as full payment for furnishing all materials, labor, tools and equipment, for performing all operations necessary to complete the work under the Contract, and also in full payment for all loss or damages arising from the nature of the Work, or from any discrepancy between the actual quantities of work and quantities herein estimated by the Engineer, or from the action of the elements or from any unforeseen difficulties which may be encountered during the prosecution of the Work until the final acceptance by the Owner.

B. The prices stated in the Proposal include all costs and expenses for taxes, labor, equipment, materials, commissions, transportation charges and expenses, patent fees and royalties, labor for handling materials during inspection, together with any and all other costs and expenses for performing and completing the Work as shown on the Drawings and specified herein. The basis of payment for an item at the unit price shown in the Proposal shall be in accordance with the description of that item in this Section.

C. The Contractor's attention is again called to the fact that the quotations for the various items of work are intended to establish a total price for completing the work in its entirety. Should the Contractor think that the cost for any item of work has not been established by the Bid Form or Payment Items, he shall include the cost for that work in some other applicable bid item, so that his proposal for the Project does reflect his total price for completing the Work in its entirety.

1.02 MEASUREMENT

A. The quantities for payment under this Contract shall be determined by actual measurement of the completed items, in place, ready for service and accepted by the Owner, in accordance with the applicable method of measurement therefore contained herein.

1.03 PAYMENT ITEMS

A. The following will clarify the work included for bid items in the Pay Items Sheet:

1. Mobilization and Demobilization: (Bid Item #1)

   a. Measurement for mobilization and demobilization will not be made for payment, and all items shall be included in the Contract lump sum price.

   b. Payment for mobilization and demobilization will be made at the Contract lump sum price for the item, which price and payment shall be
full compensation for the preparatory work and operations in mobilizing for beginning work on the Project including, but not limited to, those operations necessary for the movement of personnel, equipment, supplies and incidentals to the project site, and for the establishment of field office, building, safety equipment and first aid supplies, sanitary and other facilities, as required by these Specifications, and state and local laws and regulations; and any other pre-construction expense necessary for the start of the Work; the cost of permits and fees, construction schedules, preconstruction video and photographs, project signs, shop drawings, temporary facilities, laydown storage area, construction aids, work associated with contractor support during Owner/Engineer reviews and inspection, re-inspections and any re-work resulting from same, cleaning, project records documents, and operation and maintenance data. The Contractor shall submit invoices substantiating the cost of mobilization and demobilization with each pay request. Ten percent (10%) of the cost for mobilization and demobilization will be withheld until acceptance and final payment.

2. General Requirements, Bonds, Permits: (Bid Item #2)

   a. Measurement for general requirements, bonds and permits will not be made for payment, and all items shall be included in the Contract lump sum price.

   b. Payment for general requirements, bonds and permits will be made at the Contract lump sum price for the item, which price and payment shall be full compensation for all insurance requirement costs, the cost of all bonds, permits, and all administrative costs associated with acquiring and maintaining the necessary coverage as described in the Contract Documents. This item will be paid upon each payment request made by the Contractor. The Contractor shall attach with the pay request invoices to substantiate that the Contractor has obtained appropriate insurance and bonds.

3. Maintenance of Traffic: (Bid Item #3)

   a. Measurement for maintenance of traffic will not be made for payment, and all items shall be included in the Contract lump sum price.

   b. Payment for maintenance of traffic will be made at the Contract lump sum price for the item, which price and payment shall be full compensation for labor, materials, permitting, and maintenance of any necessary detour facilities; the providing of necessary facilities for access to residences, businesses, etc., along the project; the preparation of maintenance of traffic plan required by the right-of-way agencies, the furnishing, installing and maintaining of traffic control, barricades, railings, message boards, warning lights, and other safety devices during construction, the control of dust, providing the services of uniformed
off-duty police officers, and other special requirements for the safe and expeditious movements of traffic as called for in the Specifications and shown on the Drawings.

4. Layout Survey, Utility Locates & As-Built Survey: (Bid Item #4)

a. Measurement for layout survey, utility locates and as-built survey as described in Section 01050 will not be made for payment, and all items shall be included in the Contract lump sum price.

b. Payment for layout survey, utility locates and as-built survey will be made at the Contract lump sum price for the item, which price and payment shall be full compensation for all labor, materials, and equipment necessary for providing surveying, layout and field staking, including replacement/restoration of any damaged/removed items, shall be paid in equal monthly amounts based on the scheduled duration of the project from Notice to Proceed to Substantial Completion.

c. Payment for Locating Utilities in Advance of Construction will be made at the contract lump sum price for this item, which price and payment shall be full compensation for all labor, materials, and equipment necessary to physically locate all utilities in the immediate area using non-destructive digging equipment, supplies and personnel experienced in the use of subsurface utility engineering (SUE) to determine precise horizontal and vertical positions of all utilities within the project limits. The Contractor shall perform utility locates at least 21 calendar days in advance of construction in order to request clarification if required from the Engineer. The Engineer will have 7 calendar days to respond. This construction scheduling will allow all necessary decisions to be made prior to the contractor’s crews reaching the work area and having a delay claim and/or a crew mobilization/demobilization claim.

The work includes equipment to paint/mark the approximate position of the public or private underground utility, vacuum excavation equipment that includes air tools (water jet, air lance) to break up the surface and soil. The vacuum excavation equipment involves removing the disturbed soil and temporarily storing it. The exposed underground utility is examined and pertinent data such as size, type, material, and depth is gathered. A marker such as an iron rod and cap or nail and disk are placed next to the test hole and the depth measurement is taken to this point. The stored soil is then returned to the excavated test hole and the surface is returned to its original state; asphalt patch is tamped into the hole when applicable. Markings such as paint and/or lathe and ribbon are left near the hole for future identification. Assume all lines to be located are active lines and service must be maintained at all times possible.
5. Stormwater Pollution Prevention: (Bid Item #5)
   a. Measurement for stormwater pollution prevention as described in Section 01568 will not be made for payment, and all items shall be included in the Contract lump sum price.
   b. Payment for stormwater pollution prevention will be made at the Contract lump sum price for the item, which price and payment shall be full compensation for all labor, materials, and equipment necessary for implementing, maintaining, and inspecting erosion and sediment controls, stormwater management, waste collection and disposal, and other practices shown in the Drawings, or as required by the Project NPDES permit. Any costs to repair and/or replace damaged items will be included under the payment for stormwater pollution prevention.

6. Temporary Stormwater Control: (Bid Item #6)
   a. Measurement for temporary stormwater control as described in Section 01568 will not be made for payment, and all items shall be included in the Contract lump sum price.
   b. Payment for temporary stormwater control will be made at the Contract lump sum price for the item, which price and payment shall be full compensation for all labor, materials, and equipment necessary for preventing siltation of receiving waters from dewatering activities, storm water, etc. Installation, maintenance and removal of silt barriers and inlet protection, turbidity barriers, including all labor, materials, equipment, and other incidentals necessary to complete the item, as shown in the Drawings, and specifically, the erosion control plans. Any costs to repair and/or replace damaged items will be included under the payment for temporary stormwater control.

7. Asphalt Pavement and Road/Driveway Restoration: (Bid Items #7-10)
   a. Measurement for asphalt pavement and road/driveway restoration will be based on the dimensions of asphalt pavement, road and driveway installed and accepted, as specified in the Drawings.
   b. Payment for asphalt pavement and road/driveway restoration will be made at the Contract unit price per square yard for the depth and type installed, which price and payment shall be full compensation for all labor, materials, and equipment; saw cutting (as necessary), excavation, removal and disposal of existing material within specified limits, clean fill material, compaction, stabilized subgrade, base course, super pave asphaltic concrete pavement, milling, overlaying, leveling course, prime and surface courses (as necessary), concrete, formwork and protection from elements (as necessary), expansion joint and joint seals (as necessary), tree trimming, restoration, vegetation removal, removal and replacement of fences, coordination with the utility companies, for any
associated clean-up and disposal, and for all equipment, materials and all other work necessary to complete the installation as specified. Any costs to repair and/or replace damaged items will be included under the payment for asphalt pavement and road/driveway restoration.

8. Sod Restoration: (Bid Item #11)
   a. Measurement for sod restoration will be based on the dimensions of sod restoration, as specified in the Drawings.
   b. Payment for sod restoration will be made at the Contract unit price per square yard, which price and payment shall be full compensation for all labor, materials, and equipment necessary as outlined in Section 02822 and Section 02920, including but not limited to the removal and resetting of any private or public signs, markers, mailboxes, fences and other appurtenances, filling and final grading of all areas within the project, final grading of disturbed areas (to provide positive drainage), removal of trees, bushes and other vegetation, sodding, seeding, mulching, hauling, watering, fertilizing, all labor, materials, equipment, and other incidentals necessary to complete the item. Any costs to repair and/or replace damaged items will be included under the payment for sod restoration.

9. 10” Gravity Main: (Bid Item #12-15)
   a. Measurement for 10” gravity main will be based on the length of pipe installed and accepted, as specified in the Drawings, and as measured along the centerline of the installed pipe.
   b. Payment for 10” gravity main will be made at the Contract unit price per linear foot for the size and type installed, which price and payment shall be full compensation for all labor, materials, and equipment; excavation, sheeting, shoring, trench box, support of adjacent utilities, de-watering, bedding, clean fill material, compaction, tree trimming, restoration, vegetation removal, fittings, restrained joints, sleeves, thrust blocks, thrust collars, supports, disinfection, water required to fill the main, flushing, pigging, testing (pressure and bacteriological), pipe location wire, removal and replacement of fences, coordination with the utility companies, for any associated clean-up and disposal, and for all equipment, materials and all other work necessary to complete the installation as specified. Any costs to repair and/or replace damaged items will be included under the payment for 10” gravity main.

10. 6” Force Main: (Bid Item #16)
    a. Measurement for 6” force main will be based on the length of pipe installed and accepted, as specified in the Drawings, and as measured
along the centerline of the installed pipe measured along their centerlines.

b. Payment for 6” force main will be made at the Contract unit price per linear foot for the size and type installed, which price and payment shall be full compensation for all labor, materials, and equipment; pipe, fittings, excavation, sheeting, shoring, trench box, support of adjacent utilities, de-watering, bedding, clean fill material, compaction, tree trimming, restoration, vegetation removal, restrained joints, sleeves, thrust blocks, thrust collars, restraints, supports, pipe, temporary jumper connection(s), sleeves, bends, and incidental fittings, pipe deflections and transitions, disinfection, water required to fill the main, flushing, pigging, testing (pressure and bacteriological), pipe location wire, removal and replacement of fences, coordination with the utility companies, for any associated clean-up and disposal, and for all equipment, materials and all other work necessary to complete the installation as specified. Any costs to repair and/or replace damaged items will be included under the payment for 6” force main.

11. Cut and Cap Existing Force Main: (Bid Items #17-18)

a. Measurement for cut and cap existing force main will be based on a lump sum basis installed and accepted as specified in the Drawings.

b. Payment for cut and cap existing force main will be made at the Contract lump sum basis which price and payment shall be full compensation for all labor, materials, and equipment; excavation, flushing, cutting, mechanical joint cap, capping, restraint, plugs, grouting, associated clean-up and disposal, safety measures for working with asbestos cement pipe, and restoration of the existing pipe, sheeting, shoring, trench box, support of adjacent utilities, de-watering, clean fill material, compaction, tree trimming, restoration, vegetation removal, removal and replacement of fences, coordination with the utility companies, for any associated clean-up and disposal, and for all equipment, materials and all other work necessary to cut and cap the main to decommission all utilities as specified. Any costs to repair and/or replace damaged items will be included under the payment for cut and cap existing force main.

12. Connect to Existing 8” Force Main: (Bid Item #19)

a. Measurement for connecting to existing 8” force main will be based on the number of connections installed and accepted as specified in the Drawings.

b. Payment for connecting to existing 8” force main will be made at the Contract unit price per each, which price and payment shall be full compensation for all labor, materials, and equipment; excavation,
sheeting, shoring, trench box, support of adjacent utilities, de-watering, bedding, clean fill material, compaction, tree trimming, restoration, vegetation removal, cutting, restrained joints, connections, pipe supports, removal and replacement of fences, coordination with the utility companies, for any associated clean-up and disposal, and for all equipment, materials and all other work necessary to complete the installation as specified. Any costs to repair and/or replace damaged items will be included under the payment for connecting to existing 8” force main.

13. Sanitary Sewer Laterals: (Bid Item #20)

a. Measurement for sanitary sewer laterals will be based on the number of units installed and accepted.

b. Payment for sanitary sewer laterals will be made at the Contract unit price per each, which price and payment shall be full compensation for all labor, materials, and equipment; excavation, sheeting, shoring, trench box, support of adjacent utilities, de-watering, bedding, clean fill material, compaction, tree trimming, restoration, vegetation removal, “non-shear” Furnco connection to existing pipe, pvc pipe, removal and replacement of fences, coordination with the utility companies, for any associated clean-up and disposal, and for all equipment, materials and all other work necessary to complete the minimum 4 foot installation repair as specified. Any costs to repair and/or replace damaged items will be included under the payment for sanitary sewer laterals.

14. Sanitary Sewer 4’ Manholes: (Bid Items #21-24)

a. Measurement for Sanitary Sewer 4’ Manholes will be based on the number of units installed and accepted as specified in the Drawings.

b. Payment for sanitary sewer 4’ manholes will be made at the Contract unit price per each, which price and payment shall be full compensation for all labor, materials, and equipment; excavation, sheeting, shoring, trench box, support of adjacent utilities, de-watering, bedding, clean fill material, compaction, tree trimming, restoration, vegetation removal, manhole frame and cover set to finished grade, pipe external manhole heat shrink seal, removal and replacement of fences, coordination with the utility companies, for any associated clean-up and disposal, and for all equipment, materials and all other work necessary to complete the installation as specified. Any costs to repair and/or replace damaged items will be included under the payment for sanitary sewer 4’ manholes.
15. Lift Station #5 Improvements: (Bid Items #25 and #26)

   a. Measurement for lift station #5 improvements shall be based on satisfactory construction of the new Pump Station complete and ready for continuous operation.

   b. Payment for lift station #5 improvements will be made at the Contract lump sum price, which price and payment shall be full compensation for all labor, materials, and equipment; Work includes but is not necessarily limited to the following: pump station improvements including demolition and disposal of existing structures, bypass operations, wetwell, top slab, hatches, pumps, motors, control panel, SCADA control panel, SCADA pole, cables, rails, valves, water service connection, HDPE discharge pipes and S.S. ball valves, valve vault, pressure piping, valves, and appurtenances, as shown on the Drawings. All coordination with the electric power company, transformer pad, transformers, conduit, materials, equipment, tools, labor and fees to install an electrical service connection. Installation of all site and adjacent improvements noted on drawings including driveways and driveway connections, fencing with curb and gate, earthwork, suitable clean fill, final grading, rock fill and sodding. All work required to construct, complete start-up testing and deliver a complete operational Pump Station without interruption of service.

16. Lift Station #35 Improvements: (Bid Item #27)

   a. Measurement for lift station #35 improvements shall be based on satisfactory demolition of the Pump Station.

   b. Payment for lift station #35 improvements will be made at the Contract lump sum price, which price and payment shall be full compensation for all labor, materials, and equipment; Work includes but is not necessarily limited to the following: pump station improvements including demolition and disposal of existing structures, bypass operations, wetwell, top slab, hatches, pumps, motors, control panel, SCADA control panel, SCADA pole, cables, rails, valves, water service connection, HDPE discharge pipes and S.S. ball valves, valve vault, pressure piping, valves, and appurtenances, as shown on the Drawings. All coordination with the electric power company, transformer pad, transformers, conduit, materials, equipment, tools, labor and fees to install an electrical service connection. All work required to demolish and restore the Pump Station without interruption of service.

17. Polymer Concrete Manholes: (Bid Alternate #1)

   a. Measurement for polymer concrete manholes will be based on the number of units installed and accepted as specified in the Drawings.
b. Payment for polymer concrete manholes will be made at the Contract unit price per each, which price and payment shall be full compensation for all labor, materials, and equipment; excavation, sheeting, shoring, trench box, support of adjacent utilities, de-watering, bedding, clean fill material, stone, compaction, tree trimming, restoration, vegetation removal, manhole frame and cover set to finished grade, pipe external manhole heat shrink seal, removal and replacement of fences, coordination with the utility companies, for any associated clean-up and disposal, and for all equipment, materials and all other work necessary to complete the installation as specified. Any costs to repair and/or replace damaged items will be included under the payment for polymer concrete manholes.

18. Miscellaneous Sewer Improvements: (Bid Alternate #2)

a. Measurement for various items covered under Miscellaneous Sewer Improvements will not be made for payment, and all items shall be included in the lump sum price.

b. Payment for General Requirements shall include all Insurance requirement costs, the cost of bonds, and all Administrative costs. This item will be paid upon each payment request made by the Contractor. The Contractor shall attach with the pay request invoices to substantiate that appropriate insurance and bonds have been obtained by the Contractor.

c. Payment for Mobilization/Demobilization will be made at the Contract lump sum price for the item, which price and payment shall be full compensation for the preparatory work and operations in mobilizing for beginning Work on the project including, but not limited to, those operations necessary for the movement of personnel, equipment, supplies and incidentals to the project site, and for the establishment of field office, building, safety equipment and first aid supplies, sanitary and other facilities, as required by these Specifications, and State and local laws and regulations; and any other preconstruction expense necessary for the start of the Work; the cost of field engineering, permits and fees, construction schedules, shop drawings, temporary facilities, laydown storage area, construction aids, erosion control, work associated with contractor support during Owner/Engineer reviews and inspection, reinspections and any re-work resulting from same, as described in Section 01710: Cleaning; and Section 01720: Project Records Documents. The Contractor shall submit invoices substantiating the cost of mobilization with each pay request. Mobilization/demobilization shall not be more than five percent (5%) of the alternative bid price. Ten percent of the cost for mobilization will be withheld until substantial completion and site clean-up.
d. Payment for Indemnification: In consideration of the Contractor's Indemnity Agreement as set out in the Contract Documents, Owner specifically agrees to give the Contractor the amount listed in the Bid Form and other good and valuable consideration, receipt of which is acknowledged upon signing of the Agreement.

e. Payment for the Miscellaneous Sewer Improvements Construction: This item shall include all materials, equipment, testing, permits, appurtenances, and work required for the construction of the Miscellaneous Sewer Improvements, excluding bid items listed elsewhere.

END OF SECTION
SECTION 01041

PROJECT COORDINATION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish personnel and equipment that will be efficient, appropriate and large enough to secure a satisfactory quality of work and a rate of progress that will ensure the completion of the work within the Contract time. If at any time, such personnel appear to the Engineer to be inefficient, inappropriate or insufficient for securing the quality of work aforementioned, 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 or his obligations to secure the quality of the work and rate of progress.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PIPE LOCATIONS

A. All pipes 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 with existing structures or for other reasons. Where fittings are 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.

3.02 OPEN EXCAVATIONS

A. Contractor shall adequately safeguard all open excavations 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 workmen. All open excavations shall comply with applicable OSHA Standards.

3.03 TEST PITS

A. Test pits for the purpose of locating underground pipelines 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.
3.04 CARE AND PROTECTION OF PROPERTY

A. The Contractor shall be responsible for the preservation of all public and private property and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the Work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in other manner acceptable to the Engineer.

3.05 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 no additional expense to the Owner.

B. Protect all structures in a suitable manner to prevent damage. Should any part of a structure 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. 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. Further, 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. Further, the Contractor shall 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.

3.06 MAINTENANCE OF TRAFFIC

A. Unless permission to close a street is received in writing from the proper authority (County, City, FDOT, etc.), 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.

B. Detours around construction will be subject to the approval of the Owner and the Engineer. 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 Owner. All maintenance of traffic plans required for construction shall be approved by the local governmental entity having jurisdiction.
C. 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.

3.07 PRIVATE LAND

A. The Contractor shall not enter or occupy private land outside the site, except by written permission of the appropriate Owners. Contractor shall provide Owner a copy of such written permission prior to entering private land.

3.08 COOPERATION WITHIN THIS CONTRACT

A. The Contractor shall, prior to interrupting a utility service (water, sewer, etc.) for the purpose of making cut-ins to the existing lines or for any other purposes, contact the Owner and make arrangements for the interruption, which will be satisfactory to the Owner.
SECTION 01050

FIELD ENGINEERING AND SURVEYING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall provide and pay for field engineering services required for the Project as follows.

1. Survey work required in execution of Work.

2. Civil, structural or other professional engineering services required to execute Contractor’s construction methods.

B. The Contractor shall retain the services of a Registered Land Surveyor licensed in the State of Florida to:

1. Identify and verify existing horizontal and vertical control points, and property line corners and stakes indicated on the Drawings, as required. All surveys with elevation data will indicate NGVD 88 as the required datum and a description of the benchmark upon which the survey was based.

2. Verify all existing structure locations. The Record of Survey will show all found points, property corners, Permanent Reference Markers (PRMs), section corners, ¼-section corners, control points, lift station locations, and equipment locations along the general route of the project.

C. The method of field staking for the construction of the Work shall be at the option of the Contractor. The Utilities Commission of New Smyrna Beach shall provide the engineering surveys to establish reference points, which in the Utilities Commission of New Smyrna Beach’s judgment are necessary to enable the Contractor to proceed with his Work. The Contractor shall be responsible for obtaining, from the Utilities Commission of New Smyrna Beach, the recorded legal descriptions of easements prior to commencing Work in each easement.

D. The accuracy of any method of staking shall be the responsibility of the Contractor. All engineering for vertical and horizontal control shall be the responsibility of the Contractor.

E. The Contractor shall be held responsible for the preservation of all stakes and marks. If any stakes or marks are disturbed, the Contractor shall not proceed with any Work until he has reestablished such points, marks, lines and elevations as may be necessary for the prosecution of the Work.
1.02 QUALIFICATIONS OF SURVEYOR OR ENGINEER

A. Registered Professional Engineer or Land Surveyor of the discipline required for the specific service on the project, currently licensed in the State of Florida, in good standing.

1.03 SURVEY REFERENCE POINTS

A. Existing horizontal and vertical control points for the project are those designated on Drawings or provided by Utilities Commission of New Smyrna Beach.

B. Locate, protect and verify horizontal and vertical control points prior to starting site work, and preserve all permanent reference points during construction. Contractor shall:

1. Make no changes or relocations without prior written notice to the Utilities Commission of New Smyrna Beach.

2. Report to the Utilities Commission of New Smyrna Beach when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

3. Require surveyor to correctly replace project control point that may be lost or destroyed. Establish replacements based on original survey control.

C. Safeguarding Marks

1. The Contractor shall safeguard all points, stakes, grade mark monuments and bench marks made or established on the Work, bear the cost of reestablishing them if disturbed, and bear the expense of rectifying Work improperly installed due to not maintaining, protecting, or removing without authorization such established points, stakes and marks.

2. The Contractor shall safeguard all existing and known property corners, monuments and marks adjacent to but not related to the Work and, shall bear the cost of reestablishing the corners, monuments and marks if disturbed or destroyed.

3. Public land survey corners and accessories destroyed during construction must be restored or replaced according to the provisions of the Florida Statutes, Chapter 177.507, Certification of Corners. Copies of all certified corner records filed with the Florida State Bureau of Surveying and Mapping pursuant to the provisions of Chapter 177.507 must be submitted to the Utilities Commission of New Smyrna Beach who will then submit the documents to the Utilities Commission of New Smyrna Beach Engineer’s office.
4. The Contractor will not be required to replace existing survey tacks (i.e., traverse points) located in roadways which have been previously extended from monuments by others.

1.04 PROJECT SURVEY REQUIREMENTS FOR BUILDING AND STRUCTURES

A. Establish a minimum of two permanent benchmarks on site, referenced to data established by survey control points. Record locations, with horizontal and vertical data, on Project Record Documents.

B. Establish lines and levels, locate and layout, by instrumentation and similar appropriate means:

1. Site improvements.
   a. Stakes for grading, fill and topsoil placement.
   b. Utility slopes and invert elevations.

2. Batter boards for structures.

3. Building foundation, column locations and floor levels.

4. Controlling lines and levels required for mechanical and electrical trades.

1.05 PROJECT SURVEY REQUIREMENTS FOR UTILITIES AND ROADWAYS

A. The construction drawings for this project contain surveys prepared by licensed professional land surveyors. The Utilities Commission of New Smyrna Beach and Engineer makes no representation, express or implied, as to the accuracy of the previously performed survey and the Contractor acknowledges that the Utilities Commission of New Smyrna Beach and the Engineer are in no way responsible or liable, in whole or in part, for any errors or omissions in the previously performed survey. The Contractor shall have full responsibility to reviewing and checking all previous survey information and data.

B. Establish all lines and grades prior to construction of line work for all pressure mains and gravity sewers to ensure proper installation.

C. Staking for roadway reconstruction shall be provided on both sides of the roadway at no more than 100-foot intervals. These stakes must be in place at the time of final subgrade and base inspection by the Utilities Commission of New Smyrna Beach.

D. The center line, point of tangent, point of intersection, and point of curve of all reconstructed roadways shall be re-established prior to paving. These centerlines and points shall be adequate to ensure the paving Subcontractor can properly layout their work.

E. Roadways shall be reconstructed to the pre-existing centerline elevations as shown on the drawings. Centerline elevation may be adjusted to match existing driveway elevations.
Two-Lane roadways shall be reconstructed to the pre-existing centerline elevations with a 2% cross-slope from centerline as shown on the Drawings. Minor adjustments to the centerline elevation or the slope of a driveway apron replaced as part of the Work, where deemed appropriate, may be made to provide the necessary elevation for the pavement/driveway interface. Any adjustments to the centerline elevation or driveway slope shall be reviewed by the Utilities Commission of New Smyrna Beach prior to commencement of the reconstruction.

1.06 RECORDS

A. In survey field books, maintain a complete, accurate log of all control and survey work as it progresses.

B. Update the Project Record Drawings on a monthly basis based on the Work performed during the month ending at the pay request as a condition for approval of monthly progress payment requests.

C. Maintain an accurate record of piping changes, revisions, and modifications.

D. All surveys conducted for the purpose of supplying record drawings shall be recorded in both the latitude/longitude coordinate system, within an accuracy of 0.001 seconds, and the State Plane Florida East NAD 83 Coordinate System, within an accuracy of 0.01 feet. No conversion shall be allowed.

1.07 SUBMITTALS

A. Submit name and address of registered land surveyor or professional engineer to the Utilities Commission of New Smyrna Beach.

B. Furnish a certified statement (i.e., survey report) on a street by street or other basis acceptable to the Utilities Commission of New Smyrna Beach that the horizontal and vertical control shown on the engineering plans was verified prior to laying out any proposed improvements. This may be done on the Contractor’s daily report form. This survey report must comply with F.S. 472.027.

C. At the Substantial Completion date, submit certified drawings (signed and sealed by the registered land surveyor) of the items listed below. These drawings shall be included with, and made a part of, the Project Record Documents.

1. Certified record survey showing the horizontal and vertical data of each benchmark and monument used for the construction of the project. The Certified Record Survey shall be at the same scale as the Engineer’s line drawings and must comply with F.S. 472.027.
2. Certified as-built drawings at the same scale providing the following:

a. Manholes:
   - All manhole invert elevations
   - Rim elevation

b. Storm Drainage Structures
   - Grate elevations
   - All drainage pipe invert elevations
   - Bleeder invert elevations
   - Notch invert and width elevations

c. Pressure Pipe (Potable Water Pipe, Wastewater Pipe) – Top of pipe at all surveyed locations.
   - Valves
   - Fittings
   - Changes in Direction
   - 50’ Minimum Between Shots

d. Roadways
   - High and low points elevations
   - Any significant road elevation changes

D. All record drawings shall be in AutoCAD Civil 3D 2018 or later using laying system specified by Utilities Commission of New Smyrna Beach. In addition, the Contractor is required to submit a coordinate file (i.e., CSV) for use by Utilities Commission of New Smyrna Beach.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.01 PERMITS OBTAINED BY OWNER

A. The Owner has obtained the following approvals and permits. Contractor shall be responsible for complying with all permit requirements.

<table>
<thead>
<tr>
<th>Permit</th>
<th>Permit No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. FDEP Notification/ Application for Constructing a Domestic Wastewater Collection/ Transmission System</td>
<td></td>
</tr>
<tr>
<td>2. City of New Smyrna Right-of-Way Utilization Permit</td>
<td></td>
</tr>
</tbody>
</table>

B. The Contractor shall apply for, pay permit fees, and obtain the following permits and approvals:

1. Miscellaneous Building, Electrical and other required Permits from the Volusia County.

2. NPDES permit in accordance with Section 01066, NPDES Requirements.

3. Permits and licenses necessary for the performance of this work shall be secured and paid for by the awarded vendor(s) prior to execution of the contract or purchase order.

4. If the bidder has a valid state certified contractor's license, they are required to register with the Volusia County, Licensing/Business Tax Division. If the bidder currently possesses a state certified contractor's license, a County Competency License is also required.

5. Failure to provide evidence of any required occupational or competency licenses may be cause for rejection of bid.

6. Copies of these permits are included in Appendix A and shall be kept on the project site. Copies of these permits also shall be provided to the Utilities Commission of New Smyrna Beach.
C. The Contractor shall procure all necessary permits and licenses, pay all charges and fees, and give all notices necessary and incidental to the due and lawful prosecution of the work. The Contractor shall determine what permits are required for construction of the Work and procure them.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION
SECTION 01070

ABBREVIATIONS AND SYMBOLS

PART 1 - GENERAL

1.01 STANDARDS AND ABBREVIATIONS

A. Referenced Standards: Any reference to published specifications or standards of any organization or association shall comply with the requirements of the specification or standard which is current on the date of Advertisement for Bids. In case of a conflict between the referenced specifications or standards, the one having the more stringent requirements shall govern.

In case of conflict between the referenced specifications or standards and the Contract Documents, the Contract Documents shall govern.

B. Abbreviations:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>AA</td>
<td>Aluminum Association</td>
</tr>
<tr>
<td>AAA</td>
<td>American Arbitration Association</td>
</tr>
<tr>
<td>AABC</td>
<td>Associated Air Balance Council</td>
</tr>
<tr>
<td>AAMA</td>
<td>Architectural Aluminum Manufacturers Association</td>
</tr>
<tr>
<td>AASHO</td>
<td>The American Association of State Highway Officials</td>
</tr>
<tr>
<td>ABA</td>
<td>American Bar Association</td>
</tr>
<tr>
<td>ABMA</td>
<td>American Boiler Manufacturers Association</td>
</tr>
<tr>
<td>ABPA</td>
<td>Acoustical and Board Products Association</td>
</tr>
<tr>
<td>ACI</td>
<td>American Concrete Institute</td>
</tr>
<tr>
<td>ACPA</td>
<td>American Concrete Pipe Association</td>
</tr>
<tr>
<td>AEIC</td>
<td>Association of Edison Illuminating Companies</td>
</tr>
<tr>
<td>AFBMA</td>
<td>Anti-Friction Bearing Manufacturers Association</td>
</tr>
<tr>
<td>AGA</td>
<td>American Gas Association</td>
</tr>
<tr>
<td>AGC</td>
<td>Associated General Contractors of America</td>
</tr>
<tr>
<td>AGMA</td>
<td>American Gear Manufacturers Association</td>
</tr>
<tr>
<td>AHA</td>
<td>American Hardboard Association</td>
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<tr>
<td>AI</td>
<td>The Asphalt Institute</td>
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<tr>
<td>AIA</td>
<td>American Institute of Architects</td>
</tr>
<tr>
<td>AIA</td>
<td>American Insurance Association</td>
</tr>
<tr>
<td>AIEE</td>
<td>American Institute of Electrical Engineers (Now IEEE)</td>
</tr>
<tr>
<td>AIMA</td>
<td>Acoustical and Insulating Materials Association</td>
</tr>
<tr>
<td>AISC</td>
<td>American Institute of Steel Construction</td>
</tr>
<tr>
<td>AISI</td>
<td>American Iron and Steel Institute</td>
</tr>
<tr>
<td>AITC</td>
<td>American Institute of Timber Construction</td>
</tr>
<tr>
<td>AMCA</td>
<td>Air Moving and Conditioning Association</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standard Institute</td>
</tr>
<tr>
<td>APA</td>
<td>American Plywood Association</td>
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<tr>
<td>API</td>
<td>American Petroleum Institute</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>APWA</td>
<td>American Public Works Association</td>
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<tr>
<td>AREA</td>
<td>American Railway Engineering Association</td>
</tr>
<tr>
<td>ARI</td>
<td>American Refrigeration Institute</td>
</tr>
<tr>
<td>ASA</td>
<td>American Standards Association (Now ANSI)</td>
</tr>
<tr>
<td>ASAHC</td>
<td>American Society of Architectural Hardware Consultants</td>
</tr>
<tr>
<td>ASCE</td>
<td>American Society of Civil Engineers</td>
</tr>
<tr>
<td>ASHRAE</td>
<td>American Society of Heating, Refrigerating and Air Conditioning Engineers</td>
</tr>
<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
</tr>
<tr>
<td>ASSHTO</td>
<td>American Association of State Highway Transportation Officials</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
</tr>
<tr>
<td>AWG</td>
<td>American Wire Gauge</td>
</tr>
<tr>
<td>AWI</td>
<td>Architectural Woodwork Institute</td>
</tr>
<tr>
<td>AWPA</td>
<td>American Wood Preservers Association</td>
</tr>
<tr>
<td>AWPB</td>
<td>American Wood Preservers Bureau</td>
</tr>
<tr>
<td>AWPI</td>
<td>American Wood Preservers Institute</td>
</tr>
<tr>
<td>AWS</td>
<td>American Welding Society</td>
</tr>
<tr>
<td>AWWA</td>
<td>American Water Works Association</td>
</tr>
<tr>
<td>BHMA</td>
<td>Builders Hardware Manufacturers Association</td>
</tr>
<tr>
<td>BIA</td>
<td>Brick Institute of America (formerly SCPI)</td>
</tr>
<tr>
<td>CDA</td>
<td>Copper Development Association</td>
</tr>
<tr>
<td>CFS</td>
<td>Cubic Feet Per Second</td>
</tr>
<tr>
<td>CMMA</td>
<td>Crane Manufacturers Association of America</td>
</tr>
<tr>
<td>CRSI</td>
<td>Concrete Reinforcing Steel Institute</td>
</tr>
<tr>
<td>CS</td>
<td>Commercial Standard</td>
</tr>
<tr>
<td>DHI</td>
<td>Door and Hardware Institute</td>
</tr>
<tr>
<td>DIPRA</td>
<td>Ductile Iron Pipe Research Association</td>
</tr>
<tr>
<td>DOT Spec</td>
<td>Standard Specification for Road and Bridge Construction Florida Department of Transportation</td>
</tr>
<tr>
<td>E/A</td>
<td>Engineer and/or Architect</td>
</tr>
<tr>
<td>EDA</td>
<td>Economic Development Association</td>
</tr>
<tr>
<td>EEI</td>
<td>Edison Electric Institute</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>FCI</td>
<td>Fluid Control Institute</td>
</tr>
<tr>
<td>FDEP</td>
<td>Florida Department of Environmental Protection</td>
</tr>
<tr>
<td>FDOT</td>
<td>Florida Department of Transportation</td>
</tr>
<tr>
<td>Fed Spec</td>
<td>Federal Specification</td>
</tr>
<tr>
<td>FPS</td>
<td>Feet Per Second</td>
</tr>
<tr>
<td>FS</td>
<td>Federal Standards</td>
</tr>
<tr>
<td>GPM</td>
<td>Gallons Per Minute</td>
</tr>
<tr>
<td>HMI</td>
<td>Hoist Manufacturers Institute</td>
</tr>
<tr>
<td>HP</td>
<td>Horsepower</td>
</tr>
<tr>
<td>HSBII</td>
<td>Hartford Steam Boiler Inspection and Insurance Co.</td>
</tr>
<tr>
<td>ID</td>
<td>Inside Diameter</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronic Engineers</td>
</tr>
<tr>
<td>IFI</td>
<td>Industrial Fasteners Institute</td>
</tr>
<tr>
<td>IPCEA</td>
<td>Insulated Power Cable Engineers Association</td>
</tr>
</tbody>
</table>
IPS  Iron Pipe Size
MGD  Million Gallons Per Day
MHI  Materials Handling Institute
MMA  Monorail Manufacturers Association
NBFU  National Board of Fire Underwriters
NBHA  National Builders’ Hardware Association
NBS  National Bureau of Standards
NCSA  National Crushed Stone Association
NCSPA  National Corrugated Steel Pipe Association
NEC  National Electrical Code
NECA  National Electrical Contractors' Association
NEMA  National Electrical Manufacturers' Association
NFPA  National Fire Protection Association
NLA  National Lime Association
NPC  National Plumbing Code
NPT  National Pipe Threads
NSC  National Safety Council
NSF  National Sanitation Foundation
OD  Outside Diameter
OSHA  U.S. Department of Labor, Occupational Safety and Health Act
PCA  Portland Cement Association
PCI  Prestressed Concrete Institute
PS  United States Products Standards
PSI  Pounds per Square Inch
PSIA  Pounds per Square Inch Absolute
PSIG  Pounds per Square Inch Gauge
RPM  Revolutions Per Minute
SAE  Society of Automotive Engineers
SDI  Steel Decks Institute
SJI  Steel Joists Institute
SMACNA  Sheet Metal and Air Conditioning Contractors' National Association
SSI  Scaffolding and Shoring Institute
SSPC  Steel Structures Painting Council
SSPC  Structural Steel Painting Council
STA  Station (100 feet)
TDH  Total Dynamic Head
TH  Total Head
UBC  Uniform Building Code
UL  Underwriter's Laboratories, Inc.
USASI or  United States of America Standards Institute
VCDoH  Volusia County Department of Health

C. Additional abbreviations and symbols are shown on the Drawings.
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01090

REFERENCE STANDARDS

PART 1 -- GENERAL

1.01 GENERAL

A. Titles of Sections and Paragraphs: Titles and subtitles accompanying specification sections and paragraphs are for convenience and reference only, and do not form a part of the Specifications.

B. Applicable Publications: Whenever in these Specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date of bid submittal shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth in the Specifications or shown on the Drawings will be waived because of any provision of, or omission from, said standards or requirements.

C. Specialists, Assignments: In certain instances, specification text requires (or implies) that specific work is to be assigned to specialists or expert entities, who must be engaged for the performance of that work. Such assignments shall be recognized as special requirements over which the CONTRACTOR has no choice or option. These requirements shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the WORK; also they are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of Contract requirements remains with the CONTRACTOR.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. The CONTRACTOR shall construct the WORK in accordance with the Drawings, Specifications and Contract Documents and the referenced portions of each referenced code, standard, and specification.

Department of Transportation. The latest edition of the codes as approved by the Municipal Code and used by the local agency as of the date that the WORK is advertised for bids, as adopted by the agency having jurisdiction, shall apply to the WORK herein, including all addenda, modifications, amendments, or other lawful changes thereto.

C. In case of conflict between codes, reference standards, drawings, and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the OWNER for clarification and directions prior to ordering or providing any materials or furnishing labor. The CONTRACTOR shall bid the most stringent requirements.

D. References herein to "OSHA Regulations for Construction" shall mean Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

E. References herein to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards, Code of Federal Regulations (OSHA), including all changes and amendments thereto.


1.03 REGULATIONS RELATED TO HAZARDOUS MATERIALS

G. The CONTRACTOR shall be responsible for all work included in the Contract Documents and shall comply with all EPA, OSHA, RCRA, NFPA, and any other Federal, State, and Local Regulations governing the storage and conveyance of hazardous materials, including petroleum products.
SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. The Contractor shall cooperate and coordinate with the Engineer to schedule and administer the preconstruction meeting, periodic progress meetings, presentations to the Utilities Commission of New Smyrna Beach, and specifically called meetings throughout the progress of the Work. The Contractor shall:
   a. Prepare agenda for meetings.
   b. Make physical arrangements for meetings.
   c. Prepare Powerpoint presentations for all Commission meetings.

2. Representatives of Contractor, subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

3. The Owner will attend meetings to ascertain that the Work is expedited consistent with Contract Documents and construction schedules.

4. The Contractor shall record the preconstruction meeting and each progress meeting in its entirety, and shall provide the Engineer with a regular cassette copy of such recording, having good quality and clarity, and a typed transcript of the minutes of the meeting. The Engineer will prepare meeting minutes.

B. Related Requirements Described Elsewhere:

1. Construction Progress Schedules: Section 01310.


3. Project Record Documents: Section 01720.

1.02 PRECONSTRUCTION MEETING

A. Engineer will schedule a preconstruction meeting no later than twenty (20) days after date of Notice to Proceed. The meeting shall be scheduled at the convenience of all parties.

B. Location: A local site, convenient for all parties, designated by the Engineer.
C. Attendance:

1. Owner's representative.
2. Engineer and his professional consultants.
3. Resident project representative.
4. Contractor and his superintendent.
5. Major subcontractors.
6. Representatives of major suppliers and manufacturers as appropriate.
7. Governmental and Utilities representatives as appropriate.
8. Others as requested by the Contractor, Owner, and Engineer.

D. The Engineer shall preside at the preconstruction meeting and shall provide for keeping minutes and distribution of minutes. The purpose of the preconstruction meeting is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established.

E. The suggested agenda for the preconstruction meeting will include but not be limited to the following:

1. Distribution and discussion of:
   a. List of major subcontractors and suppliers.
   b. Projected schedules.
   c. Schedule of Values.
2. Critical work sequencing.
3. Major equipment deliveries and priorities.
4. Project coordination: Designation and responsible personnel.
5. Procedures and processing of:
   a. Field decisions.
   b. Proposal requests.
   c. Request for Information.
   d. Submittals.
d. Change Orders.

f. Applications for Payment.

6. Submittal of Shop Drawings, project data and samples.


8. Procedures for maintaining Record Documents.

9. Use of premises:
   a. Office, work, and storage areas.
   b. Owner's requirements.
   c. Access and traffic control.

10. Construction facilities, controls, and construction aids.

11. Temporary utilities.


13. Check of required Bond and Insurance certifications.

14. Completion time for contract and liquidated damages.


16. Procedures for periodic monthly (or whatever interval is deemed appropriate or necessary, however, a minimum of monthly meetings will be required) progress meetings, for all involved.

17. Security procedures.


19. Guarantees on completed work.

20. Equipment to be used.

21. Project layout and staking of work.

22. Project inspection.

23. Labor requirements.
24. Laboratory testing of material requirements.
25. Provisions for material stored on site and monthly inventory of materials stored.
26. Requirements of other organizations such as utilities, railroads, highway departments, building departments.
27. Rights-of-way and easements.
29. Posting of signs and installation of Project Sign.
30. Pay request submittal dates.
31. Equal opportunity requirements.

1.03 PROGRESS MEETINGS

A. The Engineer shall schedule regular periodic meetings. The progress meetings will be held a minimum of once every thirty (30) days and at other times as required by the progress of the Work. The first meeting shall be held within thirty (30) days after the preconstruction meeting or thirty (30) days or less after the date of Notice to Proceed.

B. Hold called meetings as required by progress of the Work.

C. Location of the meetings: As designated by the Owner.

D. Attendance:

1. Engineer and his professional Subconsultants as needed.
2. Resident Project Representative.
3. Contractor and his Superintendent.
4. Owner's representatives.
5. Subcontractors (active on the site, as appropriate to the agenda).
6. Others as appropriate to the agenda (suppliers, manufacturers, other subcontractors, etc.).

E. The Engineer shall preside at the meetings and provide for keeping minutes and distribution of the minutes. The purpose of the meetings will be to review the progress of the Work.

F. The suggested agenda for the progress meetings will include but not be limited to the following:
1. Review approval of minutes of previous meeting.

2. Review of Work progress since previous meeting and Work scheduled (3-week look ahead schedule).

3. Field observations, problems, conflicts.

4. Problems which impede construction schedule.

5. Review of off-site fabrication, delivery schedules.

6. Corrective measures and procedures to regain projected schedule.

7. Status of Construction Schedule and revisions to the Construction Schedule as appropriate.

8. Progress schedule during succeeding work period.

9. Coordination of schedules.

10. Review status of submittals and submittal schedule, expedite as required.


12. Pending changes and substitutions.


14. Review proposed changes for:
   a. Effect on Construction Schedule and on completion date.
   b. Effect on other contracts of the Project.

15. Critical/long lead items.

16. Other business.

G. The Contractor is to attend progress meetings and is to study previous meeting minutes and current agenda items, and be prepared to discuss pertinent topics and provide specific information including but not limited to:

1. Status of all submittals and what specifically is being done to expedite them.

2. Status of all activities behind schedule and what specifically will be done to regain the schedule.
3. Status of all material deliveries, latest contact with equipment manufacturers, and specific actions taken to expedite materials.

4. Status of open deficiencies and what is being done to correct the same.

H. The Contractor is to provide a current submittal log at each progress meeting in accordance with Section 01340: Shop Drawings, Working Drawings, and Samples.

PART 2- PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01300

CONTRACTOR SUBMITTALS

PART 1 - GENERAL

1.01 GENERAL

A. Wherever submittals are required in these specifications or Drawings, all such submittals by the Contractor shall be submitted in accordance with Section 01340 – Shop Drawings, Working Drawings and Samples.

1.02 PRE-CONSTRUCTION CONFERENCE SUBMITTALS

A. Prior to the pre-construction conference referred to in Section 01010 - Summary of Work, the Contractor shall submit the following items to the Utilities Commission of New Smyrna Beach for review:

1. A list of required permits and licenses the Contractor will obtain indicating the agency required to grant the permit, the expected date of submittal for the permit, and required date for receipt of the permit.

2. An Overall Project Bar Chart in accordance with Section 01310 – Construction Progress Schedules.

3. The Contractor’s temporary field office layout (if provided) and temporary utilities plan.

4. Location of laydown areas with permission letter and/or agreement from the property owners.

5. A direct purchase materials plan including a list of materials to be purchased and required delivery dates and lead times for ordering.

6. NPDES Notice of Intent (NOI) documents.

7. All relevant insurance certificates, Performance and Payment Bonds, licenses, etc.

8. Hurricane Preparedness Plan in accordance with Section 01540.

9. Quality Control Plan in accordance with Section 01400.

10. Safety Program.


12. Project sign details
1.03 CONTRACTOR SUBMITTALS

A. An accurate updated log of submittals will be maintained by the Contractor and subject to review by the UCNSB or Engineer at each scheduled progress meeting.

1.04 MONTHLY UPDATES

A. The Contractor shall provide on a monthly basis the following in a shop drawing submittal format:

1. Monthly Schedule Updates and Revisions
2. Monthly Updates of Approved Record Drawings
3. Monthly Injury and Illness Report (including Subcontractors)
4. Monthly NPDES inspection forms and certifications
5. Lien Waivers Received
6. Potable Water Meter Readings

1.05 RECORD DRAWINGS AND FINAL SUBMITTALS

A. The Contractor shall provide Certified As-Built Drawings at Substantial Completion date and Final Submittals at Final Completion date in accordance with the Contract Documents.

1.06 OWNER'S MANUAL

A. The Contractor shall submit technical operation and maintenance information for each item of mechanical, electrical and instrumentation equipment in an organized manner in the OWNER'S MANUAL. Do not include bulk materials such as pipe, fittings or other non-operating items in the OWNER’S MANUAL. It shall be written so that it can be used and understood by the UTILITIES COMMISSION OF NEW SMYRNA BEACH’s operation and maintenance staff. Refer to Section 01730 – Operating and Maintenance Data.

1.07 RECORD DRAWINGS

A. The Contractor shall keep and maintain, at the job site, one record set of Drawings. All project conditions, locations, configurations, and any other changes or deviations which vary from the details represented on the original Drawings, including buried or concealed construction and utility features which are revealed during the course of construction shall be recorded on the Record Drawings. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Drawings. The Record Drawings shall be supplemented by any detailed sketches as necessary or directed to indicate, fully, the Work as actually constructed. These master Record Drawings are the Contractor’s
representation of as-built conditions, including all revisions made necessary by addenda, change orders, RFIs, or other changes, and shall be maintained up-to-date during the progress of the Work.

B. The Record Drawings shall show all utility mains (e.g. force main, water transmission, etc.), indicating lines, grades, materials, stationing at change in elevations, fittings, roadway intersections and at increments not more than 50 feet, paving options and materials, storm drain size and type, directional bore elevations (starting point, ending point, and intermediate elevations), and gravity sewer stub invert elevations. Elevations shall be given at all structure bottom(s), gravity sewer pipe invert(s), rim and grate elevations, bleed down holes, and high/low points of the roadway.

C. Utilities Commission of New Smyrna Beach Inspectors shall review As-Built Drawings once a month to determine that Drawings are being adequately updated. Requests for Progress payments received without this review of the Record Drawings will be returned as non-complying.

D. In the case of those drawings which depict the detail requirement for equipment to be assembled and wired in the factory, such as motor control centers and the like, the Record Drawings shall be updated indicating any portions which are superseded by change order drawings or final shop drawings including appropriate reference information describing the change orders by number and the shop drawings by manufacturer, drawing, and revision numbers.

E. The Contractor’s Record Drawings shall be accessible to the Utilities Commission of New Smyrna Beach and Engineer at all times during the construction period.

F. Prior to and as a requirement of Substantial Completion of the Work, the Contractor shall prepare and deliver a complete set of the Contractor’s certified Record Drawings marked in red to the Utilities Commission of New Smyrna Beach. This information, submitted by the Contractor, shall be incorporated by the Engineer into the Record Drawings, will be assumed to be correct, and the Contractor shall be responsible for the accuracy of such information, and for any errors or omissions which may appear on the Record Drawings as a result of the Contractor’s information.

G. After the Engineer has incorporated the Contractor’s record information, the Utilities Commission of New Smyrna Beach and Contractor shall review the incorporated information and confirm in writing that the Record Drawings include the information as provided. Final payment will not be made until the Contractor has confirmed in writing the Engineer’s Record Drawings are accurate and the Record Drawings have been delivered to the Utilities Commission of New Smyrna Beach.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION
SECTION 01310
CONSTRUCTION PROGRESS SCHEDULES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Promptly after award of the Contract, prepare and submit to the Engineer estimated construction progress schedules demonstrating complete fulfillment of all Contract requirements utilizing a Critical Path Method (hereinafter referred to as CPM) in planning, coordinating, and performing the Work under this Contract (including all activities of subcontractors, equipment vendors, and suppliers). The principles and definition of CPM terms used herein shall be as set forth in the Associated General Contractors of America (AGC) publication, The Use of CPM in Construction, A Manual for General Contractors and the Construction Industry, Copyright 1976, but the provisions of this Specification shall govern the planning, coordinating, and performance of the Work.

2. Submit revised progress schedules on a monthly basis. No partial payments shall be approved until there is an updated construction progress schedule on hand.

B. Related Requirements Described Elsewhere:


2. Applications for Payment: Section 00844.


4. Project Meetings: Section 01200.


6. Schedule of Values: Section 01370.

1.02 QUALIFICATIONS

A. A statement of computerized CPM capability shall be submitted in writing prior to the award of the Contract and shall verify that either Contractor’s organization has in-house capability to use the CPM technique or that Contractor will employ a CPM consultant who is so qualified.
B. In-house capability shall be verified by description of construction projects to which Contractor or Contractor's consultant has successfully applied computerized CPM and shall include at least two (2) projects valued at least half the expected value of this project.

1.03 FORM OF SCHEDULES

A. Prepare schedules in the form of a horizontal bar chart.

1. Provide a separate horizontal bar for each trade or operation within each structure or item.

2. Horizontal time scale:
   a. Show starting and completion dates for each activity in terms of the number of days after Notice to Proceed. All completion dates shown shall be within the period specified for contract completion.
   b. Identify the first work day of each month.

3. Scale and Spacing: Sufficient to allow space for notations and future revisions.


B. Format of Listings: The chronological order of the start of each item of work for each structure.

C. Identification of Listings: By major specification section numbers as applicable and by structure.

D. Construction Progress Schedules shall be computer generated using software equal to Primavera Project Planner for Windows by Primavera Systems, Inc., Bala Cynwyd, P.A., or approved equal.

1.04 CONTENT OF SCHEDULES

A. Construction Progress Schedule:

1. Show the complete sequence of construction by activity and by structure.

2. Show the dates for the beginning and completion of each major element of construction in no more than a two (2) week increment scale. Specifically list, but do not limit to:
   a. Shop Drawing Schedule.
   b. Installation of temporary facilities.
   c. Site clearing.
d. Site utilities.

e. Demolition.

f. Foundation work.

g. Structural framing.

h. Subcontractor work.

i. Equipment installations.

j. Finishings.

k. Instrumentation.

l. Electrical.

m. Painting.

n. Operator training and receipt of operation and maintenance manuals.

o. Equipment testing.

p. Equipment and process start-up.

q. Receipt of spare parts.

r. Project closeout.

3. Show projected percentage of completion for each item, as of the first day of each month.

4. Show projected dollar cash flow requirements for each month of construction and for each activity as indicated by the approved Schedule of Values.

B. Submittals for construction progress schedules shall be in accordance with Section 01340: Shop Drawings, Work Drawings, and Samples. Indicate on the schedule the following:

1. The dates for Contractor's submittals.

2. The dates submittals will be required for Owner-furnished products, if applicable.

3. The dates approved submittals will be required from the Engineer.
C. A typewritten list of all long lead items (equipment, materials, etc.).

D. Failure to include any element of work required for the performance of this Contract shall not excuse the Contractor from completing all work required within any applicable completion date.

E. Scheduling Constraints: The work within Owner's property must be completed within the maximum number of days start to finish, as indicated in the Contract. Additionally, work must proceed on a continuous basis, without stoppages, except for nights and weekends. There shall be no lapses between phases of construction.

1.05 PROGRESS REVISIONS

A. Indicate progress of each activity to date of submission.

B. Show changes occurring since previous submission of schedule:
   1. Major changes in scope.
   2. Activities modified since previous submission.
   3. Revised projections of progress and completion.
   4. Other identifiable changes.

C. Provide a narrative report as needed to define:
   1. Problem areas, anticipated delays, and the impact on the schedule.
   2. Corrective action recommended, and its effect.
   3. The effect of changes on schedules of other prime contractors.

D. If the Work falls behind the critical path schedule by two (2) weeks or more, the Contractor shall prepare a recovery schedule.

1.06 SUBMISSIONS

A. Submittal Requirements.
   1. Logic network and/or time-phased bar chart, computer generated.
2. Computerized network analysis:
   a. Sort by early start
   b. Sort by float
   c. Sort by predecessor/successor

3. Narrative description of the logic and reasoning of the schedule.

B. Time of Submittals: Within ten (10) working days after Notice to Proceed, Contractor shall submit a network diagram describing the activities to be accomplished in the project and their dependency relationships, (predecessor/successor) as well as a tabulated schedule as herein defined. The total length of time indicated on the initial CPM schedule shall equal the exact number of days as defined in the Contract. The schedule produced and submitted shall also indicate calendar dates, including project starting and completion dates, based on the Contract Commencement and completion dates indicated in the Notice to Proceed. The Engineer will complete the review of the complete schedule within fifteen (15) working days after receipt. During the review process, the Engineer may meet with a representative of Contractor to review the proposed plan and schedule to discuss any clarifications that may be necessary.

C. Within ten (10) working days after the conclusion of the Engineer's review period, Contractor shall revise the network diagram as required and resubmit the network diagram and a tabulated schedule produced therefrom. The revised network diagram and tabulated schedule shall be reviewed and accepted or rejected by the Engineer within fifteen (15) working days after receipt. The network diagram and tabulated schedule, when accepted by the Engineer, shall constitute the project work schedule unless a revised schedule is required due to substantial changes in the Work, a change in Contract Time or a recovery schedule is required and requested.

D. Acceptance. The finalized schedule will be acceptable to the Engineer when, in the opinion of the Engineer, it demonstrates an orderly progression of the Work to completion in accordance with the Contract Documents. Such acceptance will neither impose on the Engineer responsibility for the progress or scheduling of the Work nor relieve Contractor from full responsibility therefore. The finalized schedule of shop drawing submittals will be acceptable to the Engineer when, in the opinion of the Engineer, it demonstrates a workable arrangement for processing the submittals in accordance with the requirements. The finalized Schedule of Values (lump sum price breakdown), as applicable, will be acceptable to the Engineer as to form and content when, in the opinion of the Engineer, it demonstrates a substantial basis for equitably distributing the Contract Price. When the network diagram and tabulated schedule have been accepted, the Contractor shall submit to the Engineer six (6) copies of the time-scaled network diagram, six (6) copies of a computerized tabulated schedule in which the activities have been sequenced by numbers, six (6) copies of a computerized tabulated schedule in which the activities have been sequenced by early starting date, and six (6) copies of a computerized, tabulated schedule in which activities have been sequenced by total float, and six (6) copies sorted by predecessor/successor.
E. Revised Work Schedules. Contractor, if requested by the Engineer, shall provide a revised work schedule if, at any time, the Engineer considers the completion date to be in jeopardy because of "activities behind schedule." The revised work schedule shall include a new diagram and tabulated schedule conforming to the requirements of Paragraph 1.09 herein, designed to show how Contractor intends to accomplish the Work to meet the completion date. The form and method employed by Contractor shall be the same as for the original work schedule. No payment will be made if activities fall more than two (2) weeks behind schedule and a revised work schedule is not furnished.

F. Schedule Revisions. The Engineer may require Contractor to modify any portions of the work schedule that become infeasible because of "activities behind schedule" or for any other valid reason. An activity that cannot be completed by its original latest completion date shall be deemed to be behind schedule. No change may be made to the sequence, duration, or relationships of any activity without approval of the Engineer.

1.07 DISTRIBUTION

A. Distribute copies of the reviewed schedules to:

1. Engineer.
3. Subcontractors.
4. Other concerned parties.
5. Owner (two copies).

B. Instruct recipients to report promptly to the Contractor, in writing, any problems anticipated by the projections shown in the schedules.

1.08 CHANGE ORDERS

A. Upon approval of a change order, the approved changes shall be reflected in the next scheduled revision or update submittal of the construction progress schedule by the Contractor.
1.09 CPM STANDARDS

A. CPM, as required by this Section, shall be interpreted to be generally as outlined in the Associated General Contractor’s (AGC) publication, The Use of CPM in Construction, A Manual for General Contractors and the Construction Industry, Copyright 1976.

B. Work schedules shall include a graphic network and computerized, tabulated schedules as described below. To be acceptable the schedule must demonstrate the following:

1. A logical succession of work from start to finish.

2. Definition of each activity. Activities shall be identified by major specification section numbers, as applicable, and by major structure.

3. A logical flow of work crews/equipment (crews are to be defined by manpower category and man-hours; equipment by type and hours).

4. Show all work activities and interfaces including submittals as well as major material and equipment deliveries.

C. Networks.

1. The CPM network, or diagram, shall be in the form of a time-scaled diagram of the customary activity-on-type and may be divided into a number of separate pages with suitable notation relating the interface points among the pages. Notation on each activity line shall include a brief work description and a duration, as described in Paragraph 1.09, D. herein.

2. All construction activities and procurement shall be indicated in a time-scaled format, and a calendar shall be shown on all sheets along the entire sheet length. Each activity arrow shall be plotted so the beginning and completion dates of said activity can be determined graphically by comparison with the calendar scale. All activities shall be shown using the symbols that clearly distinguish between critical path activities, non-critical path activities, and float for each non-critical activity. All non-critical path activities shall show estimated performances time and float time in scaled form.

D. The duration indicated for each activity shall be in calendar days and shall represent the single best time considering the scope of the work and resources planned for the activity including time for inclement weather. Except for certain non-labor activities, such as curing concrete or delivering materials, activity durations shall not exceed fourteen (14) days nor be less than one (1) day unless otherwise accepted by the Engineer.
E. Tabulated Schedules. The initial schedule shall include the following minimum data for each activity.

1. Activity Beginning and Ending Numbers (i-j numbers) (single activity numbers may be used).
2. Duration.
3. Activity Description.
4. Early Start Date (Calendar Dated).
5. Late Start Date (Calendar Dated).
6. Early Finish Date (Calendar Dated).
7. Late Finish Date (Calendar Dated).
8. Identified Critical Path.
9. Total Float (Note: No activity may show more than 20 days float).
10. Cost of Activity.
11. Equipment Hours, by type; Man-Power Hours, by crew or trade.

F. Project Information. Each tabulation shall be prefaced with the following summary data.

1. Project Name.
2. Contractor.
3. Type of Tabulation (Initial or Updated).
4. Project Duration.
5. Project Scheduled Completion Date.
6. Effective or Starting Date of the Schedule.
7. New Project Completion Date and Project Status (if an updated or revised schedule).
8. Actual Start Date and Actual Finish Date (for all updated schedules.)
1.10 SCHEDULE MONITORING

A. At not less than monthly intervals or when specifically requested by Engineer, Contractor shall submit to the Engineer a computer printout of an updated schedule for those activities that remain to be completed. Typically, the updated schedule will be submitted with the application for payment as specified below.

B. The updated schedule shall be submitted in the form, sequence, and number of copies requested for the initial schedule.

1.11 PROGRESS MEETINGS

A. For the monthly progress meeting, Contractor shall submit a revised CPM schedule and a three-week look-ahead schedule, showing all activities completed, in progress, uncompleted, or scheduled to be worked during the weeks. The three weeks include the current week plus the next two weeks. All activities shall be from the approved CPM and must be as shown on the CPM unless behind or ahead of schedule. One copy of the revised CPM schedule shall be submitted with each copy of that month's application for payment, six (6) copies minimum.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01340

SHOP DRAWINGS, WORKING DRAWINGS, AND SAMPLES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. The Contractor shall submit to the Engineer for review and approval, such Shop Drawings, Test Reports, and Product Data on materials and equipment (hereinafter in this Section called Data), and material samples (hereinafter in this Section called Samples) as are required for the proper control of work, including but not limited to those Shop Drawings, Data, and Samples for materials and equipment specified elsewhere in the Specifications and in the Drawings.

2. Within fourteen (14) calendar days after the Effective Date of the Agreement, the Contractor shall submit to the Engineer a complete list of preliminary data on items for which Shop Drawings are to be submitted. Included in this list shall be the names of all proposed manufacturers furnishing specified items. Review of this list by the Engineer shall in no way expressed or implied relieve the Contractor from submitting complete Shop Drawings and providing materials, equipment, etc., fully in accordance with the Contract Documents. This procedure is required in order to expedite final review of Shop Drawings.

3. The Contractor is to maintain an accurate updated submittal log and will bring this log to each scheduled progress meeting with the Owner and the Engineer. This log should include the following items:

   a. Submittal description and number assigned.

   b. Date to Engineer.

   c. Date returned to Contractor (from Engineer).

   d. Status of submittal (Approved, Approved as Noted, Amend and Resubmit, and Rejected).

   e. Date of resubmittal and return (as applicable).

   f. Date material release (for fabrication).

   g. Projected date of fabrication.

   h. Projected date of delivery to site.
i. Status of O&M manuals submittal.

j. Specification Section.

k. Drawings sheet number.

B. Related Requirements Described Elsewhere:

1. Construction Progress Schedules: Section 01310.

2. Products, Materials, Equipment and Submittals: Section 01600.

3. Project Record Documents: Section 01720.

4. Operating and Maintenance Data: Section 01730.

1.02 CONTRACTOR'S RESPONSIBILITY

A. It is the responsibility of the Contractor to check all drawings, data and samples prepared before submitting them to the Engineer for review. Each and every copy of the Drawings and data shall bear the 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. Shop drawings shall indicate any deviations in the submittal from requirements of the Contract Documents. If the Contractor takes exception to the specifications, the Contractor shall note the exception in the letter of transmittal to the Engineer.

B. Determine and verify:

1. Field measurements.

2. Field construction criteria

3. Catalog numbers and similar data.

4. Conformance with Specifications.

C. The Contractor shall furnish the Engineer a schedule of Shop Drawing submittals fixing the respective dates for the submission of shop and working drawings, the beginning and ending of manufacture, testing, and installation of materials, supplies, and equipment. This schedule shall indicate those that are critical to the progress schedule.

D. The Contractor shall not begin any of the work covered by a Shop Drawing, Data, or a Sample returned for correction until a revision or correction thereof has been reviewed and returned to him, by the Engineer, with approval.
E. The Contractor shall submit to the Engineer all drawings and schedules sufficiently in advance of construction requirements to provide no less than thirty (30) calendar days for checking and appropriate action from the time the Engineer receives them.

F. All submittals shall be accompanied with a transmittal letter prepared in duplicate containing the following information:

1. Date.

2. Project Title and Number.

3. Contractor's name and address.

4. The number of each Shop Drawings, Project Data, and Sample submitted.

   a. The Contractor shall indicate in bold type at the top of the cover sheet of submittal of shop drawing if there is a deviation from the Drawings, Specifications, or referenced specifications or codes.
   b. The Contractor shall also list any deviations from the Drawings, Specifications, or referenced specifications or codes and identify in green ink prominently on the applicable Shop Drawings.

6. Submittal Log Number conforming to Specification Section Number.

G. The Contractor shall submit all descriptive or product data information and Shop Drawings to the Owner and Engineer in electronic PDF format via e-mail. The Engineer will review the submittal with the Owner and return to Contractor with appropriate review comments.

H. The Contractor shall be responsible for and bear all costs of damages which may result from the ordering of any material or from proceeding with any part of Work prior to the completion of the review by the Engineer of the necessary Shop Drawings.

I. The Contractor shall be fully responsible for observing the need for and making any changes in the arrangement of piping, connections, wiring, manner of installation, etc., which may be required by the materials/equipment he proposes to supply both as pertains to his own work and any work affected under other parts, headings, or divisions of the Drawings and Specifications.

J. The Contractor shall not use Shop Drawings as a means of proposing alternate items to demonstrate compliance with the Drawings and Specifications.

K. Each submittal will bear a stamp indicating that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and
approval of that submittal. The Contractor stamp shall be similar to the sample given below.

| (OWNER'S NAME) |
| (PROJECT NAME) |
| (PROJECT NUMBER) |
| SHOP DRAWING NO.: ____________________________ |
| SPECIFICATION SECTION: ______________________ DRAWING NO.______ |

WITH RESPECT TO THIS SHOP DRAWING OR SAMPLE, I HAVE DETERMINED AND VERIFIED ALL QUANTITIES, DIMENSIONS, SPECIFIED PERFORMANCE CRITERIA, INSTALLATION REQUIREMENTS, MATERIALS, CATALOG NUMBERS, AND SIMILAR DATA WITH RESPECT THERETO AND REVIEWED OR COORDINATED THIS SHOP DRAWING OR SAMPLE WITH OTHER SHOP DRAWINGS AND SAMPLES AND WITH THE REQUIREMENTS OF THE WORK AND THE CONTRACT DOCUMENTS.

_______ NO VARIATION FROM CONTRACT DOCUMENTS

_______ VARIATION FROM CONTRACT DOCUMENTS AS SHOWN

| (CONTRACTOR'S NAME) |
| (CONTRACTOR'S ADDRESS) |
| BY: _______________________________ DATE: ________ |
| AUTHORIZED SIGNATURE |

L. Drawings and schedules shall be checked and coordinated with the work of all trades and sub-contractors involved, before they are submitted for review by the Engineer and shall bear the Contractor's stamp of approval as evidence of such checking and coordination. Drawings or schedules submitted without this stamp of approval shall be returned to the Contractor for resubmission.

1.03 ENGINEER'S REVIEW OF SHOP DRAWINGS

A. The Engineer's review of Shop Drawings, Data, and Samples as submitted by the Contractor will be to determine if the item(s) generally conforms to the information in the Contract Documents and is compatible with the design concept. The Engineer's review and exceptions, if any, will not constitute an approval of dimensions, connections, quantities, and details of the material, equipment, device, or item shown.

B. The review of drawings and schedules will be general, and shall not be construed:

1. As permitting any departure from the Contract Documents.

2. As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials.

3. As approving departures from details furnished by the Engineer, except as otherwise provided herein.
C. If the drawings or schedules as submitted describe variations and show a departure from the Contract Documents which the Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or contract time, the Engineer may return the reviewed drawings without noting an exception.

D. "Approved As Noted" - Contractor shall incorporate Engineer's comments into the submittal before release to manufacturer. The Contractor shall send a letter to the Engineer acknowledging the comments and their incorporation into the Shop Drawing.

E. "Amend And Resubmit" - Contractor shall resubmit the Shop Drawing to the Engineer. The resubmittal shall incorporate the Engineer's comments highlighted on the Shop Drawing.

F. "Rejected" - Contractor shall correct, revise and resubmit Shop Drawing for review by Engineer.

G. Resubmittals will be handled in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than the corrections requested by the Engineer on previous submissions. The Contractor shall make any corrections required by the Engineer.

H. If the Contractor considers any correction indicated on the drawings to constitute a change to the Drawings or Specifications, the Contractor shall give written notice thereof to the Engineer.

I. When the Shop Drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

J. No partial submittals will be reviewed. Submittals not deemed complete will be stamped "Rejected" and returned to the Contractor for resubmittal. Unless otherwise specifically permitted by the Engineer, make all submittals in groups containing all associated items for:

2. Processes.
3. As indicated in specific Specifications Sections.

All drawings, schematics, manufacturer's product data, certifications, and other Shop Drawing submittals required by a system specification shall be submitted at one time as a package to facilitate interface checking.

K. Only the Engineer shall utilize the color "red" in marking Shop Drawing submittals.

L. Shop drawing and submittal data shall be reviewed by the Engineer for each original submittal and first resubmittal; thereafter review time for subsequent resubmittals shall
be charged to the Contractor and the Contractor shall reimburse the Owner for services rendered by the Engineer as specified in the Supplementary Conditions.

1.04 SHOP DRAWINGS

A. When used in the Contract Documents, the term "Shop Drawing" shall be considered to mean Contractor's plans for materials and equipment which become an integral part of the Project. Shop Drawings shall be complete and detailed and shall consist of fabrication, erection, setting and schedule drawings, manufacturer's scale drawings, and wiring and control diagrams. Catalogs cuts, catalogs, pamphlets, descriptive literature, and performance and test data shall be considered only as supportive information to required Shop Drawings as defined above. As used herein, the term "manufactured" applies to standard units usually mass-produced; and "fabricated" means items specifically assembled or made out of selected materials to meet individual design requirements.

B. Manufacturer's catalog sheets, brochures, diagrams, illustrations, and other standard descriptive data shall be clearly marked to identify pertinent materials, products, or models. Delete information which is not applicable to the Work by striking or cross-hatching.

C. Each Shop Drawing shall be submitted with a cover sheet which shall include a title block for the submittal, refer to Section 00847 – Shop Drawing Submittal Form. The title block/cover sheet shall display the following:

1. Project Title and Number.
2. Name of project building or structure.
3. Number and title of the Shop Drawing.
4. Date of Shop Drawing or revision.
5. Name of Contractor and subcontractor submitting drawing.
6. Supplier/manufacturer.
7. Separate detailer when pertinent.
8. Specification title and Section number.
9. Applicable Drawing number.

D. Data on materials and equipment shall include, without limitation, materials and equipment lists, catalog data sheets, catalog cuts, performance curves, diagrams, verification of conformance with applicable standards or codes, materials of construction, and similar descriptive material. Materials and equipment lists shall give,
for each item thereon, the name and location of the supplier or manufacturer, trade name, catalog reference, size, finish, and all other pertinent Data.

E. For all mechanical and electrical equipment furnished, the Contractor shall provide a list including the equipment name, and address, and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained.

F. If drawings show variations from Contract requirements because of standard shop practice or for other reasons, the Contractor shall describe such variations in his letter of transmittal. If acceptable, proper adjustment in the Contract shall be implemented where appropriate. If the Contractor fails to describe such variations, he shall not be relieved of the responsibility for executing the Work in accordance with the Contract, even though such drawings have been reviewed.

G. All manufacturers or equipment suppliers who propose to furnish equipment or products shall submit an installation list to the Engineer along with the required shop drawings. The installation list shall include at least five (5) installations where identical equipment has been installed and has been in operation for a period of at least two (2) years unless specified otherwise in the Specification Section applicable.

1.05 WORKING DRAWINGS

A. When used in the Contract Documents, the term "Working Drawings" shall be considered to mean the Contractor's plan for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities, ground water control systems, forming and falsework for underpinning, 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 as noted in paragraph 1.05 A. above, shall be submitted to the Engineer where required by the Contract Documents or requested by the Engineer, and shall be submitted at least thirty (30) calendar days (unless otherwise specified elsewhere) in advance of their being required for the 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, calculations or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use. Prior to commencing such work, working drawings must have been reviewed without specific exceptions by the Engineer, which review will be for general conformance and will not relieve the Contractor in any way from his responsibility with regard to the fulfillment of the terms of the Contract. All risks to new or existing work are assumed by the Contractor; the Owner and Engineer shall have no responsibility therefor.
1.06 SAMPLES

A. The Contractor shall furnish, for the approval of the Engineer, samples required by the Contract Documents or requested by the Engineer. Samples shall be delivered to the Engineer as specified or directed. The Contractor shall prepay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in the Work until approved by the Engineer.

B. Samples shall be of sufficient size and quantity to clearly illustrate:

1. Functional characteristics of the product, with integrally related parts and attachment devices.

2. Full range of color, texture, and pattern.

3. A minimum of three (3) samples of each item shall be submitted.

C. Each sample shall have a label indicating:

1. Name of Project.

2. Name of Contractor and subcontractor.

3. Material or equipment represented.

4. Place of origin.

5. Name of producer/supplier and brand (if any).

6. Location in Project.

7. Submittal and specification numbers.

(Samples of finished materials shall have additional marking that will identify them under the finished schedules.)

D. The Contractor shall prepare a transmittal letter and a description sheet for each shipment of samples. The description sheet shall contain the information required in Paragraphs 1.06B and C above. He shall enclose a copy of the letter and description sheet with the shipment and send a copy of the letter and description sheet to the Engineer. Approval of a sample shall be only for the characteristics or use named in such approval and shall not be construed to change or modify any Contract requirements.

E. Approved samples not destroyed in testing shall be sent to the Engineer or stored at the site of the Work. Approved Samples of the hardware in good condition will be marked for identification and may be used in the Work. Materials and equipment incorporated in the Work shall match the approved Samples. Samples which failed testing or were
not approved will be returned to the Contractor at his expense, if so requested at time of submission.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01370

SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Submit to the Engineer a Schedule of Values allocated to the various lump sum portions of the Work, at the Pre-Construction Conference, and as otherwise specified or requested to be submitted earlier as evidence of the Apparent Low Bidder's qualifications.

2. Upon request of the Engineer support the values with data which will substantiate their correctness. The data shall include, but not be limited to quantity of materials, all sub-elements of the activity, and their units of measure.

3. The Schedule of Values shall establish the actual value for each activity of the Work to be completed taken from the Critical Path Method (CPM) Construction Schedule, and shall be used as the basis for the Contractor's Applications for Payment.

B. Related Requirements Described Elsewhere:


1.02 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Type schedule on 8-1/2 inch x 11 inch white paper. Contractor's standard forms and computer printouts may be considered for approval by the Engineer upon Contractor's request. Identify schedule with:

1. Title of project and location.

2. Owner and purchase order number.

3. Engineer and project number.

4. Name and address of Contractor.


6. Date of submission.
B. Schedule shall list the installed value of the component parts of the Work in sufficient detail to serve as a basis for computing item prices for progress payments during construction.

C. Identify each line item with the number and the title of the respective section of the Specifications.

D. For each major item of the Work, list sub-values of major products or operations under the major item.

E. For the various portions of the Work:
   1. The amount for each item shall reflect a total installed cost including a directly proportional amount of the Contractor's overhead and profit.
   2. For items on which progress payments will be requested for stored materials, break down the value into:
      a. The cost of the materials, delivered and unloaded, with taxes paid. Paid invoices are required for materials. Payment for materials shall be limited to the invoiced amount only. Payment for stored materials shall only include the bid items listed on the Materials Stored on Site Form included in the Construction Bid Body.
      b. The total installed value.

F. Round off figures to nearest dollar amount.

G. The sum of the costs of all items listed in the schedule shall equal the total Contract Price.

H. For each item which has an installed value of more than $15,000, provide a breakdown of costs to list major products or operations under each item.

1.03 SUBSCHEDULE OF UNIT MATERIAL VALUES

A. Submit a separate schedule of unit prices for materials to be stored on site and for those materials incorporated into the Work for which progress payments will be requested.

B. The unit values for the materials shall be broken down into:
   1. Cost of the material, delivered and unloaded at the site, with taxes paid.
   2. Copies of paid invoices for component material shall be included with the payment request in which the material first appears.
C. Only materials unique to the project may be billed when stored on site. Materials of standard use such as conduit, wire, small-diameter pipe, steel, etc., shall not be accepted for payment.

D. The installed unit value multiplied by the quantity listed shall equal the cost of that item in the Schedule of Values.

1.04 REVIEW AND RESUBMITTAL

A. After review by Engineer, revise and resubmit Schedule of Values and Schedule of Unit Material Values as required.

B. Resubmit revised schedules in same manner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01380
COLOR AUDIO VIDEO TAPING OF CONSTRUCTION AREA

PART 1 - GENERAL

1.01 DESCRIPTION

A. Prior to beginning any construction, the Contractor shall prepare a color audio video tape of all the areas to be affected by construction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PREPARATION

A. The audio video taping shall be done within the two-week period prior to placement of materials or equipment on the construction area and furnished one week prior to the start of construction.

3.01 PERFORMANCE

A. To preclude the possibility of tampering or editing in any manner, all video recordings must, by electronic means, display continuously and simultaneously on the screen digital information to include the date and time of recording. The time information shall consist of hours, minutes, and seconds, separated by colons (i.e., 10:35:18).

B. The audio video tape shall consist of one video and one audio track which must be recorded simultaneously. All tracks shall consist of original live recordings and thus shall not be copies of other audio and video recordings. The audio track shall contain the narrative commentary.

C. Taped coverage shall include all surface features located within the zone of influence of construction supported by appropriate audio description. Audio description shall be made simultaneously with video coverage. Such coverage shall include, but not be limited to all existing driveways, sidewalks, curbs, ditches, roadways, landscaping, trees, culverts, head walls and retaining walls, or buildings located within such zone of influence.

D. Houses and buildings shall be identified visually by house number, when visible, in such a manner that structures of the proposed system, i.e., manholes on a sewer system, and hydrants on a water system can be located by reference. In all instances, however, locations shall be identified by audio or visual means at intervals not to exceed 100 lineal feet in the general direction of travel.
E. The rate of speed in the general direction of travel of the conveyance used during taping shall not exceed 48 feet per minute. Panning rates and zoom-in, zoom-out rates shall be controlled sufficiently such that playback will produce clarity of the object viewed.

F. All taping shall be done during times of good visibility. No taping shall be done during period of visible precipitation, unless otherwise authorized by the Engineer.

G. The Owner shall have the authority to designate what areas may be omitted or added for audio video coverage.

H. When conventional wheeled vehicles are used, the distance from the camera lens to the ground shall not be less than eight feet (8’) to insure proper perspective.

I. In some instances, audio video tape coverage will be required in areas not accessible by conventional wheeled vehicles. Such coverage shall be obtained by walking or special conveyance by the Engineer.

END OF SECTION
PART 1 - GENERAL

1.01 DEFINITION

A. Specific quality control requirements for the Work are indicated throughout the Specifications and Drawings. The requirements of this Section are primarily related to performance of the Work beyond furnishing of manufactured products. The term "Quality Control" includes inspection, sampling and testing, and associated requirements performed by the Contractor. Quality Assurance refers to similar inspection and testing performed by the Utilities Commission of New Smyrna Beach to verify the quality control process.

1.02 SAMPLING AND TESTING

A. Unless otherwise indicated, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered.

B. The Utilities Commission of New Smyrna Beach reserves the right to make independent investigations and tests, and failure of any portion of the Work to meet any of the requirements of the Drawings or Specification, shall be reasonable cause for the Utilities Commission of New Smyrna Beach to require the removal or correction and reconstruction of any such work in accordance with the Contract Agreement.

1.03 INSPECTION AND TESTING LABORATORY SERVICE

A. Inspection and testing laboratory service shall comply with the following:

1. Contractor to perform inspection and testing.

2. The Contractor will perform inspections, testing, and other services specified in individual specification sections.

3. Reports from the testing laboratory will be provided to the Utilities Commission of New Smyrna Beach in support of NON-COMPLIANCE NOTICES (NCN).

4. All quality control data, test results and records will be submitted to the Utilities Commission of New Smyrna Beach as a part of the Project Closeout.

1.04 CONTRACTOR SUBMITTALS

A. Contractor shall submit a Quality Control Plan. Submittals shall be in accordance with Section 01300 – Contractor Submittals.
PART 3 - EXECUTION

3.01 Inspection: The Contractor shall inspect materials or equipment upon the arrival on the job site and immediately prior to installation and reject damaged and defective items.

3.02 Measurements: The Contractor shall verify measurements and dimensions of the Work as an integral step of starting each installation.

3.03 Manufacturer's Instructions: Where installations include manufactured products, the Contractor shall comply with manufacturer's applicable instructions and recommendations for installation to whatever extent these are more explicit or more stringent than applicable requirements indicated in Drawings and Specifications.

3.04 Specialist Support: QA/QC Testing provided by Contractor is as follows:

A. Miscellaneous QA/QC testing not specified below as ordered by Contractor.

B. Backfill Compaction Tests: Density tests at random intervals above pipe shall confirm compaction to the specified density as indicated in the Drawings. One compaction test location shall be required for each 300 linear feet of pipe and for every 100 square feet of backfill around structures as a minimum. A minimum of one gravity sewer compaction tests will occur between manholes. The locations of the compaction tests within the trench shall be in conformance with the following schedule:

1. One test at the spring line of the pipe unless bedding material is provided to the spring line
2. One test at an elevation of one foot above the top of the pipe
3. One test for each 2 feet of backfill placed from one foot above the top of the pipe to finished grade elevation
4. At least two test locations are required for each trench crossing existing pavement.
5. One test for each 100 SF of filled area every 2 feet of backfill placed at structures from two feet above the structure to finished grade (i.e. wetwells, inlets, and manholes).

C. LBR / Moisture: Limerock Bearing Ratio and moisture/density relationship reports to be conducted on samples, as required for FDOT, to establish proctor and LBRs.

D. Roadway Subgrade: Density tests within stabilized subgrade to confirm 98% compaction achieved for local roads (95% when proofrolled). Tests to occur at approximately 300ft intervals.
E. Roadway Base: Density tests within the base to confirm 98% compaction achieved. Tests to occur at approximately 300ft intervals.

F. Asphaltic Concrete: Asphalt extractions to confirm conformance to asphalt concrete mix design.

G. Asphaltic Concrete: Pavement thickness and density testing to be conducted as required to confirm specified paving thickness and compaction has been achieved.

H. Asphaltic Concrete: Contractor shall utilize a 20-foot wide screed for all asphalt paving.

I. Concrete Testing: Concrete compressive strength testing to be conducted at random driveway and sidewalk concrete or other placed concrete, as required by Utilities Commission of New Smyrna Beach.

J. Non-conformities to be identified to Contractor by Utilities Commission of New Smyrna Beach in writing.

K. Unsuitable fill and over excavation limits.

3.05 CONTRACTOR QA/QC TESTING

Contractor shall provide any QA/QC testing not outlined in Paragraph 3.4 above as necessary to complete the Work in accordance with the Contract Documents.

END OF SECTION
SECTION 01505
MOBILIZATION

PART 1 -- GENERAL

1.01 GENERAL

A. Mobilization shall include the obtaining of all permits; moving onto the site of all necessary equipment; furnishing and erecting temporary buildings and other construction facilities; and implementing security requirements; all as required for the proper performance and completion of the Work. Mobilization shall include the following principal items:

1. Mobilize to the site of all Contractor's equipment, personnel, supplies, and incidentals required for first month's operations.

2. Project sign in accordance with Section 01580.

3. On-site sanitary facilities, safety equipment, and first aid supplies.

4. Arrange for Work and storage yard in accordance with Section 01550.

5. Mobilize full-time superintendent to the job site.

6. Detailed approved schedule in accordance with Section 01310.

7. Required submittals which allow the Contractor to commence Work.

8. All required permits, insurance, bonds and licenses to commence Work.

9. Post all OSHA, MSDS, and NPDES required notices.

10. Submittal of the affidavit of findings of the survey of gopher tortoise nests and a plan for meeting the requirements if the nests are present.


PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

END OF SECTION
SECTION 01510
TEMPORARY UTILITIES

PART 1 -- GENERAL

1.01 GENERAL REQUIREMENTS

A. The Contractor shall be responsible for providing all temporary utilities for temporary facilities required for the completion of the Work.

B. Types: The types of utility services that may be required for general temporary use at the project site and/or the field office include the following:

   Water service (potable for certain uses)
   Sanitary sewer
   Electric power service
   Telephone service

1.02 JOB CONDITIONS

A. Scheduled Uses: The Contractor shall, in conjunction with establishment of job progress schedule, establish a schedule for implementation and termination of service for each temporary facility; and when acceptable to the Utilities Commission of New Smyrna Beach to change over from use of temporary utility service to permanent service.

PART 2 -- PRODUCTS

2.01 MATERIALS

A. The Contractor shall provide either new or used materials and equipment, which are in substantially undamaged condition and without significant deterioration and which are recognized in the construction industry, by compliance with appropriate standards, as being suitable for intended use in each case. Where the utility company provides a portion of temporary utility, the Contractor shall provide remainder with matching and compatible materials and equipment and comply with recommendations of utility company.

PART 3 -- EXECUTION

3.01 INSTALLATION OF TEMPORARY UTILITY SERVICES

A. General: The Contractor shall engage the utility company, to install temporary service to the project, locate services where they will not interfere with project construction work, including installation of permanent utility services; and maintain temporary services as installed for required period of use; and relocate, modify or extend as necessary from time
to time during that period as required to accommodate project construction work.

B. Approval of Electrical Connections: All temporary connections for electricity shall be subject to approval of the power company representative and the Utilities Commission of New Smyrna Beach, and shall be removed at the Contractor's expense prior to final acceptance of the Work.

C. Construction Wiring: All wiring for temporary electric light and power shall be properly installed and maintained and shall be securely fastened in place. All electrical facilities shall conform to the requirements of Subpart K of the OSHA Regulations for Construction, and local electric codes.

3.02 INSTALLATION OF POWER DISTRIBUTION SYSTEM

A. Power: The Contractor shall provide all necessary power required for its operations under the Contract Agreement, and shall provide and maintain all temporary power lines required to perform the Work in a safe and satisfactory manner.

B. Temporary Power Distribution: The Contractor shall provide a weatherproof, grounded, temporary power distribution system sufficient to accommodate performance of entire Work of project, including, but not necessarily limited to, temporary electrical for heating and air conditioning (HVAC) where required, operation of test equipment and test operation of building equipment and systems which cannot be delayed until permanent power connections are operable, temporary operation of other temporary facilities, including permanent equipment and systems which must be placed in operation prior to use of permanent power connections (pumps, HVAC equipment, elevators, and similar equipment), and power for temporary operation of existing facilities (if any) at the site during change-over to new permanent power system. Provide circuits of adequate size and proper power characteristics for each use; run circuit wiring generally overhead, and rise vertically in locations where it will be least exposed to possible damage from construction operations, and result in least interference with performance of the Work; provide rigid steel conduit or equivalent raceways for wiring which must be exposed on grade, floors, decks, or other recognized exposures to damage or abuse.

3.03 INSTALLATION OF LIGHTING

A. Construction Lighting: All Work conducted at night or under conditions of deficient daylight shall be suitably lighted to insure proper Work and to afford adequate facilities for inspection and safe working conditions.

B. Temporary Lighting: The Contractor shall provide a general, weatherproof, grounded temporary lighting system in every area of construction Work, as soon as overhead floor/roof deck structure has been installed; and provide sufficient illumination for safe Work and traffic conditions; and run circuit wiring generally overhead, and rise vertically in locations where it will be least exposed to possible damage from construction operations on grade, floors, decks, or other recognized areas of possible damage or abuse.
3.04 INSTALLATION OF SANITARY FACILITIES

A. Toilet Facilities: Fixed or portable chemical toilets shall be provided wherever required for the use of Contractor’s employees. Toilets at construction job sites shall conform to the requirements of Subpart D, Section 1926.51 of the OSHA Regulations for Construction. Provide separate field office facilities in conformance with City Standards.

B. Sanitary and Other Organic Wastes: The Contractor shall establish regular collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the Contractor or organic material wastes from any other source related to the Contractor’s operations shall be disposed of offsite in accordance with all laws and regulations pertaining thereto.

3.05 INSTALLATION OF COMMUNICATIONS

A. Telephone Services: The Contractor shall provide and maintain at all times during the progress of the Work not less than one telephone (cellular) in good working order, at or near the site of the Work.

3.06 OPERATIONS AND TERMINATIONS

A. Inspections: Prior to placing temporary utility services into use, the Contractor shall inspect and test each service and arrange for governing authorities’ required inspection and tests, and obtain required certifications and permits for use thereof.

B. Protection: The Contractor shall maintain distinct markers for underground lines and protect from damage during excavating operations.

C. Termination and Removal: When need for a temporary utility service or a substantial portion thereof has ended, or when its service has been replaced by use of permanent services, or not later than time of substantial completion, the Contractor shall promptly remove temporary installation. The Contractor shall complete and restore areas which may have been delayed or affected by installation and use of temporary utility, including repairs to construction and grades and restoration and cleaning of exposed surfaces.

3.07 POTABLE WATER FOR USE DURING CONSTRUCTION

A. Contractor shall meter all potable water used during the construction process including but not limited to filling, testing, flushing, etc. of main lines, positive service test, and any other construction activities as listed below. Meter reading shall be read by the Utilities Commission of New Smyrna Beach monthly, no later than the Friday following the designated end of the month’s pay period. Potable water shall only be used for filling, testing or flushing of potable water lines. All costs of water and meter rental (billed by the Utilities Commission of New Smyrna Beach).
1. Extracting water directly from canals or other surface water will not be permitted.

END OF SECTION
SECTION 01530

PROTECTION OF EXISTING FACILITIES

PART 1 - GENERAL

1.1 GENERAL

A. The Contractor shall protect all existing utilities and improvements not designated for removal and shall restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than the original condition prior to such damage or temporary relocation, all in accordance with the Drawings and Specifications.

1.2 EXISTING FACILITIES/PRIVATE PROPERTY

A. The Contractor shall not perform work that would affect any oil, gas, sewer, or water pipeline; any telephone, telegraph, or electric transmission line; any fence; or any other structure, nor shall the Contractor enter any private property until authorization has been obtained from the appropriate party by the Contractor and approved by the Utilities Commission of New Smyrna Beach.

B. After authority has been obtained, the Contractor shall give said party due notice of its intention to begin work, if required by said party, and shall remove, shore, support, or otherwise protect or replace such pipeline, transmission line, ditch, fence, or any other structure, etc.

1.3 RESTORATION OF PAVEMENT

A. General: All paved areas cut or damaged during construction shall be restored in accordance with the Drawings and Specifications. Pavements that are subject to partial removal shall be neatly saw cut in straight lines and shall be swept clean as needed.

B. Temporary Resurfacing: Wherever required by the public authorities having jurisdiction, the Contractor shall place temporary surfacing promptly after backfilling and shall maintain such surfacing for the period of time fixed by said authorities before proceeding with the final restoration of improvements.

C. Permanent Resurfacing: In order to obtain a satisfactory junction with adjacent surfaces, the Contractor shall saw cut back and trim the edge of pavement so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement.

D. Pavement Markings: All painted or reflective markers shall be replaced if damaged or removed.
1.4 EXISTING UTILITIES AND IMPROVEMENTS

A. General: The Contractor shall protect underground Utilities and other improvements that may be impaired during construction operations, regardless of whether or not the Utilities are indicated on the Drawings. The Contractor shall take all possible precautions for the protection of unforeseen Utility lines to provide for uninterrupted service and to provide such special protection as may be necessary. Contractor shall not operate existing valves without prior approval from the Utilities Commission of New Smyrna Beach.

1. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way, the Contractor shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than 3 days nor more than 7 days prior to excavation so that a representative of said owners or agencies can be present during such work if they so desire. The Contractor shall also notify Sunshine at 1-800-432-4770 at least 48 hours, but no more than 14 days, prior to such excavation.

B. Field Location of Existing Utilities: Contractor shall be responsible for exploratory excavations as the Contractor deems necessary to determine the exact locations and depths of utilities which are part of or may interfere with the Work. All such exploratory excavations shall be performed as soon as practical after Notice to Proceed and, in any event, a sufficient time in advance of construction to avoid possible delays to the Contractor’s progress. When such exploratory excavations show the utility location as shown on the Drawings to be inaccurate, the Contractor shall adjust the installation as directed by the Utilities Commission of New Smyrna Beach to protect, avoid, or relocate the existing utilities. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the existing utility.

C. Utilities to be Moved or Relocated: In case it shall be necessary to move the property of any public utility or franchise holder, the Utilities Commission of New Smyrna Beach shall be notified by the Contractor to determine any necessary remedial action required. When utility lines that are to be moved are encountered within the area of operations, the Contractor shall notify the Utilities Commission of New Smyrna Beach a sufficient time in advance for the necessary measures to be taken to prevent interruption of service.

D. Utilities to be Removed: Where the proper completion of the Work requires the temporary or permanent removal of an existing utility or other improvement such removal shall be coordinated with the Utilities Commission of New Smyrna Beach and performed by the Contractor.

1. Contractor shall notify Utilities Commission of New Smyrna Beach of any identified asbestos cement (AC) pipe. If AC pipe must be removed, this can only be performed under the direct supervision of the Utilities Commission of New Smyrna Beach’s selected OSHA certified competent person. If AC pipe is
encountered, that must be removed and cannot be avoided, all work must cease immediately and the Utilities Commission of New Smyrna Beach’s representative shall be contacted. The Contractor will be advised on how to proceed in compliance with OSHA and NESHAP’s requirements. Under no circumstances should AC pipe be crushed, ground or cut using abrasive methods.

E. Utilities Commission of New Smyrna Beach’s Right of Access: The right is reserved to the Utilities Commission of New Smyrna Beach and to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the Work.

F. Underground Utilities Indicated: Existing utility lines that are indicated or the locations of which are made known to the Contractor prior to excavation and that are to be retained, and all utility lines that are constructed as part of the Work shall be protected from damage during excavation and backfilling and, if damaged, shall be immediately repaired or replaced by the Contractor, unless otherwise repaired by the owner of the damaged Utility. If the owner of the damaged facility performs its own repairs, the Contractor shall reimburse the utility owner for the costs of repair caused by its action.

G. Underground Utilities Not Indicated: In the event that the Contractor damages existing utility lines that are not indicated on contract drawings, identified through Florida Call Sunshine or Florida One-Call, or the locations of which are not made known to the Contractor prior to excavation, a verbal report of such damage shall be made immediately to the Utilities Commission of New Smyrna Beach and the owner of the facility and a written report thereof shall be made promptly thereafter.

H. Approval of Repairs: All repairs to a damaged Utility or improvement are subject to inspection and approval by an authorized representative of the Utility or improvement owner before being concealed by backfill or other work.

I. Maintaining in Service: Unless indicated otherwise, oil and gasoline pipelines, power, and telephone or the communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and telecommunication wires and cables, etc., encountered along the line of the Work shall remain continuously in service during all the operations under the Contract, unless other arrangements are made with the Utilities Commission of New Smyrna Beach and owner of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, or wire or cable. The Contractor shall be responsible for and shall repair all damage due to its operations, and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.

J. Verification by Trial Excavation for Hot-Tap Connections: Where hot-tap connections are indicated as connections to the existing pressure piping utility systems, the Contractor is required to conduct a trial excavation to verify the existing piping prior to the procurement of the tapping sleeve and gate valve.
1.5 NON-EXOTIC TREES OR SHRUBS WITHIN STREET RIGHTS-OF-WAY AND PROJECT LIMITS

A. General: The Contractor shall remove all trees, shrubs and vegetation in the ROW, inlets, services, etc. that directly impede construction activities. At least 30-days prior to excavation of utility lines the Contractor shall notify the affected property owner of their option to relocate vegetation outside of the right-of-way via certified mail or other verifiable proof. When trees, shrubs or vegetation must be removed, the Contractor shall exercise all necessary precautions so as not to damage or destroy any trees or shrubs, including those lying within street rights-of-way and project limits not in conflict with installation of utilities proposed under this Work, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the jurisdictional agency, or the Utilities Commission of New Smyrna Beach. Existing trees and shrubs that are damaged during construction shall be trimmed. Tree trimming shall be accomplished in accordance with the following paragraphs.

B. Replacement: The Contractor shall immediately notify the Utilities Commission of New Smyrna Beach if any tree is damaged by the Contractor’s operations. If, in the opinion of the Utilities Commission of New Smyrna Beach, the damage is such that replacement is necessary, the Contractor shall replace the tree at the Contractor’s expense. The tree shall be of a like size and variety as the tree damaged or the Contractor shall pay to the owner of said tree a compensatory payment acceptable to the tree owner. Planting of replacement trees and shrubs shall be in accordance with the recommendations of the nursery furnishing the plants. The Contractor shall water and maintain such replacement trees and shrubs as specified under Section 02920 – Restoration.

C. Trimming: Symmetry of the tree shall be preserved. Stubs, splits, and torn branches shall be removed. Clean cuts shall be made close to the trunk or large branch.

1.6 LAWN AREAS

A. Lawn or landscaped areas damaged during construction shall be repaired to match the pre-construction condition as per Section 02920- Restoration.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01550
SITE ACCESS AND STORAGE

PART 1 - GENERAL

1.01 HIGHWAY LIMITATIONS

A. The Contractor shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the Work. It shall be the Contractor's responsibility to construct and maintain any haul roads required for its construction operations and repair any damage to public and private roads caused by the Contractor’s construction operations.

1.02 TEMPORARY CROSSINGS

A. General: Continuous, unobstructed, safe, and adequate pedestrian and vehicular access shall be provided to fire hydrants, commercial and industrial establishments, churches, schools, parking lots, service stations, motels, fire and police stations, hospitals and any other public facilities. Safe and adequate public transportation stops and pedestrian crossings on major roadways shall be maintained as determined by Utilities Commission of New Smyrna Beach. The Contractor shall cooperate with parties involved in the delivery of mail and removal of trash and garbage so as to maintain existing schedules for such services. Vehicular access to residential driveways shall be maintained to the property line except when necessary construction precludes such access for reasonable periods of time.

B. Temporary Bridges: Wherever necessary, the Contractor shall provide suitable temporary bridges or steel plates over unfilled excavations. All such bridges or steel plates shall be maintained in service until access is provided across the backfilled excavation. Temporary bridges or steel plates for street and highway crossing shall conform to the requirements of the authority having jurisdiction in each case, and the Contractor shall adopt designs furnished by said authority for such bridges or steel plates, or shall submit designs to said authority for approval, as may be required.

C. Street Use: Nothing herein shall be construed to entitle the Contractor to the exclusive use of any public street, alleyway, or parking area during the performance of the Work hereunder, and it shall so conduct its operations as not to interfere unnecessarily with the authorized work of utility companies or other agencies in such streets, alleyways, or parking areas. No roadway shall be closed to the public using type III barricades and signage without first obtaining permission of the Utilities Commission of New Smyrna Beach. Permission must be obtained two (2) weeks prior to closure. Toe boards shall be provided to retain excavated material if required by the Utilities Commission of New Smyrna Beach or the agency having jurisdiction over the street or highway. Operating fire hydrants on or adjacent to the Work shall be kept accessible to fire-fighting equipment at all times. Temporary provisions shall be made by the Contractor to assure the use of
sidewalks (unless posted with Sidewalk Closed signage) and the proper functioning of all
gutters, storm drain inlets, and other drainage facilities.

D. Traffic Control: Traffic control shall be provided by Contractor as specified in Section
01570 – Maintenance of Traffic.

E. Temporary Street Closure: If closure of any street is required during construction, the
Contractor shall submit such requests in writing to the Utilities Commission of New
Smyrna Beach. The traffic control plan indicating detours and emergency access to cul-de-
sacs shall accompany any request. The Contractor shall provide placards reading “Road
Closed Local Traffic Only” during the closure of any street.

F. Temporary Mailbox Cluster(s): The Contractor shall provide temporary mailbox clusters
where the permanent mailboxes are not accessible for delivery due to construction.

1.03 TEMPORARY SOIL TRACKING PROTECTION MEASURES

A. General: The Contractor shall provide temporary soil tracking protection measures at the
entrance to central storage areas that affect paved roads. The temporary protection
measures shall be in accordance with the ‘Florida Erosion and Sediment Control
Inspectors Manual.’ Proposed details for the temporary construction entrance are shown
in the contract drawings.

B. Temporary Soil Tracking Protection Measures shall be constructed with FDOT No. 1 Coarse
aggregate (1.5 - 3.5 in. stone) as indicated in FDOT Standard Specifications for Road and
Bridge Construction. The thickness of the aggregate layer shall be a minimum of 6 inches
and shall cover the full width of the vehicular ingress/egress area. The entrance shall be a
minimum of 50 feet and accommodate a turning radius for large trucks. The temporary
Soil Tracking Protection Measures shall follow the contour of the natural terrain. Slopes
shall not exceed 10 percent. The road shall be stabilized with 2-inch stone to reduce
erosion and degradation of the temporary roadbed.

C. The area for the temporary Soil Tracking Protection Measures shall be cleared of all
vegetation, roots and other unsuitable material. A geotextile shall be laid directly
underneath the gravel layer.

D. Soil Tracking Protection Measures shall be maintained in a condition which prevents
tracks or flow of mud into the public right of way. The Contractor shall be responsible for
the maintenance of Soil Tracking Protection Measures during the construction period.

1.04 CONTRACTOR’S WORK AND STORAGE AREAS

A. The Contractor shall make its own arrangements for all temporary storage, shop, or field
office areas necessary for the proper execution of the Work and shall obtain prior written
permission from any owner whose property is used for such purposes.

B. The Contractor’s temporary areas shall be kept in a clean and orderly fashion at all times.
The areas will be sloped to drain off all storm runoff. The entrance to the storage areas
shall be constructed in accordance with the drawings with a drainage pipe to protect the swale and an entrance driveway of 6 inches of crushed stone road base laid on suitable geotextile (filter fabric). Sediment control traps shall be positioned so as to ensure that downstream catch basins and drains are protected from runoff containing silt from the temporary areas. A sedimentation trap can be constructed by either excavating below grade or building an embankment across a swale and an open-channel spillway provided. Silt fence shall be provided around all central storage areas, limerock and central soil stockpiles.

C. Storage of materials and equipment on corners, intersections, or turn lanes shall not obstruct line of sight in intersection and shall be at least 6 feet off of the edge of pavement. All central storage sites shall be posted with “No Trespassing” signs every 100 feet around the site.

D. The Contractor shall construct and use a separate storage area for hazardous materials used in constructing the Work and shall obtain written permission from any owner whose property is used for storage or shop areas.

1. For the purpose of this paragraph, hazardous materials to be stored in the separate area are defined as all products labeled with any of the following terms: Warning, Caution, Poisonous, Toxic, Flammable, Corrosive, Reactive, or Explosive. In addition, whether or not so labeled, the following materials shall be stored in the separate area: diesel fuel, gasoline, new and used motor oil, hydraulic fluid, cement, paints and paint thinners, two-part epoxy coatings, sealants, asphaltic products, glues, solvents, wood preservatives, sand blast materials, and spill absorbent.

2. Hazardous materials shall be stored in groupings according to the Material Safety Data Sheets.

3. The Contractor shall develop and provide to the Utilities Commission of New Smyrna Beach a plan for storing and disposing of the materials above.

4. The separate storage area shall meet all the requirements of all authorities having jurisdiction over the storage of hazardous materials. Such authorities include the Florida Department of Environmental Protection.

5. All hazardous materials that are delivered in containers shall be stored in the original containers until use. Hazardous materials that are delivered in bulk shall be stored in containers that meet the requirements of authorities having jurisdiction.

E. The Contractor shall maintain the storage area while it is in use and restore it to its original condition at the completion of the Project. Restoration shall include removal of temporary culverts and driveways and establishing grass by seeding or sodding disturbed construction and storage areas. All areas must be completely restored and have an established stand of grass in accordance with Section 02920 - Restoration. Downstream
sediment traps shall be removed once the restoration is complete and the grass has stabilized the area from significant erosion.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

END OF SECTION
SECTION 01568
TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall provide effective temporary erosion control and sediment control measures during construction or until permanent erosion controls become effective so as to prevent pollution of water, detrimental effects to public or private property adjacent to the project and damage to WORK on the project.

B. The Contractor’s attention is called for complying with all necessary NPDES requirements during the execution of the WORK.

C. All temporary erosion control measures shall be in accordance with FDOT specifications section 104 and 125. If a conflict exists between the FDOT and the Utilities Commission of New Smyrna Beach Specifications, the Contractor shall bring that discrepancy to the attention of the Utilities Commission of New Smyrna Beach for clarification prior to construction.

D. Related Specification Sections:
   1. 01300 – Contractor Submittals
   2. 02920 – Restoration

1.02 Contractor SUBMITTALS

A. Submittals shall be in accordance with Section 01300 - Contractor Submittals.

B. Product Data: Manufacturer’s catalog sheets on geotextile fabrics.

PART 2 - PRODUCTS

2.01 GENERAL

A. Temporary erosion and water pollution control features consist of, but are not limited to, temporary grassing, temporary sodding, temporary mulching, turbidity barriers, and silt fence.
2.02 SEEDING AND SODDING

A. Seeding and sodding material will be in accordance with Section 02920-Restoration.

2.03 FILTER FABRIC

A. Fabric shall be woven or non-woven consisting of long-chain polymeric filaments or yarns such as polypropylene, polyethylene, polyester, or polyamide. The base plastic shall contain stabilizers and/or inhibitors to make the filaments resistant to deterioration due to ultra-violet light, heat exposure and chemicals. The fabric shall be free of any treatment that may significantly alter its physical properties. The edges of the fabric shall be salvaged or otherwise finished to prevent the outer yarn from pulling away from the fabric.

B. Fabric shall have the following properties:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Standard Method</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grab tensile strength</td>
<td>ASTM D 4632</td>
<td>100 lb.</td>
</tr>
<tr>
<td>Burst strength</td>
<td>ASTM D 3786</td>
<td>200 psi</td>
</tr>
<tr>
<td>Apparent opening size</td>
<td>ASTM D 4751</td>
<td>Between 200 and 70 sieve size</td>
</tr>
</tbody>
</table>

C. Fabric Manufacturer, or Utilities Commission of New Smyrna Beach Approved equal:

1. Mirafi

2.04 FENCING

A. Woven wire fabric fencing shall be galvanized, mesh spacing of 6 inches, maximum 14-gauge, at least 30 inches tall.

2.05 FASTENERS

A. Fasteners to wood posts shall be steel, at least 1 1/2 inches long.

B. Fasteners to steel posts shall be galvanized clips or tie wire.

2.06 SYNTHETIC BARRIERS

A. All synthetic barriers shall be in accordance with FDOT specification 106-6.4.8
PART 3 -- EXECUTION

3.01 GENERAL

A. The Contractor shall prevent pollution of streams, canals, lakes, reservoirs, and other water impoundments with fuels, oils, bitumens, calcium chloride, or other harmful materials. The Contractor shall conduct and schedule operations to avoid or otherwise minimize pollution by siltation.

B. Provide and maintain, for the duration of the project, erosion control barriers as required to prevent erosion and silt loss from the Site. Erosion control measures shall remain in place until an adequate stand of grass has been established, per FDOT standards.

C. The Contractor shall not commence clearing, grubbing, earthwork, or other activities that may cause erosion until barriers are in place.

3.02 SEEDING AND SODDING

A. Seeding and sodding shall be placed in accordance with Section 02920-Restoration.

3.03 HANDLING AND STORAGE

A. The geotextile fabric shall be wrapped in a protective covering which is sufficient to protect it from sunlight, dirt, and other debris during shipment and storage.

3.04 INSTALLATION

A. Barrier systems shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.

B. Attach the woven wire fencing to the posts that are spaced a maximum of 6 feet apart and embedded a minimum of 12 inches. Install posts at a slight angle toward the source of the anticipated runoff.

C. Trench in the toe of the filter fabric barrier with a spade or mechanical trencher so that the downward face of the trench is flat and perpendicular to the direction of flow. Lay fabric along the edges of the trench. Backfill and compact.

D. Securely fasten the fabric materials to the woven wire fencing with tie wires or galvanized clips.

E. Reinforced fabric barrier shall have a minimum height of 18 inches.
F. Provide the filter fabric in continuous rolls and cut to the length of the fence to minimize the use of joints. When joints are necessary, splice the fabric together only at a support post with a minimum 6-inch overlap and seal securely.

3.05 MAINTENANCE

A. Regularly inspect and repair or replace damaged components of the barrier. Unless otherwise directed, maintain the erosion control system until final acceptance; then remove erosion and sediment control systems promptly.

B. Remove sediment deposits when silt reaches a depth of 6 inches or 1/2 the height of the barrier, whichever is less. Dispose of sediments at an acceptable site arranged by the Contractor that is not in or adjacent to a stream, floodplain, canal, lake, reservoir, or other water impoundments.

C. During periods of heavy rain, the Contractor shall monitor the temporary erosion control measures to ensure that they are not causing localized flooding. The Contractor may be required to cut slits in the fabric to drain flooded areas. Fabric shall be replaced after heavy rain events.

END OF SECTION
SECTION 01570

MAINTENANCE OF TRAFFIC

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall be responsible for the maintenance of traffic within the limits of the project for the duration of the construction and temporary suspensions of the Work in accordance with the requirements of the Contract Documents. The term “Maintenance Of Traffic” includes all of such facilities, devices, and operations required for the safety and convenience of the public as well as for minimizing public nuisance.

1.02 CONTRACTOR SUBMITTALS

A. General: Submittals shall be furnished in accordance with Section 01300 – Contractor Submittals. Maintenance of Traffic plans shall be signed by a FDOT Certified Advanced MOT.

B. Traffic Control Plans for 2-lane roads shall be submitted to the Utilities Commission of New Smyrna Beach two weeks prior to the scheduled commencement of the work. Traffic Control Plans for 2-lane roads shall be typical plan submittals. All Traffic Control Plans shall be prepared in accordance with FDOT and MUTCD.

C. MOT message boards will be required on Maintenance of Traffic. The message board wording is to be submitted by the Contractor for approval by the Utilities Commission of New Smyrna Beach and is required to be in place at each end of the MOT section two weeks prior to the start of construction. The Contractor shall maintain the message boards for a period not less than 4 weeks after construction commencement. The Utilities Commission of New Smyrna Beach reserves the right to modify the locations of the message boards to suit the overall MOT phasing works with adjoining contract areas.

PART 2 – PRODUCTS

A. Barricades, flashers, lights, and “Danger”, “Caution”, “Road Closed – Local Traffic Only”, etc. signs shall meet the requirements of the Florida Department of Transportation and the Manual of Uniform Traffic Control Devices (MUTCD) and shall be inspected and maintained in working condition, weighed down with sandbags or by other suitable means.
PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall implement the Traffic Control Plan. At the end of this Contract, the Contractor shall remove temporary equipment and facilities when no longer required, and restore grounds to original or improved conditions.

B. All Work specified in this section will conform to the current edition of the MUTCD, the Florida Department of Transportation Roadway and Traffic Design Standards (600 Series), and the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, 2020 edition.

C. The Contractor is responsible for communicating with the Traffic Control company on any matters concerning deficiencies with the traffic control plan at any time day or night. The Contractor shall be in possession of the barricade company’s 24-hour number. The barricade company’s representative shall be certified by the American Traffic Safety Services Association or the International Municipal Signal Association.

D. All existing drainage flow must be maintained to prevent flooding of roadways and adjoining property. Where temporary construction causes flooding of the right-of-way, the Contractor shall provide temporary facilities to connect to the permanent drainage system.

E. Curb inlets shall have temporary traffic bearing traversable grates placed on top where applicable until the curb and gutter is constructed.

F. Temporary pipe shall be used under driveways to convey drainage flow where necessary.

G. Access to private residences and commercial businesses shall be maintained at all times during construction. The Contractor shall coordinate with the Utilities Commission of New Smyrna Beach on any temporary access closings prior to beginning Work in the area.

H. The Contractor shall supply signage to identify entrances for affected businesses.

3.02 TRAFFIC CONTROL PLAN

A. Generic traffic control plans are acceptable for all construction work affecting 2-lane local roads for the Contract. These generic plans shall be submitted for the approval by the Utilities Commission of New Smyrna Beach. A pre-design meeting will be held to review the Contractor’s preliminary submittal.

B. The Traffic Control Plan shall be reproducible, dimensioned, pictorial plans of the area of the proposed MOT showing all signs, devices, tapers, and buffer zones listing the proper distances and lengths per the Manual of Uniform Traffic Control Devices and Florida Department of Transportation (Roadway and Traffic Design Standards Index Series 600).
C. The Traffic Control Plan must include a brief description of the Work being done, along with the start and completion dates, Work hours, night activity, etc. It also must include a 24-hour emergency telephone number of the supervisor on the job responsible for the maintenance of the Traffic Control Plan.

D. The Traffic Control Plan shall cover the major construction operations for this project. The Contractor shall be responsible for the proper execution of the traffic control during related minor construction operations.

E. Locations for advance warning and other construction signs as depicted on the Traffic Control Plans shall be approximate considering the existing field conditions.

F. For the protection of traffic in public or private streets and ways, the Contractor shall provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights, flag persons and other safety devices in accordance with the requirements of the "Manual of Uniform Traffic Control Devices, Part VI - Traffic Controls for Street and Highway Construction and Maintenance Operations," published by U.S. Department of Transportation, Federal Highway Administration (ANSI D6.1) and the appropriate indexes (600-660) of the FDOT Roadway and Traffic Design Standards.

1. The Contractor shall take all necessary precautions for the protection of the Work and the safety of the public. Barricades and obstructions shall be illuminated at night, and all lights shall be kept burning from sunset until sunrise. Cones are not acceptable for night time use. The Contractor shall station guards or flag persons and shall conform to such special safety regulations relating to traffic control as may be required by the public authorities within their respective jurisdictions. Signs, signals, and barricades shall conform to the requirements of Subpart G, Part 1926, of the OSHA Safety and Health Standards for Construction. Lights shall be inspected and maintained at least once per week to ensure proper operation.

2. The Contractor shall submit three copies of a Traffic Control Plan to the Utilities Commission of New Smyrna Beach for review a minimum of 2 weeks prior to construction. The Utilities Commission of New Smyrna Beach shall be allowed access to observe these traffic control plans in use. The Utilities Commission of New Smyrna Beach may make changes to the MOT as field conditions warrant.

3. The Contractor shall remove traffic control devices when no longer needed, repair all damage caused by installation of the devices, and shall remove post settings and backfill the resulting holes to match grade.

G. The traffic control plan shall include any pedestrian crossing or walkway issues.

H. Arrows on the Traffic Control Plans denote direction of traffic only and do not reflect pavement markings unless otherwise shown.
MAINTENANCE OF TRAFFIC

A. The CONTRACTOR shall take all necessary precautions to prevent injury to public.

B. All manholes, valve boxes, or other similar structures shall each be adequately barricaded and lighted if they pose a danger to the public or are within 6 feet of the edge of pavement. Cones shall not be used.

C. Excavated material and construction materials shall not be stockpiled in such manner as to unnecessarily hinder or confuse traffic adjacent to work. Materials shall be stored at least 6 feet beyond the edge of pavement and at least 10 feet from the radius of any intersection or as necessary to maintain proper site distances.

D. Toe boards will be provided to retain excavated material if required by the Utilities Commission of New Smyrna Beach or by the agency having jurisdiction over the street or highway.

E. Maintain all lanes that are being used for the maintenance of traffic, including those on detours and temporary facilities, under all weather conditions. Keep the lanes reasonably free of dust, and, when necessary to accomplish this, sprinkle them with water, or apply some other dust palliative. Grade roads as necessary to provide a smooth, pot hole-free driving surface.

F. The alteration of existing traffic patterns to create a Work zone shall not commence until all labor and materials are available for the construction in that area.

G. The Contractor shall repair all potholes in new, and existing asphalt created from the construction process as soon as practical and shall maintain a supply of asphalt cold mix on the project site to expedite those repairs.

H. If during construction any manhole or valve box cover protrudes higher than one inch above the pavement, the contractor shall place an asphalt wedge around the cover. If any obstructions extend more than 1” above the roadway, they shall be protected with at least one Type II lighted barricade.

I. Contractor shall restore roadways to a minimum of 20’ wide clear travel lanes within 24 hours of backfilling at the end of a work-day.

J. Throughout the project limits where sidewalks currently exist, pedestrian and wheelchair travel-ways shall be maintained on the project at all times. The travel-way shall be a minimum of 4 feet in width, smooth, but not slick with waterproof surface, and shall be ramped as necessary for continuity.

K. The Contractor shall maintain safe vehicular access to all adjacent property at all times.

L. Traffic disruptions which are not shown by the Traffic Control Plan, but which are necessary to construct the project, shall be submitted in writing to the Utilities Commission of New Smyrna Beach for approval two weeks prior to commencement of
Work. Submitted material shall include sketches, calculations and other data required by the Utilities Commission of New Smyrna Beach.

M. During and after completion of construction, the Contractor shall provide all necessary temporary pavement markings (i.e. lane lines, arrows, crosswalks, stop bars, etc.) until permanent markings are installed.

N. Conflicting existing pavement markings shall be removed. Removal of existing pavement marking shall be accomplished by milling, grinding, sand or hydro–blasting, or by any other method approved by the Utilities Commission of New Smyrna Beach. Use of black paint to cover existing pavement markings shall be prohibited. Any conflicting existing pavement markings that have been removed shall be replaced upon completion of the project.

O. Contractor shall remove or cover any existing or proposed signs that conflict with the Traffic Control Plans. When the conflict no longer exists, the Contractor shall restore the signs to their original condition. Unnecessary construction signs and markers that are no longer applicable are to be covered or removed at the end of each workday.

P. The Contractor shall repair and maintain roads and shoulders throughout the duration of the contract. Repairs shall be made to any low or rutted-out shoulders and restored to the condition at which it was at the beginning of the Work. Road shoulders shall be maintained within 2” from the top of pavement, throughout the duration of the contract and shall provide adequate driveability.

3.04 DETOURS

A. The Contractor shall notify the Utilities Commission of New Smyrna Beach at least 2 weeks in advance for a 2-lane road closure so that all notifications of such closings can be completed at least 48 hours in advance. To the greatest extent possible, no more than one (1) lane of roadway shall be closed to vehicles and pedestrians. With any such closings adequate provision shall be made for the safe expeditious movement of vehicles and pedestrians.

B. Traffic may only be detoured upon approval of the Utilities Commission of New Smyrna Beach. The Contractor shall construct and maintain detour facilities wherever it becomes necessary to divert traffic from an existing roadway. While traffic is detoured, the Contractor shall expedite construction operations. When detours are allowed, they will be strictly controlled by the Utilities Commission of New Smyrna Beach.

C. The Contractor shall be responsible for notifying Police, Fire and Ambulance Departments and Volusia County School Board whenever roads are impassable. Contractor shall confirm schedule with the Utilities Commission of New Smyrna Beach at least 48 hours before road closure and immediately upon the reopening of the road.

D. Temporary travel lanes shall be no less than 10 feet in width, except as allowed or directed by the Utilities Commission of New Smyrna Beach.
3.05 ACCESS REQUIREMENTS

A. The CONTRACTOR shall provide necessary facilities for access to residences, businesses, etc., along the project. Access to residence will be provided to the property line by the end of the work-day. Additional access requirements shall be provided as specified in Section 01550 – Site Access and Storage and Section 02920 - Restoration.

3.06 MAINTENANCE, REMOVAL, AND REINSTALLATION OF EXISTING TRAFFIC SIGNS

A. The Utilities Commission of New Smyrna Beach will be given a 48-hour advance notice for any removal or relocation of any stop sign. The removal or relocation of stop signs will be the responsibility of the Contractor. A portable stop sign may only be used in case of an emergency and shall be mounted at a height of 7 feet to the bottom of the sign.

B. The maintenance and/or removal and reinstallation of any existing traffic control sign, or street name sign, (hereinafter-termed Traffic Control Devices) within the area of the project will be the responsibility of the Contractor.

C. The Contractor shall conduct all operations such that they will in no way obstruct or interfere with the operation of any existing traffic control device.

D. The Contractor will be held responsible for any existing traffic control devices which are damaged or removed without approval of the Utilities Commission of New Smyrna Beach, and will be charged for their replacement. This includes, but is not limited to, traffic signal loop, detector loops embedded in the street, signal conduits, cable, synchronization cables, and pull boxes at signalized intersections.

E. The Contractor will be held liable for any damage from any accident resulting from the removal, relocation or failure of any existing traffic control devices by construction operations.

F. The Contractor shall coordinate with the appropriate jurisdiction.

G. The Contractor shall be responsible to construct, relocate, and maintain all traffic control signs, pavement markings, barriers, barricades and other devices to cover and or remove signs as needed, and to do all Work necessary to maintain a safe Work zone. The Contractor shall respond within 2 hours of notification by the Utilities Commission of New Smyrna Beach or his representative to correct any missing or deficient traffic control devices.

H. Barricades and obstructions will be illuminated at night and all lights will be left on from sunset until sunrise. Signs, signals and barricades will conform to the requirements of Subpart G. Part 1926 of the OSHA Safety and Health Standards for Construction, FDOT and MUTCD.
I. Existing permanent pavement markings shall be maintained by the Contractor. Any temporary pavement markings required to reroute traffic during construction operations will be the responsibility of the Contractor.

END OF SECTION
SECTION 01580

PROJECT SIGN

PART 1 - GENERAL

1.01  THE REQUIREMENT

A. The Contractor shall provide one project identification sign, complete, in accordance with the Drawings and Specifications.

1.02  SUBMITTAL

A. The Contractor shall submit a shop drawing of the Project Sign in accordance with Section 01300 for approval.

PART 2 - PRODUCTS

2.01  SIGN CONSTRUCTION

A. The sign shall be constructed of a minimum 3/4-inch Medium Density Overlay (MDO) plywood with 4-inch by 4-inch supports and 2-inch by 4-inch cross bracing. The sign shall be bolted to the support allowing for easy removal during the Hurricane Preparedness Plan.

B. An experienced professional sign maker shall fabricate sign.

2.02  COLORS

A. Sign colors and lettering are provided to the Contractor in the Contract Drawings.

2.03  SIGN CONTENT

A. Sign content and size shall be as indicated on the Drawings. The relationships of letter size and logo size shall be as indicated on the Drawings.

PART 3 -- EXECUTION

3.01  SIGN LOCATION

A. The project sign shall be located at the site in the right-of-way at such a location so as to be highly visible and not obstruct pedestrian or vehicular traffic. The Utilities Commission of New Smyrna Beach will determine sign location.
B. The sign shall be set 4 feet above the ground, measured from grade to the lower edge of the plywood sheet.

3.02 REMOVAL

   A. The Contractor shall remove the project sign upon receipt of the Notice of Completion.

END OF SECTION
SECTION 01600

PRODUCTS, MATERIALS, EQUIPMENT AND SUBSTITUTIONS

PART 1 - GENERAL

1.01 DEFINITIONS

A. The word "Products," as used herein, is defined to include purchased items for incorporation into the Work, regardless of whether specifically purchased for the project or taken from Contractor's existing stock of previously purchased products. The word "Materials," is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of Work. The word "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated and particularly including products with service connections (wiring, piping, and other like items). Definitions in this paragraph are not intended to negate the meaning of other terms used in the Contract Documents, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," special construction," and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

B. Neither "Products" nor "Materials" nor "Equipment" includes machinery and equipment used for preparation, fabrication, conveying and erection of the Work.

1.02 QUALITY ASSURANCE

A. Source Limitations: To the greatest extent possible for each unit of Work, the Contractor shall provide products, materials, and equipment of a singular, generic kind from a single manufacturer.

B. Compatibility of Options: Where more than one choice is available as an option for the Contractor's selection of a product, material, or equipment, the Contractor shall select an option which is compatible with other products, materials, or equipment. Compatibility is a basic general requirement of product, material and equipment selections.

1.03 PRODUCT DELIVERY AND STORAGE

A. The Contractor shall deliver and store the products, materials and equipment in accordance with manufacturer's written recommendations and by methods and means that will prevent damage, deterioration, and loss including theft. Delivery schedules shall be controlled to minimize long-term storage of products at site and overcrowding of construction spaces. In particular, the Contractor shall ensure coordination to ensure minimum holding or storage times for flammable, hazardous, easily damaged, or sensitive materials to deterioration, theft, and other sources of loss.
1.04 TRANSPORTATION AND HANDLING

A. Products shall be transported by appropriate methods to avoid damage and shall be delivered in undamaged condition in manufacturer's unopened containers and packaging.

B. The Contractor shall provide equipment and personnel to handle products, materials, and equipment including those provided by Utilities Commission of New Smyrna Beach, by methods to prevent soiling and damage.

C. The Contractor shall provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.

1.05 STORAGE AND PROTECTION

A. Products shall be stored in accordance with manufacturer's written instructions and with seals and labels intact and legible. Sensitive products shall be stored in weather-tight climate controlled enclosures and temperature and humidity ranges shall be maintained within tolerances required by manufacturer's recommendations.

B. For exterior storage of fabricated products, products shall be placed on sloped supports above ground. Products subject to deterioration shall be covered with impervious sheet covering and ventilation shall be provided to avoid condensation.

C. Loose granular materials shall be stored on solid flat surfaces in a well-drained area and shall be prevented from mixing with foreign matter. Loose granular and aggregate material shall be stored at least 6 feet beyond the edge of pavement and at least 10 feet from the radius of any intersection or as necessary to maintain proper site distances.

D. Storage shall be arranged to provide access for inspection. The Contractor shall periodically inspect storage sites to ensure products are undamaged and maintained under required conditions.

E. Storage shall be arranged in a manner to provide access for maintenance of stored items and for inspection.

F. Valves, gaskets and seals shall be covered to protect from sunlight.

G. Pipe shall not be stored more than two bundles high.

1.06 MAINTENANCE OF STORAGE

A. Stored products shall be periodically inspected on a scheduled basis.

B. The Contractor shall comply with manufacturer's product storage requirements and recommendations.

C. The Contractor shall maintain manufacturer’s required environmental conditions continually.
D. The Contractor shall ensure that surfaces of products exposed to the elements are not adversely affected and that weathering of finishes does not occur.

E. For mechanical and electrical equipment, the Contractor shall maintain a copy of the manufacturer's service instructions with each item and the exterior of the package shall contain notice that instructions are included.

F. Products and equipment requiring service shall be serviced on a regularly scheduled basis prior to acceptance by the Utilities Commission of New Smyrna Beach. Service records shall be submitted with Owner's Manuals.

1.07 PROPOSED SUBSTITUTIONS OR "APPROVED OR-EQUAL" ITEM

A. Whenever materials or equipment are indicated in the Drawings or Specifications by using the name of a proprietary item or the name of a particular Supplier, the naming of the item is intended to establish the type, function, and quality required. If the name is followed by the words "or equal" indicating that a substitution is permitted, materials or equipment of other suppliers may be accepted if sufficient information is submitted by the Contractor to allow the Utilities Commission of New Smyrna Beach to determine that the material or equipment proposed is equivalent or equal to that named, subject to the following requirements:

1. The burden of proof as to the type, function, and quality of any such substitution product, material or equipment shall be upon the Contractor.

2. The Utilities Commission of New Smyrna Beach will be the sole judge as to the type, function, and quality of any such substitution and the Utilities Commission of New Smyrna Beach's decision shall be final.

3. The Utilities Commission of New Smyrna Beach may require the Contractor to furnish additional data about the proposed substitution.

4. The Utilities Commission of New Smyrna Beach may require the Contractor to furnish a special performance guarantee or other surety with respect to any substitution.

5. Acceptance by the Utilities Commission of New Smyrna Beach of a substitution item proposed by the Contractor shall not relieve the Contractor of the responsibility for full compliance with the Contract Documents and for adequacy of the substitution.

6. The Contractor shall be responsible for resultant changes including design and construction changes resulting from the changes which the accepted substitution requires in the Contractor's Work, and the Work of its subcontractors.
B. The procedure for review by the Utilities Commission of New Smyrna Beach will include the following:

1. If the Contractor wishes to provide a substitution item, the Contractor shall make written application to the Utilities Commission of New Smyrna Beach.

2. Unless authorized in writing by the Utilities Commission of New Smyrna Beach a substitution request shall be submitted within the 35-day period after award of the Contract.

3. Wherever a proposed substitution item has not been submitted within said 35-day period, or wherever the submission of a proposed substitution material or equipment has been judged to be unacceptable by the Utilities Commission of New Smyrna Beach, the Contractor shall provide the material or equipment indicated in the Drawings and Specifications.

4. The Contractor shall certify that the proposed substitution will perform adequately the functions and achieve the results called for by the general design, and be similar and of equal substance to that indicated, and be suited to the same use as that specified.

5. The Utilities Commission of New Smyrna Beach will evaluate each proposed substitution within fourteen (14) days.

6. As applicable, no shop drawing submittals shall be made for a substitution item nor shall any substitution item be ordered, installed, or utilized without the Utilities Commission of New Smyrna Beach’s prior written acceptance of the Contractor’s indicating a substitution request.

C. The Contractor's substitution request shall contain the following statements and information that shall be considered by the Utilities Commission of New Smyrna Beach in evaluating the proposed substitution:

1. The evaluation and acceptance of the proposed substitution will not cause a delay in the Contractor's achievement of substantial completion.

2. Whether or not acceptance of the substitution for use in the Work will require a change in any of the Drawings or Specifications to adopt the design to the proposed substitution.

3. Whether or not incorporation or use of the substitution in connection with the Work is subject to payment of any license fee or royalty.

4. All variations of the proposed substitution from the items originally specified will be identified.

5. Available maintenance, repair, and replacement service will be indicated. The manufacturer shall have a local service agency that maintains properly trained
personnel and adequate spare parts and is able to respond and complete repairs within 24 hours.

6. Itemized estimate of all costs that will result directly or indirectly from acceptance of such substitution, including cost of redesign and claims of other subcontractors affected by the resulting change.

D. Without any increase in cost to the Utilities Commission of New Smyrna Beach, the Contractor shall be responsible for and pay all costs in connection with proposed substitutions and of inspections and testing of equipment or materials submitted for review prior to the Contractor’s purchase thereof for incorporation in the Work, whether or not the Utilities Commission of New Smyrna Beach accepts the proposed substitution or proposed equipment or material.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

END OF SECTION
SECTION 01650
START-UP AND CHECK-OUT

I. SCOPE OF WORK

A. The work specified in this SECTION consists of start-up and final check out of Mechanical, Electrical, Communications, Pneumatic, Hydraulic, Conveyance or Special Construction or any other discipline as called for by the technical specifications of the Contract Documents. These systems (heating, ventilating, air conditioning, plumbing, fire protection systems, HVAC and control systems, communications and alarm systems, lighting, power distribution, controls, and other electrical systems and elevators) and other operating equipment as required; will be demonstrated, to ENGINEER, to operate in the manner prescribed by the Contract Documents to ensure a complete operating systems, ready for CITY’s use.

II. IMPLEMENTATION

A. Preliminary Requirements

1. Start-up Certification: Prior to start-up of a system, successfully complete all the testing required of the individual components of the system. Submit five copies of DEMONSTRATION CERTIFICATION (attached to this section) signed by CONTRACTOR, subcontractor and the manufacturer’s representative. All copies shall be provided with the respective copies of the Operation and Maintenance Manual. This form shall be completed and submitted before Instruction in Operation to ENGINEER or a request for final inspection.

2. Demonstrate to ENGINEER and DESIGN ENGINEER that all of the components of the system are operating under their own controls as designated.

3. Coordinate start-up activities with CITY’s operating personnel, the Manufacturers Representative and with ENGINEER prior to commencing start-up of a system.

B. START-UP

1. Confirm that all equipment in a system is properly energized, prior to start-up.

2. Initiate start-up of each system in accordance with the Operation and Maintenance Manual.

3. Observe the system operation and make adjustments as necessary to optimize the system performance.

4. Coordinate with ENGINEER and DESIGN ENGINEER for any adjustments desired or
operational problems requiring debugging.

5. Make adjustments as necessary.

6. Acceptability of each system’s performance will be based on the system performing as specified, under actual operating conditions. The intent of the start-up is to demonstrate to ENGINEER that each system will function as a complete and operable system under normal as well as emergency operating conditions and is ready for acceptance.

7. Demonstrate the essential features of the systems as delineated elsewhere in the Contract Documents. Each system shall be successfully demonstrated only once, after completion of all required testing. The disciplines involved may include, but are not limited to:

a. Mechanical
b. Conveyance
c. Electrical
d. Communication
e. Instrumentation & Controls
f. Pneumatic
g. Hydraulic
h. Specialized Construction

C. Certificate of Completed Start-Up Demonstration:

1. Submit five copies of Certificate of Completed Start-Up Demonstration memo signed by CONTRACTOR, Subcontractor and ENGINEER and insert one copy in each Operation and Maintenance Manual.
MANUFACTURER'S CHECK CERTIFICATION

___ CITY OF NEW SMYRNA BEACH: No. Copies ____
___ ENGINEER No. Copies ____
___ DESIGN ENGINEER: No. Copies ____
___ CONTRACTOR No. Copies ____
___ FIELD: No. Copies ____
___ OTHER: No. Copies ____

PROJECT DATA AND CONTRACT DATA

NAME OF PROJECT:______________________________________ PROJECT NUMBER________________

LOCATION:______________________________________________ DATE:___________________________

CITY:____________________________________________________  DRAWING NO.:__________________

OTHER:________________________________________________________________________________

SYSTEM DESCRIPTION:____________________________________________________________________

Name of equipment checked:_______________________________________

Name of manufacturer or equipment:_______________________________

1. The equipment furnished by us has been checked on the job by us. We have reviewed (where applicable) the performance verification information submitted to us by CONTRACTOR.

2. The equipment is properly installed, except for items noted below.*

3. The equipment is operating satisfactorily, except for items noted below.*

4. The written operating and maintenance information (where applicable) has been presented to CONTRACTOR, and has been reviewed with him in detail. Five (5) copies of all applicable operating and maintenance information and parts lists have been furnished to CONTRACTOR for insertion in each of the Equipment Brochures.
MANUFACTURER'S CHECK CERTIFICATION
SIGNATURE PAGE

MANUFACTURER*                       CONTRACTOR

Checked By: __________________________      _________________________________

Name of Mfgr’s Rep.            Name of CONTRACTOR

____________________________________  _________________________________

____________________________________  _________________________________

____________________________________  _________________________________

Address & Phone # of Rep.            Address & Phone # of Contractor

____________________________________  _________________________________

Authorized Sign/Title/Date                                                         Authorized Sign/Title/Date

____________________________________

SUBCONTRACTOR                       DATE OF CERTIFICATION CHECK

____________________________________ Date

Name of Subcontractor Making Check

____________________________________

____________________________________

Address & Phone # of Subcontractor

____________________________________

Authorized Sign/Title/Date

*Manufacturer's Representative Notations: Exceptions noted at time of check were:

_______________________________________________________________________________________

_______________________________________________________________________________________

_______________________________________________________________________________________

_______________________________________________________________________________________

____________________________________

ZAW/jm/specs/01650
Tt #200-08460-20003        01650-1-4      040121
Manufacturer's Representative to note adequacy of related equipment that directly affects operation, performance or function of equipment checked. (No comment presented herein will indicate adequacy of related systems or equipment):
DEMONSTRATION / START-UP CERTIFICATION

___ CITY OF NEW SMYRNA BEACH:  No. Copies ___
___ ENGINEER:  No. Copies ___
___ DESIGN ENGINEER:  No. Copies ___
___ CONTRACTOR:  No. Copies ___
___ FIELD:  No. Copies ___
___ OTHER:  No. Copies ___

PROJECT DATA AND CONTRACT DATA

NAME OF PROJECT:_________________________  PROJECT NUMBER_________________________

LOCATION:_________________________  DATE:_________________________

CITY:_________________________  DRAWING NO.:_________________________

OTHER:________________________________________________________________________________

SYSTEM DESCRIPTION:____________________________________________________________________

NOTE TO CONTRACTOR:

Submit five (5) copies of all information listed below for checking at least one week before scheduled start-up demonstration of the system. After all information has been approved by ENGINEER, give CITY a start-up demonstration as specified and have the CITY sign five copies of this form. After this has been done, a written request for a final inspection of the system shall be made.

MEMORANDUM:

This memo is for the information of all concerned that the CITY has been given a start-up demonstration on the system described above. This start-up demonstration consisted of the system operation, during which all major items of equipment were explained and demonstrated, and the following items were given to the CITY:
(a) CITY's copy of Operation and Maintenance Manual for the system containing approved submittal sheets on all items, including the following:

(1) Maintenance information published by manufacturer on equipment items.

(2) Printed warranties by manufacturers on equipment items.

(3) Performance verification information as recorded by CONTRACTOR.

(4) Check-out Memo on equipment by manufacturer’s representative.

(5) Written operating instructions on any specialized items.

(6) Explanation of guarantees and warranties on the system.

(b) Prints showing actual "As-Built" conditions.

(c) A demonstration of the system in operation and of the maintenance procedures which will be required.

______________________________________________________________________________

(Name of CONTRACTOR)

By:___________________________________________________________________________

(Authorized Signature, Title & Date)

______________________________________________________________________________

(Name of Subcontractor)

By:___________________________________________________________________________

(Authorized Signature, Title & Date)

Operation and Maintenance Manual, Instruction Prints, Start-Up Demonstration and Instruction in Operation Received:

______________________________________________________________________________

(CITY OF NEW SMYRNA BEACH)

By:___________________________________________________________________________

(Authorized Signature, Title & Date)

-END-
SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the Work.

B. Related Requirements Described Elsewhere:

1. Start-Up: Section 01650

2. Cleaning: Section 01710.

3. Project Record Documents: Section 01720.

4. Operating and Maintenance Data: Section 01730.

5. Warranties and Bonds: Section 01740.

1.02 SUBSTANTIAL COMPLETION

A. The Work will not be substantially complete, and Contractor may not request substantial completion inspection unless the following submittals and work is completed:

1. All Operation and Maintenance manuals have been submitted and approved to the requirements of Section 01730.

2. All equipment has been checked-out by the equipment manufacturer and Certificates of Manufacturer's Check-Out have been submitted as required by Section 01650.

3. All start-up and demonstration testing completed and Certificates of Completed Demonstration submitted to the requirements of Section 01650.

4. Project Record Documents are complete and have been submitted and reviewed to the requirements of Section 01720.

5. All training of Owner's personnel completed.

6. All areas to be used and occupied are safe, operable in automatic and complete.
7. All painting, finishes, fencing, cleanup, final grading, grassing, planting, sidewalk construction, and paving shall have been completed and are ready for inspection.

8. All deficiencies noted on inspection reports or nonconformances are corrected or the correction plan approved.

B. When the conditions of paragraph 1.02 A. are met the Contractor shall submit to the Engineer:

1. A written notice that he considers the Work, or portion thereof, is substantially complete, and request an inspection.

2. A punchlist of items to be corrected. (Uncompleted work which is not related to the safe, effective, efficient use of the Project may be allowed on the punchlist with the Engineer’s approval.)

C. Within a reasonable time after receipt of such notice, the Engineer will make an inspection to determine the status of completion.

D. Should the Engineer determine that the Work is not substantially complete:

1. The Engineer will promptly notify the Contractor in writing, giving the reasons therefor.

2. Contractor shall remedy the deficiencies in the Work and send another written notice of substantial completion to the Engineer.

3. The Engineer will within reasonable time, reinspect the Work. The Contractor will be liable for reinspection fees as described in Paragraph 1.04, herein.

E. When the Engineer finds that the Work is substantially complete, he will:

1. Schedule a walk-through of the facility to include the Owner. Engineer shall determine the completeness of the punchlist and readiness of the facility for occupancy by the Owner.

2. Prepare and deliver to Owner a tentative Certificate of Substantial Completion with the tentative punchlist of items to be completed or corrected before final inspection.

3. After consideration of any objections made by the Owner as provided in Conditions of the Contract, and when the Engineer considers the Work substantially complete, he will execute and deliver to the Owner and the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be completed or corrected. Any incomplete work allowed on a punchlist must be reinspected upon completion and any deficiencies found will be added to the punchlist.
1.03  FINAL INSPECTION

A.  Prior to Contractor's request for a final inspection the following submittals and work must be complete:

1.  Project Record Documents must be approved.

2.  All spare parts and maintenance materials must be suitably delivered to the Owner per the requirements of the Technical Sections of the Specifications.

3.  Contractor to submit evidence of compliance with requirements of governing authorities.

B.  After satisfying the requirements of Paragraph 1.03 A. and when Contractor considers the Work complete, he shall submit written certification that:

1.  Contract Document requirements have been met.

2.  Work has been inspected for compliance with Contract Documents.

3.  Work has been completed in accordance with Contract Documents.

4.  Equipment and systems have been tested in the presence of the Owner's representative and are operational.

5.  All punchlist items have been corrected or completed and the Work is ready for final inspection.

C.  The Engineer will, within reasonable time, make an inspection to verify the status of completion after receipt of such certification.

D.  Should the Engineer consider that the Work is incomplete or defective:

1.  The Engineer will promptly notify the Contractor in writing, listing the incomplete or defective work.

2.  Contractor shall take immediate steps to remedy the stated deficiencies, and send another written certification to the Engineer that the Work is complete.

3.  The Engineer will, within a reasonable amount of time, reinspect the Work and the Contractor shall be liable for reinspection fees as described in Paragraph 1.04, herein.

D.  When the Engineer finds that the Work is acceptable under the Contract Documents, the Contractor may make closeout submittals.
1.04 RE-INSPECTION FEES

A. Should the Engineer perform re-inspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:

1. Contractor will compensate the Owner for such additional services.

2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

1.05 CONTRACTOR'S CLOSEOUT SUBMITTALS

A. Warranties and Bonds: To requirements of Section 01740.

B. Evidence of Payment and Release of Liens: To requirements of General and Supplementary Conditions.

C. Certificate of Insurance for Products and Completed Operations.

1.06 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to the Engineer.

B. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract Sum.

2. Additions and deductions resulting from:
   a. Previous change orders or written amendments.
   b. Allowances.
   c. Unit prices.
   d. Deductions for uncorrected work.
   e. Penalties and bonuses.
   f. Deductions for liquidated damages.
   g. Deductions for reinspection payments.
   h. Other adjustments.

3. Total Contract Sum, as adjusted.

4. Previous payments.
5. Sum remaining due.

C. Engineer will prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.07 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01710
CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Execute cleaning, during progress of the Work and at completion of the Work.

1.02 DISPOSAL REQUIREMENTS

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

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.01 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 or personal activities.

B. Provide on-site containers for the collection of waste materials, debris and rubbish.

C. Remove waste materials, debris and rubbish from the site periodically, or as directed by the Owner, and dispose of at legal disposal areas away from the site.

3.02 DUST CONTROL

A. The Contractor shall employ construction techniques that minimize the production and distribution of dust.
B. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.

C. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.

3.03 FINAL CLEANING

A. Employ skilled workmen for final cleaning.

B. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces.

C. Prior to final completion, or Owner occupancy, Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces and all work areas, to verify that the entire Work is clean.

END OF SECTION
SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Maintain at the site for the Owner one (1) record copy of:

1. Drawings.
2. Specifications.
3. Addenda.
5. Engineer's Field Orders or written instructions.
6. Approved Shop Drawings, Working Drawings and Samples.
7. Field test records.
8. Construction photographs.

B. Related Requirements Described Elsewhere:

1. Field Engineering and Surveying: Section 01050.
2. Shop Drawings, Working Drawings and Samples: Section 01340.
3. Pre-Construction Photos/Videos: Section 01380.

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with CSI format with section numbers as provided herein.
C. Maintain documents in a clean, dry, legible, condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by the Engineer or the Owner.

E. As a prerequisite for monthly Progress payments, the Contractor is to exhibit the currently updated "Record Documents" for review by the Engineer and Owner. Payment may be withheld if record documents are not satisfactorily maintained.

1.03 MARKING DEVICES

A. Provide felt tip marking pens for recording information in the color code designated by the Engineer.

1.04 RECORDING

A. Label each document "PROJECT RECORD" with a rubber stamp having one (1) inch high letters.

B. Record information concurrently with construction progress.

1. Do not conceal any work until required information is recorded.

C. Drawings: Legibly and clearly mark, to scale, each drawing to record actual construction:
   1. Depths of various elements of foundation in relation to finish first floor datum.
   2. All underground piping with elevations and dimensions. Changes to piping location. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Actual installed pipe material, class, etc.
   3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
   4. Field changes of dimension and detail.
   5. Changes made by Field Order or by Change Order.
   6. Details not on original Contract Drawings.
   7. Equipment and piping relocations.
   8. Major architectural and structural changes including relocation of doors, windows, etc.
9. Architectural schedule changes according to Contractor's records and shop drawings.

D. Specifications and Addenda: Legibly mark each section to record:

1. Manufacturer, trade name, catalog number of Supplier of each product and item of equipment actually installed.

2. Changes made by Field Order or by Change Order.

E. Shop Drawings (after final review and approval): Provide six (6) sets of record shop drawings within the Operation and Maintenance Manual, for each process equipment, piping, electrical system and instrumentation system (see Section 01730).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01730
OPERATING AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under Contract.
   a. Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of Specifications.

2. Instruct Owner's personnel in maintenance of products and in operation of equipment and systems.

B. Related Requirements Described Elsewhere:


2. Project Record Documents: Section 01720.

3. Mechanical: Division 15.

4. Electrical: Division 16.

1.02 QUALITY ASSURANCE

A. Preparation of data shall be done by personnel:

1. Trained and experienced in maintenance and operation of described products.

2. Familiar with requirements of this Section.

3. Skilled as technical writer to the extent required to communicate essential data.

4. Skilled as draftsman competent to prepare required drawings.

1.03 FORM OF SUBMITTALS

A. Prepare data in form of an instructional manual for use by Owner's personnel.
B. Format:

1. Size: 8-1/2 inches x 11 inches.
2. Paper: 20 pound minimum, white, for typed pages.
3. Text: Manufacturer's printed data, or neatly typewritten.
4. Drawings:
   a. Provide reinforced punched binder tab, bind in with text.
   b. Reduce larger drawings and fold to size of text pages but not larger than 14 inches x 17 inches.
5. Provide fly-leaf for each separate product, or each piece of operating equipment.
   a. Provide typed description of projects and major component parts of equipment.
   b. Provide identified tabs.
6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:
   a. Title of Project.
   b. Identity of separate structure as applicable.
   c. Identity of general subject matter covered in the manual.

C. Binders:

1. Commercial quality, three D-ring type binders with durable and cleanable white plastic covers. Binders shall be presentation type with clear vinyl covers on front, back and spine. Binders shall include two sheet lifters and two, horizontal inside pockets.
3. When multiple binders are used, correlate the data into related consistent groupings.

D. In addition to standard operation and maintenance manuals, all manufacturers supplying equipment specified in Division 15 shall submit their operation and maintenance manuals on magnetic media/floppy disks in Microsoft Word, WordPerfect
or text, ".txt" formats. All graphic files shall be in BMP, PCS, CDR, JPEG, DWG or DXF formats.

1.04 CONTENT OF MANUAL

A. Neatly typewritten table of contents for each volume, arranged in systematic order.

1. Contractor, name of responsible principal, address and telephone number.

2. A list of each product required to be included, indexed to content of the volume.

3. List, with each product, name, address and telephone number of:
   
a. Subcontractor, manufacturer and installer name, addresses and telephone numbers.

b. A list of each product required to be included, indexed to content of the volume.

c. Identify area of responsibility of each.

d. Local source of supply for parts and replacement equipment including name, address and telephone number.

4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

B. Product Data:

1. Include only those sheets which are pertinent to the specific product.

2. Annotate each sheet to:
   
a. Clearly identify specific product or part installed.

b. Clearly identify data applicable to installation.

c. Delete references to inapplicable information.

3. Operation and maintenance information as herein specified.

4. Record shop drawings as submitted and approved with all corrections made for each product.
C. Drawings:

1. Supplement product data with drawings as necessary to clearly illustrate:
   a. Relations of component parts of equipment and systems.
   b. Control and flow diagrams.

2. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.

3. Do not use Project Record Documents as maintenance drawings.

D. Written test, as required to supplement product data for the particular installation:

1. Organize in consistent format under separate headings for different procedures.

2. Provide logical sequence of instruction of each procedure.

E. Copy of each warranty, bond and service contract issued.

1. Provide information sheet for Owner's personnel, give:
   a. Proper procedures in event of failure.
   b. Instances which might affect validity of warranties or bonds.

1.05 MANUAL FOR MATERIALS AND FINISHES

A. Submit six (6) copies of complete manual in final form.

B. Content: for architectural products, applied materials and finishes:

1. Manufacturer's data, giving full information on products.
   a. Catalog number, size, composition.
   b. Color and texture designations.
   c. Information required for reordering special manufacturing products.

2. Instructions for care and maintenance.
   a. Manufacturer's recommendation for types of cleaning agents and methods.
   b. Cautions against cleaning agents and methods which are detrimental to product.
c. Recommended schedule for cleaning and maintenance.

C. Content, for moisture protection and weather-exposed products:
1. Manufacturer's data, giving full information on products.
   a. Applicable standards.
   b. Chemical composition.
   c. Details of installation.

2. Instructions for inspection, maintenance and repair.

D. Additional requirements for maintenance data: Respective sections of Specifications.

1.06 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit six (6) copies of complete manual in final form.

B. Content, for each unit of equipment and system, as appropriate:

1. Description of unit and component parts.
   a. Function, normal operating characteristics, and limiting conditions.
   b. Performance curves, engineering data and tests.
   c. Complete nomenclature and commercial number of replaceable parts.
   d. Summary of information listed on equipment and motor data plates.

2. Operating procedures:
   a. Start-up, break-in, routine and normal operating instructions.
   b. Regulation, control, stopping, shut-down and emergency instructions.
   c. Summer and winter operating instructions.
   d. Special operating instructions.
3. Maintenance procedures:
   a. Routine operations.
   b. Guide to "trouble-shooting".
   c. Disassembly, repair and reassembly.
   d. Alignment, adjusting and checking.

4. Servicing and lubrication required.

5. Manufacturer's printed operating and maintenance instructions.

6. Description of sequence of operation by control manufacturer.

7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
   a. Predicted life of parts subject to wear.
   b. Items recommended to be stocked as spare parts.

8. As-installed control diagrams by controls manufacturer.

   a. As-installed color coded piping diagrams.

10. Charts of valve tag numbers, with location and function of each valve.

11. List of original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.

12. Other data as required under pertinent sections of specifications.

13. Approved record shop drawings with all corrections made, and a copy of the warranty statement, checkout memo, demonstration test procedures and demonstration test certification.

C. Content, for each electric and electronic systems, as appropriate:

1. Description of system and component parts.
   a. Function, normal operating characteristics, and limiting conditions.
   b. Performance curves, engineering data and tests.
c. Complete nomenclature and commercial number of replaceable parts.

2. Circuit directories and panelboards.
   a. Electrical service.
   b. Controls.
   c. Communications.

3. As installed color coded wiring diagrams.

4. Operating procedures:
   a. Routine and normal operating instructions.
   b. Sequences required.
   c. Special operating instructions.

5. Maintenance procedures:
   a. Routine operations.
   b. Guide to "trouble-shooting".
   c. Disassembly, repair and reassembly.
   d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.

7. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

8. Other data as required under pertinent sections of specifications.

D. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner’s personnel.

E. Additional requirements for operating and maintenance data: Respective sections of Specifications.
1.07 SUBMITTAL SCHEDULE

A. Submit two (2) copies of preliminary draft of proposed formats and outlines of contents of Operation and Maintenance Manuals within 30 days after approval of submittals.

B. Submit two (2) copies of completed data in preliminary form no later than 20 days following Engineer's review of the last shop drawing of a product and/or other submittal specified under Section 01340, but no later than delivery of equipment. One (1) copy will be returned with comments to be incorporated into the final copies and the other copy will be retained on-site for use in any early training.

C. Submit six (6) copies of approved manual in final form directly to the offices of the Engineer, Tetra Tech, within 10 days after the reviewed copy or last item of the reviewed copy is returned.

D. Provide six (6) copies of addenda to the operation and maintenance manuals as applicable and certificates as specified within 30 days after final inspection.

E. Provide two (2) compact discs containing each operation and maintenance manual in PDF format.

1.08 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to demonstration test, fully instruct Owner's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.

B. Operating and maintenance manual shall constitute the basis of instruction. Review contents of manual with Owner's operating and maintenance personnel in full detail to explain all aspects of operations and maintenance.

C. Instructors shall be fully qualified personnel as outlined within the individual equipment specifications. If no specific training specifications are listed with the equipment, the Contractor shall provide the instruction with qualified Contractor personnel.

D. The Contractor shall provide a list to the Owner indicating the date, time and instructors that will be present for all training sessions.

E. The instructors shall provide for and prepare lesson scopes and handouts for up to five individuals designated by the Owner that outline the items to be covered. Separate sessions for operation and maintenance instruction shall be provided consecutively. Handouts shall be submitted to the Owner with at least one week's notice prior to the training sessions.

F. All instruction sessions shall be recorded with portable video recording cameras and digital media supplied by the Contractor. Recordings shall be made by the Contractor under the direction of the Owner. Recording equipment shall provide files in a digital format that is compatible with personal computers and DVD players.
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Related Work Described Elsewhere:


1.02 SUBMITTAL REQUIREMENTS

A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.

B. Number of original signed copies required: Two (2) each.

C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product of work item.

2. Firm, with name of principal, address and telephone number.


4. Date of beginning of 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 or warranty or bond.

7. Contractor, name of responsible principal, address and telephone number.

1.03 FORM OF SUBMITTALS

A. Prepare in duplicate packets.
B. Format:

1. Size 8-1/2 inches by 11 inches, punch sheets for standard three (3) ring 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 (3) D-ring type binders with durable and cleanable white plastic covers and maximum D-ring width of two (2) inches. Binders shall be presentation type with clear vinyl covers on front, back, and spine. Binders shall include two sheet lifters and two horizontal inside pockets.

1.04 WARRANTY SUBMITTALS 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 final acceptance by the Owner.

B. The Contractor shall be responsible for obtaining certificates for equipment warranty for all major equipment specified under Divisions 11: Equipment; 13: Special Construction; 15: Mechanical; and 16: Electrical and which has at least 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.

C. In the event that the equipment manufacturer or supplier is unwilling to provide a one (1) year warranty commencing at the start of the Correction Period, the Contractor shall obtain from the manufacturer a two (2) year warranty commencing at the time of equipment delivery to the job site. This two (2) year warranty from the manufacturer shall not relieve the Contractor of the one (1) year warranty, starting at the time of Owner's acceptance of the equipment.

D. The Owner shall incur no labor or equipment cost during the guarantee period.

E. Guarantee shall cover all necessary labor, equipment, materials, and replacement parts resulting from faulty or inadequate equipment design, improper assembly or erection, defective workmanship and materials, leakage, breakage or other failure of all equipment and components furnished by the manufacturer or the Contractor.
F. A one (1) year warranty shall cover all necessary labor, equipment, materials, and replacement parts resulting from improper assembly or erection, defective workmanship and materials, leakage, breakage or other failure of all components furnished by the manufacturer or the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
DIVISION 2

SITEWORK
PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. This Section includes furnishing all labor, materials, permits, notifications, equipment and incidentals required for the demolition and disposal of all materials and equipment designated for removal.

2. These Specifications call attention to certain activities necessary to maintain and facilitate operation during and immediately following construction and do not purport to cover all of the activities necessary. The Contractor shall exercise due care to maintain continuous operation of the existing facilities and minimize operation inconvenience. In accordance with this requirement, a Demolition and Removal Plan shall be developed and submitted in accordance with Paragraph 1.06 herein and Section 01310 – Construction Project Schedules.

3. Demolition includes, but is not limited to:
   a. Removal of sanitary sewer piping, force main piping, miscellaneous piping, valves, fencing, asphalt pavement, clearing and grubbing, and other items as shown on the Drawings or necessary to complete the Project.
   b. Disposal of nonsalvageable and excess unacceptable material as specified below.
   c. Off-site disposal of excess and unacceptable materials.

4. The Contractor shall examine the Contract Documents, visit the project site and determine the extent of the work affected therein, and all conditions under which the work will be performed.

1.02 PERMITS AND NOTICES

A. Permits and Licenses: Contractor shall obtain all necessary permits and licenses for performing the work and shall furnish a copy of same to the Owner prior to commencing the Work. The Contractor shall comply with the requirements of the permits.

B. Notices: Contractor shall issue written notices of planned demolition at least one (1) month prior to any demolition to all residence in surrounding subdivision, along with
companies or local authorities owning utility conduit, wires or pipes running to or through the project site. Notices to residences shall include a project description, estimated duration and anticipated traffic constriction for the project. Drafts of said notices shall be submitted to the Engineer.

C. Utility Services: Contractor shall notify utility companies or local authorities furnishing gas, water, electrical, telephone, cable television, or sewer service to remove any equipment owned by them in structures to be demolished and to remove, disconnect, cap, or plug their services to facilitate demolition.

1.03 CONDITIONS AND STRUCTURES

A. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable, however, minor variations within the structure may occur prior to the start of demolition work.

1.04 RULES AND REGULATIONS

A. The Florida Building Code and applicable codes shall control demolition, modification, or alteration of the existing buildings or structures.

B. No blasting shall be done on site. The Contractor shall not bring or store any explosives on site.

C. The Contractor shall dispose of all wastewater contents (including sediment) and discharge structure in accordance with FDEP Rules and Regulations.

1.05 DISPOSAL OF MATERIAL

A. Salvageable material shall become the property of the Owner, if the Owner requests any specific item. The Contractor shall dismantle all the materials to such a size that they can be readily handled, and deliver any of the salvageable materials requested by the Owner to a designated storage area on-site, as directed by the Owner.

B. Prior to disposal of any material from the site, Contractor shall coordinate with Owner to verify that Owner does not want to maintain ownership.

C. Any material that the Owner rejects shall become the Contractor’s property and must be removed from the site, transported, and disposed of by the Contractor.

D. Concrete, concrete block, and unsalvageable bricks shall be hauled to a waste disposal site by the Contractor.

E. The storage of or sale of removed items on the site shall not be allowed.
1.06 SUBMITTALS

A. Submit to the Engineer within twenty (20) days after the Notice-to-Proceed for approval, five (5) copies of the proposed Demolition and Removal Plan for the structures and modifications as shown on the Drawings or as specified herein prior to the start of Work. Include a detailed schedule showing the coordination of bypassing, shutoff, capping and continuation of utility service as required. The Demolition and Removal Plan shall include as a minimum, the following:

1. A detailed sequence of demolition and removal work to ensure the continued conveyance of wastewater service and compliance with regulatory agency requirements, as well as the expeditious completion of the Contractor's work.

2. A list of all activities, including Owner activities, bypass activities and shutdowns, required to complete the work.

3. Evidence (by signature) of review of the lift station manager of the work plan.

4. The sequence of demolition and renovation of existing facilities shall be in accordance with the approved Demolition and Removal Plan as specified in this Section. The Contractor is solely responsible for construction and demolition sequencing of the Work.

5. Submit signed and sealed demolition/shoring drawings and calculations prepared by a professional engineer, registered in the State of Florida.

B. Before commencing demolition work, all modifications necessary to bypass the affected structure shall be completed. Contractor shall coordinate with the Owner's personnel to determine the locations of the affected equipment, valves and fittings at least 48 hours in advance of any demolition work.

C. The above procedure shall be followed for each individual demolition operation.

1.07 TRAFFIC AND ACCESS

A. Conduct demolition and modification operations, and the removal of equipment and debris to ensure minimum interference with roads, streets, and sidewalks both on-site and off-site and to ensure minimum interference with occupied or used facilities.

B. The Contractor shall at all times maintain safe and convenient access to the adjacent properties.

C. Do not close or obstruct streets or walks without permission from the Owner and Engineer. Provide alternate traffic routes around closed or obstructed access ways.

D. Special attention is directed towards maintaining safe and convenient access to the existing facilities remaining in service by Utilities Commission of New Smyrna Beach
personnel. Relocation of the Contractor's materials or equipment due to uncoordinated interruption will be at the Contractor's expense.

1.08 DAMAGE

A. Promptly repair damage caused to adjacent facilities by demolition operations at no cost to the Owner.

1.09 UTILITIES

A. Existing utilities to remain in service and protect against damage during demolition operations.

B. Do not interrupt existing utilities serving occupied or used facilities, except when authorized by the Owner and the Engineer. Provide temporary service during interruptions to existing utilities as acceptable to the Utility Owner.

C. The Contractor shall cooperate with the Owner to shut off utilities serving structures as required by demolition operations.

D. The Contractor shall be solely responsible for making all necessary arrangements and for performing any necessary work involved in connection with the discontinuance or interruption of all public and private utilities or services under the jurisdiction of the utility companies.

E. All utilities being abandoned shall be disconnected and terminated at the service mains in conformance with the requirement of the utility companies or the municipality owning or controlling them.

1.10 POLLUTION CONTROL

A. For pollution control, use water sprinkling, temporary enclosures, and other suitable methods as necessary to limit the amount of dust and dirt rising and scattering in the air to the lowest level of air pollution practical for the conditions of work. Comply with the governing regulations.

B. Take all necessary measures and means to provide dust, dirt, debris and paint abatement methods to prevent damage to surrounding properties, on-site structures, and private property.

C. Clean on-site structures and improvements of all dust, dirt and debris caused by demolition operations as directed by the Engineer. Clean or repair all off-site property as shown on the Drawings and specified herein. Return areas to conditions existing prior to the start of work.

1.11 QUALITY CONTROL

A. Protect all existing materials and equipment to be salvaged or reused from damage.
B. No above-ground pipes, junction boxes, conduits, or wires are to be left abandoned.

C. Leave all exposed ends of all pipe and conduit or junction boxes covered and safe.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 SEQUENCE OF WORK

A. The sequence of demolition and renovation of existing facilities shall be in accordance with the approved demolition and removal plan as specified in Section 01014 – Construction Sequence and Section 01310 – Project Schedules.

B. The Contractor shall have a basic understanding of the operation of the existing wastewater collection system before preparation of the Demolition and Removal Plan to maintain facility operation and reliability during the demolition process.

C. Show the complete sequence of construction by activity and by structure. Utilize proposed sequence of work in Section 01014 – Construction Sequence as a basis for the detailed sequence of construction.

3.02 REMOVAL OF EXISTING EQUIPMENT, PIPING, AND APPURTEINANCES

A. Subject to the constraints of maintaining the existing facilities in operation, existing equipment, non-buried valving and piping, and appurtenances not necessary for the operation of the new facilities shall be removed as shown or indicated on the Drawings.

B. All equipment, piping, and appurtenances shall be cleaned, flushed, and drained. Equipment to be retained by the Owner as specified in Paragraph 1.05 above shall be dismantled sufficiently to permit thorough cleaning and draining. All valves shall be left open.

3.03 BURIED PIPING

A. Remove all demolished and abandoned buried piping encountered during excavation unless otherwise directed by Owner.

END OF SECTION
SECTION 02090

SOIL BORINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Soil boring data consisting of reproductions of boring logs were made for the Engineer by Ardaman & Associates, Inc. A copy of the complete soils report is included in the Appendix.

B. The boring data has been used by the Engineer for the design of the proposed utilities and roadway improvements.

C. The subsurface information contained herein was obtained for design purposes and may not be an adequate representation of actual conditions for project construction. Information shown, including water levels, represents existing conditions at the specific boring locations at the time the borings were made. All risks resulting from use or interpretation of the subsurface data shown shall be borne by the Contractor.

D. The data is included for information only and may be useful as a guide in estimating and planning the work.

E. If additional subsurface information is required by the Bidder/Contractor, it shall be the Bidder's/Contractor's responsibility to obtain such data.

F. Refer to Section 00700 – General Conditions Article 5, and Section 00800 – Supplementary Conditions for further explanation of subsurface conditions.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION
SECTION 02100
SITE PREPARATION

PART 1 - GENERAL

1.01 THE REQUIREMENT
   A. The work of this Section includes measures required during the Contractor's initial mobilization onto the Site to protect existing fences, houses and associated improvements, streets, and utilities downslope of construction areas from damage due to boulders, trees or other objects dislodged during the construction process; clearing, grubbing and stripping; and regrading of certain areas to receive embankment fill.

1.02 SITE INSPECTION
   A. Prior to moving onto the Site, the Contractor shall inspect the Site conditions and the Utilities Commission of New Smyrna Beach’s property and right-of-way lines.
   B. The Contractor’s attention is directed to any Soil Erosion and Sediment Control Ordinances in force. The Contractor shall comply with all applicable sections of these ordinances and NPDES requirements.

1.03 PRE CONSTRUCTION VIDEO
   A. Prior to any work being performed, the Contractor shall prepare a preconstruction video in accordance with Section 01380.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PRIMARY SITE ACCESS
   A. The Contractor shall develop any necessary access to the Site, including access barriers to prohibit entry of unauthorized persons.
   B. Utility Interference: Where existing utilities interfere with the WORK, notify the utility owner and the Utilities Commission of New Smyrna Beach before proceeding per Section 01530 – Protection of Existing Facilities.
3.02 CLEARING AND GRUBBING

A. Except as otherwise directed the Contractor shall cut, grub, remove and dispose of all trees, stumps, brush, shrubs, roots and any other objectionable material within the limits of the construction.

B. All trees, stumps, brush, shrubs, roots and other objectionable material shall be cut, grubbed, removed and disposed of from areas needed to construct buildings, structures, roads, pipelines and any other areas to be stripped.

C. Contractor shall protect trees or groups of trees, designated by the Utilities Commission of New Smyrna Beach to remain, from damage by all construction operations by erecting suitable barriers, or by other approved means. Clearing operations shall be conducted in a manner to prevent falling trees from damaging trees designated to remain.

D. Areas outside the easements or limits of clearing shall be protected from damage and no equipment or materials shall be stored in these areas, unless prior written permission is granted before use of these areas.

E. No stumps, trees, limbs, or brush shall be buried in any fills or embankments.

3.03 STRIPPING

A. The Contractor shall strip topsoil from all areas to be excavated or filled. Avoid mixing topsoil with subsoil and stockpile topsoil in areas on the Site as approved by the Utilities Commission of New Smyrna Beach. Topsoil shall be free from brush, trash, large stones and other extraneous material and protected until it is placed as directed. Dispose of any remaining topsoil as directed by the Utilities Commission of New Smyrna Beach.

3.04 DISPOSAL OF MATERIALS

A. All tree trunks, limbs, roots, stumps, brush, foliage, other vegetation and objectionable material shall be removed from the Site and disposed of in a manner satisfactory to the Utilities Commission of New Smyrna Beach. Disposal (including hauling) of cleared, grubbed, and unsuitable material and debris shall be the responsibility of the Contractor.

B. Burning of cleared and grubbed materials will not be permitted.

3.05 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

A. The Contractor shall avoid unnecessary disturbance of private property along the route of the construction. See Section 02920 - Restoration for requirements.

B. The Contractor shall clean up the construction site across private property immediately after construction is completed.
3.06 PRESERVATION OF PUBLIC PROPERTY

A. The appropriate paragraphs of Articles 3.1, 3.2, and 3.4 of these specifications shall apply to the preservation and restoration of public lands, parks, rights-of-way, private easement, and all other damaged areas.

3.07 EXCAVATED MATERIALS UNSUITABLE FOR CONVENTIONAL DISPOSAL

A. It will be the Contractor’s responsibility to properly dispose of materials unsuitable for conventional disposal. The cost of disposal shall be included in the Contractor’s Bid Price.

END OF SECTION
SECTION 02140
DEWATERING

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall provide all labor, materials, and equipment necessary to dewater trench and structure excavations, in accordance with the requirements of the contract Documents. The Contractor shall secure all necessary permits to complete the requirements of this Section of the Specifications. Refer to Specification Sections 01065 – Permits & Fees.

1.02 QUALITY CONTROL

A. It shall be the sole responsibility of the Contractor to control the rate and effect of the dewatering in such a manner as to avoid all objectionable settlement and subsidence.

B. All dewatering operations shall be adequate to assure the integrity of the finished project and shall be the responsibility of the Contractor.

C. Where critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement, which may develop. The responsibility for conducting the dewatering operation in a manner, which will protect adjacent structures and facilities, rests solely with the Contractor. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor.

D. All dewatering shall comply with the regulations of the St. Johns River Water Management District and any other agency with jurisdiction.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Dewatering may include the use of well points, deep wells, and temporary pipelines for water disposal. The temporary pipelines shall not be used as permanent piping for the WORK. Standby pumping equipment shall be maintained on the jobsite.
PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. The Contractor shall provide all equipment necessary for dewatering. It shall have on hand, at all times, sufficient pumping equipment and machinery in good working condition and shall have available, at all times, competent workmen for the operation of the pumping equipment. Adequate standby equipment shall be kept available at all times to insure efficient dewatering and maintenance of dewatering operation during power failure.

B. Dewatering for structures and pipelines shall commence when groundwater is first encountered, and shall be continuous until such times as water can be allowed to rise in accordance with the provisions of this Section or other requirements.

C. At all times, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and be pumped or drained by gravity from the excavation to maintain a bottom free from standing water.

D. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

E. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with crushed rock meeting FDOT Specification No. 57 gradation requirements.

F. The Contractor shall maintain the water level one-foot below the bottom of excavation in all work areas where groundwater occurs during excavation, construction, backfilling, and testing.

G. The Contractor shall prevent flotation by maintaining a positive and continuous removal of water. The Contractor shall be fully responsible and liable for all damages, which may result from failure to adequately keep excavations dewatered.

H. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sandpacked and/or other means used to prevent pumping of fine sands or silts from the subsurface. Well points cannot be jetted in with Utilities Commission of New Smyrna Beach irrigation water. A continual check by the Contractor shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation. Immediately upon withdrawal of well points, the contractor shall backfill the hole with clean sand, bedding rock meeting FDOT No. 89 gradation requirements or equal.

I. The Contractor shall dispose of water from the WORK in a suitable manner without damage to adjacent property. The Contractor shall be responsible for obtaining any permits that may be necessary to dispose of water. No water shall be drained into work...
built or under construction unless hydraulic compaction is employed as their means of compaction and with prior approval of the Utilities Commission of New Smyrna Beach. Water shall be filtered using an approved method to remove sand and fine-sized soil particles before disposal into any drainage system.

J. The reestablishment of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill and prevent flotation or movement of structures, pipelines, and sewers.

K. Contractor shall provide sound attenuating structures for the above ground pumps as required and directed by the Utilities Commission of New Smyrna Beach.

END OF SECTION
SECTION 02150

TRENCH SAFETY

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall provide Trench Safety in accordance with the Florida Trench Safety Act to ensure worker safety at the construction site. The Contractor shall be responsible for the implementation and maintenance of trench safety standards.

1.02 SUBMITTALS

A. The Contractor shall prepare and submit a trench safety plan which shall include the means to be utilized and the conditions determining which type of trench safety standard(s) will be used during construction.

B. The trench safety plan shall include the names, positions, experience, and training information of a “Competent Persons”, who shall insure the implementation of the measures and standards for complying with the Florida Trench Safety Act.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 The Contractor shall provide Trench Safety measures as required and shall maintain the necessary supervision on site at all times to assure the Trench Safety requirements are being implemented on their project. The Contractor shall monitor his Subcontractors to ensure they comply also with the Florida State Trench Safety Act.

END OF SECTION
PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall perform all earthwork indicated and required for construction of the work, complete and in place, in accordance with the Contract Documents. The Contractor shall furnish all labor, materials, equipment, and incidentals necessary to perform the work.

B. The Contractor shall examine the site, and review the results of subsurface investigations provided including soil borings, prior to commencing the work. In particular, the Contractor shall make a thorough investigation of the surface and subsurface conditions of the site and any special construction problems which may arise as a result of nearby water courses and flood plains, especially in areas where construction activities may encounter water bearing sands and gravels. The Contractor shall make his own investigations necessary to determine ground conditions at the project site.

1.02 QUALITY CONTROL

A. The Contractor shall engage the services of a qualified testing firm which is approved by the Utilities Commission of New Smyrna Beach, at the cost of the Contractor, to provide quality control testing and inspection services during earthwork operations as required in the Contract Documents. The Contractor shall provide the testing firm access to the site and earthwork under construction at such times as the testing firm requests and as is necessary for testing of the work.

1.03 QUALITY ASSURANCE BY OTHERS

A. The Utilities Commission of New Smyrna Beach may utilize its own personnel or retain its own testing firm to perform quality assurance of the quality control functions performed by the Utilities Commission of New Smyrna Beach. The quality assurance function is to confirm and document the accuracy of testing provided by the Testing Laboratory. The Utilities Commission of New Smyrna Beach and the Contractor shall cooperate with the Utilities Commission of New Smyrna Beach’s quality assurance program and shall provide access and samples when requested.

1.04 CONTRACTOR SUBMITTALS

A. The Contractor shall provide access for the Testing Laboratory to the source location of all bedding and backfill materials proposed to be used in the work in accordance with...
the requirements in Section 01300 – Contractor Submittals. The sample sizes shall be as
determined by the Testing Laboratory.

B. The Contractor shall provide submittals for any alternative methods of placement of
materials, in accordance with the requirements in Section 01300 – Contractor
Submittals.

C. Submit to the Engineer for review the proposed methods of construction, including
dewatering, excavation, bedding, filling, compaction and backfilling for the various
portions of the work. Review shall be for information only. The Contractor shall remain
responsible for the adequacy and safety of the methods. Where sheeting and bracing is
required for construction, the design shall be performed by a Professional Engineer.

D. Submit to the Engineer for review the Report, as performed by a Professional Engineer,
that indicates all muck has been removed from the proposed project area and that
backfilling has been conducted in substantial accordance with the project specifications
herein.

PART 2 - PRODUCTS

2.01 MATERIAL REQUIREMENTS

A. General: Materials for use as bedding and backfill, whether insitu or borrow, shall be as
described herein. Fill, backfill, and embankment materials shall be suitable materials
selected from the onsite operations or processed clean, fine earth, rock, or sand, free
from grass, roots, brush, or other organic material.

B. Common Fill: Common fill material shall be non-cohesive and shall consist of mineral
soil, substantially free of clay, organic material, loam, wood, trash and other
objectionable material which may be compressible or which cannot be properly
compacted. Common fill shall not contain stones larger than 6 inches in any dimension,
asphalt, broken concrete, masonry, rubble or other similar materials. It shall have
physical properties such that it can be readily spread and compacted during filling.
Additionally, common fill shall be no more than 12 percent by weight finer than the No.
200 mesh sieve unless finer material is approved for use in a specific location by the
Utilities Commission of New Smyrna Beach.

C. Select Common Fill: Select common fill material shall be as specified above from
common fill, with the exception that the material shall contain no stones more than 1-
1/2 inches in largest dimension, and shall be no more than 5 percent by weight finer
than the No. 200 mesh sieve.
D. Bedding Rock: Bedding rock material used in pipe trench within pipe zone, under abutments, and under concrete structures shall be crushed stone or gravel meeting the gradation and durability requirements of FDOT No. 89 and FDOT No. 57 stone, as indicated on the Contract Drawings. Number 131 and 132 Screenings may be substituted for FDOT No. 89 and FDOT No. 57 stone.

E. Structural Fill: Materials for structural fill shall be bedding rock or select common fill as specified herein or suitable material as approved by the Utilities Commission of New Smyrna Beach.

F. Unsuitable Material: Materials deemed not suitable for use on the project by the Utilities Commission of New Smyrna Beach.

G. Contractor shall be required to test and confirm requirements of common fill and select common fill prior to disposal on Utilities Commission of New Smyrna Beach provided property. Contractor shall also be responsible for hauling, stockpiling, and arranging said materials on Utilities Commission of New Smyrna Beach owned property per Utilities Commission of New Smyrna Beach’s direction.

2.02 USE OF FILL, BACKFILL, AND BEDDING MATERIAL TYPES

A. Backfill and bedding material types shall be used as indicated in the Drawings.

B. Structural Fill shall be used as backfill against the exterior walls of structures, or as shown on the Contract Drawings.

PART 3 - EXECUTION

3.01 EXCAVATION - GENERAL

A. General: Excavation shall include the removal of all existing soil materials encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of these materials shall conform to the lines and grades indicated in the Contract Drawings. Where indicated, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. Excavations shall be sloped or otherwise supported in a safe manner in accordance with the Florida Trench Safety Act and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926). The Contractor shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations.
B. Sheet ing and Bracing:

1. Furnish, put in place, and maintain sheeting and bracing as required to support the sides of excavations, to prevent movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures, and to protect workers from hazardous conditions or other damage. Such support shall consist of braced steel sheet piling, braced wood lagging and soldier beams or other approved methods. If the Owner is of the opinion that sufficient or proper supports have not been provided, he may order additional supports be installed at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids besides the sheeting, but if voids are formed, they shall be immediately filled and compacted. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill at no additional expense to the Owner.

2. The Contractor shall construct sheeting outside the neat lines of the foundation unless another configuration is desirable for his method of operation. Sheetin g shall be plumb and securely braced and tied in position. Sheetin g and bracing shall withstand all pressure to which the structure or trench will be subjected. Any deformation shall be corrected by the Contractor at his own expense so as to provide the necessary clearances and dimensions.

3. Where sheeting and bracing is required for construction, the Contractor shall engage a Professional Engineer, registered in the State of Florida, to design the sheeting and bracing. The sheeting and bracing installed shall conform with the design, and certification of this shall be provided by the Professional Geotechnical Engineer.

4. The installation of sheeting, particularly by driving or vibrating, may cause distress to existing structures. The Contractor shall evaluate the potential for such distress and, if necessary, take all precautions to prevent distress of existing structures because of sheeting installation.

5. The Contractor shall leave in place to be embedded in the backfill, all sheeting and bracing not shown on the Drawings but which the Owner directs him in writing to leave in place at any time during the progress of the work for the purpose of preventing injury to structures, utilities, or property, whether public or private. The Owner may direct that timber used for sheeting and bracing be cut off at any specified elevation.

6. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction, or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted for that purpose, or otherwise directed by the Owner.
7. The right of the Owner to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue such orders, and his failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

8. No wood sheeting is to be withdrawn if driven below mid-diameter of any pipe, and under no circumstances shall any wood sheeting be cut off at a level lower than one (1) foot above the top of any pipe.

C. Pumping and Drainage

1. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels as stipulated in Section 02140. The Contractor shall submit to the Engineer for review a plan for dewatering systems prior to commencing work. The installed dewatering system shall be in conformity with the overall construction plan. The Contractor shall be required to monitor the performance of the dewatering systems during the progress of the work and require such modifications as may be required to assure that the systems are performing satisfactorily.

2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the bottom of the excavation and to preserve the integrity of adjacent structures. Well or sump installations shall be constructed with proper sand filters to prevent intermixing of finer grained soil from the surrounding ground.

3. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.

4. The Contractor shall take all additional precautions to prevent buoyant uplift of any structure during construction.

5. The conveying of dewatered liquids in open ditches or trenches will not be allowed. Permission to use any storm sewers, or drains, for water disposal purposes shall be obtained from the authority having jurisdiction. Any requirements and costs for such use shall be the responsibility of the Contractor. The Contractor shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and he shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or
6. Flotation shall be prevented by the Contractor by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.

7. Removal of dewatering equipment shall be accomplished after the system is no longer required; the material and equipment constituting the system, shall be removed by the Contractor.

8. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, etc. in order to prevent adverse effects on groundwater quality.

3.02 STRUCTURE, ROADWAY, AND EMBANKMENT EXCAVATION

A. General: Excavations shall conform to the elevations and dimensions shown on the Contract Drawings within a tolerance of plus or minus 0.10 feet and extending a sufficient distance from footings and foundations to permit placing and removing formwork, installation of piping services and other construction, and inspection. In excavating for footings and foundations, care shall be exercised not to disturb the bottom of the excavation. Bottoms shall be trimmed to required lines and grades to leave a solid base to receive concrete.

B. Excavation for Structures and Embankments: Except where otherwise indicated for a particular structure, excavation shall be carried to the grade of the bottom of the footing or slab. Where unsuitable materials are encountered at the bottom of a footing or slab, areas beneath the structures or fills shall be over-excavated and backfilled to grade with Structural Fill material compacted to the requirements of the adjacent fill material.

3.03 PIPELINE AND UTILITY TRENCH EXCAVATION

A. General: Unless otherwise indicated or ordered, excavation for pipelines and utilities shall be open-cut trenches as indicated in the Contract Drawings.

B. Trench Bottom: The bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe bedding.

C. Open Trench: The maximum amount of open trench permitted in any one location shall be 500 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater. For open trenches greater than 500 feet in length, pre-approval from the Utilities Commission of New Smyrna Beach of New Smyrna Beach
must be obtained. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. If steel plates are used, no more than 40 feet in length along the trench will be allowed. The above requirements for backfilling or use of steel plate will be waived in cases where the trench is located more than 100 feet from any traveled roadway or occupied structure. In such cases, however, barricades, orange safety fences, and warning lights meeting safety requirements shall be provided and maintained.

D. Over-Excavation: Where trenches or excavations are required to be over-excavated to remove unsuitable materials, the excavation shall be to the minimum depth required to remove the unsuitable material, and shall be backfilled with common fill to the grade of the bottom of the pipe bedding as indicated in the Contract Drawings. Classification of the material as unsuitable shall be made by the Contractor based on test results and or inspection of the material in the excavation at the time of construction.

E. Where pipelines are to be installed in embankments, fills, or structure backfills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.

3.04 ROCK EXCAVATION

A. Rock excavation shall include removal and disposal of the following:

1. All boulders and rock, which require breaking by the use of special equipment or extraordinary excavation methods (may include hammers, wrecking balls, rock trenchers, drills, or other approved equipment).

2. All rock material in ledges, bedding deposits, and unstratified or conglomerate masses which cannot be removed using normal excavation methods and equipment.

B. Rock excavation shall be performed by the Contractor. The cost for removal and disposal shall be included in the Contractor’s Bid Price.

C. Blasting will not be permitted without prior written authorization of the Utilities Commission of New Smyrna Beach.

3.05 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. The Contractor shall remove and dispose of all excess excavated material not suitable or required for use on the project at a site selected and obtained by the Contractor at his own expense. The removal shall be timely and the disposal of all excess excavated materials shall be performed at least once a month.
B. Backfill replacement for unsuitable materials shall be provided from excess common fill available from on-site stockpiles. Refer also to Section 02100 – Site Preparation.

C. The Contractor shall obtain all required permits, landowner, and agency approvals for disposal of excess excavated material and shall pay all costs associated with the removal and disposal.

D. Depositing clean fill on private property within the Utilities Commission of New Smyrna Beach of New Smyrna Beach limits will not be permitted unless the property owner possesses a current building permit that requires fill. Contractors shall provide proof of said permit to the Engineer for review and approval prior to placing clean fill on the permitted property.

3.06 BACKFILL - GENERAL

A. The Contractor shall examine the areas and conditions under which excavating, filling and grading are to be performed, and shall not proceed with the work until unsatisfactory conditions have been corrected. The Contractor shall examine existing grade prior to commencement of the work and report to the Utilities Commission of New Smyrna Beach if elevations of existing grade vary from elevations shown on the Drawings.

B. The Contractor shall notify the Utilities Commission of New Smyrna Beach when an area or location is ready for testing and allow the Contractor’s Testing Laboratory to inspect and test fill materials and fill layers before further construction is performed.

C. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength (minimum of 75% of the 28-day design strength) to support the loads imposed.

D. Except for rock bedding materials being placed in over-excavated areas or trenches, backfill shall be placed after all water is removed from the excavation, and the trench sidewalls and bottom have been dried to a moisture content suitable for compaction.

E. If a moveable trench shield is used during excavation, pipe installation, and backfill operations, the shield shall be moved by lifting the shield free of the trench bottom or backfill and then moving the shield horizontally. The Contractor shall not drag trench shields along the trench causing damage or displacement to the trench sidewalls, the pipe, or the bedding and backfill.

F. Immediately prior to placement of backfill materials, the bottoms and sidewalls of trenches and structure excavations shall have all loose sloughing, or caving soil and rock
materials removed. Trench sidewalls shall consist of excavated surfaces that are in a relatively undisturbed condition before placement of backfill materials.

G. The surface of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the Drawings. No soft spots or uncompacted areas will be allowed in the work.

H. Backfill shall be compacted to 98 percent of maximum density (AASHTO T-180) under structures and paved areas, and 95 percent of maximum density (ASSHTO T-180) elsewhere unless otherwise indicated on the drawings.

3.07 PLACING AND SPREADING OF BACKFILL MATERIALS

A. Backfill materials shall be placed and spread evenly in layers. When compaction is achieved using mechanical equipment, the layers shall be evenly spread so that when compacted, each layer shall not exceed 12 inches in thickness.

B. The use of flooding and jetting methods to achieve compaction may be permitted upon approval. The Contractor shall submit methods documenting procedures to be utilized for approval to the Engineer and for the Utilities Commission of New Smyrna Beach for final approval.

C. During spreading, each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Backfill around pipes shall be manually spread around the pipe so that when compacted, the backfill will provide uniform bearing and side support.

D. Where the backfill material moisture content is below the optimum moisture content, water shall be added before or during spreading until the proper moisture content is achieved.

E. Where the backfill material moisture content is too high to permit the specified degree of compaction the material shall be dried until the moisture content is satisfactory.

1. Backfilling shall be carried up evenly on all walls of an individual structure. No backfill shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength (minimum of 75% of the 28-day design strength).

2. Bedding rock shall be used for bedding under all structures and pipe as indicated on the Drawings. The Contractor shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of the bedding.
3. In locations where pipes pass through structure walls, Structural Fill shall be placed for a distance of not less than 3 feet either side of the vertical center line of the pipe and the Contractor shall make special efforts to consolidate the fill up to the horizontal centerline of the pipe.

3.08 COMPACTATION OF FILL, BACKFILL, AND BEDDING MATERIALS

A. Each layer of backfill materials shall be compacted to the density indicated on the Drawings. A compacted effort approved by the Utilities Commission of New Smyrna Beach shall be employed to compact backfill layers before the water table is reestablished. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content.

B. Hydraulic compaction will be an acceptable alternative under certain soil conditions. Contractor shall submit methods to the Utilities Commission of New Smyrna Beach for approval.

C. Flooding, ponding, or jetting shall not be used for backfill around structures, for final backfill materials, or aggregate base materials without written authorization of the Utilities Commission of New Smyrna Beach.

D. Equipment weighing more than 10,000 pounds shall not be used closer to walls than a horizontal distance equal to the depth of the fill. Hand operated power compaction equipment shall be used where use of heavier equipment is impractical or restricted due to weight limitations.

3.09 PIPE AND UTILITY TRENCH BACKFILL

A. Backfilling over and around pipes shall begin as soon as practical after the pipe has been laid, jointed and inspected.

B. After compacting the bedding the Contractor shall perform a final trim using a stringline or other method for establishing grade, such that each pipe section when laid will be continually in contact with the bedding along the extreme bottom of the pipe. Excavation for pipe bells shall be made as required.

C. Bedding and backfill under, around and over pipes shall be compacted using light, hand operated, vibratory compactors. After completion of at least two feet of compacted backfill over the top of pipeline, heavier compaction equipment may be used to complete the trench backfill, although heavy vibratory rolling will not be permitted.

D. If a moveable trench shield is used during backfill operations the shield shall be lifted so as to not displace the pipe or backfill while the shield is being moved.
3.10 FILL AND EMBANKMENT CONSTRUCTION

A. The area where a fill or embankment is to be constructed shall be cleared of all vegetation, roots and organic material. The surface shall be moistened, scarified to a depth of 6 inches, and rolled or otherwise mechanically compacted. Embankment and fill material shall be placed and spread evenly in approximately horizontal layers. Each layer shall be moistened or aerated, as necessary. Each layer shall not exceed 6 inches of compacted thickness. The embankment, fill, and the scarified layer of underlying ground shall be compacted.

B. When an embankment or fill is to be made and compacted against hillsides or fill slopes steeper than 4:1, the slopes of hillsides or fills shall be horizontally benched to key the embankment or fill to the underlying ground. A minimum of 12 inches normal to the slope of the hillside or fill shall be removed and re-compact as the embankment or fill is brought up in layers. Material thus cut shall be re-compact along with the new material at no additional cost. Hillside or fill slopes 4:1 or flatter shall be prepared in accordance with Paragraph A, above.

C. Where embankment or structure fills are constructed over pipelines, the first 2 feet of fill over the pipe shall be constructed using light placement and compaction equipment that does not damage the pipe. Heavy construction equipment shall maintain a minimum distance from the edge of the trench equal to the depth of the trench until at least 2 feet of fill over the pipe has been completed.

3.11 QUALITY CONTROL TESTING

A. Compaction Tests: One compaction test location shall normally be required for each 300 linear feet of pipe and for every 100 square feet of backfill around structures as a minimum, or as shown on the Drawings. The locations of the compaction tests within the trench shall be in conformance with the following schedule:

1. One test at the spring line of the pipe.
2. One test at an elevation of one foot above the top of the pipe.
3. One test for each 2 feet of backfill placed from one foot above the top of the pipe to finished grade elevation.
4. At least two test locations are required for each trench crossing existing pavement.

B. In case the test of the fill or backfill show non-compliance with the required density, the Contractor shall accomplish such remedy as may be required to ensure compliance.
C. The Contractor shall provide test trenches and excavations including excavation, trench support, and groundwater removal for the soils testing operations. The trenches and excavations shall be provided at the locations and to depths required by the testing firm. All work for test trenches and excavations shall be provided at no additional cost.

END OF SECTION
SECTION 02510

PIPELINE REMOVAL AND ABANDONMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work specified in this Section consists of furnishing all labor, equipment and materials and performing all work connected with the removal and/or abandonment of existing pipelines and placement of the cementaceous grout to fill the voids.

B. Applicable Codes, Standard and Specifications:


2. All work associated with asbestos material shall be performed in accordance with the standards listed below and all other applicable local, State, or Federal standards.

   a. Florida Administrative Code, Chapter 17-25 1, "Asbestos"

   b. National Emission Standards Hazardous Air Pollution (NESHAP), 40 CFR 61, subpart M.

   c. Occupational Safety and Health Act, 29 CFR

   d. Environmental Protection Agency (EPA) Asbestos Abatement Worker Protection Rule

   e. Florida Statute 455.300

C. Definitions:

1. Pipeline Abandonment - isolate from active pipelines, remove from service, dispose of pipeline contents, grout pipeline, plug pipeline, leave pipe in place.

2. Pipeline Removal - isolate from active pipelines, remove from service. Dispose of pipeline contents, remove pipe, valves, fittings, dispose or stockpile removed materials as required.
1.02. QUALITY ASSURANCE

A. All work associated with the removal or taking out of service of existing asbestos cement pipelines shall be performed by a licensed asbestos abatement contractor or subcontractor registered in the State of Florida.

1.03 SUBMITTALS

A. Shop Drawings: Shop Drawings shall be submitted in accordance with Division 1. In addition, the following shall be submitted to the Engineer for acceptance prior to construction.

1. A detailed description of equipment and operational procedures to accomplish the grouting operation, including grout mixture design, grout mixer data, grout samples and test data.

2. Asbestos abatement contractor/subcontractor licensing and qualifications, if necessary.

3. Pipeline grouting contractor/subcontractor licensing and qualifications.

PART 2 PRODUCTS

2.01 FITTINGS

A. Fittings shall be manufactured of ductile iron, conforming to ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53.

B. All fittings shall be Class 250.

2.02 CONCRETE GROUT

A. Provide grout with minimum 28-day compressive strength of 1000 psi, minimum slump of 5 inches, maximum slump of 9 inches. The grout mixture per cubic yard shall be:

1. Cement - 500 pounds

2. Fly Ash - 500 pounds

3. Water - 350 pounds (42 gallons)

4. Sand - 2248 pounds

5. Air entrainment admixture (Darex or equal) - 3 ounces

6. Bentonite - 6 pounds (to be mixed with sufficient water to form colloidal mixture, added at the job site)
2.03 EQUIPMENT

A. All grout shall be mixed with a high shear, high energy colloidal type mixer to achieve the best uniform density.

B. The grout shall be pumped with a non-pulsating centrifugal or tri-plex pump.

C. The mixer shall be capable of continuous mixing. Batch mixing shall not be permitted.

2.04 ASBESTOS PIPE REMOVAL AND DISPOSAL PROCEDURES

A. General. The Contractor will be responsible for permitting, removal and disposal of asbestos-cement (A-C) pipe segments required to perform the Work as shown on the Drawings. The following paragraphs briefly summarize permitting, field procedures and disposal activities related to the A-C pipe. In these discussions, certain local, state and federal laws have been referenced. The Contractor must comply with all applicable local, state and federal laws/regulations whether or not such laws/regulations are referenced in these specifications.

B. The Contractor shall provide evidence of experience of proper procedures in removal, handling and disposal of asbestos-cement pipe materials within the past five (5) years. References from at least three completed projects shall be provided at the Preconstruction Conference. If the Contractor proposes to utilize the services of a duly qualified Subcontractor for this portion of the work, these same requirements shall be met.

C. Permitting. The Contractor shall apply for and obtain all permits related to removal of the A-C pipe segments. In accordance with Florida Department of Environmental Protection (FDEP) Rule 62-257.30 1 of the Florida Administrative Code (FAC), the Contractor must submit a “Notice of Asbestos Removal Project” form with a copy to the Engineer. The Contractor will submit the form to FDEP in a timely manner in accordance with the schedule contained in Rule 62-257. The agencies that may require permits for this project are not necessarily limited to the FDEP.

D. Field Procedures. The Contractor is responsible for all procedures, including safety and health procedures, which will be used when handling A-C pipe segments. The Contractor’s handling of A-C pipe segments shall be in conformance with 29 CFR 1926.58 (OSHA Safety and Health Standards).

E. Cutting of A-C pipe shall be done in conformance with the recommended practices contained in the American Water Works Association’s (AWWA) Manual No. M-16. Cutting methods should be used which minimize the production of airborne dust.

F. Preparation of Transport of Materials. The Contractor will remove the pipe sections from the ground in whole pieces without fracturing, breaking or otherwise damaging pipe. The A-C pipe segments shall be carefully loaded onto the transport vehicle without damaging the pipe. The transport vehicle shall totally enclose the A-C pipe segments so
that wind and rain cannot disperse dust from the pipe material. Transport of the A-C pipe segments shall also meet the requirements of the waste disposal agency.

G. Waste Disposal. As stated in Rule 62-701.520(3), the FDEP indicates that asbestos containing waste materials can be accepted at a permitted Class I, II or III landfill. The regulations also indicate that the waste generator (the Contractor) shall make arrangements with the landfill operator before disposal of the asbestos containing waste materials and inform the operator of the quantity of the waste and the scheduled date the shipment will arrive at the landfill. The Contractor shall provide the Engineer and the Owner a manifest immediately following disposal.

PART 3 EXECUTION

3.01 PREPARATION

A. Traffic control measures shall be implemented prior to construction.

3.02 PERFORMANCE

A. Pipe Isolation:

1. Where indicated on the Drawings, line stops shall be utilized to isolate portions of pressurized mains.

2. In lieu of line stops, the use of existing valves may be used to isolate portions of the pipeline. Submit work plan showing existing valves to be closed to provide isolation. Review of plan will be conducted by Engineer and Utility to determine affected area. In no case will service to residences and businesses affected by the isolation be allowed to be interrupted by more than 1 hour.

3. Line stops shall be completed while the pipelines are pressurized.

4. Line stops shall consist of a line stop fitting, stopping valve, blind flange for installation after stop is completed, and 1 inch equalization/purge fitting.

5. Provide additional pipe restraining in the vicinity of the line stop for preventing pipe movement due to any unbalanced forces created by the line stop and subsequent cutting and removal of existing pipe adjacent to any line stop.

6. In the event a pressurized potable water pipeline that will remain in service loses pressure to less than 20 psi, disinfect the water main and submit bacteriological test results to the Florida Department of Environmental Protection. Satisfactory test results are required to be submitted for tests conducted on two consecutive days.
B. Pipe Cutting and Plugging:

1. Cut all pipe as necessary. Cut sections of pipe shall be cleared and smoothed. The contents of the pipe are to be removed and disposed as allowed by local rules and regulations.

2. Plug ends of pipe to remain in accordance with the following:
   a. Remaining pressurized pipe - install ductile iron plug fitting. Install restraining devices to prevent pipe movement.
   b. Remaining non-pressurized pipe - grout ends of pipe or install ductile iron cap fitting.

C. Pipeline Abandonment: Limits of removal and/or abandonment (take out of service) shall be in accordance with information shown on the Drawings. Abandonment shall be in accordance with the following:

1. Pipes under roadways or less than five feet from the edge of pavement, 2-inches and larger, shall be fully grouted along entire length. Pipe sizes less than 2-inches shall be capped or grouted at the ends of the pipe.

2. Pipes outside of roadways five feet or greater from the edge of pavement, 2-inches and larger, shall be fully grouted along entire length. Pipes sizes less than 2 inches shall be capped or grouted at the ends of the pipe. All ductile iron pipes shall be capped or grouted at the ends of the pipe.

D. Pipeline Grouting:

1. Grouting of the annular space due to the abandonment of the existing water pipe will be allowed in continuous individually bulkheaded segments of up to 500 linear feet.

2. Grout shall be placed in a maximum of three stages, with the initial stage volume equal to or greater than 50% of the total volume for that section of pipe being grouted. The maximum time wait between grouting stages shall be 24 hours.

3. For each stage, mix and pump the material in one continuous process so as to avoid partial setting of some grout material during that stage, thus, eliminating voids and possible subsequent surface damage due to "cave-ins".

4. Each section shall be grouted by injecting grout from the lowest point and allowing it to flow toward the highest point to displace water from the annulus and assure complete void-free coverage. Grout shall be placed through tubes installed in the bulkheads at the insertion pits or manholes. Grout tubes shall be at least 2-inch nominal diameter.
5. One set of the 3 inch x 6 inch sample test cylinders shall be made for each grout mix preparation.

6. After the ends of each section of pipe are exposed, the entire space, not to exceed 500 linear feet end to end, shall be sealed by controlled pumping of grout until it flows from the pipe at the opposite end of the grouting. Grouting shall be carried out until the entire space is filled.

7. Grout pressure in the void space is not to exceed five (5) psi above maximum hydrostatic groundwater level. An open ended, highpoint tap or equivalent vent must be provided and monitored at the bulkhead opposite to the bulkhead through which grout is injected. This bulkhead will be blocked closed as grout escapes to allow the pressuring of the annular space.

8. The pump used for grouting shall be a continuous flow positive displacement model with a pugmill type mixing vat having a minimum shaft speed of 60 rpm and incorporated as an integral part of the equipment. Alternate equipment may be used subject to the approval of the Engineer. The rate of pumping shall not exceed 6 cubic feet per minute.

E. Restoration

1. All areas disturbed as a result of pipeline removal and abandonment shall be restored to equal or better condition than the existing condition.

3.03 FIELD QUALITY CONTROL

A. The quality of the grout, application of the equipment and installation techniques is the responsibility of the Contractor. The review and acceptance or approval of specific mix design, equipment or installation procedures shall in no way relieve the Contractor of his obligation to provide the final product as specified herein.

B. Contractor shall coordinate with the Owner to shut-off all system valves. Only the Owner’s staff may operate valves. All valves shall be shut-off and water service shall be verified for all customers in the affected area prior to grout being injected.

END OF SECTION
SECTION 02574

PAVEMENT REMOVAL AND REPLACEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Work included under this Section consists of cutting, removing, protecting and replacing existing pavements, driveways, sidewalks, curb and combination curb and gutter of the various types encountered.

B. Protection of Existing Improvements: The Contractor shall be responsible for the protection of all pavements, sidewalks and other improvements within the work area. All damage to such improvements, as a result of the Contractor's operations, beyond the limits of the work of pavement replacement as described herein, shall be repaired by the Contractor at his expense.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials minimum thicknesses, including stabilized subgrade (12 inches), base (8 inches), bituminous prime and tack coat, and asphaltic concrete (1½ inches) for the above work shall meet the requirements established herein.

1. Stabilized subgrade shall conform to Section 160 of the Florida Department of Transportation (FDOT) Standard Specification of Road and Bridge Construction (latest edition).

2. Base material shall be crushed concrete conforming to Section 200 of the FDOT Standard Specification of Road and Bridge Construction (latest edition). Use graded crushed concrete aggregate base material of uniform quality throughout, that is free from organic matter, shale, lumps, remnant steel, clay balls, and having a Limerock Bearing Ration value of not less than 120.


4. Asphalt concrete shall be Type SP 9.5 or 12.5 depending on thickness required or to match existing and conform to Section 334 of the FDOT Standard Specification of Road and Bridge Construction (2020 edition).

PART 3 - EXECUTION

3.01 PERFORMANCE

A. Removals:

1. Pavement Removal:

   a. Where existing pavement is to be removed, the surfacing shall be mechanical saw cut prior to trench excavation, leaving a uniform and straight edge, with minimum disturbance to the remaining adjacent surfacing. The width of cut for this phase of existing pavement removal shall be minimized.

   b. Immediately following the specified backfilling and compaction, a temporary sand seal coat surface or temporary asphalt 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 10 days in order to assure the stability of the backfill under normal traffic conditions. Following this period and prior to 15 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 dimensions specified in the Drawings. Following the above operation, the Contractor shall proceed immediately with final pavement restoration in accordance with these requirements.

2. Sidewalk, Drive & Curb Removal:

   a. Concrete sidewalks, curbs, combination curb and gutter, walks, drive ribbons, or driveways shall be removed by initially sawing the structure, with a suitable power saw, as specified above for pavement. The removal line shall be extended to the next joint, each way. After sawing, the material shall be removed. Temporary paths of travel shall be provided to maintain pedestrian traffic. Particular attention should be given to providing accessible routes to the disabled.

   b. All open-cut driveways are to be restored within 24-hours with an all-weather asphaltic paver to permit temporary property access until final restoration is completed.
B. Restorations:

1. General: Street or roadway pavement cut and removed in connection with trench excavation shall be replaced or restored in equal or better condition than the original and as shown on the Drawings. Street or roadway pavement restoration shall begin immediately upon completion of backfill and compaction or curing of flowable backfill. The Drawings indicate minimum requirements.

2. Asphalt Pavement Restoration: Restoration of existing pavement shall be in accordance with the provisions of Section 334 of the FDOT Standard Specifications for Road and Bridge Construction (2020). Asphalthic concrete shall be SuperPave Type 12.5 or match existing, a minimum of 2 inches thick.

3. Asphalt Driveway Restoration: Driveway pavement with base cut and removed in connection with trench excavation shall be replaced or restored as specified above for street or roadway pavement, except the new base course shall equal the existing base course in thickness, except that in no case shall new driveway base course be less than 8 inches in thickness and the asphalthic concrete shall be SuperPave Type 12.5, 3 inches thick. Muck or unsuitable material found under existing driveway construction will not be removed and replaced.

4. Concrete, Sidewalk, Walkway, Driveway Ribbon and Curb Restoration:
   a. Concrete sidewalks, walkways, driveways, driveway ribbons and curbs required to be removed for the installation of facilities under this Contract shall be restored. Class B concrete shall be used in all cases.
   b. Replaced portions of these items shall conform to the lines, grades, and cross sections of the removed portions. Concrete sidewalks and walkways subject to vehicular traffic shall be of 6-inch thickness; concrete sidewalks and walkways not subject to vehicular traffic shall be of 4-inch thickness; concrete driveways and driveway ribbons shall be 6-inch thickness. Replaced concrete curb and/or gutter shall extend the next control joint, each way.

5. Concrete Pavement Restoration: Rigid pavement shall be replaced in kind with Class B concrete, using high early strength cement. The base course for rigid pavement shall be replaced in kind and compacted to a thickness to match the existing base.

6. Asphaltic Concrete Surface Course Overlay:
   a. The work under this section includes asphaltic concrete surface course overlay paving as and where directed by the Engineer. Where this paving is directed it shall take the place of asphaltic concrete pavement restoration as specified herein above. This surface course overlay shall extend over the reconstructed base course and the existing pavement
to the limits directed by the Engineer, which generally shall be the full width of the roadway.

b. After the base course construction in the trench area has been completed and primed, the asphalt pavement surface shall be tack coated and a 1-1/2-inch compacted thickness of Type S-III asphaltic concrete shall be constructed in accordance with the requirements specified above for pavement restoration.

END OF SECTION
SECTION 02595

POLYETHYLENE PIPE FOR SERVICE CONNECTIONS

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install all polyethylene (PE) pipe and fittings for service connections, only with pre-approval from the Utilities Commission of New Smyrna Beach, complete in place, in accordance with the New Smyrna Beach Utilities Commission Potable Water Rules, Design and Construction Specifications.

1.02 CONTRACTOR SUBMITTALS

A. Submittals shall be in accordance with Section 01300 – Contractor Submittals.

B. The Contractor shall provide manufacturer data for all pipe, fittings, and appurtenances.

PART 2 - PRODUCTS

2.01 GENERAL

A. PE pipe shall meet AWWA C-901, ASTM D-3350 cell classification of 334434C and be in accordance with the New Smyrna Beach Utilities Commission Wastewater Rules, Design and Construction Specifications, permanently marked with the type/size/use of the pipe. PE pipe shall only be permitted by specific written approval by the Utilities Commission of New Smyrna Beach. The minimum radius of curvature shall be thirty (30) pipe diameters and bending shall not cause kinking. Wastewater pipe shall be green in color.

B. Brass Compression Coupling Fittings: Brass compression coupling fittings shall be permitted as approved by the Utilities Commission of New Smyrna Beach.

C. HDPE Compression Coupling Fittings: PE piping with HDPE compression fittings shall be permitted as approved by the Utilities Commission of New Smyrna Beach. PE piping with the HDPE 4710 molded fittings does not require stainless steel stiffeners.

D. Mechanical Coupling Fittings: The mechanical coupling fittings shall meet and/or exceed the maximum design pressure requirements of the piping system. The couplings shall prevent the entry of dust, dirt, and moisture. Mechanical coupling fittings shall not be permitted unless specifically approved in writing by the Utilities Commission of New Smyrna Beach.

E. PVC Compression Coupling Fittings: PE piping with PVC compression fittings shall not be permitted unless specifically approved in writing by the Utilities Commission of New Smyrna Beach.
PART 3 - EXECUTION

3.01 GENERAL

A. Any material found to have defects during the progress of the project shall be immediately removed from the site by the Contractor at no additional cost.

3.02 HANDLING AND STORAGE

A. Handling: Pipe, fittings and accessories shall be carefully inspected before and after installation and those found defective shall be rejected. Pipe and fittings shall be free from fins and burrs. Before being placed in position, pipe, fittings, and accessories shall be cleaned, and shall be maintained in a clean condition. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings, or any other material be dropped or dumped into trenches.

B. Storage: Pipe shall be stored at the job site in unit packages provided by the manufacturer. Pipe shall be stored in such a way as to prevent sagging or bending.

3.03 TRENCHING AND BACKFILL

A. Trench excavation shall conform to the requirements for utility pipeline construction as specified in Section 02200 - Earthwork.

3.04 INSTALLATION

A. Installation shall conform to the pipe manufacturer recommendations. Wherever the provisions of this Section and the aforementioned requirements are in conflict, the more stringent provision shall apply.

3.05 FIELD TESTING AND DISINFECTION

A. Field testing and disinfection of water piping shall conform to the requirements of Section 02666 – Pressure Pipeline Testing and Disinfection.

END OF SECTION
SECTION 02661
WASTEWATER FORCE MAINS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The work under this Section includes providing a complete system for wastewater transmission pressure piping and appurtenant items.

1.02 QUALITY ASSURANCE

A. Design Requirements

1. Piping shall be laid with a minimum cover of 36-inches below finished grade, unless otherwise indicated.

2. Pipelines shall be constructed of the materials indicated on the Drawings.

3. All force mains shall be installed with a continuous insulated 14-gauge solid copper wire. Wire shall terminate at the top of each valve and be capable of extending 12-inches above the top of the box.

4. All PVC force mains shall be solid green. All lettering shall appear legibly on the pipe and shall run the entire length of the pipe. Lettering shall read as is acceptable for the intended use.

5. Flanged ductile iron used in valve vaults or above ground piping at pump stations shall be Protecto 401 lined and coated per New Smyrna Beach Utilities Commission design and construction specifications. Flanged DIP shall be epoxy coated from the factory and shall not be coated with bitumastic or asphaltic exterior coatings.

B. Pipe Inspection: The Contractor shall obtain from the pipe manufacturers a certificate of inspection to the effect that the pipe and fittings supplied for this contract have been inspected at the plant and that they meet the requirements of these specifications. All pipe and fittings shall be subjected to visual inspection at time of delivery and just before they are lowered into the trench to be laid. Joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor. The entire product of any plant may be rejected when, in the opinion of the Owner, the methods of manufacture fail to secure uniform results, or where the materials used produce inferior pipe or fittings.

C. Prevention of Electrolysis: Where shown on Drawings or deemed necessary, electrolytic action through the contact of dissimilar metals shall be prevented by either;
1. The separation of one material from the other by means of an insulating or
dielectric coupling (polyethylene wrap), or

2. The use of alternative materials, as directed by the Owner.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the Engineer for review and acceptance prior to
construction in accordance with the General Conditions and New Smyrna Beach Utilities
Commission design and construction specifications.

1. Certified test reports on pipe.

2. Details of restrained and flexible joints.

3. Detailed laying schedule for pipe.

4. Valves and valve boxes.

B. Acceptance of Material: The Owner reserves the right to sample and test any pipe or
fitting after delivery and to reject all pipe and fittings represented by any sample which
fails to comply with the specified requirements.

1.04 JOB CONDITIONS

A. Water in Excavation: Water shall not be allowed in the trenches while the pipes are
being laid and/or tested. The Contractor shall not open more trenches than the
available pumping facilities are able to dewater to the satisfaction of the Owner. The
Contractor shall assume responsibility for disposing of all water so as not to injure or
interfere with the normal drainage of the territory in which he is working. In no case
shall the pipelines being installed be used as drains for such water, and the ends of the
pipe shall be kept properly and adequately blocked during construction by the use of
acceptable stoppers and not by improvised equipment. All necessary precautions shall
be taken to prevent the entrance of mud, sand, or other obstructing matter into the
pipelines. If on completion of the Work any such material has entered the pipelines, it
must be cleaned as directed by the Owner so that the entire system will be left clean
and unobstructed.

PART 2 - PRODUCTS

2.01 GENERAL

A. All material supplied shall be one of the products specified in Appendix A "Approved
Manufacturers and Materials " appended to these technical specifications.
2.02  POLYVINYL CHLORIDE (PVC) PIPE

A. Large PVC Pressure Piping: PVC pressure pipe for nominal diameters 4-inches and larger in size shall conform to the requirements of AWWA C900 DR18 up to 12 inches, and AWWA C905 DR18 larger than 12 inches with gasketed integral bell ends. Pipe shall be designed for a maximum working pressure of not less than 150 psi and not with less than a 4 to 1 sustained hydrostatic pressure safety factor. Pipe shall be made to ductile iron pipe O.D.‘s instead of IPS. Fittings shall be ductile iron fittings with restrained mechanical joint ends as specified in Section 15062. The PVC pressure pipe shall be manufactured with an integral color depending on its intended service. Wastewater pipe shall be safety green.

B. Bell and Spigot: Pipe joints shall be made with integral bell and spigot pipe ends. The bell shall consist of an integral thickened wall section designed to be at least as strong as the pipe wall. The bell shall be supplied with a factory glued rubber ring gasket which conforms to the manufacturer’s standard dimensions and tolerances. The gasket shall meet the requirements of ASTM F477 "Elastomeric Seals (Gaskets) for Joining Plastic Pipe". PVC joints shall be "Ring-Tite" as manufactured by J-M Manufacturing Company, Inc. or an equal approved by the Engineer.

C. Restrained Joints: In accordance with the Drawings, to prevent pipe joints and fittings from separating under pressure, pipe joints and fittings shall be restrained as follows:

1. PVC pipe bell and spigot joints shall be restrained with the EBBA Iron MEGALUG® Series 1500 Restrainer or an equal approved by the Engineer. The restraining device and tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A536, Grade 6542-10. Clamping bolts and nuts shall be manufactured of high strength, low alloy steel meeting the requirements of ANSI/AWWA C111/A21.11. Acceptable restraint systems are listed in the Approved Manufacturer’s List in Appendix A.

2. Mechanical joint fittings used with PVC pipe shall be restrained with the EBBA Iron MEGALUG® Series 2000 PV Restrainer or an equal approved by the Engineer. The restraining device and tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A536, Grade 65-42-10. Clamping bolts and nuts shall be manufactured of high strength, low alloy steel meeting the requirements of ANSI/AWWA C111/A21.11. Acceptable restraint systems are listed in the Approved Manufacturer’s List in Appendix A.

2.03  PIPE COUPLINGS

A. Pipe couplings used to join two pieces of plain end pipe shall be sized to suit the outside diameter of the pipe ends to be jointed. Transition couplings shall be used to join pipes of different outside diameters. All pipe couplings shall be rigid connections. All couplings shall be restrained.
B. Coating: All carbon steel parts of the coupling shall be coated on the interior and exterior with a fusion bonded thermosetting epoxy coating with a 12-mil nominal coating thickness. The coating shall be equal to AL-CLAD as manufactured by Dresser Industries, Inc.

C. Gaskets: Gaskets for the coupling shall be wedge type manufactured of Buna-N resilient rubber.

D. Bolts: Bolts shall be manufactured of high strength Type 316 stainless steel with Type 316 stainless steel hexagonal nuts. Bolts and nuts shall conform dimensionally to ANSI/AWWA C111, latest revision.

E. Manufacturer: Couplings for similar pipe shall be Style 38 as manufactured by Dresser Industries, Inc. or an equal approved by the ENGINEER. Transition couplings for connection of asbestos cement pipe and AWWA C900 PVC pipe shall be JCM model 212, or equal approved by the ENGINEER.

F. Additional Work: Additional items of construction, necessary for the complete installation of the systems, shall conform to specific details shown on the Drawings and shall be constructed of first-class materials conforming to the applicable portions of these specifications.

PART 3 - EXECUTION

3.01 PREPARATION

A. Bedding: Upon satisfactory installation of the pipe bedding material as specified in Section 02220 "Excavating, Backfilling and Compacting", a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging. The pipe shall be laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.

B. Cleanliness: The interior of the pipes shall be thoroughly cleaned of all foreign matter before being gently lowered into the trench and shall be kept clean during laying operations by means of plugs or other methods acceptable by the Owner. 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 foreign material from entering the pipe.

3.02 INSTALLATION

A. Pipe Identification/Location

1. All PVC wastewater mains shall be solid green in color. All lettering shall appear legibly on the pipe and shall run the entire length of the pipe. Lettering shall read as is acceptable for the intended use.
2. All HDPE wastewater mains shall be either a solid green or black with four co-extruded equally spaced green stripes of the same material as the pipe. Stripes painted on the pipe outside surface shall not be acceptable.

3. All mains (PVC and HDPE) shall be installed with a continuous, insulated 14-gauge copper wire installed directly above the pipe for location purposes. Locate wire shall terminate in a test station box and be capable of extending 12-inches above the top of the box. Directionally drilled pipe shall be installed with two 8-gauge wires. One steel core and one solid copper.

B. Pipe:

1. Gradient: Lines shall be laid straight, and depth of cover shall vary to provide uniform gradient or slope to pipe, whether grading is completed or proposed at time of pipe installation. When a grade or slope is shown on the Drawings, batter boards with string line paralleling design grade, or other previously approved means, shall be used by the Contractor to assure conformance to required grade.

2. Pipe Joint Deflection: No joint deflection or pipe bending is allowed in PVC pipe. The maximum allowable tolerance in the joint due to variances in installation is 0.75° (degrees), (3-inches per joint per 20-ft stick of pipe). No bending tolerance in the pipe barrels shall be acceptable. Alignment changes shall be made with sleeves and fittings as shown in Drawings. Deflection in fittings and sleeves shall not exceed 50% of the limits recommended by the fitting manufacturer.

3. Rejects: Any pipe found defective shall be immediately removed from the site and replaced with sound pipe at the Contractor's expense.

4. Joint Compounds: No sulfur base joint compound shall be used.

5. Thrust restraints shall be accomplished by the use of mechanical restraining devices unless specifically identified otherwise on the Drawings or herein. Restraining devices are specified in Section 15064 "Polyvinyl Chlorine Pipe and Fittings", respectfully.

C. Installing Valves and Boxes

1. Valves: Valves shall be carefully inspected, opened wide and then tightly closed and the various nuts and bolts shall be tested for tightness. Plug valves shall have the disc shaft installed horizontally with the plug rotating upward to the top of the valve. Any valve that does not operate correctly shall be removed and replaced.

2. Valve Boxes: Valve boxes and riser shall be centered over the operating nuts of the valves with a centering ring or disc so as to permit a valve key to be fitted easily to the operating nut. In unpaved areas, valve boxes shall be set to conform to the level of the finished surface and held in position by a concrete
collar placed under the support flange as shown on the Drawings. The valve box shall not transmit surface loads to the pipe or valve. Extensions or risers for valve boxes shall be an integral part of the box. No cut sections of D.I. or PVC pipe shall be used in extending the box to its proper height. 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 out and reset. Before final acceptance of the Work all valve boxes shall be adjusted to finish grade.

D. Concrete Encasement

1. Concrete encasement shall be constructed in accordance with details shown on the Drawings and shall be constructed of Class C concrete. Encasement shall be constructed where
   a. As indicated on the Drawings.
   b. As directed by the Owner.

2. 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.

3. Concrete Collar: Each valve installed in an unimproved area (outside of pavement, driveways or sidewalks) shall require a 24-inch x 24-inch x 6-inch concrete pad or collar as shown in the Drawings.

E. Flush Out Connections: Flush out connections shall be installed at the locations as determined by the Owner and be full pipe size to accommodate a full diameter flush for pipes 12-inches and smaller or a swab for pipes greater than 12-inches.

F. Backfilling: Backfilling shall be in accordance with Section 02220 "Excavating, Backfilling and Compacting" of these specifications.

3.03 CLEANING

A. General: At the conclusion of the Work the Contractor shall thoroughly clean the new pipe lines by flushing with water or other means to remove all dirt, stones or other material which may have entered the line during the construction period.

B. Flushing 12-inch pipes and less: Flushing to remove all sand and other foreign matter from pipelines shall only be permitted for mains 12-inches and smaller. Flushing shall be accomplished through full pipe size connections at full pipe depth. The velocity of the flushing water shall be at least 4-feet per second. Flushing shall be terminated at the direction of the Owner. The Contractor shall dispose of the flushing water without causing a nuisance or property damage. The Contractor shall arrange and pay for the source of flushing water with the Owner or others.
C. Swabbing in lieu of flushing: New mains may be hydraulically or pneumatically cleaned with a polypropylene swabbing device to remove dirt, sand and debris from main. If swabbing access and egress points are not provided in the design drawings, it will be the responsibility of the Contractor to provide temporary access and egress points for the cleaning, as required. Passage of cleaning poly swabs though the system shall be constantly monitored, controlled and all poly swabs entered into the system shall be individually marked and identified so that the exiting of the poly swabs from the system can be confirmed. Cleaning of the system shall be done in conjunction with the initial filling of the system for its hydrostatic test. After initial slow-fill, pipe shall sit full for 24 hours to facilitate cleaning and collection of debris from interior of pipe. The Contractor shall insert flexible polyurethane foam swabs (2-pounds per cubic foot density) complete with rear polyurethane drive seal, into the first section of pipe. The swabs shall remain there until the pipeline construction is completed. The line to be cleaned shall only be connected to the existing distribution system at a single connection point. Locate and open all new in-line valves beyond the point of connection on the pipeline to be cleaned during the swabbing operation. At the receiver or exit point for the poly swab, the Contractor is responsible for creating a safe environment for collection of debris, water and the swab. Considerations shall be made for protecting surrounding personnel and property and safe retrieval of the swab. Only the Owner's personnel shall operate the supply valve from the existing distribution system. Cleaning and flushing shall be accomplished by propelling the swab down the pipeline to the exit point with potable water. Flushing shall continue until the water is completely clear and swab is retrieved.

3.04 FIELD QUALITY CONTROL

A. Correction of Non-Conforming Work: All non-conforming work shall be repaired or replaced by the Contractor at no additional expense to the Owner. Non-conforming work shall be defined as failure to adhere to any specific or implied directive of this Project Manual and/or the Drawings, including but not limited to pipe not laid true to the lines and grades as shown on the Drawings, damaged or unacceptable materials, misalignment or diameter ring deflection in pipe due to bedding or backfilling, visible or detectable leakage and failure to pass any specified test or inspection.

B. Pressure and Leakage Tests of Pressure Piping

1. General: The Contractor shall perform hydrostatic pressure and leakage tests on all pressure piping. Tests shall be conducted on segments between valves and no more than 2,000 linear feet is to be tested at one time unless otherwise acceptable by the Owner.

2. Standard: AWWA C600, Section 5 (DI pipe) and AWWA C605 Section 7 (PVC pipe) with the exceptions required herein and the exception that the Contractor shall furnish all gauges, meters, pressure pumps and other equipment needed to test the lines.
3. Hydrostatic Pressure Test

a. Test Pressure: All pipe sections to be tested shall be subjected to a hydrostatic pressure of 100 psi or 1.5 times the design working pressure; whichever is greater.

b. Test Duration: Test shall be for a period of 2-hours. If during the test, the integrity of the tested line is in question, the Owner may require a 6-hour pressure test. No leakage is allowed.

c. Air Release: Corporation cocks at least 3/4-inch in diameter, pipe riser and angle globe valves shall be provided at each dead-end to bleed air from the line.

END OF SECTION
SECTION 02666
PRESSURE TESTING OF PIPING

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall perform flushing and testing of all gravity sewer and wastewater force main pipelines and appurtenant piping, including conveyance of test water from CITY designated source to point of use and all disposal thereof, all in accordance with the New Smyrna Beach Utilities Commission Wastewater Rules, Design and Construction Specifications.

B. Flushing Plan: Flushing Plan shall include marked up Master Plans for each testing area indicating the limits of the areas to be flushed, valves to be operated to achieve a flushing velocity of 2.5 ft/second, volume of water required, proposed water source, and flushing water disposal method.

C. Hydrostatic Test Plan: Hydrostatic Test Plan shall include marked up Master Plans for each testing area indicating the limits of the areas to be tested, valves to be opened and closed during the test, volume of pipeline being tested, allowable leakage calculation per paragraph 3.3.H and I, and points used for bleed down after testing.

D. Positive Service Identification Plan: Positive Service Identification shall include marked up Master Plans for each testing area indicating the limits of the areas to be tested, and valves to be closed during the test.

1.02 CONTRACTOR SUBMITTALS

A. Flushing Plan, Hydrostatic Test Plan, and Positive Service Identification Plan shall be provided to the Utilities Commission of New Smyrna Beach, a minimum of 7 days before testing is to start.

PART 2 - PRODUCTS

2.01 MATERIALS REQUIREMENTS

A. Temporary valves, plugs, bulkheads, and other air pressure testing and water control equipment and materials shall be provided by the Contractor subject to the Utilities Commission of New Smyrna Beach's review. No materials shall be used which would be injurious to pipeline structure and future function. Air test gages shall be laboratory-calibrated test gages and shall be recalibrated by a certified laboratory at the Contractor's expense prior to the leakage test, if required by the Utilities Commission of New Smyrna Beach. Pressure test pump assemblies must be fabricated using threaded iron or brass fittings only. PVC assemblies are not allowed. Contractor shall
demonstrate to the Utilities Commission of New Smyrna Beach that the assemblies are free from defects, corrosion or other hazards prior to attachment to the system.

B. The Contractor will provide potable water jumper assemblies and backflow preventers for temporary use on the Project. The jumper assemblies and backflow preventers may be available by the Utilities Commission of New Smyrna Beach. All other test equipment, chemicals for chlorination, temporary valves, bulkheads, or other water control equipment and materials shall be determined and furnished by the Contractor. No materials shall be used which would be injurious to the construction or its future function.

PART 3 - EXECUTION

3.01 GENERAL

A. Unless otherwise provided herein, water for testing and flushing all pressure rated lines will be furnished by the UTILITIES COMMISSION OF NEW SMYRNA BEACH; however, the Contractor shall make all necessary provisions for conveying the water from the UTILITIES COMMISSION OF NEW SMYRNA BEACH designated source to the points of use.

B. All pressure pipelines shall be hydrostatically tested and leak tested.

D. The Contractor shall provide 48-hour notice to the ENGINEER prior to all pressure testing. All pressure testing must be done in the presence of the ENGINEER.

3.02 Pipelines shall be cleaned and flushed to remove all sand and other foreign matter. Water used for flushing shall achieve a minimum velocity of 2.5 feet per second in every section of the pipe and the flow shall be maintained for sufficient duration to assure a complete change of the volume of water within the pipe. The Contractor shall be responsible for developing a flushing plan to be submitted to the Utilities Commission of New Smyrna Beach for approval prior to flushing. The Contractor shall dispose of all water used for flushing without causing a nuisance or property damage. Any permits required for the disposal of flushing water shall be the responsibility of the Contractor.

3.03 PIGGING (PRESSURE MAINS GREATER THAN 12” DIAMETER)

A. The Contractor shall clean the system thoroughly by pigging to remove sand, grit, gravel, stones, fluids, construction waste, and all material which would not be found in a properly cleaned pipeline. Pigging shall obtain a smooth interior pipe surface free from any material or fluid not used in cleaning. Pigging will not be required where butterfly valves are located along the pipe length being tested.

B. Pigging shall be defined as passage of a sufficient number of pigs through the pipeline to achieve the clean conditions above. Flushing will not be acceptable as a substitute for pigging.
C. Provision for pig access and egress points and disposal of water and materials shall be the Contractor’s responsibility.

D. Pigs shall be individually marked and their location shall be controlled and monitored so that no pigs remain in the system after cleaning.

E. Pigging may be done in conjunction with initial filling for the hydrostatic test.

3.04 HYDROSTATIC TESTING OF PIPELINES

A. Prior to hydrostatic testing, all potable water and force mains less than or equal to 12 inches shall be flushed at a minimum of 2.5 ft/second. The Contractor shall test all completed pipelines in accordance with the approved test plan. Complete installation shall include all water services, blow-offs, air release valves, and other appurtenances in their final position. No section of the pipeline shall be tested until all field-placed concrete or mortar has attained an age of 14 days. The test shall be made by closing valves when available, or by placing temporary plugs in the pipe and filling the line slowly with water. The Contractor shall be responsible for ascertaining that all test plugs are suitably restrained to resist the thrust of the test pressure without damage to, or movement of, the adjacent pipe. Any unharnessed sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test, to avoid movement and damage to piping and equipment. The Contractor shall provide sufficient temporary air tappings in the pipelines to allow for evacuation of all trapped air in each pipe segment to be tested. After completion of the tests, such taps shall be permanently plugged. Care shall be taken to see that all air vents are open during filling.

B. The pressure gauge utilized for pressure testing shall be less than one (1) year old or calibrated within the past year. The pressure gauge will be liquid filled with a range of 0 to 200 psi. The Utilities Commission of New Smyrna Beach and an authorized UTILITIES COMMISSION OF NEW SMYRNA BEACH representative must approve the pressure gauge being used. The Contractor will perform hydrostatic testing of all distribution areas and will conduct the tests in the presence of the Utilities Commission of New Smyrna Beach and the UTILITIES COMMISSION OF NEW SMYRNA BEACH representative, with 7-days advance notice provided.

C. The pressure system should be filled slowly with a flow velocity less than 2 feet per second (fps). The drinking water systems will be filled using a potable water source and the force main systems will be filled using the UTILITIES COMMISSION OF NEW SMYRNA BEACH irrigation water or another approved source.

D. All the air must be expelled from the systems prior to pressure testing. It is recommended the Contractor use services, hydrants, air release valves, blow-offs, and temporary taps to expel the air.

E. After the pipeline or section has been filled, flushed or pigged, and most of the air has been expelled, the system shall be pumped up to 60 psi (approximately 5 psi over the existing pressure). Then the system shall be allowed to stand for at least 24 hours. This
will allow the remaining air to escape and the pressure to stabilize. During this period, bulkheads, valves, services, hydrants, blow-offs, and connections shall be examined for leaks. If leaks are found, corrective measures shall be taken. After the above process has been completed, re-pump the system to the test pressure specified: 150 psi for the potable water and irrigation mains and 100 psi for the force mains. The pressure shall be maintained for one hour prior to the final pressure test.

F. The hydrostatic test shall consist of holding the test pressure on the pipeline for a period of 2 hours. The test pressure shall be measured at the lowest point of the pipeline section being tested. All visible leaks shall be repaired.

G. If during the two-hour period the pressure gauge drops more than 5 psi, re-pump the system back to the specified test pressure and measure the volume of water required in gallons. At the end of the two-hour test period re-pump the system to the specified test pressure and measure the volume of water required in gallons. The leakage volume of the pipe is the sum of the volume of water required to maintain the specified test pressure during the 2 hour hydrostatic test and the water required at the end of the hydraulic test to re-pump the system to the specified pressure.

H. The maximum allowable leakage for distribution and transmission pipelines shall be computed on the basis of AWWA Standard C600 or the applicable formula for other than 20-foot lengths. In the case of pipelines that fail to pass the prescribed leakage test, the Contractor shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipelines.

I. The system will be bled down to zero psi after it has passed the test by bleeding off the pressure at the ends of the pressure system using hydrants, blow-offs, services, and any other appropriate appurtenances. One person should monitor the pressure gauge while another, in contact with the first, will supervise the bleed down process. This will verify that the pressure gauge is working properly and that the entire system has been tested. If the system being bled down has more than one tie-in (connection point), bleed off enough pressure from each area of the system to make the gauge show a drop for each area. If after all pressure has been released and the gauge reads zero psi, the test will be deemed acceptable.

J. The Contractor shall fill in any washouts and repair any damaged pipe or appurtenances caused by the test.

K. Final paving cannot be installed until after all pipelines are satisfactorily pressure tested. If the pavement is to be placed in two lifts, testing must be completed prior to installation of the final layer of asphalt.

3.06 CONNECTIONS TO EXISTING SYSTEM

A. The Utilities Commission of New Smyrna Beach will notify the Contractor when a Letter of Clearance is received from the FDEP. At this time the Contractor will be allowed to schedule the connection of the new line to the existing system. The Contractor shall
notify the UTILITIES COMMISSION OF NEW SMYRNA BEACH Utility Department and schedule a time for connection to the existing system. Thorough flushing shall be started as soon as the connection is completed and shall be continued until discolored water is eliminated. Additional sampling after connection shall be performed as required by the FDEP.

B. It will be not necessary to pressure test services that are installed on existing mains. These services are to be visually inspected at the existing line pressure.

END OF SECTION
SECTION 02730

PREFABRICATED FIBERGLASS WETWELL LINER

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work included under this Section consists of furnishing all labor, equipment and materials necessary for the installation of prefabricated fiberglass wetwell liners and appurtenances as described in the specifications herein.

B. Related Work Specified Elsewhere:

2. Warranties and Bonds: Section 01740.

1.02 SUBMITTALS

A. Submit shop drawings, manufacturer's literature and other descriptive material in accordance with Section 01300 and Section 01340.

1.03 QUALITY ASSURANCE

A. The manufacturer shall provide an independent certification which consists of a copy of the manufacturers test report and accompanied by a copy of the test results stating the wetwell has been sampled, tested, and inspected in accordance with the specifications herein. Each completed wetwell shall be tested for dimensional requirements, hardness, and workmanship.

B. Contractor shall follow all applicable OSHA Standards concerning confined space entry.

C. Warranty: Prior to its installation, the manufacturer shall provide a warranty for the fiberglass wetwell liners to be free from defects and constructed as specified herein. During and after installation, the Manufacturer shall provide a 20-year warranty on the completed installation to cover the complete cost including costs for materials, equipment, and labor. The warranty shall cover any and all damage to the liners resulting from manufacturing or installation issues such as cracking, deterioration, or leaking due to settlement or chemical attack and as specified in Section 01740 herein.

D. Approved manufacturers include L.F. Manufacturing Inc., AFE, or Containment Solutions, Inc. (Flowtite).
PART 2 - PRODUCTS

2.01 FIBERGLASS WETWELL LINERS

A. General: Fiberglass reinforced wetwell liners shall be manufactured from commercial grade polyester resin or other suitable polyester or vinyl ester resins, with fiberglass reinforcements. Liners shall consist of a barrel section and cover the ceiling of the wet well. The liner will contain necks around all openings including through top of wet well, including but not limited to, hatches, vent, level openings, etc. Fiberglass products shall be manufactured in accordance with National Bureau of Standards, Voluntary Product Standard PS 1569 and ASTM D-3753. The manufacturer shall have a minimum of five (5) years experience in manufacturing products which meet the specified standards and shall provide three (3) references to verify the qualifications of the manufacturer.

B. Materials: Resins shall be a commercial grade unsaturated polyester resin. Reinforcing materials shall be commercial grade "E" type glass in the form of mat, chopped roving, continuous roving, roving fabric or a combination of the above, having a coupling agent that will provide a suitable bond between the glass reinforcement and resin. All materials including resins, glass reinforcement, fillers and additives shall be chemically resistant to hydrogen sulfide gas and the sanitary sewer environment. The combined thickness of the inner surface and the interior layer shall not be less than 0.10 inch. Seams shall be sealed at the factory with the same glass-resin jointing process.

C. Fabrication: The exterior surface shall be relatively smooth with no sharp projections and no exposed fibers. The exterior surface shall have a gray gel-coat coating. The interior surface shall be resin rich with no exposed fibers. The interior and exterior surfaces shall be free of crazing, delaminations, blisters larger than 1/2" diameter, wrinkles of 1/8" or greater in depth, resin runs, dry areas, sharp projections, or surface pits greater than 6 per square foot if they are less than 1/4" diameter and less than 1/16" deep. To provide UV protection, the exterior surface shall have a factory applied gray pigment for a minimum thickness of 0.125 inches.

D. Construction Procedure: After inner layer has been applied the liner wall shall be constructed with chop and continuous strand filament wound manufacturing process which insures continuous reinforcement and uniform strength and composition. Seams shall be fiberglassed on the inside and the outside using the same glass-resin jointing procedure. Field joints shall not be acceptable by anyone except the manufacturer.

E. Physical Properties: The fiberglass reinforced wetwell liner shall be designed for H-20 wheel loading and tested in accordance with ASTM D-3753 8.5 (note 1).
The cylinder shall meet the following pipe stiffness requirements.

<table>
<thead>
<tr>
<th>Length (feet)</th>
<th>F/AY (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 – 6.5</td>
<td>0.75</td>
</tr>
<tr>
<td>7 – 12.5</td>
<td>1.26</td>
</tr>
<tr>
<td>13 – 20.5</td>
<td>2.01</td>
</tr>
<tr>
<td>21 – 25.5</td>
<td>3.02</td>
</tr>
<tr>
<td>26 – 35.0</td>
<td>5.24</td>
</tr>
</tbody>
</table>

The fiberglass reinforced wetwell liner shall meet the following physical requirements:

<table>
<thead>
<tr>
<th></th>
<th>Hoop Direction</th>
<th>Axial Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength (psi)</td>
<td>18,000</td>
<td>5,000</td>
</tr>
<tr>
<td>Tensile Modulus (psi)</td>
<td>$0.6 \times 10^6$</td>
<td>$0.7 \times 10^6$</td>
</tr>
<tr>
<td>Flexural Strength (psi)</td>
<td>26,000</td>
<td>4,500</td>
</tr>
<tr>
<td>Flexural Modulus (psi)</td>
<td>$1.4 \times 10^6$</td>
<td>$0.7 \times 10^6$</td>
</tr>
<tr>
<td>Compressive (psi)</td>
<td>18,000</td>
<td>12,000</td>
</tr>
</tbody>
</table>

F. Soundness: Following installation, the Contractor shall determine soundness by applying air or water pressure (3-5 psi) to the wetwell liner. While holding at the established pressure, inspect the entire wetwell for leaks, based on loss of measured pressure. Any leakage through the laminate is cause for failure of the task. The Contractor shall be responsible for isolating the work of this contract from existing work and shall be solely responsible for the method of such isolation. Refer to ASTM D-3253 8.6.

G. Chemical Resistance: When tested in accordance with ASTM D3753 8.7 the log of percent retention of each property after immersion testing when plotted against the log of immersion time and extrapolated to 100,000 hrs. shall assure retention of at least 50% of the initial properties.

H. Fillers and Additives: Fillers, when used, shall be inert to the environment. Sand shall not be accepted as an approved filter. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the specific manufacturing process to be used to meet the requirements of this standard. The resulting reinforced-plastic material must meet the requirements of this Specification.

I. Loading Rating: The complete wetwell liner shall have a minimum dynamic-load rating of 16,000 lbs. when tested in according with ASTM 3753 8.4 (note 1). To establish this rating the complete wetwell shall not leak, crack, or suffer other damage when load tested to 40,000 lbs. and shall not deflect vertically downward more than 0.25 in. at the point of load application when loaded to 24,000 lbs.
2.02 CEMENT MORTAR

A. Cement mortar for wetwell construction shall be as specified in ASTM Designation C 270, Type M, except the cement shall be Portland Type II. No mortars that have stood for more than one (1) hour shall be used.

2.03 NON-SHRINK GROUT

A. Non-shrink grout used in the bench area or on pipe penetrations shall be 100% calcium aluminate, un-thinned and un-altered, as manufactured by Sewpercoat, Strong-Seal, or an approved equal.

2.04 MISCELLANEOUS MATERIALS

A. Additional items of construction necessary for the complete installation of the system shall conform to specific details on the Drawings and shall be constructed of first-class materials conforming to the applicable portions of these Specifications.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fiberglass Wetwell Liner:

1. The interior of the wetwell shall be pressure washed with an 800 to 1000 psi water blast, acid washed with a 20% muratic acid solution, and pressure washed a second time. All loose materials, grease/fats, and hydrogen sulfide contamination shall be removed. The existing bench areas in each wetwell shall be removed prior to pressure washing.

2. Wetwell liner diameter shall be approximately 4-inches smaller than the inside diameter of the barrel section of the wetwell.

3. Wetwell liner depth shall be from finish floor to top elevation minus the thickness of the ring and cover.

4. The existing wetwell top slab section shall be removed and discarded by the Contractor in accordance with all applicable regulations at the Contractor's expense.

5. Lower liner into wetwell and level.

6. Construct new fillets and tie-in and seal bottom of liner with a quick setting non-shrink grout as specified herein.
7. Pour or pump a 3000 psi pump mix into the annual space between the liner and existing wetwell.

8. Any exposed concrete and non-shrink grout shall be coated with a resin and fiberglass matting (patch kit).

9. Excavation around newly installed fiberglass liners shall be backfilled in accordance with specification Section 02200.

3.02 SHIPPING

A. Do not drop or impact the fiberglass wetwell liner. Use of chains or cables in direct contact with the liner is prohibited.

3.03 MAINTENANCE OF SERVICE

A. The Contractor shall sequence the Work so that wastewater service is maintained to existing customers at all times as specified in Sections 02050 and 11312.

3.04 FIELD QUALITY CONTROL

A. Workmanship: It is imperative that all sewers and appurtenances be built watertight and that the Contractor adhere rigidly to the specifications for materials and workmanship. Upon completion, the sewers will be tested and gauged and if leakage is above the allowable limits specified, the sewer will be rejected.

B. Cleaning:

1. Prior to final acceptance and final inspection of the sewer system, flush and clean all parts of the system. Remove all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the sewer system at or near the closest downstream manhole. If necessary, use mechanical rodding or bucketing equipment.

2. Upon the Engineer's final inspection of the sewer system, if any foreign matter is still present in the system, flush and clean the section and portions of the lines as required.

C. Inspection: Upon completion of each section of sewer, point repair or such other times as the Engineer may direct the section of sewer shall be cleaned, tested and inspected.

1. Each wetwell shall be watertight (no leakage allowed by visual inspection), neatly and substantially constructed, with the top set permanently to the position and grade shown on the Drawings. All repairs shown necessary by the inspection shall be made; broken or cracked pipe replaced; all deposits removed and the sewer left true to line and grade, entirely clean, and ready for use.
D. Testing: Upon installation, cleaning, and visual inspection, the Contractor shall, in the presence of the Engineer, test the entire lined surface in accordance with paragraph 2.01, F of this Section. Any repairs required shall be repaired in accordance with the manufacturer’s recommendations at the Contractor’s expense. The cost for the performance of this test shall be borne entirely by the Contractor.

END OF SECTION
SECTION 02740

PREFABRICATED FIBERGLASS MANHOLE LINER

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work included under this Section consists of furnishing all labor, equipment and materials necessary for the installation of prefabricated fiberglass manhole liners and appurtenances as described in the specifications herein.

B. Related Work Specified Elsewhere:
   1. Drawings and Submittals:  Section 01420.
   2. Warranties and Bonds:  Section 01740.

1.02 SUBMITTALS

A. Submit shop drawings, manufacturer's literature and other descriptive material in accordance with Section 01300 and Section 01340.

1.03 QUALITY ASSURANCE

A. The manufacturer shall provide an independent certification which consists of a copy of the manufacturers test report and accompanied by a copy of the test results stating the manhole has been sampled, tested, and inspected in accordance with the specifications herein. Each completed manhole shall be tested for dimensional requirements, hardness, and workmanship.

B. Contractor shall follow all applicable OSHA Standards concerning confined space entry.

C. Warranty: Prior to its installation, the manufacturer shall provide a warranty for the fiberglass manhole liners to be free from defects and constructed as specified herein. During and after installation, the Manufacturer shall provide a 20-year warranty on the completed installation to cover the complete cost including costs for materials, equipment, and labor. The warranty shall cover any and all damage to the liners resulting from manufacturing or installation issues such as cracking, deterioration, or leaking due to settlement or chemical attack and as specified in Section 01740 herein.

D. Approved manufacturers include L.F. Manufacturing Inc., AFE, or Containment Solutions, Inc. (Flowtite).
PART 2 - PRODUCTS

2.01 FIBERGLASS MANHOLE LINERS

A. General: Fiberglass reinforced manhole liners shall be manufactured from commercial grade polyester resin or other suitable polyester or vinyl ester resins, with fiberglass reinforcements. Manhole liner shall be a one-piece unit consisting of a bottom, with anti-flotation collar as appropriate, barrel section, corbel or reducer section, with a fiberglass neck that extends to the ring and cover. Fiberglass products shall be manufactured in accordance with National Bureau of Standards, Voluntary Product Standard PS 1569 and ASTM D-3753. The manufacturer shall have a minimum of five (5) years experience in manufacturing products which meet the specified standards and shall provide three (3) references to verify the qualifications of the manufacturer.

B. Materials: Resins shall be a commercial grade unsaturated polyester resin. Reinforcing materials shall be commercial grade "E" type glass in the form of mat, chopped roving, continuous roving, roving fabric or a combination of the above, having a coupling agent that will provide a suitable bond between the glass reinforcement and resin. All materials including resins, glass reinforcement, fillers and additives shall be chemically resistant to hydrogen sulfide gas and the sanitary sewer environment. The combined thickness of the inner surface and the interior layer shall not be less than 0.10 inch. Seams shall be sealed at the factory with the same glass-resin jointing process.

C. Fabrication: The exterior surface shall be relatively smooth with no sharp projections and no exposed fibers. The exterior surface shall have a gray gel-coat coating. The interior surface shall be resin rich with no exposed fibers. The interior and exterior surfaces shall be free of crazing, delaminations, blisters larger than 1/2" diameter, wrinkles of 1/8" or greater in depth, resin runs, dry areas, sharp projections, or surface pits greater than 6 per square foot if they are less than 1/4" diameter and less than 1/16" deep. To provide UV protection, the exterior surface shall have a factory applied gray pigment for a minimum thickness of 0.125 inches.

D. Construction Procedure: After inner layer has been applied the manhole liner wall shall be constructed with chop and continuous strand filament wound manufacturing process which insures continuous reinforcement and uniform strength and composition. The cone section, if produced separately, shall be affixed to the barrel section at the factory with resin-glass reinforced joint resulting in a one piece unit. Seams shall be fiberglassed on the inside and the outside using the same glass-resin jointing procedure. Field joints shall not be acceptable by anyone except the manufacturer.

E. Physical Properties: The fiberglass reinforced manhole liner shall be designed for H-20 wheel loading and tested in accordance with ASTM D-3753 8.5 (note 1). The manhole cylinder shall meet the following pipe stiffness requirements.
<table>
<thead>
<tr>
<th>Length (feet)</th>
<th>F/AY (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 – 6.5</td>
<td>0.75</td>
</tr>
<tr>
<td>7 – 12.5</td>
<td>1.26</td>
</tr>
<tr>
<td>13 – 20.5</td>
<td>2.01</td>
</tr>
<tr>
<td>21 – 25.5</td>
<td>3.02</td>
</tr>
<tr>
<td>26 – 35.0</td>
<td>5.24</td>
</tr>
</tbody>
</table>

The fiberglass reinforced manhole liner shall meet the following physical requirements:

<table>
<thead>
<tr>
<th></th>
<th>Hoop Direction</th>
<th>Axial Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength (psi)</td>
<td>18,000</td>
<td>5,000</td>
</tr>
<tr>
<td>Flexural Strength (psi)</td>
<td>26,000</td>
<td>4,500</td>
</tr>
<tr>
<td>Flexural Modulus (psi)</td>
<td>$1.4 \times 10^6$</td>
<td>$0.7 \times 10^6$</td>
</tr>
<tr>
<td>Compressive (psi)</td>
<td>18,000</td>
<td>12,000</td>
</tr>
</tbody>
</table>

F. **Soundness:** Following installation, the Contractor shall determine soundness by applying air or water pressure (3-5 psi) to the manhole liner. While holding at the established pressure, inspect the entire manhole for leaks, based on loss of measured pressure. Any leakage through the laminate is cause for failure of the task. The Contractor shall be responsible for isolating the work of this contract from existing work and shall be solely responsible for the method of such isolation. Refer to ASTM D-3253 8.6.

G. **Chemical Resistance:** When tested in accordance with ASTM D3753 8.7 the log of percent retention of each property after immersion testing when plotted against the log of immersion time and extrapolated to 100,000 hrs. shall assure retention of at least 50% of the initial properties.

H. **Fillers and Additives:** Fillers, when used, shall be inert to the environment. Sand shall not be accepted as an approved filter. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the specific manufacturing process to be used to meet the requirements of this standard. The resulting reinforced-plastic material must meet the requirements of this Specification.

I. **Loading Rating:** The complete manhole liner shall have a minimum dynamic-load rating of 16,000 lbs. when tested in accordance with ASTM 3753 8.4 (note 1). To establish this rating the complete manhole shall not leak, crack, or suffer other damage when loaded tested to 40,000 lbs. and shall not deflect vertically downward more than 0.25 in. at the point of load application when loaded to 24,000 lbs.

2.02 ADJUSTMENT RINGS

A. **Brick for manhole construction shall not be allowed.** The Contractor shall furnish and install concrete grade adjustment rings sized specifically for the individual liners. Adjustment rings shall be designed to accept an H-20 traffic load. Plastic grade adjustment rings shall not be allowed.
2.03 CEMENT MORTAR

A. Cement mortar for manhole construction shall be as specified in ASTM Designation C 270, Type M, except the cement shall be Portland Type II. No mortars that have stood for more than one (1) hour shall be used.

2.04 NON-SHRINK GROUT

A. Non-shrink grout used in the bench area or on pipe penetrations shall be 100% calcium aluminate, un-thinned and un-altered, as manufactured by Sewpercoat, Strong-Seal, or an approved equal.

2.05 MANHOLE COVER AND LIDS

A. Contractor shall install manhole lids with lifting eyes per City details as shown on the Drawings.

2.06 COVER AND RING SUPPORT

A. The manhole shall provide an area from which a grade adjustment ring can be installed to accept the specified ring and cover and have the strength to support an H-20 traffic load without damage to the manhole.

2.07 MANHOLE BENCH

A. The existing concrete bench area shall be removed completely during initial preparation of the manhole. Upon installation of the manhole liner, a new bench shall be constructed with non-shrink grout and shall be field coated with resin and fiberglass in a dry environment after wastewater flows are diverted. The newly constructed bench shall sufficiently overlap the newly installed liner to prevent migration of fluids or gases between the liner and the bench. There shall be no exposed concrete between the factory manufactured fiberglass liner and the field installed fiberglass bench overlay.

2.08 MANHOLE PIPE PENETRATIONS

A. Inlet and outlet piping shall extend past the liner into the fiberglass manhole or be flush with the liner. If the existing piping does not fully penetrate the fiberglass liner, the Contractor must extend similar material piping into the fiberglass manhole. Any gaps on joints must be sealed with a non-shrink grout specified herein.

2.09 MANWAY NECK OR LIP

A. Manhole liner neck section shall extend from the ring and cover support area up to the adjustment rings and cover. The neck section shall be designed to protect the adjustment ring(s), used to bring the ring and cover to final grade.
2.10 MISCELLANEOUS MATERIALS

A. Additional items of construction necessary for the complete installation of the system shall conform to specific details on the Drawings and shall be constructed of first-class materials conforming to the applicable portions of these Specifications.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fiberglass Manhole Liner:

1. The interior of the manhole shall be pressure washed with an 800 to 1000 psi water blast, acid washed with a 20% muratic acid solution, and pressure washed a second time. All loose materials, grease/fats, and hydrogen sulfide contamination shall be removed. The existing bench areas in each manhole shall be removed prior to pressure washing.

2. Manhole liner diameter shall be approximately 4-inches smaller than the inside diameter of the barrel section of the manhole.

3. Manhole liner depth shall be from invert to top elevation minus the thickness of the ring and cover. The top 12-inches of the manhole liner shall be a fiberglass neck that extends from the liner corbel or cone section to the bottom of the ring and cover. The neck is used to protect the concrete grade rings or brick and mortar adjustments from the sewer environment.

4. The manhole corbel or cone section shall be removed and discarded by the Contractor in accordance with all applicable regulations at the Contractor's expense.

5. Measure and cut manhole liner to exact length and invert configuration. Measure and cut all incoming and outgoing line openings.

6. Lower manhole liner into manhole and level.

7. Extend all incoming and outgoing lines inside the liner with PVC or other approved pipe.

8. Construct new benches and tie-in and seal bottom of liner with a quick setting non-shrink grout as specified herein.

9. Tie-in and seal all lines extending into the manhole liner with non-shrink grout.

10. Pour or pump a 3000 psi pump mix into the annular space between the liner and existing manhole.
11. Use concrete grade rings on top of the liner cone section to bring ring and cover to finish grade.

12. Any exposed concrete and non-shrink grout shall be coated with a resin and fiberglass matting (patch kit). Minimum ¼-inch thick fiberglass matting shall be placed on bench area above the water line and extending to the pipe channel if possible. A non-shrinking grout as specified herein shall be applied to areas that cannot be fiberglassed due to water.

13. Excavation around newly installed fiberglass liners shall be backfilled in accordance with specification Section 02200.

3.02 SHIPPING

A. Do not drop or impact the fiberglass manhole liner. Use of chains or cables in direct contact with the manhole is prohibited.

3.03 MAINTENANCE OF SERVICE

A. The Contractor shall sequence the Work so that wastewater service is maintained to existing customers at all times as specified in Sections 02050 and 11312.

3.04 FIELD QUALITY CONTROL

A. Workmanship: It is imperative that all sewers and appurtenances be built watertight and that the Contractor adhere rigidly to the specifications for materials and workmanship. Upon completion, the sewers will be tested and gauged and if leakage is above the allowable limits specified, the sewer will be rejected.

B. Cleaning:

1. Prior to final acceptance and final inspection of the sewer system, flush and clean all parts of the system. Remove all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the sewer system at or near the closest downstream manhole. If necessary, use mechanical rodding or bucketing equipment.

2. Upon the Engineer's final inspection of the sewer system, if any foreign matter is still present in the system, flush and clean the section and portions of the lines as required.

C. Inspection: Upon completion of each section of sewer (manhole to manhole), manhole, point repair or such other times as the Engineer may direct the section of sewer shall be cleaned, tested and inspected.

1. Each manhole shall be watertight (no leakage allowed by visual inspection), neatly and substantially constructed, with the top set permanently to the position and grade shown on the Drawings. All repairs shown necessary by the
inspection shall be made; broken or cracked pipe replaced; all deposits removed and the sewer left true to line and grade, entirely clean, and ready for use.

D. Testing: Upon installation, cleaning, and visual inspection, the Contractor shall, in the presence of the Engineer, test the entire lined surface in accordance with paragraph 2.01, F of this Section. Any repairs required shall be repaired in accordance with the manufacturer’s recommendations at the Contractor’s expense. The cost for the performance of this test shall be borne entirely by the Contractor.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish all labor, materials, equipment and incidentals required to prepare lawn bed and install sodding as specified.

2. All sodded areas disturbed by Contractor activities shall be replaced with like kind.

B. Related Work Described Elsewhere


2. Earthwork: Section 02200.

3. Loaming, Seeding, and Mulching: Section 02922.

1.02 QUALITY ASSURANCE (NOT APPLICABLE)

1.03 SUBMITTALS

A. Provide technical data as required in Section 01340 regarding all materials or installation procedures required under this Section.

B. Submit representative topsoil samples for analysis by a private laboratory to determine nutrient deficiencies and outline a proper fertilization program.

PART 2 - PRODUCTS

2.01 GENERAL

A. Loam (topsoil) shall be fertile, natural soil, typical of the locality, free from large stones, roots, sticks, peat, weeds and sod and obtained from naturally well drained areas. It shall not be excessively acid or alkaline nor contain toxic material harmful to plant growth. Topsoil stockpiled under other Sections of this Division may be used, but the Contractor shall furnish additional loam at his own expense, if required.
2.02 SOIL CONDITIONERS

A. Fertilizer:

1. Fertilizer shall be a complete fertilizer, the elements of which are derived from organic sources. Fertilizer shall be a standard product complying with State and Federal fertilizer laws.

2. Fertilizer shall be delivered to the site, mixed as specified, in the original unopened standard size bags showing weight, analysis and name of manufacturer. Containers shall bear the manufacturer's guaranteed statement of analysis, or a manufacturer's certificate of compliance covering analysis shall be furnished to the Engineer. Store fertilizer in a weatherproof place and in such a manner that it will be kept dry and its effectiveness will not be impaired.

3. Fertilizer must be applied in accordance with Volusia County Ordinance 2014-09.

   a. The application of fertilizers containing nitrogen or phosphorous is prohibited from June 1 through Sept. 30 of each year.
   b. Fertilizer may not be applied within 15 feet of water bodies.
   c. The application of fertilizers containing phosphorous is prohibited unless a deficiency is verified.
   d. Fertilizer containing nitrogen may be applied only between Oct. 1 and May 31 and must contain no less than 50 percent slow-release nitrogen

B. Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes containing not less than 20 available phosphoric acid.

C. Lime shall be ground limestone.

2.03 SOD

A. Sod shall match existing kind and be of firm texture having a compacted growth and good root development as approved.

B. Sod shall be certified to meet Florida State Plant Board specifications, absolutely true to varietal type, and free from weeds or other objectionable vegetation, fungus, insects and disease of any kind.

C. Before being cut and lifted the sod shall have been mowed 3 times with the final mowing not more than a week before cutting into uniform dimensions.
PART 3 - EXECUTION

3.01 PREPARATION

A. Areas to be sodded shall be cleared of all rough grass, weeds, and debris, and ground brought to an even grade as approved.

B. The soil shall then be thoroughly tilled to a minimum 8 inch depth.

C. Loam shall be placed to a minimum depth of 4 inches and shall be lightly compacted. No loam shall be spread in water.

D. Lime shall be applied at a rate necessary to achieve a pH of 6 to 7.

E. Apply superphosphate at a rate of 5 pounds per 1,000 square feet and apply fertilizer at a rate of 16 pounds per 1,000 square feet.

F. 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.

3.02 INSTALLATION

A. During delivery, prior to planting, and during the planting of the lawn 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 protected 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 and with the joints offset relative to upper and lower panels. Immediately following sod laying the lawn areas shall be rolled with a lawn roller customarily used for such purposes, and then thoroughly watered.

C. Bring the sod edge in a neat, clean manner to the edge of all paving and shrub areas. Top dressing with approved, clean weed free sand may be required at no additional cost to the Owner if deemed necessary by the Engineer.

3.03 MAINTENANCE

A. The Contractor shall produce a dense, well established lawn. The Contractor shall be responsible for the repair and resodding of all eroded or bare spots until project acceptance and during the warranty period. Repair sodding shall be accomplished as in the original work except that fertilizing may be omitted. Sufficient watering shall be done by the Contractor to maintain adequate moisture for optimum development of the lawn areas. Sodded areas shall receive no less than 1.5 inches of water per week.
The Contractor shall also mow lawn areas once per week until final completion of the Project.

3.04 REPAIRS TO LAWN AREAS DISTURBED BY CONTRACTOR'S OPERATIONS

A. Lawn areas planted under this Contract and lawn areas outside the designated areas damaged by Contractor's operations shall be repaired at once by proper sod bed preparation, fertilizing and resodding, in accordance with these Specifications.

END OF SECTION
SECTION 02920

RESTORATION

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall perform all restoration Work indicated and required in accordance with the Contract Documents. The Contractor shall furnish all labor, materials, equipment and incidentals necessary to perform the Work.

B. The Contractor shall examine the site and identify items that require restoration during construction and prior to completion, and shall coordinate the restoration of such items with the Utilities Commission of New Smyrna Beach and the landowner as needed.

1.02 QUALITY CONTROL

A. The Utilities Commission of New Smyrna Beach shall perform quality control to confirm and document that all restoration Work performed by the Contractor has been completed to the satisfaction of the Utilities Commission of New Smyrna Beach and/or the landowner.

1.03 CONTRACTOR SUBMITTALS

A. The Contractor shall perform Work in accordance with the requirements in Section 01300 - Contractor Submittals.

PART 2 - PRODUCTS

2.01 REQUIREMENTS

A. General: Materials for use shall be as indicated in this Section, unless specified otherwise. For earthwork restoration, the soil materials shall be as specified in Section 02200 – Earthwork.

B. Contractor shall notify the property owner of any landscape, trees, bushes, decorative fencing, etc. located within the right-of-way conflicting with construction 60 days prior to commencing construction activities. Property owner will have 60 days to remove any landscape, trees, bushes, decorative fencing, etc. located within the right-of-way during that 60-day period. Contractor shall be required to remove and dispose of any landscape, trees, bushes, decorative fencing, etc. left within the right-of-way after 60 days.
PART 3 - EXECUTION

3.01 REQUIREMENTS

A. General: Restoration WORK shall be performed as indicated in this Section. For restoration Work related to earthwork, the execution shall be as specified in Section 02200 – Earthwork. Restoration shall begin as soon as practical after the utility has been installed. Mailboxes shall be replaced daily unless other provisions have been made. All practical efforts shall be made to complete roadway restoration including the prime coat within 60 days of beginning Work in an area. Contractor shall properly restore roadway access at the end of each workday, unless otherwise approved by the Utilities Commission of New Smyrna Beach. Asphalt paving shall be completed within 90 days of the application of the prime coat. Prime coat shall be maintained until such time as the asphalt installation is complete. Driveways, finish grading, seeding, sodding, and other final restoration shall be started in an area within 14 days of the installation of the asphalt paving. Final restoration must be completed within 60 days of the installation of the asphalt paving. All areas disturbed by construction activities shall be restored, including lots used for access to Work, lay-down, storage, excess earth stock piles, etc., to a condition equal to or better than existing prior to construction.

3.02 LAWN AREAS

A. Driveways, lawns and landscaping areas shall be restored and property such as mailboxes shall be replaced. Mailboxes shall be replaced in accordance with FDOT 2013 Design Standards Index No. 532. Where excavation occurs in lawn areas, the Contractor shall re-sod the lawn to match the existing type of grass after completion of the Work. All lots with homes or businesses shall be re-sodded in accordance with Section 02822 – Solid Sodding.

B. Right-Of-Way areas at lots without houses or businesses shall be seeded and mulched in accordance with FDOT Standard Specifications 2020 Section 981. Hydromulch in the Right-Of-Way shall not be allowed. All lots without houses or businesses shall be seeded and mulched or shall be hydro-mulch seeded in accordance with Florida Department of Transportation Section 981 and shall be green mulch mix. If seed and mulch is used for restoration, a strip of sod with a minimum width of 12" minimum shall be placed along the street side of the excavation to provide erosion protection along the pavement edge. Seed shall conform to the requirements of the Florida Department of Agriculture and Consumer Services and all applicable State laws. The seed shall have been harvested from the previous year’s crop. All seed bags shall have a label attached stating the date of harvest, LOT number, percent purity, percent germination, noxious weed certification and date of test. Seed, which has become wet, moldy, or otherwise damaged prior to use, will not be accepted.

C. Each of the species or varieties of seed shall be furnished and delivered in separate labeled bags. During handling and storing, the seed shall be cared for in such a manner that it will be protected from damage by heat, moisture, rodents, or other causes.
D. All quantities of seed specified shall be for pure live seed. It is the responsibility of the Contractor to calculate and apply the actual pure live seed poundage based on the label attached to each bag of seed. Shipping tickets shall indicate both pure live seed weight and bulk weight for each species.

E. Grass seed shall be fresh, clean, new-crop seed, composed of the varieties listed below mixed in the proportions by weight. Purity and germination percentage shall be the results of testing. Germination rate of all seed shall not be less than 80% and no seed with an excess of 5% weed shall be used.

F. A bahia/millet seed mixture will be utilized between March 1 and November 1. A rye/bahia mixture will be utilized between November 1 to March 1. The seed mixture will be spread uniformly on the prepared soil. Hay mulch will then be spread uniformly upon the seeded area to provide erosion control until the seeds germinate. The hay mulch will then be cut into the soil and crimped with specialized equipment ensuring further soil stability. Lots without houses or businesses may also be hydro-mulch seeded in accordance with Florida Department of Transportation Section 981 and shall be green mulch mix.

G. The existing sod may be carefully removed, dampened, and stockpiled to preserve it for replacement or new sod may be provided. Contractor must provide new sod if stockpiled sod has not been placed within 72 hours of cutting. Excavated material may be placed on the lawn provided that a drop cloth, plywood, or other suitable method is employed to protect the lawn from damage. The lawn shall not remain covered for more than 72 hours. Immediately after completion of backfilling, the sod shall be replaced and lightly rolled in a manner so as to restore the lawn to a condition, which meets or improves the original condition.

### 3.03 LANDSCAPING AND TREES

A. Only trees that directly impede construction activities shall be removed. Utilities Commission of New Smyrna Beach must approve any and all tree removal. Trees removed under such conditions may be required to be replaced. All trees that interfere with Work improvements and proper storm drainage flow shall be removed at no additional cost to the Utilities Commission of New Smyrna Beach, at the Utilities Commission of New Smyrna Beach’s direction.

### 3.04 SOD FOR STABILIZATION

A. At all locations where the excavated area is within 4 feet of the street pavement and where no natural stand of grass exists, two (2) strips of sod of at least 2-foot 8 inches in width shall be planted along the edge of the pavement as a means of erosion stabilization and pavement protection. The sod strips, or blocks, shall be placed with staggered transverse joints. This shall include all areas to be seeded as the basic means of stabilization and restoration. Provide two (2) strips of sod around all meter boxes installed on vacant lots. All sod shall be properly rolled when installed.
3.05 RESTORATION OF SIDEWALKS OR PRIVATE DRIVEWAYS

A. Wherever sidewalks or private driveways have been removed for purposes of construction, the Contractor shall place suitable temporary sidewalks or driveways promptly after backfilling and shall maintain them in satisfactory condition until the replacement sidewalk or driveway is constructed.

B. Private driveways shall be provided with temporary access within a maximum time of 12 hours after removal for construction. The Contractor shall provide a minimum of 48 hours notice to all affected parties prior to removing private driveways. The final restoration of the driveway shall be completed within 14 days after paving the local street. The Contractor shall maintain temporary sidewalks or driveways until the final restoration has been made. The concrete shall have a minimum cure time of 3 days. During this time period the concrete must be protected from rain, traffic and all other elements that could cause damage by the Contractor at no additional cost to the Utilities Commission of New Smyrna Beach.

C. In order to obtain a satisfactory junction with adjacent surfaces, the Contractor shall saw cut and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of driveway. Damaged edges of driveways along excavations and elsewhere shall be trimmed by saw cutting in straight lines. Incidental driveway repair (driveways that new pipe mains are not installed under) shall be full width and to a minimum length of three feet. Construction/control joints shall be at least three feet apart. Driveway replaced due to the installation of new pipe mains shall be replaced from the roadway to the nearest construction or control joint or the Right-of-Way line. All driveway restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed driveway and pavement.

D. All driveways shall be restored to preexisting conditions.

E. At Contractor’s option, he may bore and jack under existing driveways and sidewalks in lieu of open cut pipe installation, utilizing ductile iron pipe with restrained joints.

3.06 WATERING

A. Upon completion of the erosion control seeding, sodding, and other trees and plantings, the entire area shall be soaked to saturation by a fine spray. The new plantings shall be adequately watered during dry weather to establish and maintain a healthy stand of grass and viability of all plants. At no time shall the plantings be allowed to dry out. Care shall be taken to avoid excessive washing or pooling on the surface and any such damage caused thereby shall be repaired by the Contractor.

3.07 MAINTENANCE PRIOR TO FINAL ACCEPTANCE

A. The Contractor shall maintain the planted areas in a satisfactory condition until final acceptance of the project. Such maintenance shall include the filling, leveling, and
repairing of any washed or eroded areas, as may be necessary, and sufficient watering to maintain the plant materials in a healthy condition. The Utilities Commission of New Smyrna Beach may require replanting of any areas in which the establishment of the vegetative ground cover does not appear to be developing satisfactorily. Contractor shall mow sod at inlets on undeveloped lots and four lane medians prior to substantial completion.

3.08 MISCELLANEOUS ITEMS

A. Improvements to the land such as fences, walls, outbuilding, mailboxes, and other structures that of necessity must be removed, shall be replaced with equal or better quality materials and workmanship. The Contractor shall provide the homeowner the opportunity to retain any mailbox, fence, wall, outbuilding, etc. prior to removal. Mailboxes shall be replaced to match the originals at the locations encountered prior to commencement of the Work. The mailbox shall be replaced in accordance with FDOT Design Standards 2013 Index. No. 532 with the face located at least 2 feet from the edge of payment and the bottom 42” from the top of pavement.

B. Disturbed swales shall be regraded to provide positive drainage.

C. Any commercial signs, disturbed or removed, shall be restored to their original condition within 24 hours.

D. Special Items – Decorative rocks, yards signs, and other landscaping items shall be replaced in kind at the original locations.

END OF SECTION
SECTION 02922
LOAMING, SEEDING, AND MULCHING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish all labor, materials, equipment and incidentals required to prepare lawn bed, seed and mulch and establish a stand of grass for erosion and sedimentation control. All areas disturbed by Contractor activities outside of rights-of-way are to be seeded and mulched.

B. Submit to the Engineer as provided in the General Conditions, identification labels and certification that seed is Argentine Bahia.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Seed

1. Species shall be Argentine Bahia Seed. Argentine Bahia grass seed shall have a minimum pure seed content of 95 percent with a minimum germination of 80 percent.

2. Dry Mulch: The mulch material used shall normally be dry mulch of straw or hay, consisting of oat, rye, or wheat straw, or of pangola, peanut, coastal bermuda or bahia grass hay. Only undeteriorated mulch which can readily be cut into the soil shall be used.

PART 3 - EXECUTION

3.01 PREPARATION

A. Areas to be seeded shall be cleared of all rough grass, weeds, and debris, and ground brought to an even grade as approved.

B. 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.
3.02 INSPECTION AND TESTING

A. Verify that soil preparation and related preceding work has been completed.

B. Do not start work until conditions are satisfactory.

3.03 INSTALLATION

A. Apply the lawn seed with a drop type spreader while soil is still loose at the rate of eight (8) pounds per one thousand (1,000) square feet.

B. Apply half the seed in one direction and the remainder at right angles to the first seeding.

C. After applying the seed, rake the seed into the seed bed to a depth of one half inch.

D. Approximately two inches, loose thickness, of mulch material shall be applied uniformly over the seed bed and cut into the soil so as to produce a loose mulched thickness of three to four inches. The area shall be rolled thoroughly with a lawn roller immediately after completion of the seeding and mulching.

E. Water the seeded area lightly and again roll the area with a light lawn roller to assure firm contact of the soil and seed.

3.04 MAINTENANCE

A. Soil shall be kept continuously moist, but not too wet, until seed has germinated and become well established.

B. The Contractor shall, at his expense, maintain the planted areas in a satisfactory condition as required for temporary erosion and sedimentation control. Such maintenance shall include watering, and filling, leveling, and repairing of any washed or eroded areas, as may be necessary. The Engineer may require replanting of any areas in which the establishment of the grass stand does not appear to be developing satisfactorily. Replanting shall be performed at the Contractor's expense.

END OF SECTION
SECTION 02995

FLOWABLE FILL OF ABANDONED UTILITIES

PART 1 - GENERAL

1.1 SCOPE OF WORK

This Section specifies the requirements for flowable fill used to fill abandoned sanitary sewer and structures as shown in the Drawings.

The Work includes cutting into and removing sections of the existing piping to create manageable sections through which the flowable fill can be placed under acceptable pressures. Excavations and removal of piping to provide additional access points for pumping or air evacuation shall be completed at no additional cost to the UCNSB.

1.2 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACI 304R</td>
<td>Guide for Measuring, Mixing, Transporting and Placing Concrete</td>
</tr>
<tr>
<td>ACI 350R</td>
<td>Environmental Engineering Concrete Structures</td>
</tr>
</tbody>
</table>

Any clean sand with 100% passing 3/8" sieve and not more than 10% passing the 200 mesh may be used.
1.3 SUBMITTALS

Technical information for equipment and operational procedures including projected slurry injection rate, flowable fill pressure, method of controlling flowable fill pressure.

Sources and proportions of CLSM ingredients: Prior to the start of CLSM placement, the Contractor shall submit a description of the proposed mixture design. The Engineer may require the Contractor to submit appropriate laboratory or field test data documenting compliance to specified material and or performance properties.

At least 60 days prior to commencing abandonment activities, submit plan for abandonment, describing proposed sequence and any other information pertinent to completion of work.

Provide documentation that the admixture supplier has experience of at least one year, with the products being provided and any equipment required to obtain desired performance of the product.

PART 2 - PRODUCTS

2.1 MATERIALS

The Contractor shall be responsible for producing a flowable mixture using these guidelines and adjusting his mixture design as called for by circumstances or as may be directed by the Engineer.

The Flowable fill material shall be proportioned to produce a 28-day compressive strength of approximately 100-200 psi.

General mix requirements are as follows:

<table>
<thead>
<tr>
<th>Components</th>
<th>Pounds per Cubic Yard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>75-125*</td>
</tr>
<tr>
<td>Fly Ash or Granulated Blast Furnace Slag</td>
<td>0-600</td>
</tr>
<tr>
<td>Fine Sand (Adjust to yield one cubic yard of flowable fill)</td>
<td>0-2750</td>
</tr>
<tr>
<td>Water</td>
<td>500 (maximum)</td>
</tr>
</tbody>
</table>

*The percentage of cement may be increased above these limits only when early strength is required and future removal is very unlikely.

Weights for fine aggregate and water shall be adjusted according to cementitious content. The mix proportions shall be adjusted for removability, pumpability and flowability. If required, strength test data shall be provided prior to batching.

If required by the Engineer, the flowability can be measured by afflux time determined in accordance with ASTM C 939 and shall be 30 seconds +/- 5 seconds as measured on mortar
passing the No. 4 sieve. The equipment required to perform this test shall be provided by the Contractor.

2.2 SAMPLING AND TESTING

Flowable fill shall be sampled and tested in the field in conformance with either ASTM C 94 or C 685. Samples for tests shall be taken for every 115 cubic meters (150 cubic yards) of material, or fraction thereof, for each day’s placement. Tests shall include temperature reading and four compressive strength cylinders. Compressive strength sampling and testing shall conform to ASTM D 4832 with one specimen tested at 7 days, two at 28 days, and one held for each batch of four specimens. Sampling and testing shall be performed by a qualified, independent commercial testing laboratory. Test results should be submitted within 48 hours of completion of testing.

PART 3 - EXECUTION

3.1 PREPARATION

The Contractor shall remove all raw sewage, sludge, debris, and water from the force mains, gravity mains, and structures prior to filling with flowable fill.

Locate previously unidentified connections, which have not been redirected and reconnected as part of this project and report them to the Engineer. Clean placement areas of sewer and water lines of debris that may hinder fill placement. Remove excessive amounts of sludge and other substances that may degrade performance of fill.

Remove free water prior to starting fill placement.

All raw sewage, sludge, debris, and water removed from the mains and structures shall become the property of the Contractor and shall be legally disposed in location approved by the City.

All proposed force mains, gravity mains, and manholes shall be installed, pressure tested, and placed in-service prior to filling any abandoned force mains, gravity mains, or manholes.

3.2 PRODUCTION AND PLACING

Flowable fill shall be produced and delivered using concrete construction equipment. Placing flowable fill shall be by chute, pumping or other methods approved by the Engineer.

The flowable fill shall be placed to the designated fill line without vibration or other means of compaction. Placement shall be avoided during inclement weather, e.g. rain or ambient temperatures below 40 degrees F. The Contractor shall take all necessary precautions to prevent any damages caused by the hydraulic pressure of the fill during placement prior to hardening. Also, necessary means to confine the materials within the designated space shall be provided by the Contractor.

All pipes shall be abandoned in the manner which results in the abandoned pipeline not being pressurized.
After completing the work, the Contractor shall remove from the project site any excess flowable fill that resulted from spillage, et cetera, and restore the project site to a condition that is acceptable to the Engineer. If excavation is required to reach the abandoned pipe, the contractor shall restore the area to its original condition as directed by the Engineer.

3.3 ACCEPTANCE

The flowable fill shall be proportioned and placed as specified herein. In general, the strength desired is the maximum hardness that can be excavated at a later date using conventional excavating equipment. No curing protection is required.

The fill shall be left undisturbed until material obtains sufficient strength. Sufficient strength is 35 psi penetration resistance as measured using a handheld penetrometer. The penetrometer shall be provided by the Contractor.

END OF SECTION
DIVISION 3

CONCRETE
SECTION 03300
CAST IN PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies cast in place structural concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

B. Cast in place structural concrete includes the following:

1. Structural Walls.
2. Structural slabs.
3. Lightweight concrete fill

C. Related Documents include the following:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
2. Design Codes:
   b. Specifications for Structural Concrete for Buildings (ACI 301-latest edition)
   c. Florida Building Code, 2014 and latest Supplements
   d. ACI 350 -06 Code requirements for Environmental Engineering Concrete
   e. ACI 212.2R Standard Practice for Selecting Proportions for Lightweight Aggregate concrete, latest edition

1.02 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, water-stops, joint systems, epoxies, curing compounds, dry-shake finish materials, and others if requested by Engineer.

C. Submit shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar
diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

D. Samples of materials as requested by Engineer, including names, sources, and descriptions, as follows:

1. Normal and lightweight aggregates.
2. Waterstops.

E. Laboratory test reports for concrete materials and mix design test.

F. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

1.03 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
2. ACI 318, "Building Code Requirements for Reinforced Concrete."

B. Concrete Testing Service: Agency to perform material evaluation tests and to design concrete mixes. Contractor shall coordinate with Owner.

C. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.

PART 2 – PRODUCTS

2.01 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class I.
2. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

2.02 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.


C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.
   1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
   2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

D. Deformed Bar Anchors: ASTM A 496, minimum yield strength 70,000 psi.

2.03 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type II.
   1. Use one brand of cement throughout Project unless otherwise acceptable to Engineer.

B. Fly Ash: ASTM C 618, Type F.

C. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.
   1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
   2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Engineer.
D. Water: Potable.

E. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

G. Water-Reducing Admixture: ASTM C 494, Type A.

H. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.

I. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.

J. Lightweight Aggregates: refer to ACI 212R for shale aggregate of weight 105 lbs per cu. ft. minimum

2.04 RELATED MATERIALS

A. Dovetail Anchor Slots: Hot-dip galvanized sheet steel, not less than 0.0336-inch-thick (22 gage) with bent tab anchors. Fill slot with temporary filler or cover face opening to prevent intrusion of concrete or debris.

B. Sand Cushion: Clean, manufactured or natural sand.

C. Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E 154, as follows:

1. Polyethylene sheet not less than 8 mils thick.
   a. Product: Subject to compliance with requirements, provide Moistop by Fortifiber Corporation.

D. Vapor Barrier: Premolded seven-ply membrane consisting of reinforced core and carrier sheet with fortified bitumen layers, protective weather coating, and plastic antistick sheet. Water vapor transmission rate of 0.00 grains per sq. ft. per hr. when tested according to ASTM E 96, Method B. Provide manufacturer's recommended mastics and gusset tape.

1. Product: Subject to compliance with requirements, provide Sealtight Premoulded Membrane by W.R. Meadows, Inc.

E. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
1. Polyethylene film.
2. Polyethylene-coated burlap.

2.05 PROPORTIONING AND DESIGNING MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Engineer for preparing and reporting proposed mix designs.

1. Do not use the same testing agency for field quality control testing.
2. Limit use of fly ash to not exceed 25 percent of cement content by weight.

B. Submit written reports to Engineer of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Engineer.

C. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:

1. 4000-psi, 28-day compressive strength; water-cement ratio, 0.52 maximum (non-air-entrained), 0.35 maximum (air-entrained).
2. For lightweight aggregate concrete: 4000 psi, 28-day strength; water cement ratio 0.45 maximum

D. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:

1. Subjected to deicers/watertight: W/C 0.40.
2. Subjected to brackish water, or salt spray: W/C 0.40.

E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Reinforced concrete in elevated walls and slabs: Not less than 3 inches and not more than 6 inches.
2. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2-to-3-inch slump concrete.
3. Lightweight aggregate concrete: not less than 3 inches or more than 4.5 inches
4. Other concrete: Not more than 6 inches.
2.06 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

C. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.

D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer’s prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:

1. Concrete not exposed to freezing, thawing, or hydraulic pressure: 2 to 4 percent air.

E. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer’s directions.

2.07 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.

1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 – EXECUTION

3.01 GENERAL

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.02 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of
correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. Provide Class A tolerances for concrete surfaces exposed to view.
2. Provide Class C tolerances for other concrete surfaces.

3.03 VAPOR RETARDER/BARRIER INSTALLATION

A. General: Place vapor retarder/barrier sheeting in position with longest dimension parallel with direction of pour.

B. Lap joints 6 inches and seal with manufacturer's recommended mastic or pressure-sensitive tape.

1. Cover vapor retarder/barrier with sand cushion and compact to depth indicated.

3.04 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports as specified.

1. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Engineer.

D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.05 JOINTS

A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Engineer.
B. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

C. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

D. Waterstops: Provide waterstops in construction joints as required. Install waterstops to form continuous diaphragm in each joint. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's printed instructions.

E. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as required.

F. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8-inch-wide by one-fourth of slab depth or inserts 1/4 inch wide by one-fourth of slab depth, unless otherwise indicated.

1. Form contraction joints by inserting pre-molded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.

3. If joint pattern is not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).

3.06 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.


C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement
consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.

2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

3. Maintain reinforcing in proper position on chairs during concrete placement.

F. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

3.07 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Grout-Cleaned Finish: Provide grout-cleaned finish on scheduled concrete surfaces that have received smooth-formed finish treatment.
1. Combine one-part Portland cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard Portland cement and white Portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.

2. Thoroughly wet concrete surfaces apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.08 MONOLITHIC SLAB FINISHES

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.

1. After placing slabs, finish surface to tolerances of F(F) 15 (floor flatness) and F(L) 13 (floor levelness) measured according to ASTM E 1155. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.

1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation,
free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155. Grind smooth any surface defects that would telegraph through applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.

E. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

3.09 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.10 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than 7 days.
C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

D. Provide moisture curing by the following methods:

1. Keep concrete surface continuously wet by covering with water.
2. Use continuous water-fog spray.
3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.

E. Provide moisture-retaining cover curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3.11 REMOVING FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

3.12 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Engineer.

B. Mix dry-pack mortar, consisting of one-part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
2. For surfaces exposed to view, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color.
match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Engineer. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01-inch-wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, pop outs, honeycombs, rock pockets, and other objectionable conditions.
2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

F. Perform structural repairs with prior approval of Engineer for method and procedure, using specified epoxy adhesive and mortar.
G. Repair methods not specified above may be used, subject to acceptance of Engineer.

3.13 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: Refer to Division 1 for employment of testing agency to perform tests and to submit test reports.

B. Sampling and testing for quality control during concrete placement may include the following, as directed by Engineer.

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
   a. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
   b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
   c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
   d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
   e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50-cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

3. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

4. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
C. Test results will be reported in writing to Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION
SECTION 03350
CONCRETE FINISHES

PART 1 GENERAL

1.01 SCOPE OF WORK
A. Furnish all labor, materials, equipment and incidentals required and finish cast-in-place concrete surfaces as shown on the Drawings and as specified herein.

1.02 RELATED WORK
A. Cast-In-Place Concrete is included in Section 03300.
B. Grout is included in Section 03600.
C. Painting, toppings and special surfaces are included in Division 9.

1.03 SUBMITTALS
A. Submit to the Engineer, in accordance with Section 01340, shop drawings and product data showing materials of construction and details of installation for:
   1. Concrete sealer. Confirmation that the sealer is compatible with additionally applied coatings shall also be submitted.

1.04 REFERENCE STANDARDS
A. American Society for Testing and Materials (ASTM)
B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE
A. Finishes
   1. For concrete which will receive additional applied finishes or materials, the surface finish specified is required for the proper application of the specified manufacturer's products. Where alternate products are approved for use, determine if changes in finishes are required and provide the proper finishes to receive these products.
2. Changes in finishes made to accommodate products different from those specified shall be performed at no additional cost to the Owner. Submit the proposed new finishes and their construction methods to the Engineer for approval.

B. Services of Manufacturer’s Representative

1. Make available at no extra cost to the Owner, upon 72 hours notification, the services of a qualified field representative of the manufacturer of curing compound, sealer or hardener to instruct the user on the proper application of the product under prevailing job conditions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Chemical hardener shall be Lapidolith by Sonneborn; Hornolith by A.C. Horn; Penalith by W.R. Meadows or equal fluosilicate base material.

B. Concrete sealer shall be “Kure-N-Seal”, by Sonneborn, Minneapolis, MN or equal.

PART 3 EXECUTION

3.01 FORMED SURFACES

A. Forms shall not be removed before the requirements of Section 03300, have been satisfied.

B. Exercise care to prevent damaging edges or obliterating the lines of chamfers, rustications or corners when removing the forms or performing any other work adjacent thereto.

C. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete.

D. Rough-Form Finish

1. Immediately after stripping forms and before concrete has changed color, carefully remove all fins and projections.

2. Promptly fill holes left by tie cones and defects as specified in Section 03300.

E. Rubbed Finish

1. Immediately upon stripping forms and before concrete has changed color, carefully remove all fins. While the wall is still damp apply a thin coat of medium consistency neat cement slurry by means of bristle brushes to provide a bonding coat within all pits, air holes or blemishes in the parent concrete. Avoid coating large areas with the slurry at one time.
2. Before the slurry has dried or changed color, apply a dry (almost crumbly) grout proportioned by volume and consisting of 1 part cement to 1-1/2 parts of clean masonry sand having a fineness modulus of approximately 2.3 and complying with the gradation requirements of ASTM C33 for such a material. Grout shall be uniformly applied by means of damp pads of coarse burlap approximately 6-in square used as a float. Scrub grout into the pits and air holes to provide a dense mortar in all imperfections.

3. Allow the mortar to partially harden for 1 or 2 hours depending upon the weather. If the air is hot and dry, keep the wall damp during this period using a fine, fog spray. When the grout has hardened sufficiently so it can be scraped from the surface with the edge of a steel trowel without damaging the grout in the small pits or holes, cut off all that can be removed with a trowel. (Note: Grout allowed to remain on the wall too long will harden and will be difficult to remove.)

4. Allow the surface to dry thoroughly and rub it vigorously with clean dry burlap to completely remove any dried grout. No visible film of grout shall remain after this rubbing. The entire cleaning operation for any area must be completed the day it is started. Do not leave grout on surfaces overnight. Allow sufficient time for grout to dry after it has been cutoff with the trowel so it can be wiped off clean with the burlap.

5. On the day following the repair of pits, air holes and blemishes, the walls shall again be wiped off clean with dry, used pieces of burlap containing old hardened mortar which will act as a mild abrasive. After this treatment, there shall be no built-up film remaining on the parent surface. If, however, such a film is present, a fine abrasive stone shall be used to remove all such material without breaking through the surface film of the original concrete. Such scrubbing shall be light and sufficient only to remove excess material without changing the texture of the concrete.

6. A thorough wash-down with stiff bristle brushes shall follow the final bagging or stoning operation. No extraneous materials shall remain on the surface of the wall. The wall shall be sprayed with a fine fog spray periodically to maintain a continually damp condition for at least 3 days after the application of the repair grout.

F. Abrasive Blast Finish

1. Coordinate with Rubbed Finish application. Do not begin until Rubbed Finish operation is complete or before concrete has reached minimum 7-day strength. The Rubbed Finish application may be deleted by the Engineer if the unfinished concrete surface is of superior quality. Apply the abrasive blast finish only where indicated on Drawings.

2. Prepare a sample area of minimum 4-ft high by 16-ft wide Blast Finish as directed by Engineer on a portion of new wall construction which will not be exposed in the final work. Sample area shall contain a variety of finishes obtained with different nozzles, nozzle pressures, grit materials and blasting techniques for selection by Engineer. Final accepted sample shall remain exposed until completion of all Blast Finish operations.
3. Blast finish operation shall meet all regulatory agency requirements. Blast Finish contractor shall be responsible for obtaining all required permits and/or licenses.

4. Perform abrasive blast finishing in as continuous an operation as possible, utilizing the same work crew to maintain continuity of finish on each surface or area of work. Maintain patterns or variances in depths of blast as present on the accepted sample.

5. Use an abrasive grit of proper type and gradation as well as equipment and technique to expose aggregate and surrounding matrix surfaces as follows:

6. Abrasive blast corners and edge of patterns carefully, using back-up boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle pressure and blasting techniques required to match Architect's samples.

7. Upon completion of the Blast Finish operation, thoroughly flush finished surfaces with clean clear water to remove residual dust and grit. Allow to air dry until curing of concrete is complete.

8. After the concrete has cured for a minimum of 28 days, apply a clear acrylic sealer as directed by manufacturer.

3.02 FLOORS AND SLABS

A. Floated Finish

1. Machine Floating
   a. Screed floors and slabs with straightedges to the established grades shown on the Drawings. Immediately after final screeding, a dry cement/sand shake in the proportion of two sacks of portland cement to 350 lbs of coarse natural concrete sand shall be sprinkled evenly over the surface at the rate of approximately 500 lbs /1,000 sq ft of floor. Do not sprinkle neat, dry cement on the surface.

   b. The application of the cement/sand shake may be eliminated at the discretion of the Engineer if the base slab concrete exhibits adequate fattiness and homogeneity and the need is not indicated. When the concrete has hardened sufficiently to support the weight of a power float without its digging into or disrupting the level surface, thoroughly float the shake into the surface with a heavy revolving disc type power compacting machine capable of providing a 200 lb compaction force distributed over a 24-in diameter disc.

   c. Start floating along walls and around columns and then move systematically across the surface leaving a matte finish.
d. The compacting machine shall be the "Kelly Power Float with Compaction Control" as manufactured by Kelley Industries of SSP Construction Equipment Inc., Pomona, CA or equal. Troweling machines equipped with float (shoe) blades that are slipped over the trowel blades may be used for floating. Floating with a troweling machine equipped with normal trowel blades will not be permitted. The use of any floating or troweling machine which has a water attachment for wetting the concrete surface during finishing will not be permitted.

2. Hand Floating

a. In lieu of power floating, small areas may be compacted by hand floating. The dry cement/sand shake previously specified shall be used unless specifically eliminated by the Engineer. Screed the floors and slabs with straightedges to the established grades shown on the Drawings. While the concrete is still green, but sufficiently hardened to support a finisher and kneeboards with no more than 1/4-in indentation, wood float to a true, even plane with no coarse aggregate visible. Use sufficient pressure on the wood floats to bring moisture to the surface.

3. Finishing Tolerances

a. Level floors and slabs to a tolerance of plus or minus 1/8-in when checked with a 10-ft straightedge placed anywhere on the slab in any direction. Where drains occur, pitch floors to drains such that there are no low spots left undrained. Failure to meet either of the above requirements shall be cause for removal, grinding, or other correction as directed by the Engineer.

B. Broom Finish

1. Screed slabs with straightedges to the established grades indicated on the Drawings. When the concrete has stiffened sufficiently to maintain small surface indentations, draw a stiff bristle broom lightly across the surface in the direction of drainage, or, in the case of walks and stairs, perpendicular to the direction of traffic to provide a non-slip surface.

C. Steel Trowel Finish

1. Finish concrete as specified in Paragraph 3.04. Then, hand steel trowel to a perfectly smooth hard even finish free from high or low spots or other defects.

D. Concrete Sealer

1. Prepare and seal surfaces indicated on the room finish schedule to receive a sealer as follows:

a. Finish concrete as specified in the preceding paragraphs and in accordance with the Schedule in Paragraph 3.05 below.
b. Newly Placed Concrete: Surface must be sound and properly finished. Surface is application-ready when it is damp but not wet and can no longer be marred by walking workmen.

c. Newly-Cured Bare Concrete: Level any spots gouged out by trades. Remove all dirt, dust, droppage, oil, grease, asphalt and foreign matter. Cleanse with caustics and detergents as required. Rinse thoroughly and allow to dry so that surface is no more than damp, and not wet.

d. Aged Concrete: Restore surface soundness by patching, grouting, filling cracks and holes, etc. Surface must also be free of any dust, dirt and other foreign matter. Use power tools and/or strippers to remove any incompatible sealers or coatings. Cleanse as required, following the procedure indicated under cured concrete.

e. Methods: Apply sealer so as to form a continuous, uniform film by spray, soft-bristle pushbroom, long-nap roller or lambswool applicator. Ordinary garden-type sprayers, using neoprene hose, are recommended for best results.

f. Applications: For curing only, apply first coat evenly and uniformly as soon as possible after final finishing at the rate of 200 to 400 sq ft per gallon. Apply second coat when all trades are completed and structure is ready for occupancy at the rate of 400 to 600 sq ft per gallon.

g. To meet guarantee and to seal and dustproof, two coats are required. For sealing new concrete, both coats shall be applied full-strength. On aged concrete, when renovating, dustproofing and sealing, the first coat should be thinned 10 to 15 percent with reducer per manufacturer’s directions.

3.03 CONCRETE RECEIVING CHEMICAL HARDENER

A. After 28 days, minimum, concrete cure, apply chemical hardener in three applications to a minimum total coverage of the undiluted chemical of 100 sq ft per gallon and in accordance with manufacturer’s recommendations as reviewed.

3.04 APPROVAL OF FINISHES

A. All concrete surfaces, when finished, will be inspected by the Engineer.

B. Surfaces which, in the opinion of the Engineer, are unsatisfactory shall be refinished or reworked.

C. After finishing horizontal surfaces, regardless of the finishing procedure specified, the concrete shall be cured in compliance with Section 03300 unless otherwise directed by the Engineer.

3.05 SCHEDULE OF FINISHES
A. Concrete shall be finished as specified either to remain as natural concrete to receive an additional applied finish or material under another section.

B. Concrete for the following conditions shall be finished as noted on the Drawings and as further specified herein:

1. Concrete to Receive Dampproofing: Rough-form finish. See Paragraph 3.01D above.

2. Concrete Not Exposed to View and Not Scheduled to Receive an Additional Applied Finish or Material: Rough-form finish. See Paragraph 3.01D above.

3. Exterior Vertical Concrete Above Grade Exposed to View: Rubbed finish. See Paragraph 3.01E above.

4. Interior Vertical Concrete Exposed to View Except in Water Containment Areas: Rubbed finish. See Paragraph 3.01E above.

5. Vertical Concrete in Water Containment Areas. Rubbed finish on exposed surfaces and extending to two feet below normal operating water level: Rough-form finish on remainder of submerged areas. See Paragraphs 3.01E and 3.01D above.

6. Interior and Exterior Underside of Concrete Exposed to View: Rubbed finish. See Paragraph 3.01E above.

7. Exterior surfaces exposed to view and indicated to have an abrasive blast finish. See Paragraph 3.01F above.

8. Interior or Exterior Horizontal Concrete not Requiring Floor Hardener or Sealer: Floated finish. See Paragraph 3.02A above.

9. Concrete for Exterior Walks, Interior and Exterior Stairs: Broomed finish perpendicular to direction of traffic. See Paragraph 3.02B above.

10. Concrete Slabs On Which Process Liquids Flow or In Contact with Sludge: Steel trowel finish. See Paragraph 3.02C above.

11. Concrete to Receive Hardener: See Paragraph 3.02D above.

12. Concrete to Receive Floor Sealer: See Paragraph 3.02E above.

13. Concrete tank bottoms to be covered with grout: See Section 03600.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE OF WORK
   A. The Section specifies the requirements for flowable fill used for trenches, support for pipe structures, culverts, utility cuts and other works where cavities exist and where firm support is needed for pavements and structural elements. Flowable fill may also be used to fill water and sewer lines, and fuel tanks placed out of service, and at other locations approved by the Engineer of Record.

PART 2 - PRODUCTS (Not Used)

2.01 MATERIALS
   The materials used shall conform with the requirements specified in Division III of the F.D.O.T. Standard Specifications for Road and Bridge Construction, latest edition, and herein. Specific references are as follows:
   A. Portland Cement (Types I, II or III)........................................Section 921
   B. Fly Ash, Slag and other Pozzolanic Materials for Portland Cement Concrete..................................Section 929
   C. Fine Aggregate (Sand)*..................................................Section 902
   D. Water...........................................................................Section 923

   *Any clean sand with 100% passing 3/8" sieve and not more than 10% passing with 200 mesh may be used.

2.02 MIX PROPORTIONS
   A. The Contractor shall be responsible for producing a flowable mixture using these guidelines and by adjusting his mixture design as called for by circumstances or as may be directed by the Engineer of Record.
   B. Excavatable flowable fill material shall be proportioned to produce a 28-day compressive strength of 100 psi.
C. General mix quantities are as follows:

<table>
<thead>
<tr>
<th>Components</th>
<th>Pounds per Cubic Yard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>50-100*</td>
</tr>
<tr>
<td>Fly Ash or Granulated Blast Furnace Slag</td>
<td>0-600</td>
</tr>
<tr>
<td>Fine Sand</td>
<td>2,750 (adjust to yield one CY)</td>
</tr>
<tr>
<td>Water</td>
<td>500 (Maximum)</td>
</tr>
</tbody>
</table>

*The percentage of cement may be increased above these limits only when early strength is required and future removal is unlikely.

D. Weights for fine aggregate and water shall be adjusted according to cementious content. The mix proportions shall be adjusted for removability, pumpability and flowability. If required, strength test data shall be provided prior to batching.

E. If required by the Engineer of Record, the flowability can be measured by afflux time determined in accordance with ASTM C 939 and shall be 30 seconds ± 5 seconds as measured on mortar passing the No. 4 sieve. The equipment required to perform this test shall be provided by the Contractor.

2.03 APPROVED MIXES OF “EXCAVATABLE FLOWABLE FILL”

FDOT - Approved Design Mixes:

<table>
<thead>
<tr>
<th>Plant</th>
<th>Mix Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tarmac</td>
<td>04-FF-65</td>
</tr>
<tr>
<td>Rinker Materials Corp.</td>
<td>04-FF-52</td>
</tr>
<tr>
<td>Central Concrete Supermix Inc.</td>
<td>06-FF-41</td>
</tr>
<tr>
<td>Cemex</td>
<td>06-FF-48</td>
</tr>
</tbody>
</table>

PART 3 - EXECUTION (Not Used)

3.01 Flowable fill shall be produced and delivered using concrete construction equipment. Placing flowable fill shall be done by chute, pumping or other methods approved by the Engineer of Record.

3.02 CONSTRUCTION REQUIREMENTS

The flowable fill shall be placed to the designated fill line without vibration or other means of compaction. Placement shall be avoided during inclement weather, e.g. rain or ambient temperatures below 40 degrees F. The Contractor shall take all necessary precautions to prevent any damages caused by the hydraulic pressure of the fill during placement prior to hardening. Also, necessary means to confine the material within the designated space shall be provided by the Contractor.
3.03 ACCEPTANCE

A. If required by the Engineer of Record, the flowability can be measured by afflux time determined in accordance with ASTM C 939 and shall be 30 seconds ± 5 seconds as measured on mortar passing the No. 4 sieve. The equipment required to perform this test shall be provided by the Contractor.

B. The fill shall be left undisturbed until material obtains sufficient strength. Sufficient strength is 250 psi penetration resistance as measured using a hand held penetrometer. The penetrometer shall be provided by the Contractor.

C. All flowable fill areas subject to traffic loads must have a durable riding surface.

D. An approved type of accelerator may be approved for the placement of "Flowable Fill" in traffic areas when submitted to the City for F.D.O.T. approval.

END OF SECTION
SECTION 03410
PRECAST CONCRETE STRUCTURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: This Section specifies the materials, labor and equipment required to construct manholes, wetwells, valve vaults, mitered end sections, meter boxes and all other precast concrete structures, as shown on the Drawings and as specified herein.

1.02 QUALITY ASSURANCE

A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards.

2. Local Codes and Regulations.
3. ACI Building Code Requirements for Reinforced Concrete.
5. American Concrete Institute (ACI).

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the Engineer for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01420 "Drawings and Submittals."

B. Shop drawings of the concrete units, including bottom and top slabs showing details of construction, reinforcing and joints shall be submitted to and approved by the Engineer prior to the manufacture of the units. The shop drawings shall include structural design calculations for all slabs and walls which do not have reinforcement detailed on the Drawings. The design calculations shall demonstrate compliance with the specified standards and shall be signed and sealed by a professional engineer licensed in the State of Florida.

C. Manufacturer's data sheets and shop drawings shall be submitted on the following:

1. Joint mastic and gaskets.
2. Grout material.
3. Pipe connections.
4. Casting.

5. Reinforcement.

1.04 INSPECTION

A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and acceptance by the Owner. Such inspection may be made at the place of manufacture or at the site after delivery, or at both places, and the sections shall be subject to rejection at any time due to failure to meet any of the specification requirements; even though sample sections may have been acceptable as satisfactory at the place of manufacture. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. All damaged sections will be rejected. If damaged sections have already been installed; the Contractor shall remove and replace at his expense.

B. At the time of inspection, the sections will be carefully examined for compliance with the ASTM designation specified and the acceptable manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch strength", blisters, cracks, roughness, and soundness. The surface shall be dense and close textured.

C. Imperfections may be repaired subject to the review and acceptance of the Engineer after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final review and acceptance. Cement mortar used for repairs shall have a minimum compressive strength of 4,000-psi at the end of 7-days and 5,000-psi at the end of 28-days, when tested in 3-inch by 6-inch cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the review and acceptance of the Owner.

PART 2 - PRODUCTS

2.01 GENERAL

A. All material supplied shall be one of the products specified in these technical specifications.

2.02 PRECAST CONCRETE SECTIONS

A. Precast concrete wetwell sections, manhole barrel and eccentric top sections shall conform to specifications for precast reinforced concrete manhole sections, ASTM Designation C478, except as otherwise specified below or as shown on the Drawings. Signed and sealed design calculations demonstrating compliance with these requirements shall be submitted in accordance with Paragraph 1.02. Details of precast sections shown on the Drawings shall supersede ASTM C-478 when such details are more stringent than ASTM C-478. The method of construction shall conform to the detailed Drawings and the following additional requirements:
1. The minimum wall thickness for the various size barrel sections shall be 6 -
   inches, or as indicated in the civil Drawings.

2. Barrel sections shall have tongue and groove joints. Joints shall be sealed with
cold adhesive preformed plastic gaskets set in double rows on the tongue and in
the groove prior to setting the next section. All extension joints shall be sealed
with Portland Type II cement after setting of gasket and placement of manhole
section into a watertight joint.

3. Cement shall be Type II Portland Cement conforming to ASTM Designation
   C150.

4. New concrete structures shall contain a crystalline waterproofing concrete
   admix for all new concrete structures including but not limited to manholes,
   ARV vaults, wetwells, and wetwell top slabs. Crystalline waterproofing concrete
   admix shall be added to the concrete during the batching operation. Admixture
   concentration shall be added based upon manufacturer's design percent
   concentration of admixture to the required weight of cement. The amount of
   cement shall remain the same and not be reduced. A colorant shall be added to
   verify the admixture was added to the concrete. Colorant shall be added and
   provided at the admixture manufacturing facility, not at the concrete batch
   plant. It is recommended that the admixture be added first to the rock and sand
   and blended thoroughly before adding cement and water or per the
   manufacturer's recommendations. Concrete structures without crystalline
   waterproofing admixture or admixture without colorant for field verification
   shall be rejected. Contractor shall provide certification from the pre-caster that
   the admixture was added in accordance with the manufacturer's
   recommendations.

5. The date of manufacture and the name or trademark of the manufacturer shall
   be clearly marked on the inside of each precast section. Each section must be
   inspected and stamped by an accredited testing laboratory.

6. Sections shall be cured by an acceptable method for at least 28-days.

7. Manhole top sections shall be eccentric except that precast concrete slabs shall
   be used where cover over the top of the pipe is less than 4-feet for all
   manholes. Lift rings or brick collars shall be provided for handling precast
   manhole sections.

8. All precast concrete structures, including bottom slabs, walls, and top slabs,
   shall be designated to support an AASHTO H-20 loading plus all other soil and
   hydrostatic loads.

9. The tops of bases shall be suitably shaped to mate with the adjoining precast
   section.

10. Precast leveling rings for setting cast iron frames over manholes shall be 2-inch
thick and have 1 (one) #2 continuous reinforcing steel bar. Brick collars shall have a minimum of 2 courses and a maximum of 4 courses. Precast leveling rings and/or brick collars shall be used to allow for grade adjustments from a minimum of 2 inches up to a maximum height of 12 inches.

11. Concrete surfaces shall have form oil, curing compounds, dust, dirt, and other interfering materials removed by brush sand blasting and shall be fully cured prior to delivery.

12. Manholes to be installed around existing gravity sewers shall consist of a cast-in-place concrete base slab and precast concrete barrel and top sections; lined per Section 3410 – 2.01.11. The base slab shall be as shown on the Drawings and include a joint which is compatible with the bottom barrel section and acceptable to the Utilities Commission of New Smyrna Beach. The bottom barrel section shall include an inverted "U-shaped" slot to allow installation of the section over existing pipes. Flow channels shall be provided within the manholes as shown on the Drawings. Annular space between the existing pipe and slot shall be made watertight with non-shrink grout. Existing pipes shall be removed within the manhole and outlets plugged watertight with non-shrink grout as shown on the Drawings.

13. The manholes shall have an invert channel shaped to correspond with the lower half of the pipe. The top of the shelf shall be at the elevation indicated and shall be sloped to drain toward the flowing through channel. Every effort shall be made by the Contractor to construct watertight structures.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All manholes and other precast structures shall be set in the dry.

B. Manholes and other precast structures shall be constructed to the dimensions as shown on the Drawings and as specified herein.

C. The base structure may be cast-in-place concrete as specified in Division 3. The concrete structure shall be placed on the required crushed stone base as shown in the Drawings over a dry sub base of structural fill that has been compacted to 95% (percent) of the maximum dry density as determined by the modified proctor test, ASTM D1557. The tops of the cast in place bases shall be shaped to mate with the precast barrel section and shall be adjusted in grade so that the top of the dome section is at the correct elevation.

D. Precast bases conforming to all requirements of ASTM C478 and other requirements for precast section, may be used and shall be set on a sub-base as described above.

E. Precast concrete structure sections shall be set vertically with sections in true alignment with a 1/4-inch maximum tolerance per 5-feet of depth. The outside and inside joint shall be filled with a non-shrink mortar and finished flush with the adjoining surfaces. Allow joints to set for 24-hours before backfilling. Backfilling shall be accomplished
bringing the fill up evenly on all sides. If leaks appear in the structures, the inside joints shall be caulked with non-shrink grout to the satisfaction of the Engineer. The Contractor shall install the precast sections in a manner that will result in a watertight joint.

F. Lift rings or brick collars shall be provided for handling pre-cast manhole sections.

G. Where holes must be cut in the precast sections to accommodate pipes, cutting shall be done prior to setting them in place to prevent any subsequent jarring which may loosen the mortar joints.

H. Cast iron frames shall be placed over precast concrete leveling rings, shimmed and set in cement mortar to the required grade. No more than 3 courses of leveling rings shall be used.

END OF SECTION
SECTION 03600
GROUT

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included in this Section consists of grouting the various items listed hereinafter and indicated on the Drawings.

B. Related Work described elsewhere:

1. Cast-in-Place Concrete: Section 03300.

1.02 SUBMITTALS

A. Materials and Shop Drawings: Manufacturer’s literature shall be submitted for review on non-shrink grout data which shall include grout properties, mixing, surface preparation, and installation instructions in accordance with Section 01340: Shop Drawings, Working Drawings, and Samples.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Grouting materials shall be delivered and stored in unbroken containers with seals and labels intact as packaged by the manufacturer.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Non-shrink, Nonmetallic Grout: Sauereisen F-100 Level Fill or Master Builders MAsterflow 713.

B. Non-shrink, Metallic Grout: Master Builders Embeco 636 Grout pre-mixed type.

PART 3 – EXECUTION

3.01 PREPARATION

A. All bonding surfaces shall be clean and dust and oil free.
3.02 INSTALLATION

A. Non-shrink Grout:

1. Non-shrink, nonmetallic grout shall be used for grouting column base plates, anchor bolts, reinforcing bars, pipe sleeves, machinery supports, and pump base plates.

2. Non-shrink grout shall be mixed and placed as recommended by the manufacturer.

3. Grout shall be mixed as close to the work area as possible and transported quickly to its final position in a manner which will not permit segregation of materials.

4. Non-shrink grout shall be cured with water saturated burlap for at least 3 days.

5. Machinery set on grout pads shall not be operated until the grout has cured for at least 36 hours.

END OF SECTION
DIVISIONS 4-8

(NOT USED)
DIVISION 9

FINISHES
PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The work of this section consists of furnishing all materials, labor, equipment and incidentals required and performing all the painting necessary to complete this Contract in its entirety.

B. It is the intent of these Specifications to paint all proposed concrete, equipment and all other work obviously required to be painted unless otherwise specified. It is also intended to paint all existing interior and exterior surfaces affected or damaged by this project which may be exposed to view in the finished work including, but not limited to, concrete, metals, pipe, fittings, valves, equipment and all other existing items similar to proposed items specified for painting. Table 09900-A outlines the painting system to be applied to specific areas. Items omitted in the Table shall be included in the work of this Section where they come within the general intent of the specifications as stated herein.

C. The following items will not be painted unless otherwise noted:

1. Any code-requiring labels, such as Underwriters’ Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

2. Any moving parts of operating units, such as valve and damper operators, linkages, sensing devices, and motor and fan shafts.

3. Aluminum or fiberglass handrails, walkways, toeboards, windows, louvers, grating, checker plate, hatches, and stairways.

4. Stainless steel angles, tube, pipe, etc.

5. Products with polished chrome, aluminum, nickel, or stainless steel finish.

6. Stainless steel, brass, bronze, and aluminum other than exposed utility tubing.

7. Flexible couplings, lubricated bearing surfaces, insulation, and plastic pipe or duct interiors.


9. Signs and nameplates.
10. Finish hardware.

11. Packing glands and other adjustable parts, unless otherwise indicated.

12. Portions of metal, other than aluminum, embedded in concrete. This does not apply to the back face of items mounted to concrete or masonry surfaces which shall be painted before erection. Aluminum to be embedded in, or in contact with, concrete shall be coated to prevent electrolysis.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. It is the intent of this specification that all paints specified in this section be supplied by one paint supplier and be the product of one manufacturer, unless a specialty paint not available from that manufacturer is specified.

2. The paint manufacturer shall have supplied paint for water and wastewater facilities for a minimum of ten (10) years, and products supplied shall be contained within the manufacturer’s standard water and wastewater brochure.

3. Acceptable manufacturers are listed in Part 2 of this section.

B. The applicator shall be a licensed contractor having practical experience and successful history in the application of the specified products to surfaces and facilities of water and wastewater treatment plants. Upon request, this requirement shall be substantiated by furnishing a written list of references.

C. Provide undercoat paint produced by the same manufacturer as the finish coats. Undercoat and finish coat paints shall be compatible. Use only thinners approved by the paint manufacturer, and use only within recommended limits.

D. Thickness and Holiday Checking: Thickness of coatings shall be checked with a nondestructive, magnetic type thickness gauge. Coating integrity of interior coated surfaces shall be tested with an approved holiday detection unit per the paint manufacturer's recommendation. All pinholes shall be marked, repaired in accordance with the paint manufacturer's printed recommendations and re-tested. No pinholes or other irregularities will be permitted in the final coating. In cases of dispute concerning film thickness or “holidays,” the RPR's/Engineer's properly calibrated instruments and measurements shall predominate and the Contractor shall abide by their decision unless independent tests are performed by a certified lab at the Contractor’s expense. Wide film thickness discrepancies shall be measured and verified with a micrometer or other standard approved measuring instrument.

E. Inspection Devices:

1. The Contractor shall furnish, until final acceptance of such coatings, inspection devices in good working condition for the detection of holidays and
measurement of dry-film thickness of protective coatings. The Contractor shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates to test accuracy of dry film thickness gauge and certified instrumentation to test accuracy of holiday detectors.

2. Dry film thickness gauges shall be made available for the RPR's use at all times while painting is being done, until final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of the RPR.

3. Acceptable devices include, but are not limited to, Tniker Rasor Model holiday detectors for coatings in excess of twenty mils (0.50 mm) dry-film thickness, Model M-1 67 1/2 volt non-destructive holiday detector for coatings to twenty mils (0.50 mm) dry-film thickness and Mikrotest units for dry-film thickness gauging. Inspection devices shall be operated in strict accordance with the manufacturer's printed instructions.

F. Meteorological Equipment: The Contractor shall have on site the following equipment:

1. Thermometer.

2. Sling psychrometer or other approved device to measure atmospheric humidity.

3. Appropriate charts.

This equipment shall be made available to the RPR.

G. Warranty Inspection: Warranty inspection shall be conducted during the eleventh month of the one (1) year warranty period following completion of all painting work. All defective work shall be repaired in strict accordance with this specification and to the satisfaction of the paint manufacturer and the Owner or his duly appointed representative.

1.03 SAFETY AND HEALTH REQUIREMENTS

A. General: In accordance with the requirements of the OSHA Regulations for Construction, the Contractor shall provide and require the use of personal protective and lifesaving equipment for all persons working in or about the project.

B. Head and Face Protection and Respiratory Devices: Applicable health and safety precautions required by appropriate regulatory agencies such as OSHA, ANSI, etc., should be followed.

C. Ventilation: Ventilation shall be adequate to reduce the contamination of air contaminant to the degree that a hazard to the worker does not exist.

D. Sound Levels: Whenever the occupational noise exposure exceeds the maximum allowable sound levels, the Contractor shall provide and require the use of approved ear protective devices.
E. Illumination: Adequate illumination shall be provided while work is in progress. Whenever required by the RPR, the Contractor shall provide additional illumination and necessary support sufficient to cover all areas to be checked. The level of illumination required for observation purposes shall be determined by the RPR.

F. Temporary Ladders and Scaffolding: All temporary ladders and scaffolding shall conform to the applicable requirements of the OSHA Regulations for Construction. They shall be erected where requested by the RPR to facilitate proper construction observation and be moved by the Contractor to locations requested by the RPR.

1.04 SUBMITTALS

A. Submit to the Engineer as provided in the General Conditions and Division 1, shop drawings, manufacturer’s specifications and data on the proposed paint systems and detailed surface preparation, application procedures and dry film thickness.

B. Schedule of Painting Operations: The Contractor shall submit for approval a complete Schedule of Painting Operations within 30 days after the Notice to Proceed. This schedule is imperative so that the various fabricators may be notified of the proper shop prime coat to apply. It shall be the Contractor’s responsibility to properly notify and coordinate the fabricators’ surface preparation and painting operations with these Specifications. This Schedule shall include for each surface to be painted, the brand name, the volume solids, the coverage and the number of coats the Contractor proposes to use in order to achieve the specified dry film thickness, and color charts. When the schedule has been approved, the Contractor shall apply all material in strict accordance with the approved Schedule and the manufacturer's instructions. Wet and dry paint film gauges may be utilized by the Engineer to verify the proper application while work is in progress.

C. Certification: Submit certification by the paint manufacturer that the primer used on equipment/materials is compatible with the finish coat paint.

D. One copy of references specified in 1.03.B.

E. Test panels/samples: At the request of the Engineer, samples of the finished work prepared in strict accordance with these Specifications shall be furnished and all painting shall be equal in quality to the approved samples. Finished areas shall be adequate for the purpose of determining the quality of workmanship. Experimentation with color tints shall be furnished to the satisfaction of the Engineer where, standard chart colors are not satisfactory.

F. Color Samples: Manufacturer's standard color charts for color selection by Owner.

G. Samples- Painting

1. Paint colors will be selected by the Owner. Compliance with all other requirements is the exclusive responsibility of the Contractor.
2. Samples of each finish and color shall be submitted to the Owner or Engineer for approval before any work is started.

3. Samples shall be prepared so that an area of each sample indicates the appearance of the various coats. For example, where three (3) coat work is specified, the sample shall be divided into three (3) areas:
   a. One (1) showing the application of one (1) coat only.
   b. One (1) showing the application of two (2) coats.
   c. One (1) showing the application of all three (3) coats.

4. Such samples when approved in writing shall constitute a standard, as to color and finish only, for acceptance or rejection of the finish work.

5. For piping, valves, equipment and miscellaneous metal work, provide sample chips or color charts of all paint selected showing color, finish, and general characteristics.

6. Rejected samples shall be resubmitted until approved.

H. The Contractor shall submit to the Owner, immediately upon completion of the job, certification from the manufacturer indicating that the quantity of each coating purchased was sufficient to coat all surfaces, in accordance with the requirements of this Section. Such certification shall make reference to square footage figures provided to the manufacturer by the Contractor.

1.05 PRODUCT DELIVERY STORAGE AND HANDLING

A. All painting materials shall be delivered to the project site in unbroken containers, bearing the manufacturer’s brand and name. They shall be used without adulteration and mixed, thinned, and applied in strict accordance with the manufacturer’s directions for the applicable materials and surfaces and with the Engineer’s approval before using.

B. Work areas will be designated by the Engineer for storage and mixing of all painting materials. Materials shall be in full compliance with the requirements of pertinent codes and fire regulations. Proper containers outside of the buildings shall be provided and used for painting wastes, and no plumbing fixture shall be used for this purpose.

C. Deliver all materials to the job site in original, unopened packages and containers bearing manufacturer's name and label in accordance with Section 01600: Materials and Equipment.

   1. Provide labels on each container with the following information:
      a. Name or title of material.
b. Fed. Spec. number if applicable.

c. Manufacturer's stock number, date of manufacture and expiration date (shelf life).

d. Manufacturer's formula or specification number.

e. Manufacturer's batch number.

f. Manufacturer's name.

g. Generic type.

h. Contents by volume, for major pigment and vehicle constituents.

i. Application instructions: thinning, ambient conditions, etc.

j. Color name and number.

2. Containers shall be clearly marked to indicate any hazards connected with the use of the paint and steps which should be taken to prevent injury to those handling the product.

D. All containers shall be handled and stored in such a manner as to prevent damage or loss of labels or containers.

E. Used rags shall be removed every night and every precaution taken against spontaneous combustion.

1.06 WARRANTY AND GUARANTEES

A. Refer to Section 01740: Warranties and Bonds.

B. All paint and coatings work performed under these Specifications shall be guaranteed by the coatings applicator for 100 percent of the total coated area for both materials and labor against failures during the warranty period.

1. Warranty period: Minimum 5 years from date of substantial completion.

C. Failure under this warranty shall include flaking, peeling, or delaminating of the coating due to aging, chemical attack, or poor workmanship; but it shall not include areas which have been damaged by unusual chemical, thermal, or mechanical abuse.
PART 2 – PRODUCTS

2.01 GENERAL

A. All painting materials shall be fully equal to those manufactured by Carboline, Sherwin Williams, Tnemec or an approved equal. The painting schedule has been prepared on the basis of Carboline, Sherwin Williams, and Tnemec products (unless otherwise noted) and their recommendations for applications. No other brand will be considered for approval unless sufficient data substantiated by certified tests to demonstrate its equality to the paint(s) specified is submitted in writing to the Engineer for approval within 30 days after the Notice to Proceed. The type and number of tests performed shall be subject to the Engineer’s approval.

B. Paint used in successive field coats shall be produced by the same manufacturer. Paint used in the first field coat over shop painted or previously painted surfaces shall cause no wrinkling, lifting, or other damage to underlying paint. Shop paint shall be of the same type and manufacture as used for field painting by the Contractor.

C. Emulsion and alkyd paints shall contain a mildewcide and both the paint and mildewcide shall conform to OSHA and Federal requirements, including Federal Specification TT-P-19.

D. Shop priming shall be done with primers that are certified by the paint manufacturer to be compatible with the finish paints to be used.

E. No paint containing lead shall be allowed.

F. Oil shall be pure boiled linseed oil.

2.02 PAINTING SYSTEMS

A. The following summarizes the painting systems for various types of applications. Table 09900-A outlines, in general, specific job application locations.

B. All colors will be selected by the Owner from color charts supplied by the Contractor.

C. Minimum thickness shall be per manufacturer's recommendations unless a greater thickness is specified.

D. The following surfaces shall have the types of paint scheduled below applied at the minimum dry film thickness (MDFT) in mils per coat noted or at the dry film thickness (DFT) in mils per coat noted. The schedule is applicable to existing and proposed surfaces, with the exception that priming for existing surfaces is only required as specified in Part 3.

E. Any surfaces not specifically named in the Schedule and not specifically excepted shall be prepared, primed and painted in the manner and with materials consistent with these Specifications. The Engineer shall select which of the manufacturer’s products,
whether the type is indicated herein or not, shall be used for such unnamed surfaces. No extra payment shall be made for this painting.

2.03 EXTRA PAINT

A. Paint To Be Supplied To Owner: Upon completion of painting work, the Owner shall be furnished at no additional cost, unopened containers providing a minimum of one (1) gallon of each type and color of finish paint for touching up. Multi-component coatings shall have each component supplied in separate containers boxed together. Paint container labels shall be complete with manufacturer’s name, generic type, number, color, and location where used.

### TABLE 09990-A

<table>
<thead>
<tr>
<th>Coat</th>
<th>Carboline</th>
<th>Sherwin Williams</th>
<th>Tnemec</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Unpainted wood finished shelving, window frames, door frames, door casework, and trim finish with 3 coats of exterior premium Clear Urethane. Sanding or steel wool shall be used between coats.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Wood-painted finish (interior or exterior) non-submerged:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prep</td>
<td>Surface must be clean and dry, remove any dust, dirt, oils or contaminants that could interfere with adhesion.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prime</td>
<td>1 coat Sanitile 120, 1.0 to 2.0 MDFT</td>
<td>1 coat Exterior Latex Wood Primer, B42W08041 @ 1.0-2.0 mils DFT</td>
<td>1 coat Series 10-99W Undercoater, 2.0 to 3.5 MDFT.</td>
</tr>
<tr>
<td>Finish</td>
<td>2 coats Carbocrylic 3359, 2.0 to 3.0 mils DFT/coat</td>
<td>2 coats of Pro Industrial DTM Acrylic, B66W1051 Series @2.0-3.0 mils DFT/coat</td>
<td>2 coats Series 1029 Enduratone, 1.5 to 2.5 MDFT per coat.</td>
</tr>
<tr>
<td>Total</td>
<td>5 to 8 mils DFT</td>
<td>5 to 8 mils DFT</td>
<td>5 to 8.5 mils DFT</td>
</tr>
<tr>
<td>3.</td>
<td>Gypsum Dry Walls or Interior Cement Plaster:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prep</td>
<td>Surface must be clean and dry, remove any dust, dirt, oils or contaminants that could interfere with adhesion.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prime</td>
<td>1 coat Sanitile 120, 1.0 to 2.0 MDFT</td>
<td>1 coat ProMar 200 Zero VOC Interior Latex Primer, B28W02600 @ 1.0 mil DFT</td>
<td>Series 51PVA Sealer 1.0 to 2.0 MDFT.</td>
</tr>
<tr>
<td>Finish</td>
<td>2 coats Carboguard 60 4.0 to 6.0 MDFT per coat</td>
<td>2 coats Macropoxy 646, B58-600 Series/B58V600 @ 3.0-5.0 mils DFT/coat</td>
<td>2 coats Series 66HS Hi-Build Epoxoline 3.0 to 5.0 MDFT per coat</td>
</tr>
<tr>
<td>Total</td>
<td>9 to 14 mils DFT</td>
<td>7 to 11 mils DFT</td>
<td>7 to 12 mils DFT</td>
</tr>
</tbody>
</table>

**Note:** Laboratory areas shall receive special titanium base epoxy paint containing no other metals that may affect testing procedure

4. Interior non submerged concrete walls poured, precast, or masonry not subject to spray, splash and dampness:

<p>| Prep | Concrete must clean and dry. Cured for 28 days @75F and 50% relative humidity or equivalent. Laitance, form oils, curing agents, and surface hardeners must be removed by suitable method before coating application. |
| Prime | 1 coat Sanitile 100 80 sf/gal (@ 12 mils DFT) | 1 coat Heavy Duty Block Filler, B42W46 @10.0-15.0 mils DFT | N/A |
| Finish | 2 coats Sanitile 155 2.0-3.0 MDFT per coat | 2 coats of Pro Industrial DTM Acrylic, B66W1051 Series @2.0-3.0 mils DFT/coat | 2 coats Series 1026 Tneme-Cryl 2.0 to 3.0 MDFT per coat |</p>
<table>
<thead>
<tr>
<th>Coat</th>
<th>Carboline</th>
<th>Sherwin Williams</th>
<th>Tnemec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>14 to 15 mils DFT</td>
<td>14 to 21 mils DFT</td>
<td>4 to 6 mils DFT</td>
</tr>
</tbody>
</table>

5. **Exterior nonsubmerged concrete, masonry, or stucco above grade:**

<table>
<thead>
<tr>
<th>Prep</th>
<th>Concrete must clean and dry. Cured for 28 days @75F and 50% relative humidity or equivalent. Laitance, form oils, curing agents, and surface hardeners must be removed by suitable method before coating application.</th>
</tr>
</thead>
</table>
| Prime | 1 coat Sanitile 100.  
80 sf/gal (@ 12 mils DFT)  
For pre-colored masonry (split-face CMU) – no primer required.  
1 coat Cement-Plex 875,  
B42W200/B42V201 @13.0-20.0 mils DFT  
For pre-colored masonry (split-face CMU) – no primer required.  
For concrete, masonry, or stucco scheduled to be field painted: 1st coat Series 1254 at 125 sf/gal (CMU only). For pre-colored masonry (split-face CMU) – no primer required. |
| Finish | 2 coats Carbocrylic 3359  
2.0 to 3.0 MDFT per coat  
For pre-colored masonry (split-face CMU) or stucco: Apply Carbocrete Sealer WB @ 50 sf/gal per coat at 3.0 mils.  
2 coats of Pro Industrial DTM Acrylic, B66W1051 Series @2.0-3.0 mils DFT/coat  
For pre-colored masonry (split-face CMU) or stucco: Apply Loxon 7% Siloxane @ 50-75 sf/gal per coat.  
For concrete, masonry, or stucco scheduled to be field painted: 2 coats Series 1026 Tneme-Cryl 2.0 to 3.0 MDFT per coat  
For pre-colored masonry (split-face CMU) or stucco: Apply Series 626 Dur A Pell GS @ 65-85 sf/gal per coat. |
| Total | 16 to 18 mils DFT | 17 to 26 mils DFT | 17 to 26 mils DFT |

6. **Exterior non submerged concrete or masonry surfaces below grade to be backfilled:**

<table>
<thead>
<tr>
<th>Prep</th>
<th>Surfaces must be clean and dry. Employ adequate methods to remove dirt, dust, oils and all other contaminants that could interfere with adhesion of the coating. Concrete must be cured 28 days at 75F and relative humidity of 50% or equivalent. Prepare concrete in accordance with ASTM D4528 Surface Cleaning of Concrete and ASTM D4259 Abrading Concrete. Voids in concrete may require surfacing.</th>
</tr>
</thead>
</table>
| Prime | 1 coat Bitumastic 300M, thinned 33%, 4-6 MDFT  
1 coat Targuard Epoxy, B69B60/B69V60 @ 8.0-12.0 mils DFT  
1 coat Series 46H-413, thinned 33%, 4-6 MDFT |
| Finish | 1 coat Bitumastic 300M  
16.0 MDFT  
1 coat Targuard Epoxy, B69B60/B69V60 @ 8.0-12.0 mils DFT  
1 coat Series 46H-413, High Build Tneme-Tar, 14.0 to 20.0 MDFT |
| Total | 20 to 22 mils DFT | 16 to 24 mils DFT | 18 to 26 mils DFT |

7. **Interior Concrete submerged or subject to spray concrete – Color:**

<table>
<thead>
<tr>
<th>Prep</th>
<th>Surfaces must be clean and dry. Employ adequate methods to remove dirt, dust, oils and all other contaminants that could interfere with adhesion of the coating. Concrete must be cured 28 days at 75F and relative humidity of 50% or equivalent. Prepare concrete in accordance with ASTM D4528 Surface Cleaning of Concrete and ASTM D4259 Abrading Concrete. Voids in concrete may require surfacing.</th>
</tr>
</thead>
</table>
| Prime | 1 coat Carboguard 60 (non potable) or Carboguard 61 (Potable water), 4.0 to 6.0 MDFT  
1 coat Macropoxy 5500, B58-X740 Series/B58VX740 @ 3.0-5.0 mils DFT  
Series 20HS Pota-Pox (potable water) 3.0 to 5.0 MDFT |
| Finish | 2 coats Carboguard 60 (non potable) or Carboguard 61 (Potable Water), 4.0 to 6.0 MDFT per coat  
2 coats Macropoxy 5500, B58-X740 Series/B58VX740 @ 4.0-6.0 mils DFT/coat  
2 coats Series 20HS Pota-Pox (potable water), 4.0 to 6.0 MDFT per coat |
| Total | 12 to 18 mils DFT | 11 to 17 mils DFT | 11 to 17 mils DFT |

For potable water application, must NSF certified and approved color.
### 8. Concrete or Masonry (Immersed, non-potable/ non-immersed, corrosive environment) - Black:

<table>
<thead>
<tr>
<th>Coat</th>
<th>Carboline</th>
<th>Sherwin Williams</th>
<th>Tnemec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prep</td>
<td>NACE 6/SSPC SP13, and surface profile of ICRI CSP 4-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prime</td>
<td>Carboguard 1340 WB, Filler Surfacer – Carboguard 510</td>
<td>Dura-Plate 5900, Filler Surfacer - Dura-Plate 2300</td>
<td>1 coat Series 434 125 mils DFT</td>
</tr>
<tr>
<td>Finish</td>
<td>Bitumastic 300M, 2-Coats each @ 3-5 mils DFT</td>
<td>Dura-Plate 5900</td>
<td>1 coat Series 435 16.0 to 20 mils DFT</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>141 to 145 mils DFT</td>
</tr>
</tbody>
</table>

### 9. Concrete or Masonry (Immersed, non-potable/ non-immersed, corrosive environment) - Color:

<table>
<thead>
<tr>
<th>Coat</th>
<th>Carboline</th>
<th>Sherwin Williams</th>
<th>Tnemec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prep</td>
<td>NACE 6/SSPC SP13, and surface profile of ICRI CSP 4-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prime</td>
<td>Carboguard 1340 WB, Filler Surfacer – Carboguard 510</td>
<td>Dura-Plate 5900, Filler Surfacer - Dura-Plate 2300</td>
<td></td>
</tr>
<tr>
<td>Finish</td>
<td>Plasite Series 4500, 2-Coats each @ 3-5 mils DFT</td>
<td>Dura-Plate 5900</td>
<td></td>
</tr>
</tbody>
</table>

### 10. Existing Concrete or Masonry (Immersed, non-potable/ non-immersed, corrosive environment):

<table>
<thead>
<tr>
<th>Coat</th>
<th>Carboline</th>
<th>Sherwin Williams</th>
<th>Tnemec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prep</td>
<td>NACE 6/SSPC SP13, and surface profile of ICRI CSP 4-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prime</td>
<td>Filler Surfacer – Carboguard 510</td>
<td>Dura-Plate 5900, Filler Surfacer - Dura-Plate 2300</td>
<td>1 coat Series 104 6.0-8.0 MDFT</td>
</tr>
<tr>
<td>Intermediate</td>
<td>N/A</td>
<td>N/A</td>
<td>1 coat Series 104 6.0-8.0 MDFT</td>
</tr>
<tr>
<td>Finish</td>
<td>Plasite Series 4500</td>
<td>Dura-Plate 5900 Mortar</td>
<td>1 coat Series 104 6.0-8.0 MDFT</td>
</tr>
</tbody>
</table>

### 11. Sodium Hypochlorite (trace up to 18%-Resistant Coating Secondary containment, continuous flow, frequent spills, or poor drainage.):

<table>
<thead>
<tr>
<th>Coat</th>
<th>Carboline</th>
<th>Sherwin Williams</th>
<th>Tnemec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prep</td>
<td>Refer to Manufacturers Product Data Sheet and Semstone Application Guide for Surface Preparation Guidelines and recommendations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prime</td>
<td>Semstone 800 primer @ 300 sq ft per carton</td>
<td>Macropoxy 5500 @ 8.0-12.0 mils DFT</td>
<td>1 coat Series 208 16.0-20.0 MDFT</td>
</tr>
<tr>
<td>Intermediate</td>
<td>Semstone 870 w/agg @ 64 sq ft per gallon</td>
<td>N/A</td>
<td>1 coat Series 206SC-MCK Sub-Flex EP 60.0-80.0 MDFT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 coat Series 5211-0215 Chopped Strand Fiberglass pressed into the (wet) Series 206SC-MCK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 coat Series 2375C-RCK 8.0-12.0 MDFT</td>
</tr>
<tr>
<td>Finish</td>
<td>Semstone 870 @ 100 sq ft per gallon</td>
<td>Macropoxy 5500 @ 8.0-12.0 mils DFT</td>
<td>NOTE: This would be for intermittent splash and spillage. Immersion requires a different lining.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 coat Series 280 6.0-8.0 MDFT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 coat Series 290 2.0-3.0 MDFT</td>
</tr>
</tbody>
</table>

### 12. Concrete surfaces subject to sulfuric acid (interior/exterior) (Trace up to 98% Concentration Secondary containment, continuous flow, frequent spills, or poor drainage.):

<table>
<thead>
<tr>
<th>Coat</th>
<th>Carboline</th>
<th>Sherwin Williams</th>
<th>Tnemec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prep</td>
<td>Refer to Manufacturers Product Data Sheet and Semstone Application Guide for Surface Preparation Guidelines and recommendations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prime</td>
<td>1 coat Carboguard 1340 @ 1-2 mils DFT</td>
<td>Corobond 100 @ 4.0-6.0 mils DFT</td>
<td>1 coat Series 208 16.0-20.0 MDFT</td>
</tr>
<tr>
<td>Intermediate</td>
<td>N/A</td>
<td>N/A</td>
<td>1 coat Series 206SC-MCK Sub-Flex EP 60.0-80.0 MDFT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 coat Series 5211-0215 Chopped Strand Fiberglass pressed into the (wet) Series 206SC-MCK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 coat Series 2525C-RCK 8.0-12.0 MDFT</td>
</tr>
<tr>
<td>Coat</td>
<td>Carboline</td>
<td>Sherwin Williams</td>
<td>Tnemec</td>
</tr>
<tr>
<td>------</td>
<td>-----------</td>
<td>------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Finish</td>
<td>1 coat Semstone 145 @ 30 mils</td>
<td>Cor-Cote HCRFF @15.0-20.0 mils DFT</td>
<td>1 coat Series 282 6.0-8.0 MDFT 1 coat Series 290 CRU 2.0-3.0 MDFT</td>
</tr>
<tr>
<td>Total</td>
<td>31 to 32 mils DFT</td>
<td>19 to 26 mils DFT</td>
<td>92 to 123 mils DFT</td>
</tr>
</tbody>
</table>

13. **Concrete floors subject to moisture and traffic.**

<table>
<thead>
<tr>
<th>Prep</th>
<th>SSCP-SP13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>1 coat Carboguard 890 (thinned) 3.0 to 5.0 MDFT</td>
</tr>
<tr>
<td>Finish</td>
<td>2 coats Carboguard 890, 4.0 to 6.0 MDFT, each coat, with non-skid aggregate</td>
</tr>
<tr>
<td>Total</td>
<td>11.0 to 17mils DFT 11 to 17 mils DFT 11 to 17 mils DFT</td>
</tr>
</tbody>
</table>

14. **Interior Floors (Sealed)**

<table>
<thead>
<tr>
<th>Prep</th>
<th>SSCP-SP 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>1 coat Carboguard 1340 @ 1-2 mils DFT 2 coats Macropoxy 646 @ 4.0-6.0 mils DFT Series 201 @ 10.0-12.0 mils DFT</td>
</tr>
<tr>
<td>Finish</td>
<td>1 coat Semstone 140 SL Series @ 25-30 mils DFT</td>
</tr>
<tr>
<td>Total</td>
<td>26 to 32 mils DFT 8 to 12 mils DFT 10 to 12 mils DFT</td>
</tr>
</tbody>
</table>

15. **Concrete floors in chemical storage/feed areas:**

<table>
<thead>
<tr>
<th>Prep</th>
<th>SSCP-SP 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>1 coat Carboguard 1340 @ 1-2 mils DFT 1 coat Corobond 100 @ 4.0-6.0 mils DFT See Systems 12 and 13</td>
</tr>
<tr>
<td>Finish</td>
<td>1 coat Semstone 140 SL Series @ 25-30 mils DFT 2 coats CorCote HCR FF @ 10.0-15.0 mils DFT</td>
</tr>
<tr>
<td>Total</td>
<td>26 to 32 mils DFT 24 to 36 mils DFT</td>
</tr>
</tbody>
</table>

16. **Skid Resistant Concrete:**

<table>
<thead>
<tr>
<th>Prep</th>
<th>SSCP-SP 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>Epoxy Nonskid (aggregated) 1 coat 10 MDFT plus aggregate (160 sfpg) Carboguard 868 Nonskid</td>
</tr>
<tr>
<td>Finish</td>
<td>N/A N/A N/A</td>
</tr>
<tr>
<td>Total</td>
<td>10 mils DFT 6 to 10 mils DFT 6 to 8 mils DFT</td>
</tr>
</tbody>
</table>

17. **Interior non-submerged ferrous metal:**

<table>
<thead>
<tr>
<th>Prep</th>
<th>SSCP-SP6, Commercial Blast Cleaning, 1.5-3 mils anchor profile.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>1 coat Carboguard 60 4.0 to 6.0 MDFT 1 coat Macropoxy 646, B58-600 Series/B58V600 @ 3.0-5.0 mils DFT</td>
</tr>
<tr>
<td>Finish</td>
<td>2 coats Carboguard 60 4.0 to 6.0 MDFT each 2 coats Macropoxy 646, B58-600 Series/B58V600 @ 4.0-6.0 mils DFT/coat</td>
</tr>
<tr>
<td>Total</td>
<td>12.0 to 18.0 MDFT 11 to 17 mils DFT</td>
</tr>
</tbody>
</table>

18. **Exterior non-submerged ferrous metals non-UV exposure:**
<table>
<thead>
<tr>
<th>Coat</th>
<th>Carboline</th>
<th>Sherwin Williams</th>
<th>Tnemec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prep</td>
<td>SSPC-SP6, Commercial Blast Cleaning, 1.5-3 mils anchor profile.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prime</td>
<td>1 coat Carboguard 60 4.0 to 6.0 MDFT</td>
<td>1 coat Macropoxy 646, B58-600 Series/B58V600 @ 3.0-5.0 mils DFT</td>
<td>Series 66HS hi-Build Epoxoline 3.0 to 5.0 MDFT</td>
</tr>
<tr>
<td>Finish</td>
<td>1 coat Carboguard 60 4.0 to 6.0 MDFT</td>
<td>1 coat Macropoxy 646, B58-600 Series/B58V600 @ 4.0-6.0 mils DFT 1 coat of Acrolon Ultra, B65W821/B65V820 @ 2.0-3.0 mils DFT</td>
<td>2 coats Series 66HS Hi-build Epoxoline, 4.0 to 6.0 MDFT each</td>
</tr>
<tr>
<td>Total</td>
<td>8 to 12 mils DFT</td>
<td>9 to 14 mils DFT</td>
<td>11 to 17 mils DFT</td>
</tr>
</tbody>
</table>

19. **Exterior non-submerged ferrous metals UV exposure:**

<table>
<thead>
<tr>
<th>Prep</th>
<th>SSPC-SP6, Commercial Blast Cleaning, 1.5-3 mils anchor profile.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>1 coat Carboguard 60 4.0 to 6.0 MDFT</td>
</tr>
<tr>
<td>Intermediate</td>
<td>N/A</td>
</tr>
<tr>
<td>Finish</td>
<td>1 coat Carbothane 133 VOC @ 2-3 mils DFT</td>
</tr>
<tr>
<td>Total</td>
<td>6 to 9 mils DFT</td>
</tr>
</tbody>
</table>

20. **Exterior non-submerged ferrous metals, UV exposure (Complete removal of existing coating system):**

<table>
<thead>
<tr>
<th>Prep</th>
<th>SSPC-SP6 Commercial Abrasive Blast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>1 coat Carbozinc 859 Series @ 2-3 mils DFT</td>
</tr>
<tr>
<td>Intermediate</td>
<td>1 coat Carboguard 893 @ 3-5 mils DFT</td>
</tr>
<tr>
<td>Finish</td>
<td>1 coat Carbothane 133 VOC @ 2-3 mils DFT</td>
</tr>
<tr>
<td>Total</td>
<td>7 to 11 mils DFT</td>
</tr>
</tbody>
</table>

21. **Exterior non-submerged ferrous metals, UV exposure (Over-coating of localized inaccessible existing coatings and galvanized steel):**

<table>
<thead>
<tr>
<th>Prep</th>
<th>SSPC SP1/SP2/SP3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>1 coat Rustbond @ 1-2 mils DFT</td>
</tr>
<tr>
<td>Intermediate</td>
<td>N/A</td>
</tr>
<tr>
<td>Finish</td>
<td>1-2 coats Carbothane 133 VOC @ 3-5 mils DFT</td>
</tr>
<tr>
<td>Total</td>
<td>4 to 7 mils DFT</td>
</tr>
</tbody>
</table>

22. **Exterior non-submerged ferrous metals, Non-UV exposure (Over-coating of localized inaccessible existing coating):**

<table>
<thead>
<tr>
<th>Prep</th>
<th>SSPC-SP1/SP2/SP3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>1 coat Rustbond @ 1-2 mils DFT</td>
</tr>
<tr>
<td>Intermediate</td>
<td>N/A</td>
</tr>
</tbody>
</table>
### 23. Exterior non-submerged ferrous metals, UV exposure (Over-coating of existing solvent based coating system exposed to UV):

<table>
<thead>
<tr>
<th>Prep</th>
<th>Prime</th>
<th>Intermediate</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSPC-SP1/SP2/SP3</td>
<td>1 coat Rustbond @ 1-2 mils DFT</td>
<td>N/A</td>
<td>1-2 coats Carboguard 60 @ 3-5 mils DFT</td>
</tr>
<tr>
<td></td>
<td>1 coat Carboguard 60 @ 3-5 mils DFT</td>
<td>N/A</td>
<td>Macropoxy 920 Pre-Prime @ 1.0-1.5 mils DFT</td>
</tr>
<tr>
<td></td>
<td>Macropoxy 646 @ 3.0-5.0 mils DFT</td>
<td>Macropoxy 646 @ 3.0-5.0 mils DFT</td>
<td>Acrolon Ultra @ 2.0-3.0 mils DFT</td>
</tr>
<tr>
<td></td>
<td>4 to 7 mils DFT</td>
<td>6 to 9.5 mils DFT</td>
<td>1095 @ 2.5-3.5 MDFT</td>
</tr>
</tbody>
</table>

### 24. Exterior non-submerged ferrous metals, Non-UV exposure (Over-coating of existing coating, or manufacturer epoxy-primed surface not exposed to UV):

<table>
<thead>
<tr>
<th>Prep</th>
<th>Prime</th>
<th>Intermediate</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSPC-SP1/SP2/SP3</td>
<td>1 coat Rustbond @ 1-2 mils DFT</td>
<td>N/A</td>
<td>1 coat of Carbocrylic 3359 @ 3-5 mils DFT</td>
</tr>
<tr>
<td></td>
<td>1 coat Sanitle 120 @ 1-2 mils DFT</td>
<td>N/A</td>
<td>2 coats of Pro Industrial DTM Acrylic, B66W1051 Series @ 2.0-3.0 mils DFT/coat</td>
</tr>
<tr>
<td></td>
<td>Pro Industrial Procryl Universal Primer @ 3.0-4.0 mils DFT</td>
<td>N/A</td>
<td>NOTE: WB Acrolon 100 @ 2.0-3.0 mils DFT acceptable if waterbased urethane is desired</td>
</tr>
<tr>
<td></td>
<td>4 to 7 mils DFT</td>
<td>8 to 12 mils DFT</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### 25. Submerged ferrous metals and ferrous metals subject to submergence or splashing (for contact with non-potable water) – Black:

<table>
<thead>
<tr>
<th>Prep</th>
<th>Prime</th>
<th>Intermediate</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSPC-SP5, Near White Blast Cleaning</td>
<td>1 coat Bitumastic 300M Coal Tar Epoxy (thinned) 8.0 MDFT</td>
<td>N/A</td>
<td>1 coat Bitumastic 300M Coal Tar Epoxy 16.0 to 20.0 MDFT</td>
</tr>
<tr>
<td></td>
<td>1 coat Macropoxy 5500 Primer, B58-X740/B58VX740 @ 3.0-6.0 mils DFT</td>
<td>N/A</td>
<td>1 coat Targuard Epoxy, B69B60/B69V60 @ 14.0-16.0 mils DFT</td>
</tr>
<tr>
<td></td>
<td>1 coat Series 66HS-1211 @ 3.0-5.0 mils DFT</td>
<td>N/A</td>
<td>2 Coats of Series 104 H.S. Epoxy @ 6.0-8.0 mils DFT per coat.</td>
</tr>
<tr>
<td></td>
<td>24 to 28 mils DFT</td>
<td>17 to 23 mils DFT</td>
<td>17 to 21 mils DFT</td>
</tr>
<tr>
<td>Coat</td>
<td>Carboline</td>
<td>Sherwin Williams</td>
<td>Tnemec</td>
</tr>
<tr>
<td>------</td>
<td>-----------</td>
<td>-----------------</td>
<td>--------</td>
</tr>
<tr>
<td>26.</td>
<td>Submerged ferrous metals and ferrous metals subject to submergence or splashing (for contact with potable water) – Color – must be NSF certified and approved color:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prep</td>
<td>SSPC-SP10, White Blast Cleaning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prime</td>
<td>1 coat Carboguard 61 4.0 to 6.0 MDFT</td>
<td>1 coat Macropoxy 5500, B58-X740 Series/B58VX740 @ 3.0-5.0 mils DFT</td>
<td>Series 20HS Pota-Pox 3.0 to 5.0 MDFT</td>
</tr>
<tr>
<td>Finish</td>
<td>2 coats Carboguard 61 4.0 to 6.0 MDFT each</td>
<td>2 coats Macropoxy 5500, B58-X740 Series/B58VX740 @ 4.0-6.0 mils DFT/coat</td>
<td>2 coats Series 20HS Pota-Pox 4.0 to 6.0 MDFT per coat</td>
</tr>
<tr>
<td>Total</td>
<td>12.0 to 18.0 MDFT</td>
<td>11 to 17 mils DFT</td>
<td>11 to 17 mils DFT</td>
</tr>
<tr>
<td>27.</td>
<td>Exterior submerged ferrous metals (Complete removal of existing coating system for immersion surfaces):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prep</td>
<td>SSPC-SP10, Near White Blast Cleaning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prime</td>
<td>N/A</td>
<td>1 coat Macropoxy 5500, B58-X740 Series/B58VX740 @ 3.0-5.0 mils DFT</td>
<td>Series 20HS Pota-Pox 3.0 to 5.0 MDFT</td>
</tr>
<tr>
<td>Intermediate</td>
<td>N/A</td>
<td>N/A</td>
<td>Series 20HS Pota-Pox 4.0 to 6.0 MDFT</td>
</tr>
<tr>
<td>Finish</td>
<td>1 coat of Plasite 4500 Series 30-40 mils</td>
<td>2 coats Macropoxy 5500, B58-X740 Series/B58VX740 @ 4.0-6.0 mils DFT/coat</td>
<td>Series 20HS Pota-Pox 4.0 to 6.0 MDFT</td>
</tr>
<tr>
<td>Total</td>
<td>30 to 40 mils DFT</td>
<td>11 to 17 mils DFT</td>
<td>11 to 17 mils DFT</td>
</tr>
<tr>
<td>28.</td>
<td>Steel Submerged in Process or Wastewater – High Abrasion Resistant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prep</td>
<td>SSPC-SP10, Near White Blast Cleaning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prime</td>
<td>N/A</td>
<td>Sher-Glass FF @ 10-15 mils DFT</td>
<td>1 Omnithane @ 2.5-3.5 mils DFT</td>
</tr>
<tr>
<td>Finish</td>
<td>1 coat of Plasite 4500 Series 30-40 mils</td>
<td>Sher-Glass FF @ 10-15 mils DFT</td>
<td>141 Epoxoline @ 8.0-10.0 mils DFT</td>
</tr>
<tr>
<td>Total</td>
<td>30 to 40 mils DFT</td>
<td>20 to 30 mils DFT</td>
<td>10.5 to 13.5 mils DFT</td>
</tr>
<tr>
<td>29.</td>
<td>Steel or Metal surfaces subject to sulfuric acid (interior/exterior)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prep</td>
<td>SSPC SP-6 Commercial Abrasive Blast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prime</td>
<td>1 coat Carboguard 890 Series 3-5 mils</td>
<td>Macropoxy 5500 primer @ 2.0-4.0 mils DFT</td>
<td>282 6.0-8.0 MDFT</td>
</tr>
<tr>
<td>Finish</td>
<td>1 coat Carboguard 890 Series 3-5 mils</td>
<td>2 coats Corcote HCFR FF @ 10.0-15.0 mils DFT/coat</td>
<td>282 6.0-8.0 MDFT</td>
</tr>
<tr>
<td>Total</td>
<td>6 to 10 mils DFT</td>
<td>22 to 34 mils DFT</td>
<td>12 to 18 MDFT</td>
</tr>
<tr>
<td>30.</td>
<td>High Temperature Steel (to 750 degrees Fahrenheit)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prep</td>
<td>SSPC-SP 10 Near White Blast (1-3 mils angular profile)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prime</td>
<td>1 coat Carbozinc 11 Series 2-3 mils</td>
<td>Heat Flex Hi Temp 1200 @ 5.0-6.0 mils DFT</td>
<td>No Tnemec System</td>
</tr>
<tr>
<td>Finish</td>
<td>Thermaline 4700 VOC (most colors) @ 1.5 mils DFT</td>
<td>Heat Flex Hi Temp 1000 @ 1.5-2.0 mils DFT</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3.5 to 4.5 mils DFT</td>
<td>6.5 to 8 mils DFT</td>
<td></td>
</tr>
<tr>
<td>31.</td>
<td>High Temperature Steel (non-continuous up to 1200 degrees Fahrenheit)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prep</td>
<td>SSPC-SP 10 Near White Blast (1-3 mils angular profile)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prime</td>
<td>1 coat Carbozinc 11 Series 2-3 mils</td>
<td>Heat Flex Hi Temp 1200 @ 5.0-6.0 mils DFT</td>
<td>No Tnemec System</td>
</tr>
</tbody>
</table>
### Coat Specifications

<table>
<thead>
<tr>
<th>Coat</th>
<th>Carboline</th>
<th>Sherwin Williams</th>
<th>Tnemec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finish</td>
<td>Thermaline 4700 VOC</td>
<td>Heat Flex Hi Temp 1200 @ 5.0-6.0 mils DFT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aluminum or Black @ 1.5</td>
<td>NOTE: The 1200 comes in gray and dark gray. If other colors are desired, 1 coat of Heat Flex Hi Temp 1000 @ 1.5-2.0 mils DFT should be used.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>mils DFT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3.5 to 4.5 mils DFT</td>
<td>10 to 12 mils DFT</td>
<td></td>
</tr>
</tbody>
</table>

#### 32. Aluminum & Dissimilar Metal Insulation

<table>
<thead>
<tr>
<th>Prep</th>
<th>SSPC-SP1 Solvent Clean</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>In accordance with</td>
<td>Macropoxy 646 @ 3.0-4.0 mils DFT</td>
<td>66HS @ 2.5-3.5 mils DFT</td>
</tr>
<tr>
<td></td>
<td>manufacturer’s recommendations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finish</td>
<td>Coal Tar Epoxy</td>
<td>Macropoxy 646 @ 3.0-4.0 mils DFT</td>
<td>66HS @ 2.5-3.5 mils DFT</td>
</tr>
<tr>
<td></td>
<td>1 coat Bitumastic 300M @ 8-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>8 to 10 mils DFT</td>
<td>6 to 8 mils DFT</td>
<td>5 to 7 mils DFT</td>
</tr>
</tbody>
</table>

#### 33. Exposed FRP and UV Exposure, PVC (mild to moderate chemical exposure)

<table>
<thead>
<tr>
<th>Prep</th>
<th>Surface must be clean and dry, remove any dust, dirt, oils or contaminants that could interfere with adhesion. Mechanically abrade surface to create profile.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>N/A</td>
<td>N/A</td>
<td>1095 – Two Coats @ 2.5-3.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MDFTPC</td>
</tr>
<tr>
<td>Finish</td>
<td>1-2 Coats of Carbothane 133 VOC @ 3-5 mils DFT</td>
<td>Acrolon Ultra @ 2.0-3.0 mils DFT</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alternate acrylic: 2 coats of SherCryl HPA @ 2.0-3.0 mils DFT/coat also acceptable.</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3 to 5 mils DFT</td>
<td>2 to 3 mils DFT or 4 to 6 mils DFT</td>
<td>5 to 7 mils DFT</td>
</tr>
</tbody>
</table>

#### 34. Plastic Piping – Below Grade coating not required, except as noted. Exposed piping shall be painted as required in the color coding schedule.

<table>
<thead>
<tr>
<th>Prep</th>
<th>Surface must be clean and dry, remove any dust, dirt, oils or contaminants that could interfere with adhesion.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>1 coat Sanitile 120 1.0 to 21.0 mils DFT</td>
<td>N/A</td>
<td>No primer required</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finish</td>
<td>1 coat Carbothane 133 VOC 3.0 to 5.0 mils DFT</td>
<td>2 coats of Acrolon Ultra, B65W821/B65V820 @ 2.0-3.0 mils DFT/coat</td>
<td>(2) Coats of Tnemec Series 1095 @ 2.5-3.5 mils DFT</td>
</tr>
<tr>
<td>Total</td>
<td>4 to 26 mils DFT</td>
<td>4 to 6 mils DFT</td>
<td>5 to 7 mils DFT</td>
</tr>
</tbody>
</table>

### PART 3 – EXECUTION

#### 3.01 GENERAL

A. All coating and painting shall conform to the applicable requirements of the Steel Structures Painting Council Manual (most recent edition). Any material applied upon
improperly prepared surfaces shall be removed and redone to the satisfaction of the Engineer at the sole expense of the Contractor.

B. All work shall be done by skilled craftsmen who are qualified to perform the required work and shall be done in a manner comparable with the best standards of practice found in that trade.

C. The Contractor shall provide a supervisor to be at the work site during blast cleaning and coating operations. The supervisor shall have the authority to coordinate the work and make other decisions pertaining to the fulfillment of their contract.

D. All dust, dirt, oil, or any contaminants which would affect the adhesion or durability of the finish coating must be removed before painting by cleaning per SPC-SP-1. Slag and weld metal accumulation and spatters shall be removed by chipping and grinding. All sharp edges shall be peened, ground or otherwise blunted as required and directed by the RPR.

E. The Contractor's coating and painting equipment shall be designed and suitable for the application of the specific materials herein specified. Equipment shall be maintained in condition required to obtain the specified coating application. Compressors shall have suitable traps and filters installed to remove water and oils from the air. The Contractor's equipment shall be subject to the approval of the RPR based on the manufacturer's data.

F. Sandblasting and priming shall be completed on any particular area, and the application of the primer shall follow immediately after surface preparation and cleaning prior to formation of any form of corrosion. If the surface is not primed within 24 hours, preparation shall be repeated.

G. Prior to assembly, all surfaces that will be made inaccessible after assembly, shall be prepared as specified herein and shall receive the paint or coating system as specified herein.

H. Coating shall not be applied to wet or damp surfaces and shall not be applied in inclement weather. Do not apply when the surface temperature is less than 5° F above the dew point. Dew or moisture condensation should be anticipated and if such conditions are prevalent, coating should be delayed until the surfaces are dry. Further, the day's coating should be completed well in advance of when condensation will occur, in order to permit the film a sufficient drying time prior to the formation of moisture.

3.02 SURFACE PREPARATION

A. All dirt, rust, scale, splinters, loose particles, disintegrated paint, grease, oil, and other deleterious substances shall be removed from all surfaces which are to be coated.

B. Hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items and surfaces not to be painted which are in contact with or near surfaces to be
painted shall be removed, masked, or otherwise protected prior to surface preparation and painting operations. Refer to Paragraph 3.09B.

C. Before commencing work, the painter must make certain that surfaces to be covered are in proper condition and must obtain Engineer's approval to proceed. Should the painter find such surfaces impossible of acceptance, he shall report such fact to the Engineer. The application of paint shall be held as an acceptance of the surfaces and working conditions and the painter will be held responsible for the results reasonably expected from the materials and processes specified.

D. Program the cleaning and painting so contaminants from the cleaning process will not fall onto wet, newly-painted surfaces.

E. General: The following referenced surface preparation specifications of the Steel Structures Painting Council shall form a part of this specification:

1. Solvent Cleaning (SSPC-SP1): Solvent such as water, mineral spirits, xylol, toluol, etc., are used to remove solvent-soluble foreign matter from the surface of ferrous metal. Rags and solvents must be replenished frequently to avoid spreading the contaminant rather than removing it. Low-pressure (1,500-4,000 psi) high volume (3-5 gal/min) water washing with appropriate cleaning chemicals is a recognized "solvent cleaning" method. All surfaces should be cleaned per this specification prior to using hand tools or blast equipment.

2. Hand Tool Cleaning (SSPC-SP2) (SSI-St2): A mechanical method of surface preparation involving wire brushing, scraping, chipping and sanding. Not the most desirable method of surface preparation, but can be used for mild exposure conditions. Optimum performances of protective coatings system should not be expected when hand tool cleaning is employed.

3. Power Tool Cleaning (SSPC-SP3) (SSI-St3): A mechanical method of surface preparation widely used in industry and involving the use of power sanders or wire brushes, power chipping hammers, abrasive grinding wheels, needle guns, etc. Although usually more effective than hand tool cleaning, it's not considered adequate for use under severe exposure conditions or for immersion applications.

4. White Metal Blasting (SSPC-SP5), (SSI-Sa3), or (NACE #1): The removal of all visible rust, mill scale, paint, and contaminants, leaving the metal uniformly white or gray in appearance. This is the ultimate in blast cleaning. Use where maximum performance of protective coatings is necessary due to exceptionally severe conditions such as constant immersion in water or liquid chemicals.

5. Commercial Blast (SSPC-SP6), (SSI-Sa2), or (NACE #3): All oil, grease, dirt, rust scale and foreign matter are completely removed from the surface and all rust, mill scale and old paint are completely removed by abrasive blasting except for slight shadows, streaks or discolorations caused by rust stain, mill scale oxides or slight, tight residues of paint or coating that may remain. If the surface is
pitted, slight residues of rust or paint may be found in the bottom of pits, at least two-thirds of each square inch of surface area shall be free of all visible residues and the remainder shall be limited to the light residues mentioned above.

6. Brush-Off Blast (SSPC-SP7, SSI-Sa1), or (NACE #4): A method in which all oil, grease, dirt, rust scale, loose mill scale, loose rust, and loose paint or coatings are removed completely. Tight mill scale and tightly-adhered rust, paint and coatings are permitted to remain. However, all mill scale and rust must have been exposed to the abrasive blast pattern sufficiently to expose numerous flecks of the underlying metal fairly uniformly distributed over the entire surface.

7. Near White Blast (SSPC-SP10), SSI-Sa2½ or (NACE #2): In this method, all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface by abrasive blasting, except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides or slight, tight residues of paint or coating. At least 95% of each square inch of surface areas shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above. From a practical standpoint, this is probably the best quality surface preparation that can be expected today for existing plant facility maintenance work.

8. High and Ultra-High Pressure Water Jet Cleaning (SSPC-SP12) or (NACE #5): As part of the surface preparation, deposits of oil, grease, and foreign matter must be removed by ultra-high pressure water jetting, by steam cleaning with detergent, or by methods in accordance with SSPC-SP1. The difference in degrees of surface cleanliness is defined by the amount of pressure as follows:

<table>
<thead>
<tr>
<th>Pressure Level</th>
<th>Pressure Range</th>
<th>Corresponding PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Pressure Water Cleaning (LP WC)</td>
<td>34 MPa (5,000 psi)</td>
<td></td>
</tr>
<tr>
<td>High Pressure Water Cleaning (HP WC)</td>
<td>34 to 70 MPa (5,000-10,000 psi)</td>
<td></td>
</tr>
<tr>
<td>High Pressure Water Jetting (HP WJ)</td>
<td>70 to 170 MPa (10,000-25,000 psi)</td>
<td></td>
</tr>
<tr>
<td>Ultra-High Pressure Water Jetting (UHP WJ)</td>
<td>Above 170 MPa (25,000 psi)</td>
<td></td>
</tr>
</tbody>
</table>

F. The abrasive used in blast cleaning shall produce a height profile in accordance with the recommendations of the manufacturer of the protective coating which is to be applied to the surface being cleaned.

G. Field blasting cleaning for all surfaces shall be accomplished by dry sandblasting method unless otherwise directed.
H. At all times during the blast cleaning operations, adequate means shall be employed to absolutely insure that existing protective coatings shall not be exposed to abrasion from blast cleaning operations.

I. The Contractor shall at all times keep the area of his work in reasonably clean condition shall not permit blasting materials to accumulate in an uncontrolled manner such as to constitute a nuisance or hazard to the satisfactory prosecution or the work (or operation of the existing facilities).

J. All blast cleaned surfaces shall be carefully dried and cleaned prior to application or specified coatings. No coatings or paint shall be applied over damp or moist surfaces.

K. All welds shall be neutralized with a suitable solvent or other acceptable cleaner compatible with the specified Coating System materials.

L. Specified Surface Preparation: Surface preparation for the specific Service Condition shall be as follows:

1. Masonry and Concrete: All concrete shall be cured 45 days, minimum. All surfaces shall be thoroughly cleaned by sandblasting, removing all traces of previous materials. Remove all loose concrete by chipping, etc. to leave only sound firmly bonded concrete. Cracks and voids shall be repaired or filled with grout, mixed and placed in strict accordance with manufacturer's instructions. In general, final surface shall be reasonably smooth and free to voids, cavities, dirt, dust, oils, grease, laitance or other contaminants. Concrete subject to submergence shall be brush-blasted (SSPC-SP7). All other concrete and CMU to be painted shall be commercial blast (SSPC-SP6).

2. Plastic pipe shall be lightly sanded and washed clean.

3. Wood Surfaces:
   a. These surfaces, other than stained or natural finish, shall be primed and finish-coated as specified. Wood surfaces to be painted shall be cleaned of dirt, oil, and other foreign substances with mineral spirits, scrapers, and/or sandpaper. Finish surfaces exposed to view shall be made smooth by sanding. All wood items to be painted and in contact with or built into concrete, masonry, or plaster shall be back primed. Small, dry seasoned knots shall be surface scraped and thoroughly cleaned, and shall be given a thin coat of knot sealer before application of the priming coat. Pitch on large, open, unseasoned knots and all other beads or streaks of pitch shall be scraped off, or if still soft, shall be removed with mineral spirits or turpentine and the resinous area thinly coated with knot sealer. After priming, all holes and imperfections in finish surfaces shall be filled with putty or plastic wood-filler colored to match the finish coat, allowed to dry, and sanded smooth. Unless otherwise authorized, painting shall proceed only when the moisture
content of the wood does not exceed 12 percent as measured by a moisture meter.

b. Stained or Natural Finish: Interior wood surfaces to receive stained or natural finish shall be properly prepared to the approved shade and lightly sanded. Oak, and other open-grained wood, shall be given the same treatment and, in addition, shall be given a coat of paste wood filler not less than eight hours after the application of the stain. Excess filler shall be removed and the surface then sanded smooth. Each coat shall be lightly sanded prior to application of subsequent coat.

c. Wood should be clean and dry. Remove surface deposits of sap or pitch by scraping and wiping clean with rags dampened with mineral spirits or VM & P Naphtha. Seal knots and pitch pockets with shellac reduced with equal parts of shellac thinner (denatured alcohol) before sandpaper and finishing with fine grit and remove sanding dust. After the prime coat is dry, fill cracks and holes with putty or spackling compound. When filler is hard, sand flush with the surface using fine grit sandpaper. Sand lightly between coats with fine grit, open-coated sandpaper.

4. Exposed Pipe: Bituminous coated pipe shall not be used in exposed locations. Pipe which shall be exposed after project completion shall be factory primed. After installation all exterior, exposed flanged joints shall have the gap between adjoining flanges sealed with a single component Thiokol caulking to prevent rust stains.

5. Shop-Finished Surfaces: All shop-coated surfaces shall be protected from damage and corrosion before and after installation by treating damaged area immediately upon detection. Abraded or corroded spots on shop-coated surfaces shall be “Hand-Cleaned” and then touched up with the same materials as the shop coat. All shop coated surfaces which are faded, discolored, or which require more than minor touch up in the opinion of the Engineer shall be repainted. Cut edges of galvanized sheets and exposed threads and cut ends of galvanized piping, electrical conduit, and metal pipe sleeves, not to be finish painted, shall be “Solvent Cleaned” and primed.

6. Plaster Surfaces: These surfaces shall be clean, free from grit, loose plaster, and surface irregularities, and shall have an instrument-measured moisture content not exceeding eight (8) percent.

7. Aluminum embedded or in contact with concrete must be painted with one shop coat of primer followed by one heavy coat of aluminum pigmented asphalt paint.
8. Ferrous Metal Services:

a. Remove any oil or grease from surfaces to be coated with clean rags soaked in toluol or other solvent recommended by coating manufacturer in accordance with SSPC specifications. Any chemical contamination shall be eliminated by means of neutralization or flushing or both prior to additional surface preparation.

b. All sharp edges and welds shall be ground smooth to a rounder contour, all weld splatter shall be removed, and all pits and dents shall be filled, and all imperfections shall be corrected prior to surface preparation.

c. Surfaces shall be clean and dry. Remove dust and dirt by blowing off the surface with high pressure air or wiping clean with dry rags. Oil, grease and protective mill coatings shall be removed by solvent cleaning in accordance with SSPC-SP1.

d. White rust should be removed by hand or power brushing. Care should be taken not to damage or remove the galvanizing. Rust should be removed from old galvanized steel by Hand or Power Tool Cleaning in accordance with SSPC-SP2 or SP3.

Concrete Surfaces:

a. All efflorescence, laitance, chalk, dust, dirt, oils, grease, concrete curing agents, form release agents, sealers, old coatings and other chemical contaminants shall be removed either by steam cleaning with detergent, by scrubbing with a hot trisodium phosphate solution consisting of 2 pounds of trisodium phosphate to each gallon of hot water (160°F), or by high pressure water blasting (3,000 psi or higher). Multiple cleaning operations may be required to remove all contaminants. Repeat the cleaning operation until the contamination is removed and flush the area with clean water to remove residual cleaning solution. Allow to dry thoroughly before coating.

b. All concrete surfaces to be coated shall be clean and dry. "Dry" is defined for new concrete as free of moisture and fully cured which is a minimum of 30 days at 75°F and 50 percent relative humidity or some equivalent cure time at other conditions (7 days minimum for stucco). Moisture content of concrete shall be determined by using both of the following methods.

c. The presence of moisture shall be checked by taping a one-foot square piece of 20 mil thick minimum plastic film on the surface. Pieces of test plastic film should be placed at various locations that are likely to be slow curing, such as below grade, low spots in floors, inside corners and lower wall areas. The plastic film should be carefully sealed with tape to prevent the escape of any moisture or vapor that would be trapped
behind the film. The film should be left in place overnight or longer to allow sufficient time for moisture migration. After 16 hours minimum remove and examine the backside for moisture condensation and inspect the concrete surface for darkened areas. The source of the moisture, if present, shall be located, and the cause corrected prior to coating.

d. The presence of moisture shall also be determined with a moisture detection device such as a Delmhorst Model DLM2E. Moisture determined by this method shall be less than 14 percent moisture content before coating operations shall be allowed to proceed.

e. Old paint and unremoved tar stains shall be solvent cleaned with naphtha, trichloroethylene, or perchloroethylene. Proper safety precautions shall be observed if this step is necessary. The surface shall be flushed with fresh water and dried.

f. Do not use form oils incompatible with coating, concrete curing agents, or concrete hardeners on concrete surfaces to be coated.

g. Concrete and/or cinder block walls to receive a coating shall be air-blasted with 100 psi clean, dry, oil-free air to remove dust, etc., and wire brushed to remove all loose and/or weak mortar.

10. Galvanized Steel and Non-Ferrous Metal

a. Galvanized steel and aluminum will only be coated when so specified.

b. Surfaces shall be clean and dry. Remove dust and dirt by blowing off the surface with high pressure air or wiping clean with dry rags. Oil, grease and protective mill coatings shall be removed by solvent cleaning in accordance with SSPC-SP1.

c. White rust should be removed from galvanized steel or aluminum by hand or power brushing. Care should be taken not to damage or remove the galvanizing. Rust should be removed from old galvanized steel by Hand or Power Tool Cleaning in accordance with SSPC-SP2 or SP3.

d. Other surface preparation as outlined in the coating manufacturer’s latest written application instructions shall be observed for more demanding exposures.

11. Stainless Steel

a. Stainless steel will only be coated when so specified, or when it is adjacent to areas to be coated such as piping supports, anchor bolts or flange bolts.
b. Stainless steel requires only solvent cleaning prior to coating using any one of the methods in SSPC-SP1. Only solvents and cleaning solutions containing less than 200 ppm of halogens should be used to prevent stress corrosion cracking.

c. Stainless steel may be whip-blasted to provide a surface profile to increase the mechanical bond of the coating system. The height of the profile and the texture required shall be defined for the operator and as a standard for the acceptance of the work. Pictorial standards for the surface cleanliness of carbon steel are not applicable to stainless steel, since there are no corrosion products or mill scale to remove from the surface.

d. Abrasive blast cleaning procedures outlined by Steel Structures Painting Council may also be used for stainless steel. Only very hard silica sand or other abrasive media shall be used for a fast cutting action and to obtain a sharp angular profile.

12. PVC or Other Plastic Piping or Ductwork

a. Solvent clean.

b. If recommended by manufacturer, lightly abrade surface with medium grade sandpaper. Remove dust by wiping with clean rags.

3.03 PREPARATION OF SURFACES - EXISTING FACILITIES

A. All existing facilities to be painted shall be thoroughly washed with a high strength chlorine solution or a trisodium phosphate solution to provide a surface suitable for finish painting. Any corrosion of ferrous surfaces shall be removed by sandblasting, and the area primed with the appropriate primer specified in the paint schedule.

3.04 MATERIALS PREPARATION

A. Mix and prepare painting materials in strict accordance with manufacturer's recommendations and directions, stirring materials before and during application to maintain a mixture of uniform density, free of film, dirt, and other foreign materials.

B. Except where otherwise specified, thinning shall be done only if necessary for the workability of the coating material and then, only in accordance with the coating manufacturer's most recent printed application instructions. Use only thinner provided by coating manufacturer. If thinning is used, sufficient additional coats shall be applied to assure the required dry film thickness is achieved. The manufacturer's recommended thinner or clean-up solvent shall be used for all clean-up. Application by brush, spray, airless spray or roller shall be as recommended by the manufacturer for optimum performance and appearance.
3.05 APPLICATION

A. Paint all exposed surfaces in rooms scheduled for painting whether or not colors are designated in schedules, except where the natural finish of material is obviously intended and specifically noted as a surface that will not be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color of finish is not designated, the Engineer will select these from standard colors available for the materials systems as specified.

B. Color Selection

1. Colors for Multi-Coat Systems: Each coat shall be applied in a different color or shade from the preceding coat to aid in determining the uniformity and coverage of the coating. The finish coat color shall be selected by the Owner or Engineer. When a white finish coat is specified, the last two (2) coats shall be white.

2. Color Coding Piping: All exposed piping shall be identified as specified in the respective piping specification.

C. All painting shall be done by skilled and experienced craftsmen and shall be of highest quality workmanship.

D. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the type of material being applied. All equipment shall be maintained in good working order and shall be comparable to that described in the coating manufacturer's most recent application instructions. It shall be thoroughly cleaned and inspected daily. Worn spray nozzles, tips, etc., shall be replaced regularly. Effective oil and water separators shall be used and serviced on all air lines.

E. All paints and coating materials shall be stored under cover and at a temperature within 10°F of the anticipated application temperature and at least 5°F above the dew point.

F. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color, and appearance.

G. Paint shall be applied in a neat manner with finished surfaces free of runs, sags, ridges, laps, and brush marks. Each coat shall be applied in a manner that will produce an even film of uniform and proper thickness. Allow each coat to dry thoroughly before applying the next coat following manufacturer's recommendations taking into account temperature and relative humidity.

H. All interior surfaces of structures shall be finish coated prior to installation of equipment, conduit, and other exposed items. Paint back sides of access panels and removable or hinged covers to match the exposed surfaces.

I. Finish exterior doors on tops, bottoms, and side edges the same as the exterior faces, unless otherwise indicated.
J. Sand lightly between each succeeding enamel or varnish coat.

K. Omit the field primer on metal surfaces which have been shop-primed and touch-up painted, unless otherwise specified.

L. The prime and intermediate coats as specified for the various coating systems may be applied in the shop by the manufacturer. The shop coats shall be of the type specified and shall be compatible with the field coating. Items such as pumps, motors, equipment, electrical panels, etc. shall be given at least one touch-up coat with the intermediate coating material and one (1) complete finish coat in the field.

3.06 APPLICATION RESTRICTIONS

A. Environmental Requirements

1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.

   a. The conditions below shall be adhered to even if manufacturer's recommendations are less stringent. If manufacturer's recommendations are more stringent, they shall apply.

   b. No coatings shall be applied when the air, surface, and material temperature is below 55°F or above 95°F for 24 hours prior to and 24 hours after coating application. Surface temperature shall be at least 5°F above the dew point for 24 hours prior to and 24 hours after coating application. The dewpoint shall be determined by use of a sling psychrometer in conjunction with U.S. Weather Bureau psychometric tables. Do not apply coatings when the relative humidity exceeds 85 percent or to damp or wet surfaces, unless otherwise permitted by the coating manufacturer's printed instructions. No painting shall be done when the surfaces may become damaged by rain, fog or condensation or when it is anticipated that these conditions will prevail during the drying period, unless suitable enclosures to protect the surface are used. Where heat is necessary, it shall be supplied by the painting applicator and shall be of such type that it will maintain an air and coated surface temperature of 55°F minimum prior to and after the coating application as described above, and 90°F minimum during the cure stage if hot air forced curing is recommended by the coating manufacturer for special coatings. Further, this heater shall be of such type as not to contaminate the surface area to be or being coated with combustion products. The Contractor shall supply utilities to run electric or gas heaters. Any surface coating damaged by moisture or rain shall be removed and redone as directed by the Owner or Engineer.

2. Do not apply finish in areas where dust is being or will be generated during application through full cure.
3. All exterior painting shall be done only in dry weather.

4. Spray application shall occur only when wind velocities, including gusts, are less than 10 miles per hour. All materials, equipment, etc. in the vicinity of spray application shall be protected from overspray.

B. Application of materials shall be done only on properly prepared surfaces as herein specified. Between any two coats of material, unless specifically covered in the coating manufacturer's most recent printed application instructions, if more than one (1) week passes between subsequent coats, the coating manufacturer shall be contacted for his recommended preparation of the surface prior to application of the next coat. This preparation might include brush-off blasting, steam cleaning, or solvent wiping (with an indicated solvent) and shall be specified in writing by the material supplier and followed by the applicator. Any surface coating damaged by moisture or rain shall be removed and redone as directed by the Owner or Engineer.

C. In no case shall paint be applied to surfaces which show a moisture content greater than 14 percent. The presence of moisture shall be determined prior to coating by testing with a moisture detection device such as a Delmhorst Model DLM2E.

3.07 MINIMUM COATING THICKNESS

A. Coating thickness shall meet or exceed the specified minimum dry film thickness (DFT) in all areas. The average coating thickness as determined by multiple representative DFT measurements shall meet or exceed the mid-point of the specified DFT range. If the measured DFT is below this value, the surface shall be recoated with at least the minimum DFT until the total DFT meets or exceeds the mid-point DFT.

B. Coverage rates are theoretical as calculated by the coating manufacturer and are, therefore, the maximum allowable.

C. Apply a prime coat to material which is required to be painted or finished, and which has not been prime coated by others.

D. On masonry, application rates will vary according to surface texture; however, in no case shall the manufacturer's stated coverage rate be exceeded. On porous surfaces, it shall be the painter's responsibility to achieve a protective and decorative finish either by decreasing the coverage rate or by applying additional coats of paint.

E. Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
3.08 FINISHES

A. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

B. Complete Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specific requirements.

3.09 FIELD QUALITY CONTROL

A. The Contractor shall request acceptance of each coat by the Owner's representative before applying the next coat; and the Contractor shall provide the necessary properly calibrated gauges. All nonferrous surfaces shall be checked for number of coats and thickness by use of a Tooke gauge. All ferrous surfaces shall be checked for film thickness by use of an Elcometer or Micro-Test magnetic dry film gauge properly calibrated. In addition, submerged tank linings and metals shall be tested for freedom from holidays and pinholes by use of a Tinker-Rasor or K-D Bird Dog Holiday Detector. All defects shall be corrected to the satisfaction of the Owner.

3.10 PROTECTION

A. All other surfaces shall be protected while painting.

B. Protection of furniture and other movable objects, equipment, fittings, and accessories shall be provided throughout the painting operation. Remove all electric plates, surface hardware, etc., before painting; protect and replace when completed. Mask all machinery nameplates and all machined parts not to receive paint. Lay drop cloths in all areas where painting is being done to adequately protect flooring and other work from all damage.

3.11 WORKMANSHIP

A. General:

1. Primer (spot) and paint used for a particular surface shall, in general, be as scheduled for that type of new surface. Confirm with the paint manufacturer that the paint proposed for a particular re-paint condition will be compatible with the existing painted surface. Sample re-painted areas on the actual site will be required to insure this compatibility. Finished repainted areas shall be covered by the same guarantee specified for remainder of work.

2. Protection of furniture and other movable objects, equipment, fittings, and accessories shall be provided throughout the painting operations. Canopies of lighting fixtures shall be loosened and removed from contact with surface, covered and protected and reset upon completion. Remove all electric plates, surface hardware, etc., before painting, protect and replace when completed. Mask all machinery nameplates and all machined parts not receiving a paint
finish. Dropped or spattered paint shall be promptly removed. Lay drop clothes in all areas where painting is being done to adequately protect flooring and other work from all damage during the operation and until the finished job is accepted.

3. All safety equipment shall be painted in accordance with OSHA Standards.

4. Paints shall be mixed in proper containers of adequate capacity. All paints shall be thoroughly stirred before use and shall be kept stirred while using. No unauthorized thinners or other materials shall be added to any paint.

5. Only skilled painters shall be used on the work and specialists shall be employed where required.

B. Field Priming:

1. Equipment which is customarily shipped with a baked enamel finish or with a standard factory finish shall not be field painted unless the finish has been damaged in transit or during installation. Surfaces that have been shop painted and have been damaged, or where the shop coats or coats of paint have deteriorated, shall be properly cleaned and retouched before any successive painting is done on them in the field. All such field painting shall match as nearly as possible the original finish.

C. Field Painting:

1. All painting at the site shall be designated as Field Painting.

2. All paint shall be at room temperature before applying, and no painting shall be done when the temperature is below 50 degrees F, in dust-laden air, when rain or snow is falling, when relative humidity exceeds manufacturer’s recommendation when temperature is less than 5° F above the dewpoint, or until all traces of moisture have completely disappeared from the surface to be painted.

3. Each application of paint shall be applied at the recommended thickness, free to sags, runs, with no evidence of poor workmanship. Care shall be exercised to avoid lapping on glass or hardware. Paint shall be sharply cut to lines. Finished surfaces shall be free from defects of blemishes.

4. Protective coverings or drop cloths shall be used to protect floors, fixtures, and equipment. Care shall be exercised to prevent paint or coating from being spattered onto surfaces which are not to be painted. Surfaces from which such materials cannot be removed satisfactorily shall be painted or repainted, as required to produce, a finish satisfactory to the Engineer.
5. Successive coats of paint shall be tinted so as to make each coat easily distinguishable from each other with the final undercoat tinted to the approximate shade of the finished coat.

6. All welds and irregular surfaces shall receive a brush coat of the specified product prior to application of the first complete coat.

7. Finish surfaces shall not show brush marks or other irregularities. Under coats shall be thoroughly and uniformly sanded with No. 00 sandpaper or equal to remove defects and provide a smooth even surface. Top and bottom edges of doors shall be painted and all exterior trim shall be back-primed before installation.

8. Painting shall be continuous and shall be accomplished in an orderly manner so as to facilitate inspection. All exterior concrete and masonry painting shall be performed in one continuous manner structure by structure. Materials subject to weathering shall be prime coated as quickly as possible. Surfaces of exposed members that will be inaccessible after erection shall be cleaned and painted before erection.

9. All materials shall be brush painted unless spray painting is specifically approved by the Engineer. If spray painting is approved, Contractor shall accept all responsibility for any damage caused by overspray and/or drifting paint mist.

10. All surfaces to be painted as well as the atmosphere in which painting is to be done shall be kept warm and dry by heating and ventilation, if necessary, until each coat of paint has hardened. Any defective paint shall be removed and repainted in accordance with the Engineer's directions.

11. Before final acceptance of the work, all damaged surfaces of paint shall be cleaned and repainted as directed by the Engineer.

12. The aluminum work noted on the Drawings or in the Painting Schedule except all structural walkways, supports, railings, toeboards, grating, and checkered plate shall be field painted.

3.12 CLEANUP

A. The premises shall at all times be kept free from accumulation of waste material and rubbish caused by employees or work. At the completion of the painting remove all tools, scaffolding, surplus materials, and all rubbish from and about the buildings and leave work “broom clean” unless more exactly specified.

B. Upon completion, remove all paint where it has been spilled, splashed, or splattered on all surfaces, including floors, fixtures, equipment, furniture, etc., leaving the work ready for inspection.
3.13 COLOR CODING FOR PIPES AND EQUIPMENT

A. Color coding is required and shall consist of color code painting and identification of all exposed conduits and pipelines for the transport of gases, liquids and semi-liquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and all operating accessories which are integral to be whole functional mechanical pipe and electrical conduit system. The color-coding schedule shall be in accordance with respective piping specifications.

B. All hangers and pipe support floor stands shall be painted. The system shall be painted up to and including the flanges attached to the mechanical equipment. Colors shall be as selected by the Owner.

C. All systems which are an integral part of the equipment, that is originating from the equipment and returning to the same piece of equipment, shall be painted between and up to but not including, the fixed flanges or connections on the equipment.

D. The color code establishes, defines and assigns a definite color for each category of pipe. Pipelines which are not listed on the Paint Color Code Schedule shall be assigned a color by the Engineer and shall be treated as an integral part of the Contract.

E. All pipes, equipment, and accessories shall be painted according to Paint Color Code Schedule attached. All pipes shall have 6" long color-coded flow arrows with letters defining its function (i.e., potable water, air, sludge, etc.).

3.14 FABRICATED EQUIPMENT

A. Unless otherwise indicated, all fabricated equipment shall be shop primed and shop or field finished.

B. All items to be shop primed shall be thoroughly cleaned of all loose material prior to priming. If, in the opinion of the Engineer, any prime coating shall have been improperly applied or if material contrary to these Specifications shall have been used, that coating shall be removed by sandblasting to white metal and reprimed in accordance with these Specifications.

C. All shop prime coats shall be of specified materials and applied in accordance with these Specifications. The Contractor shall remove any prime coats not in accordance with these Specifications by sandblasting and apply the specified prime coat at no additional cost to the Owner.

D. Shop primed surfaces shall be cleaned thoroughly and retouched with the specified primer before the application of successive paint coats in the field.

E. Shop finish coats may be the standard finish as ordinarily applied by the manufacturer when approved by the Engineer. All pumps and motors shall be repainted after installation.
F. The Contractor shall be responsible for and take whatever steps are necessary to properly protect the shop prime and finish coats against damage from weather or any other cause.

G. If, in the opinion of the Engineer, a shop finish coat does not give the protection quality of other work of similar nature, the Contractor shall apply the coat or coats of paint as directed by the Engineer to accomplish the desired protection quality.

H. Wherever fabricated equipment is required to be sandblasted, the Contractor shall protect all motors, drives, bearings, gears, etc., from the entry of grit. Any equipment found to contain grit shall be promptly and thoroughly cleaned by the Contractor.

END OF SECTION
SECTION 09905

PIPING, VALVE, AND EQUIPMENT IDENTIFICATION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included under this Section consists of providing an identification system for piping systems and related equipment.

B. Related Work Described Elsewhere:

1. Drawings and Submittals: Section 01340.
2. Painting: Section 09900.
3. Equipment: Division 11
4. Mechanical: Division 15.
5. Electrical: Division 16.

1.02 QUALITY ASSURANCE


1.03 SUBMITTALS

A. Submit manufacturer's descriptive literature, illustrations, specifications, and other pertinent data in accordance with Section 01340.

B. Schedules:

1. Provide a typewritten list of all tagged valves giving tag color, shape, letter code and number, the valve size, type, use, and general location.
2. Provide a complete list of materials to be furnished and surfaces on which they will be used.

C. Samples:

1. Provide a sample of each type valve tag supplied.
2. Provide a sample of each type of identification tape supplied.
3. Provide manufacturer's color charts for color selection by Engineer.
1.04 PRODUCTS DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Except for locally mixed custom colors, deliver sealed containers with labels legible and intact.

B. Storage of Materials:
   1. Store only acceptable project materials on project site.
   2. Store in suitable location.
   3. Restrict storage to paint materials and related equipment.
   4. Comply with health and fire regulations.

1.05 JOB CONDITIONS

A. Environmental Requirements:
   1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.
   2. Do not apply finish in areas where dust is being generated.

B. Protection: Cover or otherwise protect finished work of other trades and surfaces not to be painted.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials for painting shall conform to requirements of Section 09900: Painting.

B. Materials selected for coating systems for each type surface shall be the product of a single manufacturer.

C. Aboveground piping shall be identified by self-adhesive pipe markers equal to those manufactured by W. H. Brady Company.
   1. Markers shall be of wording and color as shown in Table 09905.
   2. Lettering shall be:
      a) 2 1/4-inches high for pipes 3 inches diameter and larger.
      b) 1 1/8-inches high for pipes less than 3 inches diameter.
3. Flow arrows shall be:
   
a) 2 1/4-inches by 6 inches for pipes 3 inches diameter and larger.

b) 1 1/8-inches by 3 inches for pipes less than 3 inches diameter.

D. Buried piping shall be identified by identification tape installed over the centerline of the pipelines.

1. Identification Tape for Steel or Iron Pipe: Identification tape shall be manufactured of inert polyethylene film so as to be highly resistant to alkalies, acids, or other destructive agents found in soil, and shall have a minimum thickness of 4 mils. Tape width shall be 6 inches and shall have background color specified below, imprinted with black letters. Imprint shall be as specified below and shall repeat itself a minimum of once every 2 feet for entire length of tape. Tape shall be Terra Tape Standard 250, or approved equal.

2. Identification Tape for Plastic or Non-Magnetic Pipe: Identification tape shall be manufactured of reinforced polyethylene film with a minimum overall thickness of 4 mils and shall have a 0.35 mil thick magnetic metallic foil core. The tape shall be highly resistant to alkalies, acids, and other destructive agents found in soil. Tape width shall be 3 inches and shall have background color specified below, imprinted with black letters. Imprint shall be as specified below and shall repeat itself a minimum of once every 2 feet for entire length of tape. Tape shall be TerraTape Sentry Line 1350 or approved equal.

3. Tape background colors and imprints shall be as follows:

<table>
<thead>
<tr>
<th>Imprint</th>
<th>Background Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Caution Sewer Line Buried Below&quot;</td>
<td>Green</td>
</tr>
<tr>
<td>&quot;Caution Electrical Line Buried Below:&quot;</td>
<td>Red</td>
</tr>
<tr>
<td>&quot;Caution Water Line Buried Below&quot;</td>
<td>Blue</td>
</tr>
<tr>
<td>&quot;Caution Telephone Line Buried Below&quot;</td>
<td>Orange</td>
</tr>
</tbody>
</table>

4. Identification tape shall be "Terra Tape" as manufactured by Reef Industries, Inc., Houston, TX; Allen Systems, Inc., Wheaton, IL; or approved equal.

5. In addition to the metallic identification tape specified, buried metallic pipe used for reclaimed water, effluent, and non-potable water service shall be painted with three (3) continuous stripes in order to identify service. Each stripe shall be 2-inches wide and the paint color shall match the color of the corresponding identification tape. Paint shall be an acrylic or epoxy paint that is suitable for the intended service. One (1) stripe shall be located on the top of the pipe and the remaining stripes shall be on each side of the pipe.
E. Aboveground Valve Identification: A coded and numbered tag attached with brass chain and/or brass "S" hooks shall be provided on all valves.

1. Tag Types: Tags for valves on pipe shall be brass or anodized aluminum. Colors for aluminum tags shall, where possible, match the color code of the pipeline on which it is installed. Square tags shall be used to indicate normally closed valves and round tags shall indicate normally open valves.

2. Coding: In addition to the color coding, each tag shall be stamped or engraved with wording or abbreviations to indicate the valve service and number. All color and letter coding shall be approved by the Engineer. Valve service shall either be as listed in Table 09905, or by equipment abbreviation if associated with a particular piece of equipment. Valve numbering, if required, shall be as approved by the Engineer and/or Owner.

F. Buried Valve Identification: Each buried valve shall be identified by providing a concrete pad or post and bronze disc as shown on the Drawings.

PART 3 - EXECUTION

3.01 COLOR CODING FOR PIPES AND EQUIPMENT

A. Piping color codes, and code labels for pipe identification shall conform to Table 09905.

B. General Notes and Guidelines:

1. Pipelines, equipment, or other items which are not listed here shall be assigned a color by the Owner and shall be treated as an integral part of the Contract.

2. Color coding shall consist of color code painting and identification of all exposed conduits, through lines and pipelines for the transport of gases, liquids, or semi-liquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and any operating accessories which are integral to a whole functional mechanical pipe and electrical conduit system.

3. All moving parts, drive assemblies, and covers for moving parts which are potential hazards shall be Safety Orange.

4. All safety equipment shall be painted in accordance with OSHA Standards.

5. All inline equipment and appurtenances not assigned another color shall be painted the same base color as the piping. The pipe system shall be painted with the pipe color up to, but not including, the flanges attached to pumps and mechanical equipment assigned another color.

6. All pipe hangers and pipe supports shall be painted, unless specified otherwise due to material of construction.
C. All pipe hangers, pipe supports, and accessories shall be painted to match their piping. The system shall be painted up to, but not including, the face of flanges or the flexible conduit connected to electrical equipment. Structural members used solely for pipe hangers or supports shall be painted to match their piping. Where the contact of dissimilar metals may cause electrolysis and where aluminum will contact concrete, mortar or plaster, the contact surface of the metals shall be coated in accordance with Section 09900.

D. All systems which are an integral part of the equipment, that is originating from the equipment and returning to the same piece of equipment, shall be painted between and up to, but not including, the face of flanges or connections on the equipment.

E. All insulated surfaces, unless otherwise specified, shall be given one (1) coat of sizing, one (1) prime coat, and one (1) finish coat.

F. System code lettering and arrows shall conform to the requirements of ANSI A 13.1 marked on piping as follows:

1. Legends shall be of the following color for the respective pipe color:

<table>
<thead>
<tr>
<th>Key to Classification of Predominant Colors For Piping</th>
<th>Color of Letters, if not Otherwise Specified</th>
</tr>
</thead>
<tbody>
<tr>
<td>(F) Fire Protection: Red</td>
<td>White</td>
</tr>
<tr>
<td>(D) Dangerous:</td>
<td></td>
</tr>
<tr>
<td>Yellow Black</td>
<td></td>
</tr>
<tr>
<td>Orange Black</td>
<td></td>
</tr>
<tr>
<td>(S) Safe:</td>
<td></td>
</tr>
<tr>
<td>Green Black</td>
<td></td>
</tr>
<tr>
<td>White Black</td>
<td></td>
</tr>
<tr>
<td>Black White</td>
<td></td>
</tr>
<tr>
<td>Light Grey Black</td>
<td></td>
</tr>
<tr>
<td>Dark Grey White</td>
<td></td>
</tr>
<tr>
<td>Aluminum Black</td>
<td></td>
</tr>
<tr>
<td>(P) Protective:</td>
<td></td>
</tr>
<tr>
<td>Blue White</td>
<td></td>
</tr>
</tbody>
</table>

2. All piping containing or transporting corrosive or hazardous chemicals shall be identified with labels every 10 feet and with at least two (2) labels in each room. Otherwise, markers shall be placed no more than 20 feet apart with at least one (1) marker on every straight run and additional markers at turns and where pipes pass through walls.

3. An arrow indicating direction of flow shall be placed adjacent to each marker.
3.02  FABRICATED EQUIPMENT

A. Unless otherwise indicated or specifically approved, all fabricated equipment shall be shop primed and finished. See Section 09900 - Painting.

B. The Contractor shall be responsible for and take whatever steps are necessary to properly protect the shop prime and finish coats against damage.

C. Where specified in other Sections of these Specifications for mechanical equipment, the Contractor shall apply field coats of paint in accordance with Section 09900. If the shop finish coating is unsatisfactory due to poor adhesion or other problems with primer or finish coats, coatings shall be removed and replaced by sandblasting, priming and finishing in accordance with Section 09900 and this Section.

D. Wherever fabricated equipment is required to be sandblasted, the Contractor shall protect all motors, drives, bearings, gears, etc., from the entry of grit. Any equipment found to contain grit shall be promptly and thoroughly cleaned. Equipment contaminated by grit in critical areas, such as bearings, gears, seals, etc., shall be replaced at no cost to the Owner.

3.03  INSTALLATION OF IDENTIFICATION TAPE

A. Identification tape shall be installed for all buried pipelines and conduits in accordance with the manufacturer's installation instructions and as specified herein.

B. Identification tape for piping shall be installed at two (2) locations:

1. One (1) foot below finished grade along centerline of pipe, and;

2. Directly on top of the pipe.

TABLE 09905
COLOR CODES AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Service</th>
<th>Conduit, Pipe, and Valve Color Code</th>
<th>Letter and Flow Arrow Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravity Drain</td>
<td>Brown</td>
<td>N/A</td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>Green</td>
<td>N/A</td>
</tr>
<tr>
<td>Force Main</td>
<td>Green</td>
<td>Black</td>
</tr>
<tr>
<td>Potable Water</td>
<td>Blue</td>
<td>Black</td>
</tr>
<tr>
<td>Reuse Water</td>
<td>Purple</td>
<td>Black</td>
</tr>
<tr>
<td>Diesel Fuel</td>
<td>OSHA Red</td>
<td>White</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 09913

EPOXYTEC CONCRETE REHABILITATION AND STRUCTURAL LINING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish all materials, labor, equipment, testing, and incidentals required to eliminate possible infiltration/exfiltration, repair concrete voids and deterioration and installation of the protective concrete lining to all surfaces of the wet well.

B. General Design: The protective epoxy shall be intended for applications in domestic wastewater wetwells and manholes as shown on Drawings. The coating shall be compatible with the repair mortars or concretes used for the rehabilitation of the wetwell. The protective coating shall be capable of contact with a minimum of 20% sulfuric acid solution without any degradation of physical and performance properties.

C. Contractor shall adhere to this lining system specification or Specification 09915 – Green Monster Structural System.

1.02 REFERENCES

A. The latest codes and standards referenced herein and belonging to the following organizations shall be followed:

1. The America Society for Testing and Materials (ASTM)
2. National Association of Corrosion Engineers, NACE International (NACE)
3. The Society for Protective Coatings (SSPC)
4. International Concrete Repair Institute (ICRI)
5. National Association of Sewer Service Companies (NASSCO)
6. EPA Environmental Technology Verification Program (EPA ETV)
7. American Association of State Highway and Transportation Officials (AASHTO)
8. Occupational Safety and Health Administration (OSHA)
1.03 QUALITY ASSURANCE

A. Qualifications:

1. The manufacturer and/or applicator of the total lining system of wastewater containment structures shall be a company that specializes in the design, manufacture or installation of corrosion protection systems for wetwells and manholes. Applicator shall be completely trained in leak repair, surface preparation and corrosion materials application on manholes and lift station wet wells. Materials/products shall be suitable for installation in a severe hydrogen sulfide environment without any deterioration to the coating.

2. The applicator shall be trained and certified by the manufacturer for the handling, mixing, application and inspection of the lining system as described herein. Applicator shall have a minimum five (5) years of experience and five (5) successful projects documented by manufacturer.

3. To ensure total unit responsibility, all materials and installation thereof shall be furnished and coordinated with/by one supplier/applicator who turnkeys the work and assumes full responsibility for the entire operation. Manufacturer must have minimum ten (10) years of manufacturing experience and applicator must be certified for minimum of five (5) years.

B. Manufacturers: The protective concrete coating shall be:

1. Epoxytec CPP Lining System

C. Warranty: The coating manufacturer shall warrant the Epoxytech lining against failure for a period of 10 years from date of project completion. "Failure" will be deemed to have occurred if the protective lining fails to (a) prevent the internal damage or corrosion of the underlying structure due to bacteriological, chemical, gaseous, erosive and abrasive attack, including internal damage or corrosion incurred from vibration, stress cracking, (b) protect the substrate and environment from contamination by wastewater, (c) seal and protect from influent, or (d) product does not meet the physical properties or is defective in manufacture. If any such failure occurs within 10 years of initial completion of work on a structure, the damage to the structure and any other work caused by such defects shall be repaired to restore the coating at no cost to the Owner within 60 days after written notification of the failure.

1.04 SUBMITTALS

A. Shop drawings: Submit shop drawings in accordance with Division 0 and 1. Shop drawings shall include all information required to demonstrate full compliance with this Specification. The following shall be submitted as a minimum.

1. Technical data sheet on each product used/lining properties.

2. Material Safety Data Sheet (MSDS) for each product used.
3. Copies of independent testing performed on the lining product indicating the product meets the requirements as specified herein.

4. ASTM References and testing results.

5. CIGMAT evaluation.

6. Descriptive literature, bulletins and or catalogs of materials.

7. Work procedures including flow diversion plan, method of repair, etc.

8. Material and method for repair of leaks or cracks in manholes.

9. List of reference projects (minimum five (5) in last five years).

10. Certification of applicator.

11. Applicators reference of similar projects (minimum five (5) in last five years).

12. Application procedures, including repair procedures.

13. Design details for any ancillary systems and equipment to be used on site for surface preparation, application and testing. Confined space entry, flow diversion and/or bypass plans shall be presented by Contractor to Owner as necessary to perform the specified work.


15. Final installation report on completed project.

16. Warranty

1.05 DELIVERY, HANDLING, AND STORAGE

A. Deliver all materials to the job site in original, unopened packages and containers bearing manufacturer’s name and label.

1. Provide labels on each container with the following information:

   a. Name or title of material.

   b. Fed. Spec. number if applicable.

   c. Manufacturer’s stock number, date of manufacture and expiration date (shelf life).

   d. Manufacturer’s formula or specification number.

   e. Manufacturer’s batch number.
f. Manufacturer's name.

g. Generic type.

h. Contents by volume, for major pigment and vehicle constituents.

i. Application instructions: thinning, ambient conditions, etc.

2. Containers shall be clearly marked to indicate any hazards connected with the use of the paint and steps which should be taken to prevent injury to those handling the product.

B. All containers shall be handled and stored in such a manner as to prevent damage or loss of labels or containers.

C. All supplies shall be stored and maintained by the Contractor in accordance with manufacturer’s recommendations. Materials shall not be exposed to adverse conditions prior to the work. All materials shall be kept in secured area and away from general public access. The Contractor shall review and maintain all Material Safety Data Sheets (MSDS), product labeling, and technical literature at the project site.

PART 2 - PRODUCTS

2.01 GENERAL

A. The materials to be utilized in the lining of wet well shall be designed and manufactured to withstand the severe effects of hydrogen sulfide and sulfuric acid in a wastewater environment. Manufacturer of corrosion protection products shall have long proven experience in the production of the lining products utilized and shall have a satisfactory installation record.

B. Contractor is to maintain strict adherence to the protective linings manufacturer's recommendations with regard to proper surface preparation and compatibility with existing linings.

C. Thoroughly clean and prepare existing products/surfaces to effect a seal with and promote the adhesion of the lining product(s) on accordance with Part 3 – Execution, of this Specification.

D. Thoroughly Use approved equipment designed, recommended and/or manufactured by the material supplier specifically for the application of all materials in the structures.

E. Applicator shall examine the surface of the structure to receive the protective coating system. Notify the Owner in writing if the surface is not acceptable for rehabilitation.

F. Applicator shall initiate and enforce quality control procedures consistent with applicable ASTM, NACE, and SSPC standards and the structural epoxy coating manufacturer's recommendations.
G. Products are to be kept dry, in a controlled environment, protected from weather and stored under cover.

2.02 SEAL ACTIVE LEAKS

A. Products Stop active leaks with patching material or infiltration control materials applied according to manufacturer’s recommendations.

B. Materials

   a. Quick setting, hydraulic cement compound designed for minor patching, and as a leak stopper or water plug, which instantly stops running water and/or seepage through concrete.

2. Chemical grout
   b. Chemical grout material will be used for grouting active leaks shall be hydrophobic polyurethane or prior approved equal. Mixing and handling of all the chemical grout materials shall be in strict accordance with manufacturer’s recommendations. Application of materials shall be by injection method only.

2.03 REPAIR PRODUCTS

A. Concrete resurfacing shall be performed for any deep spalls, voids, gaps, holes, or defect with a valley that exceeds one-eighth inch (1/8”) in depth.

B. Materials

1. The material shall be a silicate-modified, ultra-high strength, high build, sewer grade silica fume, fiber reinforced mortar.

   Physical properties

   Flexural Strength ASTM C-293
   24 hours 600 psi
   28 days 990 psi

   Compressive Strength ASTM C-109
   24 hours 2,000 psi
   28 days 10,400 psi

   Shear Bond ASTM C-882 >1,000 psi
   Freeze/Thaw ASTM C666 100 cycles, no damage

2. Resurfacing materials shall be in conformity to coating manufacturer recommendations.
3. Specified material(s) shall be: Epoxytec Mortartec Silicate (#RCHA1) by Epoxytec International, Inc.

2.04 LINING PRODUCTS

A. Lining shall be a two-component 100% solid epoxy moisture insensitive design formulated for use in sewer systems. Light gray in color for enhanced visibility and may be applied by trowel or sprayed. Epoxy shall cure quickly, even when immersed in fresh or salt water and rapidly form a tenacious bond to freshly applied cementitious material. Repair product shall produce a smooth, glossy and homogenous protective layer that is impervious to biological corrosion, water, oils and many highly corrosive chemicals.

B. It is the intent of this specification to provide for the waterproofing, sealing, structural reinforcement and corrosion protection of existing wet wells and similar underground structures by the safe, quick and economical application of an ultra-high build 100% solids structural epoxy.

C. This specification establishes the minimum standard for material and method of application for the structural reinforcement, sealing and corrosion protection of the substrate by lining with a 100% solids structural epoxy. The liner is structural epoxy liner is installed at a minimum thickness of 125 mils DFT (0.125 inches).

D. The structural epoxy lining system will be used on all underground and/or immersive concrete and masonry wastewater structures in order to protect against corrosion.

E. Materials

1. Structural epoxy coating system must be a structural epoxy exhibiting the following features:
   i. The structural epoxy must be 100% solid, no VOCs.
   ii. The structural epoxy must be self-priming, requiring no primer.
   iii. The structural epoxy must adhere to concrete with adhesion testing results in PSI that outperformed the cohesion of concrete (CIGMAT CT-2/3).
   iv. The structural epoxy must be moisture tolerant up 100% and fully cure underwater.
   v. The structural epoxy must be able to react/perform/cure in the presence of water.
   vi. The structural epoxy must withstand freeze-thaw and wet-dry cycles without causing adverse changes to the cure and performance properties.
   vii. The structural epoxy must be able to be applied by trowel (hand-applied) in order to mobilize and apply in limited access areas.
   viii. The structural epoxy must hang with vertical and overhead thickness capability of 1/16 inch to 1/2 inch in one pass without sag.
   ix. The structural epoxy must have an indefinite recoat window without preparation for simple repair requirements.
   x. The structural epoxy shall be resistant to all forms of chemical or bacteriological attack found in municipal sanitary sewer systems, including severe hydrogen sulfide (up to 600ppm).
xi. The structural epoxy must have undergone testing and verified by the Environmental Protection Agency’s, Environmental Technology Verification Program for Infrastructure Rehabilitation Technologies (EPA ETV).

xii. The coating system must be a structural epoxy (epoxide) coating system (16,000psi or greater) exhibiting elongation (ASTM D2370) of 5% (minimum) to 10% (maximum) to ensure properties which withstand minor movement, vibration, and access induced mechanical impact.

2. Approved material shall exhibit the following physical properties:
   i. Type hybrid polymer (epoxy/epoxide)
   ii. Solids by Volume ASTM D2697 100%
   iii. Solvent (VOC) ASTM D3960 none
   iv. Adhesion Strength (concrete, dry) CIGMAT CT-2/3 substrate failure
   v. Adhesion Strength (brick, wet) CIGMAT CT-2/3 substrate failure
   vi. Adhesion Strength (steel) ASTM D4541 1,500+ psi
   vii. Water Absorption ASTM D1653 < 0.1 g/sq.m.
   viii. Acid Exposure (pH 1, H2SO4) CIGMAT CT-1 passed
   ix. Tensile Strength ASTM D638 5,500+ psi
   x. Flexural Modulus ASTM D790 500,000+ psi
   xi. Flexural Strength ASTM D790 4,000+ psi
   xii. Compressive Strength ASTM D695 16,000+ psi
   xiii. Elongation ASTM D2370 4-6%
   xiv. Complete Cure 18 hours (77F)

3. Specified material(s): Epoxytec CPP (#RC3) by Epoxytec International, Inc

PART 3 – EXECUTION

3.01 GENERAL

A. When freezing temperatures are expected in the area, the Contractor shall take measures to keep applied materials warm and provide the required heat in the manhole before repair work is started and the 24-hour period following application.

B. Do not apply materials to frozen surfaces or if freezing is expected substrate within 24-hour after application.

C. The invert shall be covered during construction operations to prevent loose materials from collecting in the pipe invert.

D. Bypassing and/or blocking of the flow in the manholes shall be done only with prior approval of the City.

E. It shall be the contractor’s responsibility to provide traffic control as required by the particular location and/or jurisdiction.

3.02 INSPECTION
A. Applicator shall take appropriate action to comply with all local, state and federal regulations including those set forth by OSHA, EPA, the Owner and any other applicable authorities.

B. Prior to conducting any work, perform inspection of structure to determine need for protection against hazardous gases or oxygen depleted atmosphere and the need for flow control or flow Diversion.

3.03 CLEANING AND SURFACE PREPARATION

A. Excessive debris, sediment, root intrusion or other foreign materials which may impact the effectiveness of the surface preparation process shall be removed prior to the commencement thereof.

B. Offset structural components, lids, covers, frames, etc. shall be repaired, replaced, or reset prior to the commencement of surface preparation.

C. Oils, grease, incompatible existing linings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants which may affect the performance and adhesion of the lining to the substrate shall be removed in accordance with SSPC-SP 1 – Solvent Cleaning.

D. Choice of surface preparation method(s) should be based upon the condition of the structure and concrete or masonry surface, potential contaminants present, access to perform work, and the required cleanliness and profile of the prepared surface to receive the repair and/or lining product(s).

E. Surface preparation method, or combination of methods, that may be used include high-pressure water cleaning, water jetting, abrasive blasting, shotblasting, grinding, scarifying, detergent water cleaning, hot water cleaning and others as referenced in industry accepted standards such as:

1. SSPC SP-13/NACE No. 6 Surface Preparation of Concrete.

2. ASTM D-4258 Standard Practice for Surface Cleaning Concrete for Lining and ASTM-D-4259 Standard Practice for Abrading Concrete.

3. ICRI Technical Guideline No. 03732 Selecting and Specifying Concrete Surface Preparation for Sealers, Linings, and Polymer Overlays.

4. NACE/SSPC Standards for the surface preparation of steel.

F. Whichever method(s) are used, they shall be performed in a manner that provides a uniform, sound, clean, and neutralized surface suitable for the specified lining product(s).

1. Resulting surface profile of the prepared concrete substrate shall be (as described in ICRI Technical Guideline No. 03732):
a. For application of cementitious materials; at least a CSP2
b. For application of lining products: at least a CSP2.

2. Concrete and/or mortar damaged by corrosion, chemical attack or other means of degradation shall be removed so that sound substrate remains,
   a. In conditions where severe chemical/microbiological attack has occurred the prepared substrate shall exhibit a pH of 8-12. Additional cleaning and/or contaminated substrate removal may be required to achieve the specified pH level.

3. Steel surfaces to be coated shall be abrasive blast cleaned.
   a. Blast air shall be free of oil and water.
   b. Abrasive shall be as required to produce the specified level of cleanliness and profile in an efficient and uniform manner. Abrasive shall not be recycled.
   c. Abrasive blasting shall not be performed when the air or steel temperature is below 40 deg F, when the relative humidity exceeds 80%, or when the steel is less than 5 deg F warmer than the dew point. The Contractor will provide dehumidification, and/or temperature control as necessary to meet these conditions.
   d. Blast cleaning shall be in accordance with SSPC-SP 5, White Metal Blast Cleaning for immersion service of the coated areas. Blast cleaning for other surfaces shall be in accordance with SSPC-SP 10, Near White Blast Cleaning. Anchor profile shall be 2.5-5.0 mils and relative to the lining thickness specified.
   e. Alternatively, surfaces to be recoated may be cleaned according to SSPC-SP 12/NACE No. 5 Surface Preparation and Cleaning of Metals by Water jetting prior to Relining.
      1. At the time of the relining, the amount of flash rust shall be no greater than “No Flash Rust” as defined in SSPC-SP 12.

3.04 REPAIR AND RESURFACING PRODUCTS

A. Prior to the application of the lining product repairs shall be completed to ensure the following:
   1. All inflow and infiltration shall be eliminated by use of appropriate repair material.
   2. All repairs to joints, pipe seals, steps, mechanical penetrations, benches, inverts, pipes or other appurtenances to be coated shall be completed and repaired surfaces prepared according to this section.
      a. Benches or other horizontal surfaces shall have adequate slope (1” rise per lineal foot minimum) to minimize the retention of debris following surcharge.
b. Inverts or flow channels shall be smooth without lips, rough edges or other features which may cause debris to collect; contoured to minimize turbulent flow; and be sloped to promote adequate flow from the inlet(s) to the outlet pipe.

c. All joints, pipe seals, steps or other penetrations shall be sealed against inflow, infiltration and exfiltration and be adequately filled, smoothed and contoured to promote monolithic lining application.

B. Areas where reinforcing steel has been exposed shall be repaired in accordance with the Project Engineer’s recommendations prior to lining with the lining product specified or other approved zinc based primer as specified by the lining product manufacturer.

C. External soil/fill voids shall be remediated and/or stabilized by replacement or injection of stabilizing grout as determined appropriate by the engineer.

E. External Repair products shall be used to fill voids, bugholes, and other surface defects which may affect the performance or adhesion of the lining product.

F. External Repair products shall be used to repair, smooth or rebuild surfaces with rough profiles to provide a concrete or masonry substrate suitable for the lining product(s) to be applied. These products shall be installed to ½” minimum thickness or as recommended within manufacturers published guidelines. Should structural rebuild be necessary, these products shall be installed to a thickness as specified by the Project Engineer.

G. The materials shall be trowel-applied utilizing proper equipment on to specified surfaces. The material thickness is determined based on filling and patching voids to bridge sharps peaks and irregularities resulting from deteriorated concrete, spalls, cracks, bugholes in order to achieve an acceptable profile for the structural epoxy system to be applied.

H. Repair products shall be used to remediate all active inflow, infiltration, and/or external soil/fill voids.

I. All repair products shall be handled, mixed, installed, and cured in accordance with manufacturer guidelines.

J. All repaired or resurfaced substrates shall be inspected for cleanliness and suitability to receive the lining product.

K. Execution

1. When leaks are not readily identifiable upon cleaning operation use blower to dry interior for positive identification of leaks and weep areas.

2. Infiltration control material shall be a rapid product specifically formulated for leak control to stop minor water infiltration and making repairs in concrete and brick structures, mixed and applied according to manufacturer’s recommendations.

3. Hydraulic cement.
i. The work consists of hand applying a dry quick-setting cementitious mix designed to instantly stop running water or seepage in all types of concrete and concrete structures. The certified applicator shall apply material in accordance with manufacturers’ recommendations.

ii. The area to be repaired must be clean and free of all debris.

iii. Proper applications should not require any special mixing of product or special curing requirements after application.

4. Chemical grout.

i. While being injected, the chemical sealant must be able to react/perform in the presence of water.

ii. The cured material must withstand submergence in water, without degradation.

iii. The resultant sealant (grout) formation must be impervious to water penetration.

iv. The final sealant must withstand freeze-thaw and wet-dry cycles without causing adverse changes to the sealant.

v. The final sealant formation must not be biodegradable.

vi. Chemical grouting material final cure must not exceed one (1) hour.

vii. Chemical grouting material must be compatible to other specified top and repair coating material and the final topcoat structural epoxy coating. Any grouting material used, must be approved by the structural epoxy coating manufacturer.

viii. All excess chemical grout must be removed from the surface via mechanical grinding means and top patched with Hydraulic cement.

3.05 APPLICATION OF LINING PRODUCTS

A. Application procedures shall conform to the recommendations of the structural epoxy coating manufacturer, including material handling, mixing, safety, and application equipment.

B. Top coating or additional coats of the structural epoxy coating should occur as soon as the prior coat becomes tack free, but no later than the recoat window for the specified material(s). Additional surface preparation procedures will be required if this recoat window is exceeded.

C. Follow all published and manufacturer recommended application methods.

D. If spraying, the spray equipment shall be specifically designed to accurately ratio and apply the specified structural epoxy coating materials and shall be regularly maintained and in proper working order. If spraying, refer to the manufacturers’ spray instruction prior to procuring material and applying any material to receive proper material and application considerations and direction.

E. If trowel-applied, properly mix and apply materials to all specified surfaces by hand-applied methods with trowel or trowel-type tools.

i. Combine 2 gallons kits, Part B to Part A of the packaged wet mix with a low-speed drill mixer for three (3) to five (5) minutes until a homogenous blend is
achieved. No additional sand or aggregates need to be added. The working time is approximately 25 minutes at ambient temperature.

ii. Trowel the surface or section: for finishing, allow product to start initial gel (circa 30 minutes at 77°F) and rub down with water to create a smooth, uniform finish. Thickness may be verified at any point with a wet gage or measuring probe.

F. Allow 24 hours to cure.

3.06 TESTING AND INSPECTION

A. Lining system thickness shall be inspected to ensure compliance with the specifications herein.

1. During application a wet film thickness gauge, meeting ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Linings by Notched Gages, shall be used. Measurements shall be taken, documented, and attested to by Contractor for submission to Owner.

2. After the lining product(s) have cured in accordance with manufacturer recommendations, lining system thickness may be measured according to SSPC-PA 9 - Measurement of Dry Lining Thickness on Cementitious Substrates Using Ultrasonic Gages.

B. High voltage holiday detection for lining systems installed in corrosive environments, when it can be safely and effectively employed, shall be performed to ensure monolithic protection of the substrate. After the lining product(s) have cured in accordance with manufacturer recommendations, all surfaces shall be inspected for holidays in accordance with NACE RPO 188-99 Discontinuity (Holiday) Testing of New Protective Linings on Conductive Substrates or ASTM D4787 Standard Practice for Continuity Verification of Liquid or Sheet Coatings Applied to Concrete Substrates. All detected holidays shall be marked and repaired according to the lining product(s) manufacturer’s recommendations.

1. Test voltage shall be a minimum of 100 volts per mil of lining system thickness.

2. Detection of a known or induced holiday in the lining product shall be confirmed to ensure proper operation of the test unit.

3. All areas repaired shall be retested following cure of the repair material(s).

4. In instances where high voltage holiday detection is not feasible a close visual inspection shall be conducted and all possible holidays shall be marked and repaired as described above.

5. Documentation of areas tested, equipment employed, results, and repairs made shall be submitted to the Owner/Engineer by Contractor.

C. Adhesion of the lining system to the substrate shall be confirmed once every 1000 square feet of coated area. After the lining product(s) have cured in accordance with manufacturer recommendations, testing shall be conducted in accordance with ASTM
D7234 Pull-Off Adhesion Strength of Linings on Concrete Using Portable Pull-Off Adhesion Testers. Owner’s representative shall select the manholes or areas to be tested.

1. For each test manhole a minimum of three 20 mm dollies shall be affixed to the coated surface; one at the cone area, one at the mid-section and one near the bottom of the structure.

2. For larger structures a minimum of three 20 mm dollies shall be affixed to the coated surface at random locations within each 1000 square foot area or as otherwise agreed upon.

3. The adhesive used to attach the dollies to the lining shall be rapid setting with tensile strengths in excess of at least twice the anticipated failure point (generally at least 1000 psi) and permitted to cure in accordance with manufacturer recommendations. The lining and dollies shall be adequately cleaned and prepared to receive the adhesive. Failure of the dolly adhesive shall be deemed a non-test and require retesting.

4. Prior to performing the pull test, the lining shall be scored to the substrate, or within 10 mils of the substrate surface, by mechanical means without disturbing the dolly or lining system bond within the test area.

5. Two of the three adhesion pulls in each test area shall exceed 200 psi and shall include substrate adhered to the back of the dolly or no visual signs of the lining product in the test hole. Pulls tests with results between 150 and 200 psi may be acceptable if more than 50 percent of the substrate in the test area is adhered to the dolly.

6. Should a structure, or area, fail to achieve two successful pulls as described above, additional testing shall be performed at the discretion of the Owner or Project Engineer. Any areas detected to have inadequate bond strength shall be evaluated by the Project Engineer. Further bond tests may be performed in that area to determine the extent of potentially deficient bonded area and repairs shall be made by Contractor.

7. All adhesion testing shall be performed by qualified personnel using calibrated equipment as specified by the applicable ASTM standard(s).

8. All adhesion testing shall be documented and submitted in a consistent format detailing location, test values, description of the failure point/mode, scoring method employed, adhesive used, cure time of lining and adhesive and other data as deemed necessary by the owner/engineer.

9. All adhesion test locations shall be repaired by the Contractor at no cost to the Owner.

D. Visual inspection shall be made by the Project Engineer and/or Inspector. Any deficiencies in the finished lining affecting the performance of the lining system or the
operational functionality of the structure shall be marked and repaired according to the recommendations of the lining product(s) manufacturer.

E. All material installed must be holiday tested for pinholes. Either a coatings representative shall approve the test or an onsite inspector employed by the owner.

F. The municipal sewer system may be returned to full operational service as soon as the final inspection has taken place and all lining materials have been adequately cured according to the lining product(s) manufacturer’s recommendations.

G. Provide final written report to Owner/Engineer detailing the location, date of report, description of repair and description of lining.

END OF SECTION
SECTION 09915
GREEN MONSTER STRUCTURAL SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work shall include the furnishing and installation of an interior protective coating system including all necessary materials, equipment and tools as required for a complete installation.

B. General Design: The completed system shall provide a waterproof, corrosion resistant liner to prevent any deterioration of concrete surfaces from hydrogen sulfide and other corrosive gases/acids produced by wastewater and to prevent infiltration. To ensure total unit responsibility, all materials and installation thereof shall be approved and furnished by, and coordinated with, GML Coatings LLC.

C. Application of the Green Monster Structural System shall be in strict accordance with the manufacturer’s recommendations.

D. Contractor shall adhere to this lining system specification or Specification 09913 - Epoxytech Concrete Rehabilitation and Structural Lining.

1.02 REFERENCES

A. The latest codes and standards referenced herein and belonging to the following organizations shall be followed:

1. The America Society for Testing and Materials (ASTM)
2. National Association of Corrosion Engineers, NACE International (NACE)
3. The Society for Protective Coatings (SSPC)
4. International Concrete Repair Institute (ICRI)
5. National Association of Sewer Service Companies (NASSCO)
6. EPA Environmental Technology Verification Program (EPA ETV)
7. American Association of State Highway and Transportation Officials (AASHTO)
8. Occupational Safety and Health Administration (OSHA)
1.03 QUALITY ASSURANCE

A. Qualifications:

1. The manufacturer and/or applicator of the total lining system of wastewater containment structures shall be a company that specializes in the design, manufacture or installation of corrosion protection systems for wetwells and manholes. Applicator shall be completely trained in leak repair, surface preparation and corrosion materials application on manholes and lift station wet wells. Materials/products shall be suitable for installation in a severe hydrogen sulfide environment without any deterioration to the coating.

2. The applicator shall be trained and certified by the manufacturer for the handling, mixing, application and inspection of the lining system as described herein. Applicator shall have a minimum five (5) years of experience and five (5) successful projects documented by manufacturer.

3. To ensure total unit responsibility, all materials and installation thereof shall be furnished and coordinated with/by one supplier/applicator who turnkeys the work and assumes full responsibility for the entire operation. Manufacturer must have minimum ten (10) years of manufacturing experience and applicator must be certified for minimum of five (5) years.

B. Manufacturers: The protective concrete coating shall be:

1. GML Coatings, LLC

C. Warranty: The coating manufacturer shall warrant the lining against failure for a period of 10 years from date of project completion. "Failure" will be deemed to have occurred if the protective lining fails to (a) prevent the internal damage or corrosion of the underlying structure due to bacteriological, chemical, gaseous, erosive and abrasive attack, including internal damage or corrosion incurred from vibration, stress cracking, (b) protect the substrate and environment from contamination by wastewater, (c) seal and protect from influent, or (d) product does not meet the physical properties or is defective in manufacture. If any such failure occurs within 10 years of initial completion of work on a structure, the damage to the structure and any other work caused by such defects shall be repaired to restore the coating at no cost to the Owner within 60 days after written notification of the failure.

1.04 SUBMITTALS

A. Shop drawings: Submit shop drawings in accordance with Division 0 and 1. Shop drawings shall include all information required to demonstrate full compliance with this Specification. The following shall be submitted as a minimum.

1. Technical data sheet on each product used/lining properties.

2. Material Safety Data Sheet (MSDS) for each product used.
3. Copies of independent testing performed on the lining product indicating the product meets the requirements as specified herein.

4. ASTM References and testing results.

5. CIGMAT evaluation.

6. Descriptive literature, bulletins and or catalogs of materials.

7. Work procedures including flow diversion plan, method of repair, etc.

8. Material and method for repair of leaks or cracks in manholes.

9. List of reference projects (minimum five (5) in last five years).

10. Certification of applicator.

11. Applicators reference of similar projects (minimum five (5) in last five years).

12. Application procedures, including repair procedures.

13. Design details for any ancillary systems and equipment to be used on site for surface preparation, application and testing. Confined space entry, flow diversion and/or bypass plans shall be presented by Contractor to Owner as necessary to perform the specified work.


15. Final installation report on completed project.

16. Warranty

1.05 DELIVERY, HANDLING, AND STORAGE

A. Deliver all materials to the job site in original, unopened packages and containers bearing manufacturer's name and label.

1. Provide labels on each container with the following information:

   a. Name or title of material.

   b. Fed. Spec. number if applicable.

   c. Manufacturer's stock number, date of manufacture and expiration date (shelf life).
d. Manufacturer's formula or specification number.

e. Manufacturer's batch number.

f. Manufacturer's name.

g. Generic type.

h. Contents by volume, for major pigment and vehicle constituents.

i. Application instructions: thinning, ambient conditions, etc.

2. Containers shall be clearly marked to indicate any hazards connected with the use of the paint and steps which should be taken to prevent injury to those handling the product.

B. All containers shall be handled and stored in such a manner as to prevent damage or loss of labels or containers.

C. All supplies shall be stored and maintained by the Contractor in accordance with manufacturer’s recommendations. Materials shall not be exposed to adverse conditions prior to the work. All materials shall be kept in secured area and away from general public access. The Contractor shall review and maintain all Material Safety Data Sheets (MSDS), product labeling, and technical literature at the project site.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials used within the lining system shall be highly resistant to hydrogen sulfide in the wastewater environment. Manufacturer of corrosion protection products shall have long proven experience in the production of the lining products utilized and shall have a satisfactory installation record.

B. Contractor is to maintain strict adherence to the protective linings manufacturer's recommendations with regard to proper surface preparation and compatibility with existing linings.

C. Thoroughly clean and prepare existing products/surfaces to effect a seal with and promote the adhesion of the lining product(s) on accordance with Part 3 – Execution, of this Specification.

D. Thoroughly Use approved equipment designed, recommended and/or manufactured by the material supplier specifically for the application of all materials in the structures.

E. Applicator shall examine the surface of the structure to receive the protective coating system. Notify the Owner in writing if the surface is not acceptable for rehabilitation.
F. Applicator shall initiate and enforce quality control procedures consistent with applicable ASTM, NACE, and SSPC standards and the structural epoxy coating manufacturer's recommendations.

G. Products are to be kept dry, in a controlled environment, protected from weather and stored under cover.

2.02 MATERIALS AND EQUIPMENT

A. Waterblasting equipment shall be no less than 4000 psi and sandblasting equipment shall deliver enough pressure to remove all deteriorated concrete in the structure providing a substrate free of loose material.

B. GML 30/60 which is high early strength calcium aluminate blend cementitious mortar shall be used to structurally rebuild substrates also providing an esthetically smooth brush finished surface.

C. All spray equipment shall be plural component manufactured by Graco and be capable of monitoring pressures and temperatures of the coating ensuring a quality application. Green Monster Structural shall only be applied with a minimum output pressure of 2,200 psi.

D. All products used in the lining system shall be approved and installed by only GML Coatings trained personnel. View product specifications below:

E. GML 30 and GML 60 Cementitious Mortar Specifications

TYPICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Strength, PSI</td>
<td>ASTM C928</td>
<td>6500</td>
</tr>
<tr>
<td>Freeze Thaw Resistance</td>
<td>ASTM C666</td>
<td>1% loss</td>
</tr>
<tr>
<td>Shear Bond Strength, PSI</td>
<td>ASTM C882</td>
<td>1650</td>
</tr>
<tr>
<td>Flexural Strength, PSI</td>
<td>ASTM C348</td>
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</table>

F. Primer Specifications

TYPICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensil Strength, PSI</td>
<td>ASTM C638</td>
<td>4500</td>
</tr>
<tr>
<td>Elongation, %</td>
<td>ASTM C638</td>
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</tr>
<tr>
<td>Compressive Strength, Neat</td>
<td>ASTM D695</td>
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<tr>
<td>Shrinkage</td>
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<tr>
<td>Bond Strength, PSI</td>
<td>ASTM D54541</td>
<td>1200</td>
</tr>
<tr>
<td>Hardness, Shore D</td>
<td>ASTM D2240</td>
<td>1200</td>
</tr>
<tr>
<td>Color</td>
<td></td>
<td>amber</td>
</tr>
<tr>
<td>Viscosity, CPS, Neat</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Final Cure @ 72 °F</td>
<td></td>
<td>20 min.</td>
</tr>
</tbody>
</table>
G. Primer shall have an extremely low viscosity allowing it to penetrate deep into the pours of the brushed concrete for permanent bonding.

H. Shall only be spray-applied and fully cured in 20 minutes or less without experiencing any shrinkage.

I. Concrete substrate shall be heated with indirect heat and surface temperature decreasing during the application of Green Monster Primer.

J. Green Monster Structural shall display excellent chemical resistance, thermal stability, and maintain flexible characteristics preventing cracking which may allow sewer gases to attack the substrate.

**TYPICAL PHYSICAL PROPERTIES**

<table>
<thead>
<tr>
<th>Property</th>
<th>Specification</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength, PSI</td>
<td>ASTM D412</td>
<td>4500</td>
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<tr>
<td>Elongation, %</td>
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<tr>
<td>Flexural Modulus</td>
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<td>Impact</td>
<td>ASTM G14-04</td>
<td>52 in/lb</td>
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<tr>
<td>Hardness, Shore D</td>
<td>ASTM D2240</td>
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<td>Flexibility, 1/8” Mandrel</td>
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<td>Flash Point, °F</td>
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<td>Taber Abrasion, Mg Loss</td>
<td>ASTM D4060</td>
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<td>CS 17 Wheels</td>
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<tr>
<td>A-Side Hose Temperature, °F</td>
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</tr>
<tr>
<td>B-Side Hose Temperature, °F</td>
<td></td>
<td>155</td>
</tr>
<tr>
<td>Block Temperature, °F</td>
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**ADHESION RESULTS: ASTM D4541 PATTI TESTER**

<table>
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<th>Surface</th>
<th>Adhesion, psi</th>
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<tbody>
<tr>
<td>Concrete</td>
<td>600</td>
</tr>
<tr>
<td>- Epoxy Glue Failure</td>
<td></td>
</tr>
<tr>
<td>Carbon Steel (Direct)</td>
<td>900</td>
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**TYPICAL PROCESSING PROPERTIES**

<table>
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<tr>
<th>Property</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gel Time, Seconds</td>
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</tr>
<tr>
<td>Tack Free Time, Seconds</td>
<td>20</td>
</tr>
<tr>
<td>Volume Ratio</td>
<td>1:1</td>
</tr>
</tbody>
</table>

K. Concrete restoration shall be between .25 and 3 inches whichever is required to return the deteriorated substrate to the original thickness. In the case of minor deterioration and spalling, an approved cementitious mortar shall be used as a resurfacer. After, the proper concrete restoration has been achieved; Green Monster Structural shall be applied at 250 mils. Product shall be Green Monster Structural by GML Coatings, LLC. or pre-approved equal.
PART 3 – EXECUTION

3.01 GENERAL

A. When freezing temperatures are expected in the area, the Contractor shall take measures to keep applied materials warm and provide the required heat in the manhole before repair work is started and the 24-hour period following application.

B. Do not apply materials to frozen surfaces or if freezing is expected substrate within 24 hours after application.

C. The invert shall be covered during construction operations to prevent loose materials from collecting in the pipe invert.

D. Bypassing and/or blocking of the flow in the manholes shall be done only with prior approval of the City.

E. It shall be the contractor’s responsibility to provide traffic control as required by the particular location and/or jurisdiction.

3.02 INSPECTION

A. Applicator shall take appropriate action to comply with all local, state and federal regulations including those set forth by OSHA, EPA, the Owner and any other applicable authorities.

B. Prior to conducting any work, perform inspection of structure to determine need for protection against hazardous gases or oxygen depleted atmosphere and the need for flow control or flow Diversion.

3.03 CLEANING AND SURFACE PREPARATION

A. Preparation will begin by sandblasting the entire substrate preparing the surface so that it is structurally intact, clean of all corrosion, and provided with a minimum of a 5-mil profile.

B. After sandblasting is completed, the surface area will be waterblasted at 4000 psi ridding the substrate of all dust, sand, and loose debris.

C. All solids and water are to be removed from the work site along with other debris.

D. Active infiltration will be injection grouted with SewerCrete™ LeakStop supplied by GML Coatings, LLC.

E. GML 30/60, a cementitious calcium aluminate mortar blend will be applied to the entire substrate to be coated, in most cases the entire surface will be structurally built up .25 to 3 inches thick providing a smooth brushed finish. Thicker applications may apply where there is more deterioration of the existing structure.
F. Work area is to be completely dried using indirect heat lowering the moisture content of the substrate.

G. Green Monster Primer is to be applied to the dry and cooling substrate providing maximum adhesion and sealing the porous concrete.

H. Green Monster Structural shall be spray applied at a 250-mil thickness. This is to be spray applied to the ring of the structure down to the coating of the bench in manholes and the entire bottom of other structures.

3.04 REPAIR AND RESURFACING PRODUCTS

A. Prior to the application of the lining product repairs shall be completed to ensure the following:

1. All inflow and infiltration shall be eliminated by use of appropriate repair material.

2. All repairs to joints, pipe seals, steps, mechanical penetrations, benches, inverts, pipes or other appurtenances to be coated shall be completed and repaired surfaces prepared according to this section.

a. Benches or other horizontal surfaces shall have adequate slope (1” rise per lineal foot minimum) to minimize the retention of debris following surcharge.

b. Inverts or flow channels shall be smooth without lips, rough edges or other features which may cause debris to collect; contoured to minimize turbulent flow; and be sloped to promote adequate flow from the inlet(s) to the outlet pipe.

c. All joints, pipe seals, steps or other penetrations shall be sealed against inflow, infiltration and exfiltration and be adequately filled, smoothed and contoured to promote monolithic lining application.

B. Areas where reinforcing steel has been exposed shall be repaired in accordance with the Project Engineer’s recommendations prior to lining with the lining product specified or other approved zinc-based primer as specified by the lining product manufacturer.

C. External soil/fill voids shall be remediated and/or stabilized by replacement or injection of stabilizing grout as determined appropriate by the engineer.

E. External Repair products shall be used to fill voids, bugholes, and other surface defects which may affect the performance or adhesion of the lining product.

F. External Repair products shall be used to repair, smooth or rebuild surfaces with rough profiles to provide a concrete or masonry substrate suitable for the lining product(s) to be applied. These products shall be installed to ½” minimum thickness or as recommended
within manufacturers published guidelines. Should structural rebuild be necessary, these products shall be installed to a thickness as specified by the Project Engineer.

G. The materials shall be trowel-applied utilizing proper equipment on to specified surfaces. The material thickness is determined based on filling and patching voids to bridge sharps peaks and irregularities resulting from deteriorated concrete, spalls, cracks, bugholes in order to achieve an acceptable profile for the structural epoxy system to be applied.

H. Repair products shall be used to remediate all active inflow, infiltration, and/or external soil/fill voids.

I. All repair products shall be handled, mixed, installed, and cured in accordance with manufacturer guidelines.

J. All repaired or resurfaced substrates shall be inspected for cleanliness and suitability to receive the lining product.

K. Repair Execution

1. When leaks are not readily identifiable upon cleaning operation use blower to dry interior for positive identification of leaks and weep areas.

2. Infiltration control material shall be a rapid product specifically formulated for leak control to stop minor water infiltration and making repairs in concrete and brick structures, mixed and applied according to manufacturer’s recommendations.

3. Hydraulic cement.
   i. The work consists of hand applying a dry quick-setting cementitious mix designed to instantly stop running water or seepage in all types of concrete and concrete structures. The certified applicator shall apply material in accordance with manufacturers’ recommendations.
   ii. The area to be repaired must be clean and free of all debris.
   iii. Proper applications should not require any special mixing of product or special curing requirements after application.

4. Chemical grout.
   i. While being injected, the chemical sealant must be able to react/perform in the presence of water.
   ii. The cured material must withstand submergence in water, without degradation.
   iii. The resultant sealant (grout) formation must be impervious to water penetration.
   iv. The final sealant must withstand freeze-thaw and wet-dry cycles without causing adverse changes to the sealant.
   v. The final sealant formation must not be biodegradable.
   vi. Chemical grouting material final cure must not exceed one (1) hour.
   vii. Chemical grouting material must be compatible to other specified top and repair coating material and the final topcoat structural epoxy coating. Any
grouting material used, must be approved by the structural epoxy coating manufacturer.

viii. All excess chemical grout must be removed from the surface via mechanical grinding means and top patched with Hydraulic cement.

I. All defects identified during inspection such as pinholes, thin film millage, etc. shall be repaired with same material and to same thickness as required of original installation.

3.05 APPLICATION OF LINING PRODUCTS

A. Application procedures shall conform to the recommendations of the structural epoxy coating manufacturer, including material handling, mixing, safety, and application equipment.

B. Top coating or additional coats of the structural epoxy coating should occur as soon as the prior coat becomes tack free, but no later than the recoat window for the specified material(s). Additional surface preparation procedures will be required if this recoat window is exceeded.

C. Follow all published and manufacturer recommended application methods.

D. If spraying, the spray equipment shall be specifically designed to accurately ratio and apply the specified structural epoxy coating materials and shall be regularly maintained and in proper working order. If spraying, refer to the manufacturers’ spray instruction prior to procuring material and applying any material to receive proper material and application considerations and direction.

E. If trowel-applied, properly mix and apply materials to all specified surfaces by hand-applied methods with trowel or trowel-type tools.
   i. Combine 2 gallons kits, Part B to Part A of the packaged wet mix with a low-speed drill mixer for three (3) to five (5) minutes until a homogenous blend is achieved. No additional sand or aggregates need to be added. The working time is approximately 25 minutes at ambient temperature.
   ii. Trowel the surface or section: for finishing, allow product to start initial gel (circa 30 minutes at 77F) and rub down with water to create a smooth, uniform finish. Thickness may be verified at any point with a wet gage or measuring probe.

F. Allow 24 hours to cure.

G. The limits of the corrosion protection system shall be all exposed concrete surfaces including walls, pipe penetrations, risers, etc., unless otherwise approved by Engineer.

H. All material installed must be holiday tested for pinholes. Either a coatings representative shall approve the test or an onsite inspector employed by the owner.
3.06 TESTING AND INSPECTION

A. Lining system thickness shall be inspected to ensure compliance with the specifications herein.

1. During application a wet film thickness gauge, meeting ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Linings by Notched Gages, shall be used. Measurements shall be taken, documented, and attested to by Contractor for submission to Owner.

2. After the lining product(s) have cured in accordance with manufacturer recommendations, lining system thickness may be measured according to SSPC-PA 9 - Measurement of Dry Lining Thickness on Cementitious Substrates Using Ultrasonic Gages.

B. High voltage holiday detection for lining systems installed in corrosive environments, when it can be safely and effectively employed, shall be performed to ensure monolithic protection of the substrate. After the lining product(s) have cured in accordance with manufacturer recommendations, all surfaces shall be inspected for holidays in accordance with NACE RPO 188-99 Discontinuity (Holiday) Testing of New Protective Linings on Conductive Substrates or ASTM D4787 Standard Practice for Continuity Verification of Liquid or Sheet Coatings Applied to Concrete Substrates. All detected holidays shall be marked and repaired according to the lining product(s) manufacturer’s recommendations.

1. Test voltage shall be a minimum of 100 volts per mil of lining system thickness.

2. Detection of a known or induced holiday in the lining product shall be confirmed to ensure proper operation of the test unit.

3. All areas repaired shall be retested following cure of the repair material(s).

4. In instances where high voltage holiday detection is not feasible a close visual inspection shall be conducted and all possible holidays shall be marked and repaired as described above.

5. Documentation of areas tested, equipment employed, results, and repairs made shall be submitted to the Owner/Engineer by Contractor.

C. Adhesion of the lining system to the substrate shall be confirmed once every 1000 square feet of coated area. After the lining product(s) have cured in accordance with manufacturer recommendations, testing shall be conducted in accordance with ASTM D7234 Pull-Off Adhesion Strength of Linings on Concrete Using Portable Pull-Off Adhesion Testers. Owner’s representative shall select the manholes or areas to be tested.

1. For each test manhole a minimum of three 20 mm dollies shall be affixed to the coated surface; one at the cone area, one at the mid-section and one near the bottom of the structure.
2. For larger structures a minimum of three 20 mm dollies shall be affixed to the coated surface at random locations within each 1000 square foot area or as otherwise agreed upon.

3. The adhesive used to attach the dollies to the lining shall be rapid setting with tensile strengths in excess of at least twice the anticipated failure point (generally at least 1000 psi) and permitted to cure in accordance with manufacturer recommendations. The lining and dollies shall be adequately cleaned and prepared to receive the adhesive. Failure of the dolly adhesive shall be deemed a non-test and require retesting.

4. Prior to performing the pull test, the lining shall be scored to the substrate, or within 10 mils of the substrate surface, by mechanical means without disturbing the dolly or lining system bond within the test area.

5. Two of the three adhesion pulls in each test area shall exceed 200 psi and shall include substrate adhered to the back of the dolly or no visual signs of the lining product in the test hole. Pulls tests with results between 150 and 200 psi may be acceptable if more than 50 percent of the substrate in the test area is adhered to the dolly.

6. Should a structure, or area, fail to achieve two successful pulls as described above, additional testing shall be performed at the discretion of the Owner or Project Engineer. Any areas detected to have inadequate bond strength shall be evaluated by the Project Engineer. Further bond tests may be performed in that area to determine the extent of potentially deficient bonded area and repairs shall be made by Contractor.

7. All adhesion testing shall be performed by qualified personnel using calibrated equipment as specified by the applicable ASTM standard(s).

8. All adhesion testing shall be documented and submitted in a consistent format detailing location, test values, description of the failure point/mode, scoring method employed, adhesive used, cure time of lining and adhesive and other data as deemed necessary by the owner/engineer.

9. All adhesion test locations shall be repaired by the Contractor at no cost to the Owner.

D. Visual inspection shall be made by the Project Engineer and/or Inspector. Any deficiencies in the finished lining affecting the performance of the lining system or the operational functionality of the structure shall be marked and repaired according to the recommendations of the lining product(s) manufacturer.

E. Final concrete structure corrosion protection system shall be completely free of pinholes or voids. Entire exposed concrete surface shall be protected with corrosion protection system. Liner preparation and thickness shall meet what is stated above.
F. The municipal sewer system may be returned to full operational service as soon as the final inspection has taken place and all lining materials have been adequately cured according to the lining product(s) manufacturer’s recommendations.

G. Provide final written report to Owner/Engineer detailing the location, date of report, description of repair and description of lining.

END OF SECTION
DIVISION 10

(NOT USED)
SECTION 11208

SUBMERSIBLE PUMPS AND APPURTEANCES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: This Section specifies the furnishing, installation, and testing of submersible pumps and associated equipment for the duplex Lift Station No. 5, complete, tested, and ready for operation. The pumps and associated equipment covered under this Section include the following requirements:

1. Two submersible pumps and motors for each duplex pump station.

2. The following accessories and associated equipment are to be provided by the pump supplier for each duplex pump station:

   a. pump control panel
   b. lifting cables and hooks
   c. hatches and frames
   d. electrical cables and cable hangers
   e. level indicators/floats
   f. mounting elbows, adapters, and anchor bolts
   g. seamless guide/slide rails with Type 316 stainless steel upper guide rail brackets
   h. pump base plates

B. Operating Requirements: Pumping equipment provided under this Section shall conform to Table 11208-A "Submersible Pumps Schedule."

1.02 QUALITY ASSURANCE

A. Unit Responsibility: All equipment including but not limited to the pumps, motors, control panel and level sensors, access hatch frames and covers (for wetwell and valve box), pump mounting elbows, guide rails, pump base plates, pump lifting cable, cable holder, and startup service shall be supplied by the pump supplier to insure unit responsibility.

B. Factory Tests: The pump manufacturer shall perform the following tests on each pump before shipment from the factory:

1. Megger the pump for insulation breaks or moisture.

2. Prior to submergence, the pump shall be operated dry and be checked for correct rotation.
3. Pump shall be operated for 30-minutes in a submerged condition.

4. Pump shall be removed from test tank, meggered immediately for moisture, oil plugs removed for checking lower seal, inspection plug removed for checking of upper seal and possible water intrusion of stator housing.

5. A written certified test report giving the above information shall be supplied with each pump at the time of shipment.

6. All ends of pump cables shall be fitted with a rubber shrink fit boot to protect cable prior to electrical installation.

C. The Contractor shall furnish and install equipment from a single manufacturer.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the UCNSB for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01340 "Shop Drawings, Working Drawings, and Samples."

B. Certified pump test performance for:

1. Flow, gpm
2. Total Dynamic Head (TDH), feet
3. NPSHr, feet
4. Input Power and Shaft Power, horsepower
5. Overall Efficiency and Pump Efficiency, %

C. Layout drawings showing installation details with dimensions specific for this application.

D. Shop Drawings for all associated equipment and accessories specified under this Section in accordance with Division 1 in sufficient detail to enable the UCNSB to determine compliance with all stated specification requirements.

E. Operating Instructions: Operating and maintenance data shall be furnished to the UCNSB as provided in the General Conditions and Division 1. The instructions shall be prepared specifically for this installation and shall include all required cut sheets and operating and maintenance instructions for personnel unfamiliar with such equipment.

F. Manufacturer’s Certification

1. After acceptance of pump Shop Drawings, factory performance test data will be submitted for approval on each pumping unit.
2. Tests shall be in accordance with the standards of the Hydraulic Institute including head, capacity, brake horsepower and pump efficiency.

3. A written certified test report shall be supplied with each pump at the time of shipment.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All equipment shall be delivered in suitable packages, cases or crates, and stored or placed as directed by the manufacturer. Each package shall have an identifying mark and a complete list showing contents. Equipment shall not be stored directly upon the ground.

B. All equipment shall be lifted and handled in a manner so as not to damage or deform the equipment in any way and in any special way as instructed by the manufacturer.

C. All parts and equipment shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation. Finished surfaces of all exposed pump openings shall be protected by securely bolted wood planks. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion during periods of storage and installation and shall be satisfactory to the UCNSB up to the time of the final acceptance test.

1.05 WARRANTY

A. Warranty: The pump manufacturer shall warrant the pumps being supplied to the UCNSB against defects in workmanship and materials for a period of 5-years or 10,000-hours under normal use, operation and service. The warranty shall apply to 100% parts and labor for the time specified and shall not be prorated.

PART 2 - PRODUCTS

2.01 GENERAL

A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 MANUFACTURERS

A. The Contractor shall furnish and install motor driven totally submersible sewage pumps and associated equipment as provided by Flygt, Hydromatic, Grundfos, Ebara, or approved equal. Submersible sewage pump manufacturers shall meet the requirements set forth in Table 11208-A.
2.03 MATERIALS

A. All hardware and accessories in the wetwell shall be Type 316 stainless steel.

2.04 PUMPS AND ACCESSORIES

A. General

1. Brass or stainless steel nameplates identifying the name of the manufacturer, voltage, phase, rated horsepower, speed and any other pertinent data shall be attached to each pump.

2. Anchors and Fasteners: All necessary foundation bolts, plates, nuts, and washers shall be furnished by the equipment manufacturer and shall be Type 316 stainless steel.

B. Pump Design: The pumps shall be capable of handling raw unscreened domestic wastewater and passing a minimum 3-inch diameter solid sphere.

C. Casing: The stator casing and oil casing shall be of gray cast iron construction, with all parts coming into contact with sewage protected by a corrosion resistant paint proven to withstand an environment of raw wastewater.

D. Impeller: The impeller shall be constructed of gray cast iron, ASTM A-48, class 30 – 40. All external bolts and nuts shall be Type 316 stainless steel. Each pump shall be provided with a replaceable metallic wear ring system to maintain pump efficiency. Impellers can be of the closed or open type. The closed type can utilize a single or double vane. The open type shall be single or double vane with a self-cleaning, adjustable cast iron wear plate. All impellers shall be dynamically balanced and of non-clog design capable of passing solids, fibrous material, and heavy sludge and constructed with long throughways with no acute turns.

E. Mechanical Seals: Each pump shall be provided with a tandem double mechanical seal running in an oil or air reservoir, composed of two separate lapped face seals, each consisting of one stationary and one rotating tungsten carbide or silicone ring with each pair held in contact by a separate spring, so that the outside pressure assists spring compression in preventing the seal faces from opening. The compression spring shall be protected against exposure to the pumped liquid. Silicone carbide may be used in place of tungsten carbide for the upper and lower seal. The pumped liquid shall be sealed from the oil or air reservoir by one face seal and the oil reservoir from the air filled motor chamber by the other. The seals shall require neither maintenance nor adjustment and shall be easily replaced. Seal shall be held in place by locking ring. Conventional double mechanical seals are not acceptable. Cartridge seals are acceptable.

F. Guide Rails, Lifting Cable, and Discharge Elbow

1. The design shall be such that pumping units will be automatically connected to
the discharge piping when lowered into place on the discharge connection. Pump removal for service or inspection will be by quick disconnect and hoist retrieve. Removal shall not require personnel to enter the wetwell nor shall nuts, bolts or fasteners require removal. Each pump shall be fitted with 6-feet of Type 316 stainless steel, minimum Grade 50, 3/4-inch chain attached to the lifting mechanism and air craft rated 1/4-inch stainless steel cable provided between the cable holder and the chain ("Grip-eye System", or acceptable equal), to permit raising the pump for inspection and removal using a closed chain hook and electric hoist. The lifting bail shall be constructed of Type 316 stainless steel for each pump.

2. A sliding guide bracket shall be an integral part of the pumping unit and the pump casing shall have a machined connecting flange to connect with the cast iron discharge connection, which shall be bolted to the floor of the wetwell with stainless steel anchor bolts and so designed as to receive the pump discharge flange without the need of any bolts or nuts.

3. Sealing of the pumping unit to the discharge connection shall be accomplished by a simple downward motion with the entire weight of the pumping unit guided by two Schedule 40 welded seamless Type 316 stainless steel guide bars which will press it tightly against the discharge connection. All Type 316 seamless tubular stainless steel guides shall be 2-inch diameter for use with pumps up to 25-horsepower. Pumps greater than 25-horsepower shall use 3-inch diameter Type 316 seamless tubular stainless steel guides. No portion of the pump shall bear directly on the floor of the wetwell and no rotary motion of the pump shall be required for sealing. Sealing at the discharge connection shall be metal-to-metal contact of the pump discharge and mating discharge connection.

4. The pump base elbow design shall be interchangeable such that it will provide a watertight connection for any of the specified or otherwise accepted pumps without requiring any special tools, gaskets or adapters. Assembly shall be capable of receiving a standard Flygt pump without special modification to either the pump or existing base elbow.

5. Approved pump manufacturers, if necessary to meet the above specification, shall provide a sliding guide bracket adapter.

6. Pump base elbow shall be bolted to a 1-inch-thick steel pump base plate which is anchored to the wetwell floor at six locations with 6-inch epoxy anchors. Pump base plate shall extend 6-inches beyond the pump volute and base elbow and trimmed to fit as necessary.

G. Pump Motor: All motors shall be built in accordance with the latest NEMA, IEEE, ANSI and AFBMA Standards where applicable. The pump motor shall be housed in an air filled watertight casing and shall have Class H insulated windings which shall be moisture resistant. The motors shall be NEMA Design B rated 155°C maximum. Pump motors shall have cooling characteristics suitable to permit continuous operation in a
totally, partially or non-submerged condition. The pump shall be capable of running continuously in a totally dry non-submerged condition under full load without damage for extended periods. Before final acceptance a field running test demonstrating this ability, with 24-hours of continuous operation under the above conditions, shall be performed for all pumps being supplied as required by the UCNSB. The motor shall be capable of a minimum of 10 starts per hour. Motors 25-horsepower and below shall be rated 230/460-volt, 3-phase and speed shall be nominal 1,750 RPM or less. Motors greater than 25-horsepower shall be 460 volt, 3-phase and speed shall be nominal 1,750 RPM or less. Pump motors shall be non-overloading over the entire published performance curve.

H. Heat and Moisture Sensors: Each motor shall incorporate a minimum of one ambient temperature compensated overheat sensing device. This protective device shall be wired into the pump controls in such a way that if excessive temperature is detected the pump will shut down. This device shall be self-resetting.

I. Cables: Cables shall be designed specifically for submersible pump applications and shall be properly sealed. A type CGB watertight connector with a neoprene gland shall be furnished with each pump to seal the cable entry at the control panel. The pump cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall be comprised of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the entry body containing a strain relief function, separate from the function of sealing the cable. The assembly shall bear against a shoulder in the pump top. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the motor interior from foreign material gaining access through the pump top. Secondary sealing systems utilizing epoxy potting compounds may be used. The manufacturers shall supply a cable cap as part of the spare parts for each pump when this type of sealing system is used. All cables shall be continuous, without splices from the motor to the control panel, unless otherwise approved by the UCNSB. The junction chamber containing the terminal board shall be perfectly leak proof.

J. Special Tools and Spare Parts

1. Special Tools: Provide special tools for normal operation and maintenance in accordance with the Appendix B "Pump Station Start-Up Report" form.

2. Spare Parts: The pump supplier will include at least one set of spare parts with a toolbox as detailed in accordance with Appendix B "Pump Station Start-Up Report" form.

K. Pump Access Hatch and Frame

1. Material: Structural aluminum or Type 316 stainless steel.

2. Design
a. Liveload: 300-pounds per square foot.
b. Regular extruded angle section frame.
c. Hatch cover (diamond pattern) opens 90° (degrees) and locks automatically with stainless steel positive locking arm and release handle. Hatch cover shall be permanently embossed "CONFINED SPACE" and painted lettering shall not be acceptable. Each door shall be equipped with a recessed hasp enclosure.

3. Frame attachments (all Type 316 stainless steel)
   a. Upper guide rail holders
   b. Lift cable holder

4. Hatch hinges: heavy-duty Type 316 stainless steel hinges with tamper proof fasteners.

5. Accessories
   a. Lifting handle: Type 316 stainless steel.

6. Finish: Mill finish with bituminous coating applied to exterior of frame.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All materials and equipment shall be installed as shown on the Drawings and as recommended by the manufacturers.

B. Additional items of construction, such as concrete work, interior grouting, piping, vents, valves, controls, and other items necessary for the complete installation of the system shall conform to specific details on the Drawings and shall be constructed of materials conforming to the applicable portions of these Specifications.

3.02 INSPECTION, TESTING AND CERTIFICATION

A. General:

1. The Engineer shall have the right to inspect, test or witness tests of all materials or equipment to be furnished under these Specifications, prior to their shipment from the point of manufacture.

2. The Engineer shall be notified in writing prior to initial shipment, in ample time so that arrangements can be made for inspection by the Engineer.

3. The Engineer or his representative shall be furnished all facilities, including labor, and shall be allowed proper time for inspection and testing of material
and equipment.

4. Materials and equipment shall be tested or inspected as required by the Engineer, and the cost of such work shall be included in the cost of the equipment. The Contractor shall anticipate that delays may result because of the necessity of inspection, testing and accepting materials and equipment before their use is approved.

5. The services of a factory representative shall be furnished for one (1) day and he shall have complete knowledge of proper operation and maintenance to inspect the final installation and supervise the test run of the equipment. With the permission of the Owner these services may be combined with those provided under Paragraph 1.05 of this Section.

6. Field tests shall not be conducted until such time as the entire installation is complete and ready for testing.

B. Pumps:

1. AFTER ALL pumps have been completely installed, and working under the direction of the manufacturer, conduct in the presence of the Engineer, such tests as are necessary to indicate that pumps conform to the Specifications. Field tests shall include all pumps included under this Section. Supply all electric power, water or wastewater, labor, equipment and incidentals required to complete the field tests.

2. If the pump performance does not meet the Specifications, corrective measures shall be taken or pumps SHALL BE REMOVED AND REPLACED WITH PUMPS WHICH SATISFY THE CONDITIONS SPECIFIED. A 24-HOUR OPERATING PERIOD OF THE PUMPS WILL BE REQUIRED BEFORE ACCEPTANCE. DURING THIS 24-HOUR OPERATING PERIOD, THE CONTRACTOR SHALL SUPPLY ALL POWER NECESSARY.

3.03 FIELD TESTING

A. Upon completion of all the mechanical work, the Contractor shall conduct testing as specified herein to demonstrate that the equipment performs in accordance with all specifications.

B. The Contractor shall perform initial testing of the equipment ensuring to himself that the tests listed in the Final Acceptance Test paragraph below can be satisfactorily completed.
C. The Contractor shall give written notice, seven (7) days in advance, of the date of Final Acceptance Test to the Owner and Engineer. All tests shall be in conformance with other applicable Sections of these Specifications.

D. The Final Acceptance Test shall demonstrate that all items of these Specifications have been met by the equipment as installed and shall include, but not be limited to, the following tests:

1. That all units have been properly installed and are in correct alignment.

2. That the units operate without overheating or overloading any parts and without objectional vibration.

3. That there are no mechanical defects in any of the parts.

4. That the pumps meet the specified hydraulic requirements.

5. That the pumps shall be capable of pumping raw, unscreened sewage.

6. That the pump sensors and controls perform satisfactorily as to sequence control, correct start and stop elevations, and proper alarm functions.

E. In the event that the equipment does not meet the Final Acceptance Test, the Contractor shall, at his own expense, make such changes and adjustments in the equipment which he deems necessary and shall conduct further tests until full satisfaction is indicated by the Engineer and written certification is received thereof.

F. The Owner will pay the salaries of the personnel selected by the Owner for operation of the equipment. Payment of all other salaries, public utility services, and operating expenses shall be borne by the Contractor for the test period and any additional test period required.

3.04 TRAINING

A. After completion of the field certification and testing, a minimum of one (1), four (4) hour operator instruction and training session on equipment and system operation shall be provided. Contractor shall provide a proposed list of dates and times to hold the training sessions to the UCNSB at least (3) three weeks prior to the proposed dates, UCNSB must approve times prior to final scheduling the training. The training shall provide a complete overview of all equipment, testing, adjusting, operation, and maintenance procedures. The training shall take the form of classroom sessions at the project site conducted by the manufacturer or local representatives who are knowledgeable and familiar with the project. Hands-on instruction and training will be conducted so that actual operation and maintenance of the equipment and systems can be performed by Owner upon completion of the training. Training shall be provided to the owner prior to final system start up. The training shall take the form of classroom and field instruction and shall cover:
1. Documentation in the final Operation and Maintenance Manuals.

2. Use the Operation and Maintenance Manuals or other guides

3. Equipment and system startup and shutdown.

4. System operation procedures for all modes of operation.

5. Procedures for dealing with abnormal conditions and emergency situations for which there is a specified system response.

6. Any and all special tools, equipment training manuals used during the training shall be the property of the OWNER upon completion of the training.

### TABLE 11208-A

**PUMP PERFORMANCE SCHEDULE**

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<thead>
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<th>Parameter</th>
<th>Lift Station No. 5</th>
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<tbody>
<tr>
<td>Number of Pumps</td>
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<tr>
<td>Pump Type</td>
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<tr>
<td>Design Capacity per Pump, GPM</td>
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<tr>
<td>TDH, ft</td>
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<tr>
<td>Shut Off Head, ft</td>
<td>38.5 – 54</td>
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<td>Run Out Condition, GPM</td>
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<td>Minimum Size Solids, in.</td>
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</tr>
<tr>
<td>Minimum Discharge Size, in.</td>
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</tr>
<tr>
<td>Maximum Horsepower Per Pump, HP</td>
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<td>Maximum, RPM</td>
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<td>Voltage, V</td>
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<tr>
<td>Phase</td>
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<tr>
<td>Frequency, Hz</td>
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SECTION 11312

COLLECTION SYSTEM BYPASS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work covered by this Section consists of providing all temporary bypassing to perform all operations in connection with the flow of wastewater around pipe segment(s) or lift stations. The purpose of bypassing is to prevent wastewater overflows and provide continuous service to all wastewater customers. The Contractor shall maintain wastewater flow in the construction area in order to prevent backup and/or overflow and provide reliable wastewater service to the users of the wastewater system at all times. Temporary bypass is required at multiple locations through the project duration.

PART 2 - PRODUCTS

2.01 GENERAL

A. The Contractor shall provide and maintain adequate equipment, piping, tankers, and other necessary appurtenances in order to maintain continuous and reliable wastewater service in all wastewater lines as required for construction. Bypass pumping operations to be conducted by manned supervision 24 hours per day (including weekends) and backup emergency auto-dialer installed. The Contractor shall have tankers, backup pumps, backup generators, piping, and appurtenances ready to deploy immediately.

B. Bypass pumps shall be skid mounted diesel pumps/systems as manufactured by Thompson Pumps, Godwin Pumps, Rain for Rent, or an approved equal.

C. Blocked gravity lines shall include two (2) line stops, one (1) primary and one (1) redundant.

D. Bypass equipment shall include discharge flow meter and multiple pressure gauges.

E. Bypass plan/systems shall have complete redundancy and shall include one (1) back-up pump equal to the primary.

PART 3- EXECUTION

3.01 GENERAL

A. The Contractor shall have scheduled delivery of all materials, equipment and labor necessary to complete the repair, replacement or rehabilitation to the job site prior to isolating the gravity main segment, manhole, or pump station. The Contractor shall
demonstrate that the pumping system is in good working order and is sufficiently sized to successfully handle flows by performing a test run for a period of 48 hours prior to beginning the work. The bypass pumping system shall be sized to pump a minimum firm capacity as indicated below:

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<tr>
<th>LS No.</th>
<th>Firm Capacity (GPM)</th>
<th>TDH</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>226</td>
<td>27.7</td>
</tr>
</tbody>
</table>

3.02 TRAFFIC CONSIDERATIONS

A. The Contractor shall locate bypass pumping suction and discharge lines so as to not cause undue interference with the use of streets, private driveways, and alleys. This requirement may necessitate temporary trenching of piping at critical intersections. Ingress and egress to adjacent properties shall be maintained at all times. Ramps, steel plates or other methods shall be deployed by the Contractor to facilitate traffic over surface piping. High traffic commercial properties may require alternate methods.

3.03 BYPASS PLAN

A. The Contractor shall submit a comprehensive written plan according to Specification 01420: Shop Drawings, Working Drawings, and Samples, that describes the intended bypass for the maintenance of flows during construction. The Contractor shall also provide a sketch showing the location of bypass pumping equipment for each pump station or line segments around which flows are being bypassed. The plan shall include any proposed tankers, pumps, bypass piping, backup plan and equipment, work schedule, monitoring log for bypass pumping, monitoring plan of the bypass pumping operation and maintenance of traffic plan. The Contractor shall cease bypass operations and return flows to the new and/or existing sewer when directed by the City. All piping shall be designed to withstand at least twice the maximum system pressure or a minimum of 50 psi, whichever is greater. During bypassing, no wastewater shall be leaked, dumped, or spilled in or onto, any area outside of the existing wastewater system. When bypass operations are complete, all bypass piping shall be drained into the wastewater system prior to disassembly.

3.04 BYPASS OPERATION

A. The City shall review and provide written comments to the bypass plan prior to implementation of the bypass. The Contractor shall plug off and pump down the sewer manhole or line segment in the immediate work area and shall maintain the wastewater system so that surcharging does not occur.

B. The City shall accept the bypass plan prior to implementation of the bypass. Contractor will plug off and pump down the sewer manhole or line segment in the immediate work area and will maintain the wastewater system so that surcharging does not occur. A successful 3-day test period shall be performed during City workdays (no weekends). If the Contractor is unable to isolate the system prior to installation of the temporary bypass connection, then a wet tap will be required at the expense of the Contractor.
C. Where work requires the line to be blocked beyond NORMAL WORKING HOURS and bypass pumping is being utilized, the Contractor shall be responsible for on-site monitoring the bypass operation 24 hours per day, 7 days per week, by on-site personnel. Additionally, back-up emergency auto-dialer installation is required.

D. During bypassing, no wastewater will be leaked, dumped, or spilled in or onto, any area outside of the existing wastewater system.

E. The Contractor shall insure that no damage will be caused to private property as a result of bypass pumping operations. The Contractor shall complete the work as quickly as possible and satisfactorily pass all tests, inspections and repair all deficiencies prior to discontinuing bypassing operations and returning flow to the sewer manhole, line segment, or lift station.

D. The Contractor shall immediately notify the City should a sanitary sewer overflow occur, and the Contractor shall take the necessary action to clean up and disinfect the spillage to the satisfaction of the City and/or another governmental agency. If sewage is spilled onto public or private property, the Contractor shall wash down, clean up and disinfect the spillage to the satisfaction of the City and/or another governmental agency. When bypassing, complete redundancy is required. One back-up pump equal to the primary unit shall be required. Bypass pumps and motors shall have a maximum rating of 55 decibels at 20 feet for sound attenuation.

F. Contractor shall provide secure temporary fencing around all bypass pumping equipment. City shall be given keys to access the bypass equipment.

3.05 CONTRACTOR LIABILITY

A. The Contractor shall be responsible for all required pumping, equipment, piping and appurtenances to accomplish the bypass and for any and all damage that results directly or indirectly from the bypass pumping equipment, piping and/or appurtenances. The Contractor shall also be liable for all City personnel and equipment costs, penalties and fines resulting from sanitary sewer overflows. In addition to the aforementioned costs to be paid by the Contractor, a fine of $5,000 per overflow occurrence or sanitary sewer disruption shall be assessed. For each 24-hour period following overflow that the wastewater overflow/damage is not completely cleaned, disinfected, and returned to full operational capacity an additional $5,000 fine will be assessed daily. It is the intent of these specifications to require the Contractor to establish adequate bypass pumping as required regardless of the flow condition.

END OF SECTION
DIVISION 12

(NOT USED)
DIVISION 13

SPECIAL CONSTRUCTION
SECTION 13410

BASIC INSTRUMENTATION REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: General administrative and procedural requirements for instrumentation installations.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:

1. Product data for each product specified.
2. Wiring diagrams, both elementary and schematic, differentiating between manufacturer installed and field-installed wiring.
3. Digital Systems: Provide the following:
   a. Digital equipment layouts of input and output racks showing complete module model number and addressing assignment. Layouts of port pin assignment, connection schematic indicating cable types and port addresses.

B. Record Drawings: At Project closeout, submit record drawings of installed products.

1. Where Drawings are drafted by computer equipment, CONTRACTOR shall furnish files on a disk. These Drawings shall include changes made by Field Orders, Change Orders, Addenda, and errors discovered during start-up and acceptance.
2. Drawings shall include terminal numbers at each wiring termination and piping termination. A complete system diagram shall be included.

C. Operation and Maintenance Manuals: Submit operation and maintenance manuals for items included under this Section.

1. Instructions shall be short, easy-to-understand directions specifically written for this Project describing various possible methods of operating equipment. Instructions shall include procedures for tests required, adjustments to be made, and safety precautions to be taken with equipment. These documents are to be submitted to ENGINEER's office.
2. Provide 1 complete set of manufacturer's documentation covering programmable equipment supplied. Include hardware manuals and prints as manufacturer normally ships with programmable equipment.
   a. Include complete software manuals for operating system, as well as manuals for any other software. Written instructions for the operations and maintenance of software shall be provided. The instructions shall be short, easy-to-understand directions specifically written for this Project describing various possible methods of operating software.
   b. Include program listings, point/address lists, cross-reference listings, images of screens, data entry forms, and sample reports.
   c. Manuals shall include instructions for program users and instructions for maintenance programmers.

D. Warranty: Submit warranties covering the items included under this Section.

1. Warranty time periods shall start from Start-up date and not ship dates.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of equipment, of types and sizes required, and whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:
   2. Applicable State and local requirements.
   3. UL listing and labeling shall be adhered to.

C. Items covered by this Section are designated as undelivered specifically manufactured equipment for which associated progress payments will be made in accordance with this Specification.

D. Equipment that does not have a UL, FM, CSA, or other listed testing laboratory label shall be furnished with a notarized letter signed by the supplier stating that equipment furnished has been manufactured in accordance with National Electric Code and OSHA requirements.

E. CONTRACTOR shall provide permits and licenses, observe and abide by applicable laws, regulations, ordinances, and rules of State, territory or political subdivision thereof, wherein the Work is done. CONTRACTOR shall pay fees for permits, inspections, licenses, and certifications when such fees are required.

F. To ensure timely performance and conformance with Specifications, Project meetings shall be held at OWNER's facility once every 3 months during course of Project. Cost of such meetings shall be included.
G. Component Requirements: For the purposes of uniformity and conformance to industry standards, signal transmission modes shall be electronic 4-20 mA DC. No other signal characteristics are acceptable; 4-20 mA DC signals shall be such that devices may be wired in parallel for 1-5 volt DC as required. 1-5 volt DC mode shall be employed only within control panel enclosures.

H. Responsibility and Coordination: Drawings and Specifications are intended to include details of a complete equipment installation for purposes specified. CONTRACTOR shall be responsible for details which may be necessary to properly install, adjust, and place in operation complete installation. Any error on Drawings or in Specifications which prevents proper operation of supplied system shall be shown correct at time of Shop Drawing submittal for approval or brought to attention of ENGINEER with or prior to submittal.

I. CONTRACTOR shall be responsible for costs incurred to correct aforementioned errors brought to ENGINEER’s attention. CONTRACTOR shall assume full responsibility for additional costs which may result from unauthorized deviations from Specifications.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Manufactured material shall be adequately packed to prevent damage during shipping, handling, storage, and erection. Material shipped to Site shall be packed in a container properly marked for identification. Blocks and padding shall be used to prevent movement.

B. CONTRACTOR shall inspect the material prior to removing it from carrier. If damage is observed, CONTRACTOR shall immediately notify carrier so that a claim can be made. If no such notice is given, material shall be assumed to be in undamaged condition; any subsequent damage that occurs to the equipment shall be the responsibility of CONTRACTOR. Repair and replacement of damaged parts will be done at no expense to OWNER.

C. CONTRACTOR shall be responsible for any damage charges resulting from handling of materials.

PART 2 - PRODUCTS

2.01 EQUIPMENT SUPPLIERS

A. References made in these Specifications to specific manufacturer’s products are intended to serve as a guide to type, construction, and materials. Listing of a manufacturer does not imply acceptance by ENGINEER of a manufacturer’s particular product, product line, or latest product revision if it does not meet Specifications.

B. Equipment Supplier: Equipment specified under Division 13 and shown on Drawings shall be designed as a system, fabricated or purchased, shipped to Site, and started up
by one of the qualified and approved equipment suppliers listed under this Section. Intent is for unit responsibility.

1. Equipment supplier shall not assign any of its rights or delegate any of its obligations under these Sections without prior written acceptance by ENGINEER.

2. Direct purchase of any items in these Sections by CONTRACTOR is not in compliance with this Specification and will not be permitted.

3. When a Service Contract is included, it shall be performed by factory-trained personnel employed by equipment supplier. Equipment supplier shall assign a qualified Engineer employed by the supplier as Project Engineer/Project Manager.

   a. Project Engineer/Project Manager’s name shall be forwarded to CONTRACTOR and ENGINEER within 30 days after receipt of a purchase order by equipment supplier.

   b. Project Engineer/Project Manager shall be focal point for design, fabrication, Contract communications, and shall be responsible for start-up and acceptance. Project Engineer/Project Manager shall be at factory test at Site for start-up and at the Site during entire acceptance procedure. Only qualified and approved equipment suppliers shall be accepted as meeting this Specification.

2.02 EQUIPMENT

A. Transmitted electronic signals to equipment of other vendors and between control panels shall be a separate isolated-floating output for each item of equipment and shall conform to ISA Standard S50.1.

B. Enclosures shall be 316 SS NEMA 4X as indicated on Drawings. Intrinsically safe systems, as approved by Factory Mutual, shall be furnished when called for.

C. No external power connections shall be allowed unless specifically called for in Specification. Where an external power source is called for, unit shall accept 120 VAC, plus or minus 10 percent power.

D. Size and style of instruments are defined in Specifications.

E. Charts and scales are shown on Drawings. Standard scales shall not be accepted without ENGINEER's approval if it differs from those shown. Ratio station scales and other scales shall be graduated such that major graduations fall on whole numbers (i.e., 1, 2, 3, or 5, 10, 15, etc.) and minor graduations fall on 0.1 or 0.2 intervals (i.e., 1.1, 1.2 or 11, 12, etc.). If two scales are called for on ratio stations, each scale shall be indexed to meet Specification. Drawing of each scale for ratio stations shall be submitted with Shop Drawings for approval.
F. Solid-state output switches, where used, shall be overvoltage transient protected and not be damaged by $\frac{dI}{dT}$ or $\frac{dv}{dt}$ for their design application under this Contract.

G. Instruments shall be equipped with permanently attached identification tag. Tag shall be included on field- and panel-mounted devices. Tags shall include ENGINEER’s tag identification and manufacturer's tag identification if different from ENGINEER's.

1. Tags shall be either stamped metal or laminated phenolic with white letters engraved on a black background. Field-mounted devices shall have tags fastened with screws. Devices mounted in panels will be tagged inside panel on subplates or on device itself where it can be easily read.

H. Finish on instruments and accessories shall provide protection against corrosion by elements in environment in which they are to be installed. Both the interior and exterior of enclosures shall be finished. Extra paint of each color used on material shall be provided by manufacturer for touch-up purposes.

I. Provide equipment identification nameplates complying with Section 16075. Nameplates shall contain ENGINEER's item designation and, for indicators and transmitters, design range and units of device shown.

2.03 SOURCE QUALITY CONTROL

A. Control and monitoring system control panels and computer equipment, if any, shall be tested at the factory and witnessed by ENGINEER prior to shipment to Site. ENGINEER shall be given 4 weeks notice before factory test date. Factory test shall include checking for conformity to Specifications, fabrication, and nomenclature. Control and monitoring system logic and terminals shall be checked line by line and function by function in total for conformity of Drawings.

B. Conduct preliminary testing prior to factory checkout by executing programs supplied for this Project. Exercise inputs to test logic for correct function and proper response of outputs. Verify correct interface with programs. Verify correct communications.

C. Factory testing shall be used to validate fieldbus and plant LAN/WAN interconnections. Proper communication between devices and software components shall be demonstrated. Data Collection and Data Management Reporting shall be demonstrated.

D. Equipment supplier shall have test equipment available at the factory. A full set of annotated logic programs and wiring diagrams with the latest revisions shall be made available to ENGINEER at factory for checking purposes. Drawings shall include wire numbers and terminal numbers.

E. Control panels and programmable equipment shall not be shipped to Site until logic conforms to Contract requirements, physical changes required by testing are made, and tags conform to factory test corrections. Equipment delivered to Site without factory test or corrections will be returned to factory at CONTRACTOR’s expense.
PART 3 - EXECUTION

3.01 INSTALLATION

A. Equipment provided under this Section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with detail drawings, specifications, engineering data, instructions, and recommendations of equipment manufacturer as approved by ENGINEER.

B. Install equipment as indicated, in accordance with manufacturer's written instruction, and in compliance with recognized industry practices to ensure that products fulfill requirements.

C. Drawings are not intended to show every detail of construction or location of piping, ductwork, or equipment. Where proper operation or construction makes it necessary or advisable to change location of piping, instrumentation equipment, air ducts, or other equipment, CONTRACTOR shall so inform ENGINEER for his approval and permission.

3.02 FIELD QUALITY CONTROL

A. Calibrate equipment in accordance with manufacturer's instructions to ranges or set points indicated on Drawings.

B. Installation and Start-up: Equipment supplier shall have an established service facility from which qualified technical service personnel and parts may be dispatched upon call. Such a service facility shall be no more than 6 hours travel time from Site.

1. Equipment supplier shall provide an experienced, factory-trained, competent, and authorized service representative for a minimum of 3 times at Site, including once during installation and start-up and once during acceptance to inspect, check, and calibrate any part of system. Supplier's service representative shall revisit Site for 8 hours per day as often as necessary after installation until trouble is corrected and equipment has passed acceptance test and is operating satisfactorily to OWNER and ENGINEER.

2. Third trip is after equipment has been accepted and shall be used to instruct OWNER's personnel in aspects of operation and maintenance, such as fuse locations, use of controls, instruction manuals, etc. Third trip shall be for duration of one, 8-hour day at OWNER's facility.

3.03 DEMONSTRATION

A. Upon completion of installation and calibration, demonstrate functioning of equipment in accordance with requirements. Where possible, correct malfunctioning units at Site, then retest to demonstrate compliance; otherwise, remove and replace with new or repaired units, and retest to demonstrate compliance.

END OF SECTION
SECTION 13423
LEVEL MEASUREMENT

PART 1 - GENERAL

1.01 SUMMARY
A. Section includes the following:
   1. Cord type float switch.
   2. Submersible level sensor.

1.02 SUBMITTALS
A. Shop Drawings: Submit Shop Drawings covering the items included under this Section.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
   1. Cord Type Float Switch:
      a. Anchor Scientific, Inc.
   2. Submersible Level Sensor:
      b. Blue Ribbon Corp

2.02 FLOAT SWITCH (CORD TYPE)
A. Direct acting float switch shall be furnished to automatically detect liquid level change. Liquid rise of 1 inch from rest position shall operate float switch and reset will occur when liquid level drops 1 inch. Float shall be free suspended. Free cable hanging floats with weights shall not be acceptable.

B. Float switch shall consist of polypropylene housing, flexible 3-conductor cable with a synthetic rubber jacket, and mercury switch. Inside float housing will be a (normally closed) mercury switch potted in epoxy. Electrical load for switch contacts shall be rated 115 volt AC at 0.5 horsepower inductive load.
C. Three-conductor cable shall be 18 AWG with 41 strands per conductor made for heavy flexing service and underwater use. A green grounding wire shall connect internally to float housing. Float cable shall be made from chemically resistant polypropylene.

D. Float switch shall be Roto Float type S.

2.03 SUBMERSIBLE LEVEL SENSOR

A. Submersible level sensor shall measure liquid depths using a fully submerged differential pressure transducer suspended in measured medium by electrical cable. Submersible level sensor shall be 3 1/2 bird cage type. Transducer shall be supplied with cable required to reach control unit from sensor location.

B. Level sensor shall be Blue Ribbon type BC001.

PART 3 - EXECUTION

3.01 GENERAL

A. Examination, Installation, Field Quality Control, Demonstration: In accordance with Section 13410.

END OF SECTION
SECTION 13430

CONTROL PANELS AND CONSOLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Control panels and consoles.
2. Switches, pushbuttons, lights.
3. Relays.
4. Intrinsically safe isolator relays.
5. Timing devices.
6. Terminal blocks.
7. Control power transformers.
8. Phase monitor

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings covering the items included under this Section.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Codes, Ordinances, and Industrial Standards: Design, testing, assembly, and methods of installation for materials, electrical equipment, and accessories proposed under this Section shall conform to National Electric Code and to applicable State and local requirements.

2. UL listing and labeling of custom-built panels (UL 508) shall be adhered to under this Contract.

PART 2 - PRODUCTS

2.01 PANEL SHOP MANUFACTURERS

A. Control panel manufacturer shall be one from the following list with out exception:

1. Data Flow Systems (DFS)
2.02 CONTROL PANELS AND CONSOLES

A. Sheet Metal Construction:

1. Panels and consoles shall be fabricated from sheet steel welded and bolted into a rigid self-supporting structure a maximum of 90 inches high and a minimum of 20 inches deep. Overall length shall be coordinated with space requirements as indicated by Drawings. Changes in length from that shown on Drawings must be brought to attention of ENGINEER within 90 days of Contract Award. Cost to modify floor plan or wall opening shall be at CONTRACTOR's expense after this 90-day period. Panel face layouts shown on Drawings are intended to indicate relative position of all components. Supplier shall fix exact locations and overall dimensions to meet requirements of its equipment.

2. Panel and console bodies shall be 12-gauge minimum steel for panels up to 42 inches in width, and 10-gauge minimum steel for panels exceeding 42 inches in width. Panel subplates shall be same gauge as enclosure. Stiffening members shall be provided for strength and stiffness as required.

3. A minimum of 3 inches shall be provided between edge of panel subplate and outside walls of panel body to ensure adequate wire-way space for external wires entering panel. Panel subplate shall be mounted on collar studs for easy removal. Print pockets shall be provided on each panel. Brackets welded to inside of panel, complete with lights, shall be provided on panels where indicated by Drawings.

4. Identification plates shall be laminated phenolic with white letters engraved on a black background and mounted with screws or double-back adhesive foam tape.

5. All components inside panel shall have identification plates. This includes instruments, relays, switches, circuit boards in plug-in racks, etc. Identification plates shall include engineering symbols (FBQ-1, SW-3, FIC-4, CR-1, etc.). Switches and circuit breakers inside panel shall have names (Horn, Audio Tone, Panel Power, etc.) on identification plates as well as engineering symbol.

6. Identification plates shall be located on or adjacent to device they are identifying and shall be readable without looking around, under, or on top of device to find identification plate.

7. Panels shall be constructed with a deadfront. The switches, lights, and pushbuttons shall be mounted to an internally hinged lexan door.

B. Access:

1. Wall- and/or floor-mounted control panels shall have continuous piano-hinged doors for ease of access. Door openings shall expose a minimum of 80 percent
of panel interior. Door openings shall be sealed with a 0.125-inch thick minimum cellular neoprene gasket cemented with oil-resistant adhesive and held in place with a retaining strip. Print pockets shall be provided on each door. Two door enclosures shall have a removable center post. Panel doors less than 40 inches high shall be equipped with a 2-point latching mechanism. Panel doors 40 inches high or more shall be equipped with a 3-point latching mechanism.

2. Components and terminals shall be accessible without removing another component except covers. Swing out sections shall be used if mounting space is required that is not normally accessible.

C. Finish:

1. Panel face openings for mounting equipment shall be smoothly finished cut with counterboring and trim strips provided as required to give a neat finished appearance. Bezels shall be used on all front panel-mounted devices to cover panel cutouts. A chrome-plated or stainless steel bezel shall be used at parting line of panels that have shipping splits or at parting line of panels placed end to end.

D. Electrical:

1. Internal panel wiring shall be 19 strand No. 16 AWG, 90°C MTW, Class C stranded, or THHN/THWN approved as 90°C MTW. All panel wiring not run in wire ducts shall be bundled and tied. Each wire shall be identified at both ends with same exclusive number. Number shall be same number shown on control schematic. Number shall not be used again for any other purpose. Wires marked differently on each end will not be accepted. Wire markers shall be provided on end of each wire at termination point.

2. Control wiring associated with control circuits de-energized when main disconnect is opened shall be color-coded red. Control wiring associated with control circuits which remains "hot" when main disconnect is opened shall be color-coded yellow. DC control wiring shall be color-coded blue. Ground wires shall be color-coded green. Terminal blocks shall be numbered in numerical order. Yellow wiring leaving panel shall be brought to an isolated set of terminal blocks.

3. Provide an instrument common bus 0.1 by 0.5 by 6-inch minimum in enclosure and isolated from enclosure. A separate instrument common wire shall be run from each common terminal on an instrument to instrument common bus. Instrument common wires looped from one terminal to another and then to instrument common bus will not be accepted.

4. Instrument common bus shall be connected to power supply common with a wire or wire braid strap as short as practical and of sufficient capacity to prevent troublesome voltage drop. Common terminals and common bus for instrument
common shall be tagged "Instrument Common." Instrument signal wires of 4-20 mA or 1-5V shall be shielded wire. Telephone wires and telemetry equipment interconnection wires shall be shielded wires.

5. Provide a copper ground bus 0.1 by 0.5 by 6-inch minimum in enclosure to which all instrument grounds and panel enclosure are tied. Separate ground wire shall be run from instrument enclosure ground terminal directly to ground bus. Instrument ground wires looped from one instrument to another will not be accepted. Under no circumstances shall neutral side of power source or any other terminals used for grounding power circuits be used as an instrument common.

6. Wires to internal components shall be connected to inside of terminal strip. Wires to external components shall be connected to outside of terminal strip. No more than 2 wires shall be connected to one terminal point.

7. Panel wire duct shall be provided between each row of components and adjacent to each terminal strip. Wire ducts shall be a minimum of 1-inch wide and 3 inches deep with removable snap-on covers and perforated walls for easy wire entrance. Wire ducts shall be constructed of nonmetallic materials with a voltage insulation in excess of maximum voltage carried therein.

8. Floor-standing panels and consoles shall be equipped with a flange mounted 600V rated main non-automatic trip circuit breaker or disconnect switch. Single phase, 60 hertz power at voltage shown on Drawings shall be supplied to main disconnect. Panel fabricator shall provide any additional voltages and power requirements at control panel to meet requirements of equipment contained therein.

9. Disconnect and transformer shall have enclosed protected terminations to prevent accidental shock.

10. Relays, timers, etc., installed on panel subplate shall be provided with a minimum spacing between component and wire duct of 1.5 inches above and 1 inch below. Minimum spacing between adjacent components shall be 0.25 inch. Relays, timers, etc., shown in schematics are intended to show function. Additional relays may be required in conjunction with items shown to provide total number of contacts required. Where limit, pressure, float switches, etc., are used and more than SPDT contacts are indicated by schematics, provide additional contacts required by using auxiliary relays. However, if a DPDT switch is called for, using a SPDT with a relay will not be accepted. All control and pilot devices such as relays, timers, etc., shall be 120V, 3 amp rated except where noted with coil voltage as required. One N.O. spare contact shall be provided on each relay.
E. Panel/Subplate Layout:

1. Panel face-mounted equipment shall consist of pilot lights, push-buttons, selector switches, meters, indicating timer, etc. Spacing between horizontal rows of components shall be 1.5 inches minimum; spacing between vertical columns of components shall be 1.875 inches minimum. Components shall be grouped and/or located as indicated on Drawings. Distance from bottom row of components to floor shall be not less than 36 inches. Top row of recording and indicating instruments shall be centered approximately 60 inches above floor. Maximum height for annunciator windows shall be 85 inches above floor. In general, indicating lights, push-buttons, etc., shall be mounted in accordance with sequence of operation from left to right and top to bottom.

2. A minimum of 2 inches shall be provided between terminal strips and wire ducts or terminal strips and terminal strips. In general, terminal strips shall be mounted on vertical edges of subplate. Where terminal strips are mounted side-by-side, terminals shall be elevated 1.5 inches above subplate to allow wires to pass underneath.

3. Subplates shall have a minimum of 15 percent spare mounting space, and terminal strips shall have a minimum of 20 percent spare terminal blocks.

2.03 SWITCH, PUSH BUTTONS, LIGHTS

A. Selector switches shall be 120 VAC rated, oil-tight construction with standard operator knob.

B. Start push buttons shall be 120 VAC rated, oil-tight construction with extended guard and black color insert.

C. Stop pushbuttons shall have a half-guard with red color insert. Contacts shall be rated NEMA B-150 and P-150.

D. Pilot lights shall be push-to-test oil-tight construction with cap colors and voltages as required. Nameplates for each switch and light shall conform to manufacturer’s series and type with engraving as called for on Drawings.

2.04 RELAYS

A. Control Relays: Switching and output relays shall be plug-in type with contacts rated 120 VAC, 3 amp with 120 VAC or 24 VDC coil, indicating light, manual operator, and plastic transparent cover. Relays shall have a retainer mechanism to prevent loosening from vibration. Relays shall not be used for switching 1-5 VDC or 4-20 mA signals associated with instruments.

B. Intrinsically Safe Isolator Relay:
1. Intrinsically safe relay shall be provided between raw sewage floats and control circuits or where shown on Drawings.

2. Relay shall operate at 24 VAC plus 10 percent with a switch rating of 1 amp rms and maximum holding current of 20 milliamp for solid-state devices. Relay shall be rated for ambient temperatures of 32 degrees F to 120 degrees F.

3. Output shall be N.O. or N.C. Equipment supplier is responsible for choosing proper output for float specified and circuits specified. If float and circuit are not defined, intrinsically safe relay shall be of such a polarity as to fail in a safe condition for function being performed.

4. When intrinsically safe relay is required in panels exposed to outdoor temperatures, relays shall be rated for ambient temperatures of –40 to 120 degrees F, or thermostatically controlled heaters must be added to panel to maintain an ambient in panel of 32 to 120 degrees F.

2.05 TIMING DEVICES

A. Solid-state timers shall be plug-in type.

B. Solid-state timers with ON or OFF delay cycles shall operate at 120 VAC, 60 hertz. Solid-state device may be analog or digital in operation. Time interval shall be as shown on Drawings or as required.

2.06 TERMINAL BLOCKS

A. Terminal blocks shall be 300 or 600 volt rated, channel-mounted box lug with pressure plate type or binding head screw type with pressure plate, and shall have a white marking strip. Terminal blocks shall be color-coded according to the following coloring scheme:

- Black 120V power circuits de-energized when main disconnect is opened.
- White 120V neutral conductors.
- Red 120V control circuits de-energized when main disconnect is opened.
- Yellow 120V control circuits which remain hot when main disconnect is opened.
- Blue Terminal blocks for DC wiring.
- Gray Terminal blocks for shields in DC wiring.
- Green Ground terminal blocks.

B. For terminals associated with 120V nonisolated input cards, individually fused terminal blocks shall be used for 120V power to field devices.

C. Provide a minimum of 20 percent spare terminals for each type and color of terminal used. All terminals of a given color shall be grouped with other terminals of the same color.
2.07 CONTROL POWER TRANSFORMERS

A. Control power transformers shall be sized to handle in-rush currents and to accommodate continuous load of circuits plus 25 percent future load with 5 percent or less voltage drop. Transformer primary voltage shall be as indicated on Drawings.

2.08 PHASE MONITORS

A. The Phase Monitor shall be an 8 pin, plug in style unit for an applied voltage of either a range from 200 to 240 VAC or 425 to 525 VAC. The Phase Monitor shall monitor Under Voltage, Phase Reversal, and Phase Imbalance. The Phase Monitor shall be able to monitor Over Voltage as an option, as well as having optional reset delay time ranges.

B. With the correct voltage applied, the Phase Monitor LED shall blink during the reset delay, and at the end of the reset delay, the LED shall come on steady, and the internal relay shall be energized.

C. The trip points for Under and Over Voltage for the 200 to 240 VAC range shall be 15% of setting, and the reset shall be 12% of setting. The trip points for Under and Over Voltage for the 425 to 525 VAC range shall be 10% of setting, and the reset shall be 8% of setting.

D. The Phase Imbalance shall have a trip delay of 5 seconds at a Phase Imbalance of 5%, and the delay shall approach zero as the Percentage of Phase Imbalance increases, with the reset being 4%.

E. The adjustment range shall be from 200 to 240 VAC or 425 to 525 VAC, with the center of the adjustable monitoring range either 230 VAC or 500 VAC.

F. The output relay shall contain one SPDT relay, rated 10A at 240 VAC, and one normally open contact between pins 6 and 7, also rated 10A, that closes when energized. The Phase Monitor shall be able to function as a diagnostic tool as well, blinking a series of pulses to identify the fault conditions Under Voltage, Over Voltage, Phase Imbalance, or Phase Reversal.

PART 3 - EXECUTION

3.01 GENERAL

A. Examination, Installation, Field Quality Control, Demonstration: In accordance with Section 13410.

B. Panel manufacturer shall have a representative present on site to attend final station startup.

END OF SECTION
DIVISION 14

(NOT USED)
SECTION 15000
MECHANICAL – GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. All equipment furnished and installed under this contract shall conform to the general stipulations set forth in this Section except as otherwise specified in other Sections.

2. Contractor shall coordinate all details of equipment with other related parts of the Work, including verification that all structures, piping, wiring, and equipment components are compatible. Contractor shall be responsible for all structural and other alternations in the Work required to accommodate equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specifications.

B. Related Work Described Elsewhere: Other Sections directly referenced in this section include the following:

1. General Requirements: Division 1.

2. Concrete: Division 3.

3. Finishes: Division 9.

4. Equipment: Division 11.

5. Electrical: Division 16.

C. Contract Drawings and Specifications: The Contract Drawings and Specifications shall be considered as complementary, one to the other, so that materials and work indicated, called for, or implied by the one and not by the other shall be supplied and installed as though specifically called for by both. The Contract Drawings are to be considered diagrammatic, not necessarily showing in detail or to scale all of the equipment or minor items. In the event of discrepancies between the Contract Drawings and Specifications, or between either of these and any regulations or ordinances governing work of these Specifications, the bidder shall notify the Engineer in ample time to permit revisions.

1.02 QUALITY ASSURANCE

A. Materials and Equipment: Unless otherwise specified, all materials and equipment furnished for permanent installation in the Work shall conform to applicable standards
and specifications and shall be new, unused, and undamaged when installed or otherwise incorporated in the Work. No such material or equipment shall be used by the Contractor for any purpose other than that intended or specified, unless such use is specifically authorized in writing by the Owner. No material shall be delivered to the site without prior acceptance of drawings and data by the Engineer.

B. Equivalent Materials and Equipment:

1. Whenever a material or article is specified or described by using the name of a proprietary product or the name of a particular manufacturer or vendor, the specific item mentioned shall be understood as establishing the type, function, and quality desired. Other manufacturers' products will be accepted provided sufficient information is submitted to allow the Engineer to determine that the products proposed are equivalent to those named. Such items shall be submitted for review in accordance with Section 01340: Shop Drawings, Working Drawings and Samples.

2. Requests for review of equivalency will not be accepted from anyone except the Contractor and such requests will not be considered until after the contract has been awarded.

C. Governing Standards: Equipment and appurtenances shall be designed in conformity with ANSI, ASME, ASTM, IEEE, NEMA, OSHA, AGMA, and other generally accepted applicable standards. They shall be of rugged construction and of sufficient strength to withstand all stresses which may occur during fabrication, testing, transportation, installation, and all conditions of operations. All bearings and moving parts shall be adequately protected against wear by bushings or other acceptable means. Provisions shall be made for adequate lubrication with readily accessible means.

D. Tolerances: Machinery parts shall conform to the dimensions indicated on the Drawings within allowable tolerances. Protruding members such as joints, corners, and gear covers shall be finished in appearance. All exposed welds shall be ground smooth and the corners of structural shapes shall be rounded or chamfered.

E. Clearances: Ample clearances shall be provided for inspection and adjustment. All equipment shall fit the allotted space and shall leave reasonable access room for servicing and repairs. Greater space and room required by substituted equipment shall be provided by the Contractor and at his expense.

F. Testing:

1. When the equipment is specified to be factory tested, the results of the tests shall be submitted to the Engineer and approval of the test results shall be obtained before shipment of the equipment.

2. When an item of equipment, including controls and instrumentation, has been completely erected, the Contractor shall notify the Engineer, who will designate a time to make such tests as required, and operate the item to the satisfaction
of the Engineer. All testing shall be done in the presence of the Engineer. "Completely erected" shall mean that the installation is erected, all necessary adjustments have been made, all required utility connections have been made, required lubricants and hydraulic fluid have been added and the unit has been cleaned and painted.

G. Pressure Test:

1. After installation, all piping shall be pressure tested. Piping shall be tested in accordance with Section 15044: Pressure Testing of Piping.

2. All tests shall be made in the presence of and to the satisfaction of the Engineer and also, to the satisfaction of any local or State inspector having jurisdiction.
   a. Provide not less than three (3) days notice to the Engineer and the authority having jurisdiction when it is proposed to make the tests.
   b. Any piping or equipment that has been left unprotected and subject to mechanical or other injury in the opinion of the Engineer shall be retested in part or in whole as directed by the Engineer.
   c. The piping systems may be tested in sections as the Work progresses but no joint or portion of the system shall be left untested.

3. All elements within the system that may be damaged by the testing operation shall be removed or otherwise protected during the operation.

4. All defects and leaks observed during the tests shall be corrected and made tight in an approved manner and the tests repeated until the system is proven tight.

5. Repair all damage done to existing or adjacent work or materials due to or on account of the tests.

6. Provide test pumps, gauges, or other instruments and equipment required for the performance of all tests. Provide all temporary bracing, test plugs, additional restraint, and thrust blocking which may be required for test pressures above normal working pressures.

7. All tests shall be maintained for as long a time as required to detect all defects and leaks but not less than the duration specified for each type of pipe or piping system in this Division.

H. Failure of Test:

1. Defects: Any defects in the equipment, or deviations from the guarantees or requirements of the Specifications, shall be promptly corrected by the Contractor by replacements or otherwise. The decision of the Engineer as to
whether or not the Contractor has fulfilled his obligations under the Contract shall be final and conclusive. If the Contractor fails to correct any defects or deviations, or if the replaced equipment when tested shall fail again to meet the guarantees or specified requirements, the Owner, notwithstanding his having made partial payment for work and materials, may reject that equipment and order the Contractor to remove it from the premises at the Contractor's expense.

2. Rejection of Equipment: In case the Owner rejects a particular item of equipment, then the Contractor hereby agrees to repay to the Owner all sums of money paid to him to deliver to the Contractor a bill of sale of all his rights, title, and interest in and to the rejected equipment provided, however that the equipment shall not be removed from the premises until the Owner obtains from other sources other equipment to take the place of that rejected. The bill of sale shall not abrogate the Owner's right to recover damages for delays, losses or other conditions arising out of the basic Contract. The Owner hereby agrees to obtain the alternate equipment within a reasonable time and the Contractor agrees that the Owner may use the original equipment furnished by him without rental or other charge until the other equipment is obtained.

J. Acceptance of Materials:

1. Only new materials and equipment shall be incorporated in the work. All materials and equipment furnished by the Contractor shall be subject to the inspection and acceptance of the Owner. No material shall be delivered to the work without prior submittal approval of the Engineer.

2. The Contractor shall submit to the Engineer data relating to materials and equipment he proposes to furnish for the work. Such data shall have in sufficient detail to enable the Engineer to identify particular product and to form an opinion as to its conformity to the Specifications.

3. Facilities and labor for handling and inspection of all materials and equipment shall be furnished by the Contractor. If the Engineer requires, either prior to beginning or during the progress of the work, the Contractor shall submit samples of materials for such special tests as may be necessary to demonstrate that they conform to the Specifications. Such sample shall be furnished, stored, packed, and shipped as directed at the Contractor's expense. Except as otherwise noted, the Owner will make arrangements for and pay for tests.

4. The Contractor shall submit data and samples sufficiently early to permit consideration and acceptance before materials are necessary for incorporation in the work.
K. Safety Requirements:

1. In addition to the components shown and specified, all machinery and equipment shall be safeguarded in accordance with the safety features required by the current codes and regulations of ANSI, OSHA, and local industrial codes.

2. The Contractor shall provide for each V-belt drive or rotating shaft a protective guard which shall be securely bolted to the floor or apparatus. The guard shall completely enclose drives and pulleys and be constructed to comply with all safety requirements.

1.03 SUBMITTALS (SEE SECTION 01420: DRAWINGS AND SUBMITTALS)

1.04 MAINTENANCE MATERIALS

A. All grease, oil, and fuel required for testing of equipment shall be furnished with the respective equipment. The Owner shall be furnished with a year's supply of required lubricants including grease and oil of the type recommended by the manufacturer with each item of equipment supplied.

B. The Contractor shall be responsible for changing the oil in all drives and intermediate drives of each mechanical equipment after initial break-in of the equipment, which in no event shall be any longer than three weeks of operation.

PART 2 - PRODUCTS

2.01 FABRICATION AND MANUFACTURE

A. Workmanship and Materials:

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

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

3. Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards. All structural members shall be designed for shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment shall be at least 1/4 inch thick.
B. Lubrication:

1. Equipment shall be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation. Lubrication systems shall not require attention during startup or shutdown and shall not waste lubricants.

2. Lubricants of the type recommended by the equipment manufacturer shall be furnished by the Contractor in sufficient quantity to fill all lubricant reservoirs and to replace all consumption during testing, startup, and operation for the entire warranty period prior to acceptance of equipment by Owner. Unless otherwise specified or permitted, the use of synthetic lubricants will not be acceptable.

3. Lubrication facilities shall be convenient and accessible. Lubrication fittings shall be the zerk type for each piece of equipment. Oil drains and fill openings shall be easily accessible from the normal operating area or platform. Drains shall allow for convenient collection of waste oil in containers from the normal operating area or platform without removing the unit from its normal installed position.

C. Safety Guards: All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard. Safety guards shall be fabricated from 16 USS gage or heavier galvanized or aluminum-clad sheet steel or 1/2 inch mesh galvanized expanded metal. Each guard shall be designed for easy installation and removal. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be galvanized. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.

D. Equipment Foundation Supports:

1. All foundations, platforms and hangers required for the proper installation of equipment shall be furnished and installed by the Contractor.

2. Unless otherwise indicated or specified, all equipment shall be installed on reinforced concrete bases at least 6 inches high and shall conform to requirements set forth in Division 3 for cast-in-place concrete. Cast iron or welded steel baseplates shall be provided for pumps, compressors, and other equipment. Each unit and its drive assembly shall be supported on a single baseplate of neat design. Baseplates shall have pads for anchoring all components and adequate grout holes. Baseplates for pumps shall have a means for collecting leakage and a threaded drain connection. Baseplates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with 1 inch minimum grout. All open equipment bases shall be filled with nonshrinking grout sloped to drain to the perimeter of the base.
3. The Contractor shall furnish, install and protect all necessary guides, bearing plates, anchor and attachment bolts, and all other appurtenances required for the installation of equipment. These shall be of ample size and strength for the purpose intended.

4. All anchor bolts, anchor bolt templates, and location drawings required for the installation of the equipment, support columns, and for all other equipment or machinery included under this Contract shall be furnished by the Contractor. All mechanical equipment shall be anchored using hook anchor bolts, cast-in-place, unless specifically called for otherwise on the Drawings. Anchor bolts, sleeves, and inserts shall be set in place in forms and cast in the concrete by the Contractor. It shall be the responsibility of the Contractor to obtain such anchor bolts, templates, and approved location drawings in proper time to avoid delay, and it shall be his further responsibility to check and approve the location and setting of the anchor bolts, sleeves, and inserts prior to the casting of the concrete. Parts of anchors or metal work that are not built into masonry and concrete shall be coated with approved paint. Anchor bolts for column base plates and other structural elements shall be of galvanized steel unless indicated otherwise; anchor bolts for drives, motors, fans, blowers, and other mechanical equipment shall be of Type 316 stainless steel. Anchor bolts shall be of ample size and shall be provided with hexagonal nuts of the same quality of metal as the bolts. All threads shall be clean cut and of U.S. Standard sizes.

5. Expansion bolts shall have malleable iron and lead composition elements of the required number of units and sizes. Expansion bolts, if called for on the Drawings, shall be furnished and installed by the Contractor. No other use of expansion bolts will be allowed without prior approval of the Engineer.

6. Unless specified otherwise, stud, tap, and machine bolts shall be of the best quality refined bar iron. Hexagonal nuts of the same quality of metal as the bolts shall be used. All threads shall be clean cut and shall conform to ANSI B1.1-latest for "Unified and American Screw Threads for Screws, Bolts, Nuts, and Other Threaded Parts."

7. All bolts, anchor bolts, nuts, and washers shall be Type 316 stainless steel.

8. Anchor bolts and expansion bolts shall be set accurately. Anchor bolts which are set before the concrete has been placed shall be carefully held in suitable templates of approved design provided under this Contract. Where indicated on the Drawings, specified, or required, anchor bolts shall be provided with square plates at least 4" x 4" x 3/8" or shall have square heads and washers and be set in the concrete forms with suitable pipe sleeves, or both.

9. Structural steel supports and miscellaneous steel required for supporting and/or hanging equipment and piping furnished under this Division shall be provided and installed by Contractor.
10. All foundations, anchor pads, piers, thrust blocks, inertia blocks and structural steel supports shall be built to template and reinforced as required for loads imposed on them.

11. The Contractor shall assume all responsibility for sizes, locations and design of all foundations, anchor pads, pier, thrust blocks, inertia blocks, curbs and structural steel supports.

E. Shop Painting:

1. All steel and iron surfaces shall be protected by suitable paint or coatings applied in the shop. Surfaces which will be inaccessible after assembly shall be protected for the life of the equipment. Exposed surfaces shall be finished smooth, thoroughly cleaned, and filled as necessary to provide a smooth uniform base for painting. Electric motors, speed reducers, starters, and other self-contained or enclosed components shall be shop primed or finished with a high-grade oil-resistant enamel suitable for coating in the field with an alkyd enamel. Coatings shall be suitable for the environment where the equipment is installed.

2. Surfaces to be painted after installation shall be prepared for painting as recommended by the paint manufacturer for the intended service, and then shop painted with one or more coats of the specified primer. Unless otherwise specified, the shop primer for steel and iron surfaces shall be Koppers "No. 10 Inhibitive Primer", or equal.

3. Machined, polished, and nonferrous surfaces which are not to be painted shall be coated with rust-preventive compound, Houghton "Rust Veto 344", Rust-Oleum "R-9", or equal.

F. Nameplates: Contractor shall provide equipment identification nameplates for each item of equipment. Nameplates shall be 1/8 inch Type 304 stainless steel and shall be permanently fastened. Plates shall be fastened using round head metallic drive screws, or where metallic drive screws are impractical, with stainless steel pop rivets. Metallic drive screws shall be brass or stainless steel, Type V and No. 8 by 3/8 inch long. Names and/or equipment designations shall be engraved on the plates and the engraving painted with a primer and black paint system compatible with stainless steel. Contractor shall submit a list of proposed names and designations for review prior to fabrication of nameplates. At a minimum, each nameplate shall include equipment manufacturer's name, year of manufacture, serial number and principal rating data.

G. Pipe Identification:

1. All pipe (except underground) shall have code letters and flow arrows painted as per Division 9. The Contractor shall ensure that the pipes are properly marked.

2. Underground pipe and tube: Pipe and tube shall be located by laying 2 inch wide plastic tape continuously along the run of pipe or tube per Division 9.
H. Noise Attenuation and Control:

1. Unless otherwise specified, the maximum permissible noise level for a complete installed piece of equipment located within or outside a structure shall not exceed 85 dB at 3 feet. A complete piece of equipment includes the driver and driven equipment, plus any intermediate couplings, gears, and auxiliaries. All equipment provided herein that is specified to be factory and field tested shall be tested as specified herein for noise generation at the equipment manufacturer's expense.

2. Maximum permissible noise (sound pressure) levels shall be in decibels as read on the "A" weighting scale of a standard sound level meter (dB); all measurements shall be made in relation to a reference pressure of 0.0002 microbar. Measurements of emitted noise levels shall be made on a sound level meter meeting at least the Type 2 requirements set forth in ANSI S1.4, Specification for Sound Level Meters. The sound level meter shall be set on the "A" scale and to slow response. Unless otherwise specified for a particular piece of equipment, the point of measurement of sound level shall be made at the specified distance from any major surface along the entire perimeter and at midheight of the piece of equipment, or at the specified distance from an outer major surface encompassing the sound source including inlets or outlets.

I. Fire Hazard Rating:

1. All piping, duct work, and equipment insulation, fastener, and jacketing materials shall have a fire hazard rating not to exceed 25 for flame spread, 50 for fuel contributed, and 50 for smoke developed. Rating shall be determined by ASTM Designation E84, "Surface Burning Characteristics of Building Materials". Corresponding ratings determined by Underwriters' Laboratories, Inc., UL-723, "Test Method for Fire Hazard Classification of Building Materials", will also be acceptable.

2. Flameproofing treatments will not be acceptable.

2.02 ACCESSORIES

A. Special Tools and Accessories: Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

B. Fasteners: All nuts, bolts, anchors and other fastening devices shall be a minimum of Type 316 stainless steel.
PART 3 - EXECUTION

3.01 INSTALLATION AND OPERATION

A. Installation: Equipment shall not be installed or operated except by, or with the guidance of, qualified personnel having the knowledge and experience necessary for proper results. When so specified, or when employees of Contractor or his subcontractors are not qualified, such personnel shall be field representatives of the manufacturer of the equipment or materials being installed.

1. The Contractor shall have on site sufficient proper construction equipment and machinery of ample capacity to facilitate the work and to handle all emergencies normally encountered in work of this character. To minimize field erection problems, mechanical units shall be factory assembled when practical.

2. Equipment shall be erected in a neat and workmanlike manner on the foundations and supports at the locations and elevations shown on the Drawings, unless otherwise directed by the Engineer during installation.

3. All equipment shall be installed in such a manner as to provide access for routine maintenance including lubrication.

4. For equipment such as pumping units, which require field alignment and connections, the Contractor shall provide the services of the equipment manufacturer's qualified mechanic, millwright, machinist, or authorized representative, to align the pump and motor prior to making piping connections or anchoring the pump base.

5. Equipment of a portable nature which requires no installation shall be delivered to a location designated by the Owner.

B. Tolerances: Precision gauges and levels shall be used in setting all equipment. All piping and equipment shall be perfectly aligned, horizontally and vertically. Tolerances for piping and equipment installation shall be 1/2 inch to 30 ft. horizontal and vertically. All valves and operators shall be installed in the position shown on the Drawings or as directed by the Engineer, if not shown.

C. Alignment and Level: The equipment shall be brought to proper level by shims (1/4 inch maximum). After the machine has been leveled and aligned, the nuts on the anchor bolts shall be tightened to bind the machine firmly into place against the wedges or shims. Grouting shall be as specified in Division 3.

D. Grouting: The grout shall be tamped into position with a board, steel bar, or other tool. Tamping should not be so hard as to raise or otherwise displace the plate.

E. Contact of Dissimilar Metals: Where the contact of dissimilar metal may cause electrolysis and where aluminum will contact concrete, mortar, or plaster, the contact
surface of the metals shall be separated using not less than one coat of zinc chromate primer and one heavy coat of aluminum pigmented asphalt paint on each surface.

F. Cutting and Patching: All cutting and patching necessary for the work shall be performed by the Contractor.

G. Operation: All equipment installed under this Contract, including that furnished by Owner or others under separate contract, shall be placed into successful operation according to the written instructions of the manufacturer or the instructions of the manufacturer's field representative. All required adjustments, tests, operation checks, and other startup activity shall be provided.

3.02 OBSERVATION OF PERFORMANCE TESTS

A. Where the specifications require observation of performance tests by the Engineer, such tests shall comply with the quality assurance paragraph in this section.

END OF SECTION
SECTION 15044
PRESSURE TESTING OF PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: This section specifies the leakage testing requirements for installed piping.

B. Test Pressures: Minimum hydrostatic test pressure of 150 psi or 1.5 times the operating pressure, whichever is greater

C. Testing Records:

1. Provide a record of each piping installation during the testing. These records shall include:
   a. Date of test.
   b. Identification of pipeline tested or retested.
   c. Identification of pipeline material.
   d. Identification of pipe specification.
   e. Test fluid.
   f. Test pressure.
   g. Remarks: Leaks identified (type and location), types of repairs, or corrections made.
   h. Certification by Contractor of no leakage as specified herein.
   i. Signature of Owner’s representative witnessing pipe test.

2. Submit five (5) copies of the test records to the Engineer's representative upon completion of the testing.

D. Testing shall comply with AWWA C600 and C651 where applicable.

E. Testing shall be completed prior to weekly roadway restoration.

PART 2 - PRODUCTS

2.01 GENERAL

A. Testing fluid shall be water for all hydrostatic tests.

B. Gravity piping shall be tested using compressed air.
2.02 MATERIALS AND EQUIPMENT

A. Provide pressure gauges, pipes, blind flanges, bulkheads, pumps, and meters to perform the hydrostatic testing.

PART 3 - EXECUTION

3.01 TESTING PREPARATION

A. Pipes shall be in place and anchored before commencing pressure testing.

B. Conduct hydrostatic tests on exposed and aboveground piping after the piping has been installed and attached to the pipe supports, hangers, anchors, expansion joints, valves, and meters.

C. Before conducting hydrostatic tests, contractor shall pig all lines as detailed in the specifications herein, to remove dirt and debris.

D. Test new pipelines which are to be connected to existing pipelines by isolating the new line from the existing line by means of pipe caps, special flanges, or blind flanges. After the new line has been successfully tested, remove caps or flanges and connect to the existing piping.

E. Conduct preliminary and final hydrostatic tests on the buried pipe after completely backfilling and compacting the trench.

F. Pressure Test:

1. All tests shall be made in the presence of and to the satisfaction of the Owner or Engineer and also, to the satisfaction of any local or state inspector having jurisdiction.
   a. Provide not less than three (3) days notice to the Owner, Engineer, and the authority having jurisdiction when it is proposed to make the tests.
   b. Any piping or equipment that has been left unprotected and subject to mechanical or other injury in the opinion of the Engineer shall be retested in part or in whole as directed by the Engineer.
   c. The piping systems may be tested in sections as the work progresses, but no joint or portion of the system shall be left untested.

2. All elements within the system that may be damaged by the testing operation shall be removed or otherwise protected during the operation.
3. Repair all damage done to existing or adjacent work or materials due to or on account of the tests.

3.02 INSPECTION AND TESTING

A. Pneumatic Testing:

1. Perform pneumatic testing using dry air or nitrogen. Perform tests only after the piping has been completely installed including supports, hangers, and anchors. Protect test personnel and Owner’s operating personnel. Secure piping to be tested to prevent the pipe from moving to prevent damage to adjacent piping and equipment. Remove or isolate from the piping any appurtenant instruments or devices that could be damaged by the test prior to applying the test.

2. Apply an initial pneumatic leakage test per pipe schedule to the piping system prior to final leak testing. Examine for leakage, detected by soap bubbles, at joints and connections. After correcting visible leaks, gradually increase the pressure in the system to not more than one-half of the test pressure. Then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure has been reached.
   a. Continuously maintain the pneumatic test pressure for a minimum time of eight hours and for such additional time as may be necessary to conduct a soap bubble examination for leakage. The piping system shall show no leakage. Correct any visible leakage and retest.

B. Hydrostatic Testing of Aboveground or Exposed Piping:

Open vents at high points of the piping system to purge air while the pipe is being filled. Subject the piping system to the test pressure indicated. Maintain the test pressure for a minimum of two (2) hours. Examine joints, fittings, valves, and connections for leaks. The piping system shall show no leakage or weeping. Correct leaks and retest until no leakage is obtained.

B. Hydrostatic Testing of Buried Piping:

1. Where any section of the piping contains concrete thrust blocks or encasement, do not make the pressure test until at least 10 days after the concrete has been poured. When testing mortar-lined piping, fill the pipe to be tested with water and allow it to soak for at least 48 hours to absorb water before conducting the pressure test.

2. Test buried pipe in sections, starting and ending at a valve.

3. Apply and maintain the test pressure by means of a hydraulic force pump. Maintain the test pressure for a minimum duration of two (2) hours.

4. No leakage is allowed.
D Hydrostatic Testing of HDPE Pipe:

1. Apply and maintain the test pressure for a minimum duration of three (3) hours. Pressure tests shall be performed prior to installation (above ground) as well as after installation. No leakage is allowed for HDPE pipe. Repair and retest any pipes indicating leakage. All piping shall be tested from valve to valve.

END OF SECTION
SECTION 15062

DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish all labor, materials, equipment and incidentals required and install, all ductile iron piping, ductile iron fittings, and appurtenances as shown on the Drawings and as specified herein.

B. General Design: The equipment and materials specified herein are intended to be standard types of ductile iron pipe and cast or ductile iron fittings for use in transporting wastewater, potable water, and reclaimed water.

C. Related Work Described Elsewhere:
   1. Wastewater Force Mains: Section 02661.
   2. Polyvinyl Chloride (PVC) Pipe and Fittings: Section 15064.

1.02 QUALITY ASSURANCE

A. Qualifications: All of the ductile iron pipe and ductile or cast iron fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

B. Approved Manufacturers

   1. American Pipe
   2. U.S. Pipe
   3. Approved Equal

C. Standards:

   1. ANSI A 21.50/AWWA C150
   2. ANSI A-21.51/AWWA C151
   3. ANSI A-21.10/AWWA C110
   4. ANSI A-21.41/AWWA C104

D. Factory Tests: The manufacturer shall perform the factory tests described in ANSI A-21.51/AWWA C151.
E. Quality Control

1. The manufacturer shall establish the necessary quality control and inspection practice to ensure compliance with the referenced standards. All pipe on this Project shall be supplied by a single manufacturer unless otherwise accepted in writing by the Utilities Commission of New Smyrna Beach.

2. In addition to the manufacturer’s quality control procedures, the Utilities Commission of New Smyrna Beach may select an independent testing laboratory to inspect the material at the foundry for compliance with these specifications. The cost of foundry inspection requested by the Utilities Commission of New Smyrna Beach will be paid for by the Utilities Commission of New Smyrna Beach.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. Submit Shop Drawings and piping layouts in accordance with Section 01340, including areas within and under buildings and structures. Shop Drawings shall include dimensioning, methods, and locations of supports and all other pertinent technical specifications. Show locations of all field cuts. Shop Drawings shall be prepared by the pipe manufacturer. Shop Drawings for piping within and under buildings and structures shall be submitted within 30-days of Execution of Contract.

B. Operating Instructions: Submit Operation and Maintenance Manuals in accordance with Section 01730.

C. Manufacturer’s Certification

1. Submit manufacturer’s sworn certification of factory tests and test results.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. The Contractor shall be responsible for all materials furnished and stored until the date of project completion. The Contractor shall replace, at his expense, all materials found to be defective or damaged in handling or storage. The Contractor shall, if requested by the Utilities Commission of New Smyrna Beach, furnish certificates, affidavits of compliance, test reports, samples, or check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

B. Delivery and Storage: Delivery and storage of the materials shall be in accordance with the manufacturer’s recommendations. Stored pipe shall be covered for protection against contamination. Joint gaskets shall be stored in clean, dark and dry location until immediately before use.
C. Handling: Care shall be taken in loading, transporting and unloading to prevent damage to the pipe and fittings and their respective coatings. Pipe or fittings shall not be rolled off the carrier or dropped. Pipe shall be unloaded by lifting with a forklift or crane. All pipe or fittings shall be examined before installation and no piece shall be installed which is found to be defective. Pipe shall be handled to prevent damage to the pipe or coating. Accidental damage to pipe or coating shall be repaired to the satisfaction of the Utilities Commission of New Smyrna Beach or be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on level ground, graded to eliminate all rock points and to provide uniform support along the full pipe length. When being transported, the pipe shall be supported at all times in a manner which will not permit distortion or damage to the lining or coating. Any unit of pipe that, in the opinion of the Utilities Commission of New Smyrna Beach, is damaged beyond repair by the Contractor shall be removed from the site.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Ductile Iron Pipe


2. Thickness/Pressure Class:

   a. Below ground piping: Class 350 (4-inch to 12-inch), Class 250 (16-inch to 24-inch) and Class 200 (30-inch to 64-inch) unless otherwise noted or specified.

   b. Above ground piping: Flanged, Class 350 (minimum) unless otherwise noted or specified.

3. Joints

   a. Push-on or Mechanical Joints (below ground piping).

      1) Standards: ANSI A21.11, AWWA C111.

      2) Class: 350-psi working pressure rating.

      3) Gaskets.

         a) Potable and Reclaimed Water Service: Styrene Butadiene Rubber (SBR) ring type.

         b) Wastewater Service: Neoprene rubber ring type.

   b. Flanged (above ground or inside below ground vaults).

2) Class: 125-pound factory applied screwed long hub flanges, plain faced without projection.

3) Gaskets.
   a) Spans less than 10-feet: full-face 1/8-inch thick neoprene rubber.
   b) Spans greater than 10-feet: Toruseal gaskets as manufactured by American Cast Iron Pipe or acceptable equal.

c. Restrained Joints.
   1) Manufacturers: EBAA Iron Inc. or approved equal.
   2) Class: 250-psi minimum design pressure rating.
   3) Mechanical joint retainer glands shall not be acceptable unless specifically approved by the Utilities Commission of New Smyrna Beach.

d. Joint Accessories.
   1) Mechanical joint bolts, washers and nuts: Corten steel.
   2) Flanged joint bolts, washers and nuts: 316 stainless steel with bolts and nuts conforming to ASTM A193 Grade B8M.

e. Pipe Length (below ground installation): 20-feet maximum nominal length.

4. Pipe Identification.
   a. Each length of pipe shall bear the name or trademark of the manufacturer, the location of the manufacturing plant, and the class or strength classification of the pipe. The markings shall be plainly visible on the pipe barrel. Pipe which is not clearly marked is subject to rejection. The Contractor shall remove all rejected pipe from the project site within five NORMAL WORKING DAYS.

B. Fittings

1. Ductile iron fittings 4-inch through 24-inch shall be pressure rated at 350-psi minimum, except flanged joint type fittings which shall be rated at 250-psi minimum. All 30-inch and larger fittings shall be pressure rated to 250-psi minimum. All fittings shall conform to ANSI/AWWA C110/A21.10, latest revision, and shall be ductile iron only. All fittings shall be cast and machined allowing the bolt holes to straddle the vertical centerline. All fittings shall be
designed to be capable to withstand, without bursting, hydrostatic tests of three times the rated water working pressure. All fittings shall have a date code cast (not printed or labeled) with identification of date, factory, and the factory unit from which it was cast and machined. Fittings shall have the pressure rating, nominal diameter of openings, manufacturer's name, and the country where cast and number of degrees or fraction of the circle distinctly cast on them. Ductile iron fittings shall have the letter "DI" or "Ductile" cast on them.

2. Joints shall be as described for ductile iron pipe for above ground/exposed and buried service.

3. All potable water main fittings shall have NSF 61 certification, and ISO 9001 certification for both the foundry and manufacturer. The NSF 61 certification shall be issued on all coatings and linings, from the said manufacturers that are used for potable water applications.

2.02 COATINGS, LININGS, AND IDENTIFICATION MARKINGS

A. Exterior Coatings

1. Below ground/buried or in a casing pipe:
   a. Type: Asphaltic coating, 1.0-mil DFT in accordance with ANSI/AWWA A21.51/C151.
   b. Markings: (continuous 3-inch wide strip within top 90 degrees of pipe - min. drying time 30-minutes before backfill).
   c. Color:
      1) Raw Wastewater: Safety Green.
      2) Reclaimed Water: Purple (Pantone 522C).
      3) Potable Water: Safety Blue.

2. Above ground/Exposed/In vaults
   a. Coatings and coating testing for ductile iron pipe and fittings for above ground/exposed applications shall be accordance with Division 9. Primer, intermediate and final coats whether shop or field applied shall be compatible and applied in accordance with the coating system manufacturer's recommendations. Refer to Division 9 for approved coating system suppliers. Asphaltic seal coat applied to the exterior of above ground piping and fittings shall be blasted and completely removed prior to coating per NACE-3/SSPC-SP6 commercial blast cleaning minimum angular anchor profile of 1.5-mils.
b. Color

1) Raw Wastewater: Safety Green.
2) Reclaimed Water: Purple (Pantone 522C).
3) Potable Water: Safety Blue.

3. Inside Wetwell

a. All piping inside of wastewater wetwell shall be 316 stainless steel.

B. Interior Lining (Applied by pipe manufacturer)

1. Wastewater: Interior coating shall ceramic epoxy material such as SP2000, Permox-CTF, or Protecto 401 for all pipe and fittings. All linings shall be applied to a nominal thickness of 40 mils. All ductile iron pipe and fittings shall be delivered to the manufacturer certified applicator without asphalt, cement lining, or any other lining on the interior surface and no coating shall have been applied to the first 6-inches of the exterior of the DIP spigot ends. Minimum surface preparation shall be SSPC-SP 1 Solvent Cleaning method to remove oil and grease followed by NACE-4 / SSPC-SP7 Brush-Off Blast Cleaning. Coating shall be applied within 12-hours of surface preparation to the interior of the pipe and fittings so as to obtain a continuous and relatively uniform and smooth integral lining with a total minimum dry film thickness of 40-mils for the complete system. No lining shall take place when the substrate or ambient temperature is below 40°F. The lining shall not be used on the face of the flange of fittings or flanged pipe. The system shall be holiday free and holiday testing (minimum 2000 volts) shall be conducted and pinholes shall be repaired prior to shipping.

2. Potable Water and Reclaimed Water: Interior coating shall be fusion-bonded epoxy (FBE) or Cement Mortar lined with asphaltic seal coat.

a. FBE for Fittings: Fittings shall be supplied with a FBE coating, both inside and outside for total protection including flanged and buried fittings. The exterior of flanged fittings for above ground assemblies shall adhere to final exterior coating requirements per 3119 2.04 A. The FBE coating system shall meet or exceed ANSI/AWWA C-550 and C116/A21.116 requirements and shall have NSF 61 certification. FBE coating thickness shall be 6 to 8-mils dry film thickness, shall be applied for secure adhesion, shall have a smooth surface and shall be holiday free.

b. Cement mortar lining with a seal coat of asphaltic material shall be in accordance with ANSI/AWWA A21.4/C104.

C. Polyethylene Encasement is required for all ductile iron pipe and fittings as per the following:

2.03 PATH MARKING TAPE

A. All ductile iron pipe shall be installed with a continuous polyethylene 3M EMS XR Path Marking Tape (Series 7600 XR). The 6-inch path marking tape shall be installed directly above the center of the pipe at a buried depth between 24 and 36 inches below final grade. The tape shall be installed printed side up.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Ductile iron pipes shall be installed in accordance with AWWA C600 and AWWA Manual M-42. When a restraining type gasket is used, the bell shall be painted red.

B. Underground Ductile Iron Pipe and Fittings.

1. Bedding firm, dry and even bearing of suitable material. Blocking under the pipe will not be permitted.

2. Placement

   a. Alignment: In accordance with lines and grades shown on the Drawings. Deflection of joints shall not exceed 75% of the values recommended by the pipe manufacturer.

   b. The Contractor shall provide line and grade stakes at a 100-foot maximum spacing and at all line and/or grade change locations. The Contractor shall provide temporary benchmarks at a maximum of 1,000-foot intervals. The minimum pipe cover shall be 36-inches below the finished grade surface or 36-inches below the elevation of the edge of pavement of the road surface whichever is greater.

   c. All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken or otherwise defective materials are being used. All homing marks shall be checked for the proper length so as to not allow a separation or over homing of connected pipe. Homing marks incorrectly marked greater than 1-inch shall result in rejection of pipe and removal from site. The Contractor shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after installation.

   d. Proper implements, tools and facilities shall be used for the safe and proper protection of the Work. Pipe shall be lowered into the trench in such a manner as to avoid any physical damage to the pipe. Pipe shall not be dropped or dumped into trenches under any circumstances.

   e. Trench Dewatering and Drainage Control: Contractor shall prevent water from entering trench during excavation and pipe-laying.
operations to the extent required to properly grade the bottom of the trench and allow for proper compaction of the backfill. Pipe shall not be laid in water.

f. Pipe Laying in Trench: Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned and re-laid. Pigging of pipe may be used to remove foreign materials in lieu of flushing. At times when pipe installation is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by the Utilities Commission of New Smyrna Beach to ensure absolute cleanliness inside the pipe. The pipe shall be installed with the color stripe and pipe text on the top of pipe.

3. Cutting: When required, cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of the pipe to be used with a push-on bell shall be beveled. Bare metal exposed at ends of the pipe shall be field coated in accordance with pipe manufacturer's recommendations. Cut pipe for wastewater service shall have exposed bare metal ends repaired with Protecto 401 using the coating system manufacturer's field repair kit.

4. Joints
   a. Joint Placement
      1) Push on joints: Pipe shall be laid with the bell facing upstream. The gasket shall be inserted and the joint surfaces cleaned and lubricated prior to placement of the pipe. After joining the pipe, a metal feeler shall be used to verify that the gasket is correctly located.
      2) Mechanical Joints: Pipe and fittings shall be installed in accordance with the "Notes on Method of Installation" under ANSI A21.11/AWWA C111. The gasket shall be inserted and the joint surfaces cleaned and lubricated with soapy water before tightening the bolts to the specified torque.

C. Thrust Restraint
   1. General: Thrust restraint shall be accomplished by the use of mechanical restraining devices unless specifically identified otherwise on the Drawings or herein.
   2. Length of Restrained Joints: In accordance with the lengths listed in the table as shown on the Drawings.

D. Installation of Pipes on Curves
1. Maximum deflections at pipe joints, fittings and laying radius for the various pipe lengths shall not exceed 50% (percent) of the pipe manufacturer's recommendation.

3.02 CLEANING AND FIELD TESTING

A. General: At the conclusion of the Work, the Contractor shall provide all associated cleaning and field testing as specified in other related sections of these specifications.
PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish all labor, materials, equipment and incidentals required to install and test all polyvinyl chloride (PVC) piping, fittings and appurtenances as shown on the Drawings and specified herein.

B. General Design: The equipment and materials specified herein are intended to be standard types of PVC pipe and ductile iron fittings for use in transporting wastewater, reclaimed water, and water.

C. Related Work Described Elsewhere:
   1. Wastewater Force Mains: Section 02661.
   2. Ductile Iron Pipes and Fittings: Section 15062.
   3. Ancillary Equipment: Section 15100.
   4. Plug Valves: Section 15207.

1.02 QUALITY ASSURANCE

A. Qualifications: All PVC pipe and ductile iron fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed, installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

B. Standards:
   1. AWWA C900
   3. NSF 14
   4. UNI-B-1 through 5
C. Factory Tests: The manufacturer shall perform the factory tests described in Section 3 - AWWA C900.

D. Quality Control:
   1. The manufacturer shall establish the necessary quality control and inspection practice to ensure compliance with the referenced standards.
   2. In addition to the manufacturer’s quality control procedures, the Utilities Commission of New Smyrna Beach may select an independent testing laboratory to inspect the material at the production facility for compliance with these specifications. The Utilities Commission of New Smyrna Beach will pay for the cost of facility inspection requested by the Utilities Commission of New Smyrna Beach.

1.03 SHOP DRAWINGS AND SUBMITTALS
   A. Submittals shall be submitted to the Engineer for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01420 “Drawings and Submittals”.
   B. Materials and Shop Drawings
   C. Manufacturer’s Certification
      1. Submit sworn certification of factory tests and their results.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING
   A. Delivery and Storage: Delivery and storage of the materials shall be in accordance with the manufacturer’s recommendations. PVC pipe shall be covered with black plastic with a minimum thickness of 15-mil. Joint gaskets shall be stored in a clean, dark and dry location until use.
   B. Handling: Care shall be taken in loading, transporting and unloading to prevent damage to the pipe or fittings and their respective coatings. Pipe or fittings shall not be rolled off the carrier or dropped. Pipe shall be unloaded by lifting with a forklift or crane. All pipe or fittings shall be examined before installation and no piece shall be installed which is found to be defective. Pipe shall be handled to prevent damage to the pipe. Accidental damage to pipe shall be repaired to the satisfaction of Utilities Commission of New Smyrna Beach or it shall be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on level ground, graded to eliminate all rock points and to provide uniform support along the full pipe length. When being transported, the pipe shall be supported at all times in a manner to prevent distortion or damage to the lining or coating. Any unit of pipe that, in the opinion of the Utilities Commission of New Smyrna Beach, is damaged beyond repair by the Contractor shall be removed from the site.
   C. The Contractor shall be responsible for all materials furnished and stored until the date
of project completion. The Contractor shall replace, at his expense, all materials found to be defective or damaged in handling or storage. The Contractor shall, if requested by the Utilities Commission of New Smyrna Beach, furnish certificates, affidavits of compliance, test reports, samples or check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Polyvinyl Chloride (PVC) Pipe

1. Standards: AWWA C900 and ASTM D1784/D3034/F679 (Gravity Sewer)

2. Compounds: Class 12454-A or Class 12454-B

3. PVC Gravity Pipe and Fittings: PVC gravity pipe (6-inch to 15-inch), shall conform to ASTM D3034, maximum SDR 35. PVC gravity pipe (18-inch to 36-inch), shall conform to ASTM F679 and uniform minimum "pipe stiffness" at 5% (percent) deflection shall be 46-psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D3212 and ASTM F477. Applicable UNI Bell Plastic Pipe Association standard is UNI B.

4. PVC Pressure Pipe and Fittings: All PVC pipe of nominal diameter 4 to 60-inches shall be manufactured in accordance with AWWA Standard C900. The PVC pipe shall have a minimum working pressure rating of 150-psi and shall have a maximum dimension ratio of 18. Pipe shall be the same outside diameter as ductile iron pipe.

5. Dimension Ratio/Thickness: (unless otherwise shown on the Drawings)

a. Raw Wastewater:

   1) Pressure Systems: DR 18
   
   2) Gravity Systems: DR 35 (ASTM D3034) or PS 46 (ASTM F679)

b. Treated Wastewater: DR 18

c. Reclaimed Water: DR 18

d. Raw Water: DR 18

e. Potable Water: DR 18

f. Irrigation Piping: Schedule 40 or SDR 21

6. Joints:
a. Push-on integral bell elastomeric gasket joints:

1) Standards: ASTM D3212/D3139/F477 and UNI-B-1

2) Gaskets:
   a) Potable and Reclaimed Water Service: Styrene Butadiene Rubber (SBR) ring type.
   b) Wastewater Service: Neoprene rubber ring type.

3) Pipe Markings: Pipes shall have a manufacturer's home-mark on the spigot. On field cut pipe, the Contractor shall provide home-mark on the spigot in accordance with manufacturer's recommendations.

b. Solvent weld (nominal diameter less than 4-inches):

1) Standards: ASTM D2466/D2564

2) Type: Slip Fitting Socket (tapered)

3) Exclusions: Plastic saddle and flange joints will not be used.

c. Restrained Joints:

1) Restrained joint devices shall be made specifically for PVC pipe and meet or exceed the requirements in ASTM F-1674.

2) Manufacturers: Meg-A-Lug or approved equal.

3) Design pressure rating equal to or above test pressure as specified herein.

d. Pipe Length:

1) Pressure systems: 20-feet maximum nominal length

2) Gravity systems: 13-feet minimum nominal length

B. Fittings – Fittings shall meet the requirements of Specification 15062: Ductile Iron Pipe and Fittings.

2.02 PATH MARKING TAPE

A. All PVC pipe shall be installed with a continuous polyethylene 3M EMS XR Path Marking Tape (Series 7600 XR). The 6-inch path marking tape shall be installed directly above the center of the pipe at a buried depth between 24 and 36 inches below final grade. The tape shall be installed printed side up.
B. Identification Markings:

1. Pipe furnished in solid color or white with color lettering as indicated below.
   
a. Lettering along top 90° (degrees) of pipe, minimum 3/4-inch in height with appropriate wording appearing 1 or more times every 21-inches along the entire length of the pipeline.

   1) Raw Wastewater: Safety Green
   2) Reclaimed Water: Purple (Pantone 522C)
   3) Potable Water: Safety Blue

PART 3 - EXECUTION

3.01 INSTALLATION

A. Standards: AWWA C900/UNI-B 3 and 4

B. Underground Polyvinyl Chloride (PVC) Pipe and Fittings

1. Bedding: Firm, dry and even bearing of suitable material. Blocking under the pipe will not be permitted.

2. Placement/Alignment:

   a. Installation shall be in accordance with lines and grades shown on the Drawings. For pressure systems, deflection of joints shall not exceed 75% of that recommended by the manufacturer.

   b. All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken or otherwise defective materials are being used. All homing marks shall be checked for the proper length so as to not allow a separation or over homing of connected pipe. Homing marks incorrectly marked on pipe shall result in rejection of pipe and removal from site. The Contractor shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after installation.

   c. Proper implements, tools and facilities shall be used for the safe and proper protection of the Work. Pipe shall be lowered into the trench in such a manner as to avoid any physical damage to the pipe. Pipe shall not be dropped or dumped into trenches under any circumstances.

   d. Trench Dewatering and Drainage Control: Contractor shall prevent water from entering trench during excavation and pipe laying operations to the extent required to properly grade the bottom of the
trench and allow for proper compaction of the backfill. Pipe shall not be laid in water.

e. Pipe Laying in Trench: Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned and re-laid. Pigging of pipe may be used to remove foreign materials in lieu of flushing. At times when pipe installation is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by the Utilities Commission of New Smyrna Beach to ensure absolute cleanliness inside the pipe. The color stripe and pipe text shall be viewed from the top of pipe when installed. When installing PVC pipe, no additional joints will be installed until the preceding pipe joint has been completed and the pipe carefully embedded and secured in place.

f. Locating Tape: All PVC pipe shall be installed with a continuous polyethylene 3M EMS XR Path Marking Tape (Series 7600 XR). The 6-inch path marking tape shall be installed directly above the center of the pipe at a buried depth between 24 and 36 inches below final grade. The tape shall be installed printed side up.

g. PVC Pressure Pipe Installation and Training: PVC pipe shall be installed in accordance with standards set forth in the UNI-BELL "Handbook of PVC Pipe", AWWA C605, and AWWA Manual M-23. The pipe shall be laid by inserting the spigot end into the bell flush with the insertion line or as recommended by the manufacturer. At no time shall the bell spigot end be allowed to go past the "insertion line" or "homing mark" for pressure pipe applications and homing mark shall be visible.

h. Field Cutting: PVC pipe can be cut with a handsaw or power driven abrasive disc making a square cut. The end shall be beveled with a beveling tool, wood rasp or power sander to the same angle as provided on the factory-finished pipe. The insertion line on the spigot shall be remarked to the same dimensions as the factory-marked spigot.

i. PVC Gravity Pipe Installation: Gravity sewer pipe shall be installed to the homing mark, no tolerance. Any noticeable separation shall be removed and reinstalled. The homing mark may be disregarded to meet the maximum of 1-inch separation between bell and spigot requirement.
3. Joints:
   a. Joint Placement:
      1) Push on joints: Pipe shall be laid with the bell ends facing upstream. The gasket shall be inserted and the joint surfaces cleaned and lubricated prior to placement of the pipe. After joining the pipe, a metal feeler shall be used to verify that the gasket is correctly located.
      2) Mechanical Joints: Pipe and fittings shall be installed in accordance with the "Notes on Method of Installation" under ANSI A21.11/AWWA C111. The gasket shall be inserted and the joint surfaces cleaned and lubricated with soapy water before tightening the bolts to the specified torque.

C. Thrust Restraint
   1. Thrust restraint shall be accomplished by the use of mechanical restraining devices unless specifically identified otherwise on the Drawings or herein.
   2. Length of restrained joints shall be in accordance with the lengths listed in the table as shown on the Drawings.

D. Installation of Pipes on Curves:
   1. No joint deflection or pipe bending is allowed in PVC pipe. The maximum allowable tolerance in the joint due to variances in installation is 0.75° (degrees) (3-inches per joint per 20-foot stick of pipe). No bending tolerance in the pipe barrel shall be acceptable. Alignment change shall be made only with sleeves and fittings.

3.02 CLEANING AND FIELD TESTING
   A. At the conclusion of the Work, the Contractor shall provide all associated cleaning and field testing as specified in associated sections of these specifications.

END OF SECTION
SECTION 15070

LOW PRESSURE AIR TESTING OF INSTALLED SEWER PIPE

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish all labor, materials, equipment, and incidentals required to test all gravity sewer piping, fittings, and appurtenances as shown on the Drawings and specified herein.

1.02 FIELD TESTING

A. General: At least ten (10) days prior to beginning testing, the Contractor shall submit a testing plan to the Engineer for review.

B. Gravity Piping:

1. The Contractor shall perform low pressure air test on all gravity piping.


3. Test Section: Between adjacent manholes, not to exceed 400 feet.

4. Test Pressure: 4.0 psig greater than the average back pressure of any groundwater above the pipe invert, but not greater than 9.0 psig.

5. Preparation:

a. Before testing, the Contractor shall determine groundwater level and adjust the test pressure accordingly.

b. Before testing, the Contractor shall flush all gravity lines to obtain free flow through each line.

6. Low Pressure Test Procedure:

a. Low pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches the specified test pressure.

b. When temperatures have been equalized and pressure stabilized at the specified test pressure, the air supply shall be shut off.

c. If the time shown in the Table 15070-1 elapses before the air pressure drops 1.0 psig, the section undergoing the test shall have passed.
d. Should the section fail to meet test requirements, the Contractor shall determine the sources of leakage, make necessary repairs and repeat the test until the test section passes.

7. Closed Circuit Television Inspection:

a. Internal video inspection for the gravity sewer shall be performed by the Contractor to check for alignment and deflection. The television inspection shall also be used to check for cracked, broken, or otherwise defective pipe, and overall pipe integrity.

b. The video internal inspection will be performed in two stages. The first inspection will be within 30 days after the installation of the gravity sewer pipe, provided the road base is in place and the manhole rings and covers are to grade. The requirement of road base being in place shall be waived if the top of the sewer is 12 feet below the finished grade. In such cases, the video inspection shall be performed once the trench has been compacted up to the road base. The second inspection of the gravity sewer pipe will be before the end of the one-year warranty period.

c. Owner may also required the laterals to be televised. Lateral video cameras can be launched from the sewer main line or be of the push type.

c. If the first or second video inspection reveals cracked, broken, or defective pipe, or pipe misalignment resulting in vertical sags in excess of 1-1/2” and in the case of PVC pipe a ring defect in excess of 5%, the Contractor shall be required to repair or replace the pipeline at no extra cost to Owner. Successful passage of both the low pressure air exfiltration test and video inspection is required before acceptance by the Owner.

d. Prior to repair or replacement of failed sewer pipe, the method of repair or replacement shall be submitted to the Engineer for approval. Pressure grouting of pipe or manholes shall not be considered as an acceptable method of repair.
# TABLE 15070-1

**MINIMUM SPECIFIED TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP**

FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Specification Time for Length (L) Shown (min:sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pipe Diameter</td>
<td>Minimum Time for Minimum Time</td>
<td>Time for Longer Length</td>
<td>100 ft</td>
</tr>
<tr>
<td>in.</td>
<td>(min:sec)</td>
<td>(ft)</td>
<td>(sec)</td>
<td>100 ft</td>
</tr>
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<td>---</td>
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<td>298</td>
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<td>7:34</td>
</tr>
<tr>
<td>16</td>
<td>17:00</td>
<td>133</td>
<td>7.692 L</td>
<td>17:00</td>
</tr>
</tbody>
</table>

Note: If there has been no leakage (zero psig drop) after one hour of testing, the test section shall be accepted and the test complete (See Section 7.5).

END OF SECTION
SECTION 15100
ANCILLARY EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION
   A. Scope of Work: Provide all valves and appurtenances, ready for operation, as shown on the Drawings and as specified herein.
   B. Related Work Described Elsewhere:
      1. Plug Valves: Section 15207
      2. Combination Vacuum/Air Release Valves: Section 15208

1.02 QUALITY ASSURANCE
   A. All valves, appurtenances, and ancillary equipment shall be products of well-established reputable firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications.

1.03 SHOP DRAWINGS AND SUBMITTALS
   A. Submittals shall be submitted to the Engineer for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01420.

PART 2 - PRODUCTS

2.01 GENERAL
   A. All valves, appurtenances, and ancillary equipment shall be of the sizes shown on the Drawings and specified herein.
   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.

2.02 TAPPING SLEEVES AND VALVES
   A. General: Tapping sleeves shall be a joint type with flanged outlet manufactured by Dresser Industries Inc., Anniston, Alabama or as approved equal.
B. Mechanical Joint Sleeves: Sleeves shall be cast of gray-iron or ductile-iron and have an outlet flange with the dimensions of the Class 125 flanges shown in ANSI B16.1 and properly recessed for tapping valve. Sleeve shall be epoxy coated or stainless steel with stainless steel hardware. Glands shall be gray-iron or ductile iron. Gaskets shall be vulcanized natural or synthetic rubber. Bolts and nuts shall comply with ANSI/AWWA C111/ANSI A21.11. Sleeves shall be capable of withstanding a 200-psi working pressure.

C. Fabricated Mechanical Joint Tapping Sleeves: Sleeves shall be of split mechanical joint design with separate end and side gaskets. Sleeves shall be fabricated of high strength steel, meeting ASTM A283 Grade C or ASTM A-36. Outlet flange shall meet AWWA C-207, Class "D" ANSI I50-pound drilling and be properly recessed for the tapping valve. Bolts and nuts shall be high strength low alloy steel to AWWA C111 (ANSI A21.11). Gasket shall be vulcanized natural or synthetic rubber. Sleeve shall have manufacturer applied fusion-bonded epoxy coating, minimum 12-mil thickness.

D. Tapping Valves: Tapping valves shall be resilient seated gate valves flange by mechanical joint ends. Valves shall be compatible with tapping sleeves as specified above and specifically designed for pressure connection operations.

1. Tapping valves with alignment lip shall be placed vertical where possible for Water and Reclaimed Water.

2. Tapping Valves 16-inch and larger shall be AWWA C515 resilient seated only (16-inch and 24-inch no gearing required) above 24-inch shall be installed vertically with a spur gear actuator. When tapping existing mains, valves 24-inch and above shall be furnished with NPT pipe plugs for flushing the tracks.

2.03 VALVE BOXES FOR BURIED VALVES

A. Standard 2-piece Cast Iron Valve Box: Required for mains less than 6-feet below finished grade and less than or equal to 12-inches in diameter.

1. Valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as directed by the Utilities Commission of New Smyrna Beach’s Representative.

2. The barrel shall be 2-piece, screw type only, having 5-1/4-inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall be complete with locking cast iron covers. Coat buried cast iron pieces with coal tar epoxy.

B. Valve Box Assembly: Valve box assemblies with operating nut extension is required for any size main that is 6-feet or greater below finished grade or if mains are greater than 12-inches in diameter.

1. Valve boxes shall be adjustable, cast iron and suitably sized to the valve with a minimum diameter of 5 inches. Boxes shall be suitable for H-20 loading or equal to Clow, M and H, or US Foundry.
2. Valve boxes shall be 1 complete assembled unit composed of the valve box and extension stem that attaches and locks to the 2-inch wrench nut. The extension shall be high strength, corrosion resistant steel construction, and permanently attached to the operating nut.

3. The operating nut extension insert shall be 1 complete assembled unit with a self-adjusting extension stem system that fits inside a standard valve box that will accommodate variable trench depths 6-feet and greater as shown in the Drawings. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil.

4. A valve box-centering device designed to eliminate the shifting of the valve box against the operating nut of the valve shall be used. Valve box assembly shall be adjustable to accommodate variable trench depths 6-foot and greater as shown in the Drawings.

C. The stem assembly shall be of a telescoping design that allows for variable adjustment length. The material shall be at minimum galvanized square steel tubing. The stem assembly shall have a built-in device that prevents the stem assembly from disengaging at its fully extended length. The extension stem must be capable of surviving a torque test to 1,000-foot-pounds without failure.

D. Valve boxes shall have locking cast iron covers utilizing a 5-sided nut with a special wrench needed to open. Covers shall have "WATER", "SEWER", or "RECLAIMED WATER" cast into the top, as applicable.

E. Concrete Collar: Each valve installed in an unimproved area (outside of pavement, driveways or sidewalks) shall require a 24-inch by 24-inch by 6-inch concrete pad or collar as shown in the Drawings.

F. Identification Disc: Each 16-inch or larger valve (unless otherwise shown on the Drawings) installed shall be identified by a 3-inch diameter bronze disc anchored in the concrete pad or collar in unimproved areas and/or anchored on a 4-inch by 4-inch by 18-inch long concrete post set flush with the pavement surface in improved areas. The disc shall be stamped with the following information as shown on the Drawings:

1. Size of the valve.

2. Type of valve.


4. Direction and number of turns to open.

G. Valve markers are to be made of schedule 80 PVC and have decal applied containing information as shown on the Drawings. The marker shall be the same color as the pipe being marked.
2.04 LINE STOPPING ASSEMBLIES

A. Sleeves used to line-stop existing mains shall be provided and installed at locations as shown on the Drawings. Line-stopping sleeve shall be steel fusion epoxy coated body with stainless steel straps, bolts, nuts, and washers. Contractor shall determine the outside diameter of the existing main prior to ordering sleeve.

B. The line-stopping equipment shall consist of a resilient sealing element, which shall be attached to and transported by a plug inserter perpendicularly into the pipe. The linear actuator shall extend and retract the Line-Stopper into and out of the pipe. When retracted from the pipe, the element and inserter shall be contained within the stopper housing.

C. The hollow cylindrical sealing element shall be molded of natural rubber. The lower interior chamber of the element shall be enlarged into a hemispherical cavity to allow symmetrical deformation into sealing conformity with the bore of the pipe.

D. The linear actuator shall be hydraulic and shall have a self-contained hand operated pump. The actuator shall exert a force sufficient to perpendicularly deform the cylindrical element into axially symmetrical sealing contact with the bore of the pipe. Design of actuator shall provide adequate stroke and means to continually align the line-stop bullet stopping assemblies in sizes 14-inch through 20-inch with pressure rating to 250-psig.

E. Equalization of pressure across the sealed element shall not be required to retract the element from the pipe. No equalization fittings shall be required downstream of the line-stopper.

F. The line-stopping equipment shall be accurately aligned on the 4-inch through 8-inch fittings by locating in the external threads of the fitting nozzle. With sizes 10-inch and 12-inch the location shall be made on the centering groove of the fitting flange.

G. Line-stopping equipment must be capable of function and acceptance of multiple stopper heads and shall be compatible with existing system fittings.

2.05 SERVICE SADDLES

A. Stainless Steel Service Saddles: Shall be epoxy or nylon coated ductile iron body with stainless steel, 18-8 type 304 straps, AWWA tapered threads for 1-inch and 2-inch to be iron pipe threads. Controlled OD saddles to be used on C905 PVC pipe, double straps to be 2-inch minimum width each, single strap to be minimum of 3-inches wide.

B. PVC Pipe Service Saddle

1. One-inch and 2-inch services utilize brass body saddle with controlled OD for 12-inches and smaller pipe.
2. One-inch and 2-inch taps on existing pipes larger than 12-inches shall use controlled OD epoxy or nylon coated ductile iron body with stainless steel 18-8 type 304 straps.

3. Four-inch or larger services shall be mechanical tapping sleeves.

C. Ductile Iron Pipe Service Saddle
   1. One-inch services shall be direct tapped.
   2. Two-inch service shall use a controlled OD service tapping saddle with stainless steel straps and a ductile iron body that is either nylon or epoxy coated.
   3. Four-inch or larger services shall be mechanical tapping sleeves.

D. HDPE Pipe Service Saddle
   1. One-inch and 2-inch shall utilize controlled O.D. tapping saddle with epoxy or nylon coated stainless steel 18-8 type 304 double straps.
   2. Four-inch or larger, shall use wide body tapping sleeves with a broad cross section gasket set in a retaining groove that increases sealing capability as pressure increases.

E. Concrete Pressure Pipe Service Saddle
   1. Tapped concrete pressure pipe shall be in accordance with AWWA M-9, using a strap-type saddle made specifically for concrete cylinder pressure pipe.

F. Steel Pipe Service Saddle
   1. Welded-on steel sleeves shall be used for all sizes and applications.

2.06 CORPORATION STOPS AND CURB STOPS

A. Corporation Stops: Shall be brass body reduced port type compatible with the polyethylene tubing and threaded in accordance with AWWA C800, AWWA C901, and shall comply with NSF-61.

B. Curb Stops: Shall be brass body reduced port type compatible with the polyethylene tubing and threaded in accordance with AWWA C800, AWWA C901, and shall comply with NSF-61.

2.07 WATER MAIN AND RECLAIMED WATER MAIN SERVICE PIPE

A. Polyethylene Service Pipe: One-inch and 2-inch service lines shall be polyethylene tubing conforming to AWWA C901 and AWWA C800. Tubing shall be approved for potable water use and bear the seal of the National Sanitation Foundation (NSF). The product shall be rated for a minimum working pressure of 150-psi and a (Dimension Ratio) DR-9
size. The tubing shall be designated copper tube size and the material PE-2406 cell classification minimum PE213323C in accordance with ASTM 3350.

B. Ductile Iron Service Pipe: Services 4-inch and larger shall be DIP. If the existing main is on the same side of the street as the property to be serviced, the service pipe shall be DIP from the point of connection to the existing main to the meter assembly. If the existing main is on the opposite side of the street as the property to be serviced, at a minimum, the segment of pipe immediately upstream from the meter assembly shall be DIP.

C. No service pipe shall terminate under a driveway.

2.08 PRESSURE GAUGES

A. Pressure gauges shall be installed on each pump station discharge pipe as indicated on the Drawings.

B. Pressure gauge shall be direct mounted, diaphragm (type) gauge, stainless steel case, stainless steel sensing element, liquid filled, with a 4-1/2-inch diameter dial and furnished with a clear glass crystal window and 1/4-inch shut-off (isolation) valve. Gauges shall be weatherproof.

C. The pressure gauge face dial shall be white finished aluminum with jet-black graduations and figures and shall indicate the units of pressure measured in psi. Gauges shall be provided with pressure at normal operation at the mid range of the gauge.

D. As wastewater flows through the housing, the cylinder shall transmit pressure through the sensing liquid. Gauge outlet in the spool or ring shall be threaded, 1/4-inch, per ANSI B2.1.

E. Nipples for connecting gauges to piping shall be Schedule 80S, Grade TP 316 seamless stainless steel, conforming to ASTM A 312. Fittings shall conform to ASTM A 403, Class WP316.Threads shall conform to ANSI B2.1. Size of pipe nipple shall match the gauge connection size.

2.09 TIE RODS

A. Steel for tie rods and tie bolts shall conform to the requirements of ASTM Designation A 242, and rods shall be galvanized in conformance with requirements of ASTM Designation A 123.

2.10 BACK FLOW PREVENTION

A. Reduced Pressure Backflow Preventer shall conform to the requirements of ASSE 1013, rated to 180°F and supplied with full port ball valves. The main body and access covers shall be bronze and meet ASTM B 584, the seat ring and all internal polymers shall be NSF Noryl and the seat disc elastomers shall be silicone.
B. Dual check valves shall be required and shall be accessible for maintenance without removing the relief valve or the entire device from the line.

C. The bottom of the preventer shall be installed a minimum of 12-inches above grade and not more than 30-inches above grade.

2.11 FLANGED COUPLING ADAPTERS

A. All adapters shall be harnessed with the bolts across the joint (flange to flange or flange to lug) designed for the pipe test pressure.

B. Adapter Size: Conform in size and bolt hole placement to ANSI standards for steel and/or cast-iron flanges 125 or 150-pound standard unless otherwise required for connections.

C. Flexible Transition Coupling


PART 3 - EXECUTION

3.01 INSTALLATION

A. All ancillary equipment 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 Utilities Commission of New Smyrna Beach before installation.

B. After installation, all ancillary equipment shall be tested as specified for adjacent piping. If any joint or equipment proves to be defective, it shall be repaired and retested to the satisfaction of the Utilities Commission of New Smyrna Beach.

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 the location and shall be responsible for the proper location of these valves and appurtenances during the Construction of the structures.

D. Notification and Connections to Existing Mains

1. The Contractor shall submit a completed "System Connection" form to the Utilities Commission of New Smyrna Beach to schedule the connection. The
request shall be made a minimum of 5-working days prior to the proposed tie-in to the existing main for pressure connections and 10-working days prior to the proposed tie-in to the existing main for non-pressure connections. In this request, the Contractor shall provide the following information:

a. Points of connection, fittings to be used and method of flushing and disinfection if applicable.

b. Estimated construction time for said connections.

c. Identify pressure and non-pressure connections.

2. Connections shall only be made on the agreed upon date and time. If the Contractor does not perform the Work in the agreed upon manner or schedule, the Contractor shall be required to reschedule the connection by following the procedure outlined above.

E. Pressure Connections: Sufficient length of main shall be exposed to allow for installation of the tapping sleeve and valve and the operation of the tapping machinery. The main shall be supported on concrete pedestals or bedding rock at sufficient intervals to properly carry its own weight, plus the weight of the tapping sleeve, valve and machinery. Any damage to the main due to improper or insufficient supports will be repaired at the Contractor’s expense.

1. Prior to the tap, the Contractor shall assemble all materials, tools, equipment, labor, and supervision necessary to make the connection.

2. The Contractor shall excavate a dry and safe working area pit of sufficient size to enable the necessary Work.

3. The inside of the tapping sleeve and valve, the outside of the main and the tapping machine shall be cleaned and swabbed or sprayed with 1% liquid chlorine solution prior to beginning installation for water system pressure connections and must comply with AWWA C-651-99 or most current version.

4. After the tapping sleeve has been mounted on the main, the tapping valve shall be bolted to the outlet flange, making a pressure tight connection. Prior to beginning the tapping operation, the sleeve and valve shall be pressure tested under the observation of Utilities Commission of New Smyrna Beach personnel to 150-psi for 30-minute duration to ensure that no leakage will occur.

5. For pressure connections 4-inch through 20-inch installation, the minimum diameter cut shall be 1/2-inch less than the nominal diameter of the pipe to be attached. For larger taps, the allowable minimum diameter shall be 2 to 3-inches less than the nominal diameter of the pipe being attached. After the tapping procedure is complete, the Contractor shall submit the coupon to the Utilities Commission of New Smyrna Beach.
6. The tapping valve shall be placed horizontally for pressure connections to wastewater force mains. A plug valve shall be attached to the tapping valve after the tapping procedure is complete. The tapping valve shall be left in the open position prior to backfilling.

7. Adequate restrained joint fittings shall be provided to prevent movement of the installation when test pressure is applied.

8. The Contractor shall be responsible for properly backfilling the work area pit after the Work is completed.

F. Non-Pressure Dry Connections

1. For water service connections, no customer shall be without service for more than 6-hours. For wastewater connections, provide bypass operations. This accommodation to customers may include scheduling after Normal Working Hours.

2. The Contractor shall be ready to proceed by pre-assembling as much material as possible at the site to minimize the length of service interruption.

3. Needed pipe restraints must be installed prior to the initiation of the shutdown.

4. The excavation shall be opened and needed site preparations must be completed before the initiation of the connection work.

5. Utilities Commission of New Smyrna Beach shall postpone a service cut-off if the Contractor is not ready to proceed at the scheduled time.

6. Only Utilities Commission of New Smyrna Beach personnel shall operate the valves needed to perform the shutdown on the existing system.

3.02 PAINTING

A. All exterior surfaces of iron body valves shall be clean, dry, and free from rust and grease before coating.

B. For valves installed underground or in valve vaults, all exterior ferrous parts of valve and actuator shall be coated at the factory with a thermally bonded epoxy coating in accordance with AWWA C550, latest revision.

C. For aboveground service, the exterior ferrous parts of all valves shall be coated in weatherproof paint. The color of the finish coats shall be in accordance with the Utilities Commission of New Smyrna Beach standards and Division 9.

END OF SECTION
SECTION 15207
PLUG VALVES

PART 1 - GENERAL

1.01 THE REQUIREMENT
A. The Contractor shall provide plug valves and appurtenances, complete, and operable, and in accordance with the New Smyrna Beach Utilities Commission Wastewater Rules, Design and Construction Specifications.

1.02 CONTRACTOR SUBMITTALS
A. The Contractor shall furnish submittals in accordance with Section 01300 – Contractor Submittals.
B. The Contractor shall submit manufacturer’s data.

PART 2 – PRODUCTS
A. Non-lubricated, 175 psi CWP, drip-tight shutoff in either direction, cast iron body, welded nickel seats, cast iron plug with Buna-N facing, stainless steel or bronze bearings, flanged ends for exposed service, mechanical joint ends for buried service. Ports shall provide an unobstructed port area equal to at least 80 percent of the nominal pipe size cross sectional area.

PART 3 - EXECUTION

3.01 INSTALLATION
A. All plug valves shall be installed in strict accordance with the manufacturer’s published recommendations.
B. If the valve is installed in a horizontal sewage force main (i.e. suspended solids), the valve shall be installed with the flow entering the “seat end” (marked on the valve) of the valve and the shaft in a horizontal position with the plug up when open. For vertical installations, the valve shall be installed with the “seat end” up regardless of flow direction.
C. Support all valves connected to pumps and equipment, and in piping systems that cannot support valves.
D. Repair any scratches, marks, and other types of surface damages, etc. with original prime coating as supplied by the factory.
E. Apply finish coating in accordance with Division 09.
3.02 DEMONSTRATION AND TESTING

A. Demonstration, start-up (adjustment) and testing shall demonstrate that all valves have been properly installed and that check valves operate properly.

END OF SECTION
SECTION 15208

COMBINATION AIR/VACUUM RELEASE VALVES

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall provide air release valves and combination air/vacuum release valves and appurtenances, complete and operable, and in accordance with section 3.02 of the New Smyrna Beach Utilities Commission Wastewater Rules, Design and Construction Specifications, and with the New Smyrna Beach Utilities Commission Potable Water Rules, Design and Construction Specifications.

1.02 CONTRACTOR SUBMITTALS

A. The Contractor shall furnish submittals in accordance with Section 01300 – Contractor Submittals.

B. The Contractor shall submit manufacturer’s data.

PART 2 - PRODUCTS

2.01 AIR RELEASE AND COMBINATION AIR/VACUUM RELEASE VALVES FOR SEWER FORCE MAINS

A. General: All sewer force mains shall have air release valves or combination air/vacuum release valves installed as indicated on the Drawings. Valves shall be slow-closing type. All combination air/vacuum release valves shall be installed so that the direction of flow through the valve is in accordance with the manufacturer’s recommendations. The floats, float-guide, and stem shall be type 316 stainless steel and American made. All below ground air release valves shall be covered with a cast iron manhole lid, minimum 24-inches in diameter.

2.02 COMBINATION AIR/VACUUM RELEASE ASSEMBLY

A. Construction: The air release and combination air/vacuum release valve assembly shall include a pedestal housing designed to accommodate the assembly. The housing shall be self-latching with locking mechanism and shall have complete 360-degree access working area. The base shall be ribbed for strong support and stability. A location stripe shall be available for customized labeling and identification.

B. A total of six keys for the locking mechanism for each air release valve and combination air/vacuum release assemblies shall be provided by the Contractor to the Utilities Commission of New Smyrna Beach. The locking device shall be series LOO locking device.
C. All combination air/vacuum release valve assemblies shall be provided with a one-foot concrete pad at the base as shown in the drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All combination air release valves shall have an isolation valve connection for control as shown on the Drawings, and shall be installed in strict accordance with the Manufacturer’s published recommendations.

B. All piping shall be installed to prevent sewage from draining onto the ground.

C. Air release valve assemblies shall not be located in swales. Where swales are present, the ARVs shall be located one-foot from Right-Of-Way line as shown on the Drawings.

END OF SECTION
SECTION 15209

BALL VALVES

PART 1 - GENERAL

1.01 THE REQUIREMENT
   A. The Contractor shall provide ball valves and appurtenances, complete, and operable, and in accordance with the New Smyrna Beach Utilities Commission Wastewater Rules, Design and Construction Specifications.

1.02 CONTRACTOR SUBMITTALS
   A. The Contractor shall furnish submittals in accordance with Section 01300 – Contractor Submittals.
   B. The Contractor shall submit manufacturer’s data.

PART 2 – PRODUCTS

A. Ball valves for general liquid service
   1. Two-piece, standard port, NPT threaded ends, bronze body and end piece, hard chrome-plated solid bronze or brass ball, RTFE seats and packing, blowout-proof stem, adjustable packing gland, zinc-coated steel hand lever operator with vinyl grip, rated 600-pound WOG, 150-pound SWP, compliant with MSS SP-110.

PART 3 - EXECUTION

3.01 INSTALLATION
   A. All ball valves shall be installed in strict accordance with the manufacturer’s published recommendations, as shown on the drawings, and as directed by the Owner.
   B. Support all valves connected to equipment or in piping systems that cannot support valves.
   C. Repair any scratches, marks, and other types of surface damages with original coating as supplied by the factory.
   D. Apply finish coating in accordance with Division 09.

3.02 DEMONSTRATION AND TESTING
   A. Demonstration, start-up (adjustment), and testing shall demonstrate that all valves have been properly installed and that ball valves operate properly.

END OF SECTION
SECTION 16050

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: General administrative, procedural requirements, and installation methods for electrical installations specified in Division 16.

B. The Drawings are schematic and are not intended to show every detail of construction.
   1. In general, conduits/raceways, transitions and offsets shown on Drawings indicate approximate locations in plan and elevation where the systems are intended to be run.
   2. CONTRACTOR shall fully coordinate electrical Work with other trades to avoid interferences.
   3. In the event of interferences, CONTRACTOR shall request clarification from ENGINEER in writing.

C. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Sections, apply to Work of this Section.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings covering the items included under this Section of Work. Shop Drawing submittals shall include:
   1. Submit product data covering the items included under this Section of Work.

B. Conforming to Construction Drawings: Submit a complete set of Drawings showing the locations of the piping, ductwork, etc., as actually installed. Such Drawings shall be submitted to ENGINEER on tracing cloth, mylar, or sepia paper from which blueprints can be obtained.

C. Operation and Maintenance Manuals: Submit operation and maintenance manuals for items included under this Section. Include following information for equipment items:
   1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.

1.03 RECORD DOCUMENTS

A. Contractor shall prepare record drawings. CONTRACTOR shall submit, prior to final payment, Drawings conforming to construction records of systems it has installed. Vendor drawings shall be sized as manufacturers' standard.

B. Provide typewritten data sheets on motor control circuits with following information on each branch feeder: Load name, horsepower or KVA (transformer), fuse size, starter size, service factor of motor, motor nameplate currents, power factor correction capacitor size (if used), and thermal overload part number.

1.04 QUALITY ASSURANCE

A. National Electrical Code: Comply with NFPA 70, National Electrical Code.

B. UL Compliance and Labeling: Use products and components labeled by UL.

1.05 PERMITS, INSPECTIONS, AND LICENSES

A. CONTRACTOR shall procure all necessary permits and licenses, observe and abide by all applicable laws, codes, regulations, ordinances, and rules of the State, territory, or political subdivision thereof, wherein Work is done, or any other duly constituted public authority, and further agrees to hold OWNER harmless from liability or penalty which might be imposed by reason of an asserted violation of such laws, codes, regulations, ordinances, or other rules.

1. Upon completion of Work, CONTRACTOR shall secure certificates of inspection from the inspector having jurisdiction and shall submit 3 copies of the certificates to OWNER. CONTRACTOR shall pay the fees for the permits, inspections, licenses, and certifications when such fees are required.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification. Equipment
shall be packaged to prevent damage during shipment, storage, and handling. Do not install damaged units; replace, and remove damaged units from Site.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL ELECTRICAL INSTALLATION

A. Provide electrical materials and equipment enclosures appropriate for areas in which they are installed. Each area will be designated on Drawings with a type of construction such as NEMA 4X. An area designated by a name and elevation includes space bounded by floor, ceiling, and enclosing walls.

1. Exception: Provide manufacturer's standard construction for indoor or outdoor application where equipment is not manufactured to NEMA specifications (e.g., switchgear, transformers, high voltage capacitors, bus duct, and light fixtures; materials and equipment used in finished areas such as offices, laboratories, etc.).

B. Provide 316 stainless steel electrical materials and equipment enclosures in NEMA 4X areas; explosion-proof NEC Class I, Division 1, Group D equipment for NEMA 7 areas.

C. Supporting devices and sleeves shall be set in poured-in-place concrete and other structural components as they are constructed.

D. Install systems, materials, and equipment to conform with approved submittal data, including coordination Drawings, to greatest extent possible. Conform to arrangements indicated by Drawings recognizing that portions of Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to ENGINEER.

E. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components where installed exposed in finished spaces.

F. As much as practical, connect equipment for ease of disconnecting with minimum of interference with other installations.

G. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.02 RACEWAY INSTALLATION

A. Conduit shall be rigid aluminum.
B. Minimum size conduit shall be 3/4 inch unless shown otherwise.

C. All conduit penetrations shall enter bottom of enclosures unless otherwise approved in advance.

D. Provide “Coopers Industries” Myers hub on all conduit entries into enclosure or boxes.

E. Instrument Signal Conduit Requirements: Shielded signal wires for 4-20 mA type instruments or thermocouple wires assigned to the same control panel may be run in the same conduit. Shielded instrument signal wires, thermocouple wires, and shielded 2-wire intercom wires may be run in the same conduit. No other wires will be permitted in an instrument signal/2-wire intercom conduit.

F. Conduit Thread Paint: Make threaded conduit joints watertight by coating threaded portions with a spray-on or brush-on zinc-bearing paint. Provide paint containing 90 percent minimum by weight of metallic zinc powder in the dried film. Clean field-cut threads of oil using the recommended solvent prior to coating threads.

G. Concealed Raceways: Raceways embedded in slabs shall be installed in the middle third of the slab thickness where practical and leave at least 1-inch concrete cover. Tie raceways to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Space raceways laterally to prevent voids in the concrete. Run 1-inch and smaller raceways with a minimum of bends in the shortest practical distance. Run larger conduit parallel with or at right angles to the main reinforcement; where at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab.

H. Exposed Raceways: Install parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical. Make bends and offsets so the inside diameter is not effectively reduced. Keep the legs of a bend in the same plane and the straight legs of offsets parallel. Conduits shall slope away from loads to keep moisture from entering the load. Run parallel or banked raceways together. Make bends in parallel or banked runs from the same centerline so that the bends are parallel. Factory elbows may be used in banked runs only where they can be installed parallel. This requires that there be a change in the plane of the run, such as from wall to ceiling and that the raceways be of the same size. In other cases, provide field bends for parallel raceways. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.

I. Space raceways, fittings, and boxes 0.25 inch from mounting surface in NEMA 4X areas. Spacers shall be one-piece construction of stainless steel, galvanized steel, PVC, ABS, or other noncorrosive material.

J. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid metal conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment
connections are not made under this Contract, install screwdriver-operated threaded flush plugs with floor.

K. Flexible Connections: Use short length (maximum 3 feet) of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement, and all motors. Use liquidtight flexible conduit in wet locations and rated flexible connections for hazardous locations. Install separate ground conductor across flexible connections.

L. Join raceways with fittings designed and approved for the purpose and make joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors.

M. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate metal conduit, use threaded rigid metal conduit fittings.

N. Install raceway sealing fittings in accordance with the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL listed sealing compound. For concealed raceways, install each fitting in a flush metal box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:

1. Where conduits enter or leave hazardous locations.
2. Where conduits enter or leave NEMA 4X areas.
3. Where required by the NEC.

O. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring. Provide knockout closures to cap unused knockout holes where blanks have been removed.

P. Fasten electrical boxes firmly and rigidly to substrates or structural surfaces to which attached.

Q. Support exposed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.

R. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box and tighten the chase nipples so no threads are exposed.
S. Complete installation of electrical raceways before starting installation of conductors within raceways and prevent foreign matter from entering raceways by using temporary closure protection. Cap spare conduit. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

T. Install pull wires in empty raceways: Use No. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-pound tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.

3.03 WIRE AND CABLE INSTALLATION

A. Use pulling means including fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant where necessary.

B. Keep branch circuit conductor splices to minimum. Splice feeders only where indicated. Use a standard kit. No splices are allowed for instrument and telephone cables except at indicated splice points.

C. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced. Use splice and tap connectors which are compatible with conductor material and are UL listed as pressure type connectors.

D. Provide adequate length of conductors within electrical enclosures and train conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than No. 10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at terminal.

E. Terminate power conductors at equipment using pressure-type terminals specifically designed for type of terminations to be made. Terminate no more than 2 conductors No. 8 AWG and smaller within the same pressure-type terminal. These 2 conductors shall be no more than 4 wire gauge sizes apart. Terminate no more than 1 conductor larger than No. 8 AWG within any pressure-type terminal.

1. Exception: Power factor correction capacitor conductors may be terminated at the motor disconnect switch load terminals.

F. Seal wire and cable ends until ready to splice or terminate.
3.04 CUTTING AND PATCHING

A. Perform cutting, fitting, and patching of electrical equipment and materials required to uncover Work to provide for installation of ill-timed Work. Remove and replace Work that is either defective or does not conform to requirements of Drawings.

B. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated including, but not limited to, removal of electrical items indicated to be removed and items made obsolete by new Work. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.

C. Patch existing finished surfaces using new materials matching existing materials.

3.05 EQUIPMENT CHECKOUT AND TESTING

A. In addition to testing recommended by equipment or material supplier and called for in equipment or material specification, perform the following.

B. Electrical contractor shall be on site to attend final station startup.

C. Equipment Testing: The following tests which are applicable for a particular item of equipment shall be performed:

1. After Work has been completed, demonstrate to OWNER's Representative that entire electrical installation is in proper working order and will perform functions for which it was designed by functional testing.

2. Make any specific tests required by the manufacturer's installation instructions.

D. Check-out Procedures. In general, check-out procedures (as listed below) which are applicable for a particular item of equipment shall be performed:

1. Vacuum interior of electrical equipment and remove foreign material.

2. Check and adjust time delay, under-voltage devices, phase relay, over-current relays, etc., as required by coordination study or ENGINEER.

3. Fill motor bearings requiring oil.

4. Check and change, as required, thermal overload heater elements to correspond with motor full-load current and service factors of installed motor.
5. Check direction of rotation of motors and reverse connections if necessary. Check rotation with motor mechanically uncoupled where reverse rotation could damage equipment.

6. Equipment with two or more sources of power connected by tie breakers, transfer switches, or generator receptacles shall be checked for rotation from each possible combination of power sources. Power sources must have the same phase sequence for each source throughout entire facility.

7. Check exposed bolted power connections for tightness.

8. Check operation of breakers, contactors, etc., and control and safety interlocks.

9. Check tightness of bolted structural connections.

10. Check leveling and alignment of enclosures.

11. Check operating parts and linkages for lubrication, freedom from binding, vibration, etc.

12. Check tightness and correctness of control connections at terminal blocks, relays, meters, switches, etc.

13. Clean auxiliary contacts and exposed relay contacts after vacuuming.

END OF SECTION
SECTION 16060
GROUNDING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Electrical grounding and bonding Work as follows:
   1. Solidly grounded.

B. Applications of electrical grounding and bonding Work in this Section:
   1. Underground metal piping.
   2. Underground metal water piping.
   3. Electrical power systems.
   4. Grounding electrodes.
   5. Raceways.
   7. Equipment.
   8. Lighting standards.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Product Data: Submit manufacturer's data on grounding and bonding products and associated accessories.

1.03 QUALITY ASSURANCE

A. Codes and Standards:
   1. UL Compliance: Comply with applicable requirements of UL Standards No. 467, "Electrical Grounding and Bonding Equipment," and No. 869, "Electrical Service Equipment," pertaining to grounding and bonding of systems, circuits, and equipment. In addition, comply with UL Standard 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products which are UL listed and labeled for their intended usage.

   2. IEEE Compliance: Comply with applicable requirements and recommended installation practices of IEEE Standards 80, 81, 141, and 142 pertaining to grounding and bonding of systems, circuits, and equipment.
PART 2 - PRODUCTS

2.01 GROUNDING AND BONDING

A. Materials and Components:
   1. Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for complete installation. Where more than one type component product meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products which comply with NEC, UL, and IEEE requirements and with established industry standards for those applications indicated.

   2. Conductors: Electrical copper grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.

   3. Service Arrester: Electrical service arrester, 3-phase, 4-wire, for exterior mounting. See electrical drawings for voltage.


   5. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.

PART 3 - EXECUTION

3.01 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

A. Connect grounding conductors to underground grounding electrodes using exothermic weld process or mechanical compression type connectors.

B. Ground electrical service system neutral at service entrance equipment to grounding electrodes.

C. Connect together system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.
D. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug, bus, or bushing.

E. Connect grounding electrode conductors to 1-inch diameter or greater, metallic cold water pipe using a suitably sized ground clamp. Provide connections to flanged piping at street side of flange.

F. Bond grounding cables to both ends of metal conduit or sleeves through which such cables pass.

G. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque-tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

H. Install braided type bonding jumpers with code-sized ground clamps on water meter piping to electrically bypass water meters.

I. Route grounding connections and conductors to ground and protective devices in shortest and straightest paths as possible while following building lines to minimize transient voltage rises. Protect exposed cables and straps where subject to mechanical damage.

J. Apply corrosion-resistant finish to field connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed and are subjected to corrosive action.

K. Contractor shall test the resistance of the ground loop at the test well and if greater than 5 ohms contractor shall provide additional ground rods to the counterpoise until the resistance is less than 5 ohms.

END OF SECTION
SECTION 16075

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including, but not limited to, the following:

1. Buried electrical line warnings.
2. Identification labeling for cables and conductors.
3. Warning and caution signs.
4. Equipment labels and signs.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:

1. Product Data for each type of product specified.

PART 2 - PRODUCTS

2.01 ELECTRICAL IDENTIFICATION PRODUCTS

A. Colored Adhesive Marking Tape for Wires and Cables: Self-adhesive, vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.

B. Pre-tensioned Flexible Wraparound Colored Plastic Sleeves for Cable Identification: Flexible acrylic bands sized to suit raceway diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the cable.

C. Underground Line Marking Tape: Permanent, bright colored, continuous printed, plastic tape compounded for direct-burial service not less than 6 inches wide by 4 mils thick. Printed legend indicative of general type of underground line below.

D. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with pre-printed numbers and letter.

E. Aluminum, Wraparound Cable Marker Bands: Bands cut from 0.014-inch-thick aluminum sheet, fitted with slots or ears for securing permanently around wire or cable jacket or around groups of conductors. Provide for legend application with stamped letters or numbers.
F. Engraved, Plastic Laminated Labels, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/16 inch minimum thick for signs up to 20 square inches or 8 inches in length; 1/8-inch thick for larger sizes. Engraved legend in white letters on black face and punched for mechanical fasteners.

G. Baked Enamel Warning and Caution Signs for Interior Use: Pre-printed aluminum signs, punched for fasteners, with colors, legend, and size appropriate to the location.

H. Exterior Metal-Backed Butyrate Warning and Caution Signs: Weather-resistant, nonfading, pre-printed cellulose acetate butyrate signs with 20-gauge galvanized steel backing, with colors, legend, and size appropriate to location. Provide 1/4-inch grommets in corners for mounting.

I. Fasteners for Plastic Laminated and Metal Signs: Self-tapping stainless steel screws or Number 10/32 stainless steel machine screws with nuts and flat and lock washers.

J. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18 inch minimum width, 50-pound minimum tensile strength, and suitable for a temperature range from minus 50 to 350 degrees F. Provide ties in specified colors when used for color coding.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification Work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by Code.

B. Underground Electrical Line Identification: During trench backfilling for exterior nonconcrete encased underground power, signal, and communications lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench, do not exceed an overall width of 16 inches; install a single line marker.

C. Install line marker for underground wiring, both direct buried and in raceway.

D. Conductor Color Coding: Provide color coding for secondary service, feeder, and branch circuit conductors throughout the Project secondary electrical system following OWNER's method of phase identification:
E. Wiring Standards:

1. Control Wiring:
   
a. Red Control circuit wiring that is de-energized when the main disconnect is opened.
   
b. Yellow Control circuit wiring that remains energized when the main disconnect is opened.
   
c. Blue DC.
   
d. Green Ground.

F. Use conductors with color factory applied entire length of conductors except as follows:

1. The following field applied color coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.

   a. Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last 2 laps of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.

   b. In lieu of pressure-sensitive tape, colored cable ties may be used for color identification. Apply 3 ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal spaced 3 inches apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.

G. Power Circuit Identification: Securely fasten identifying metal tags of aluminum wraparound marker bands to cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms with 1/4-inch steel letter and number stamps with legend to correspond with designations on Drawings. If metal tags are provided, attach them with approximately 55-pound test monofilament line or one-piece self-locking nylon cable ties.

H. Install wire/cable designation tape markers at termination points, splices, or junctions in each circuit. Circuit designations shall be as indicated on Drawings.

END OF SECTION
SECTION 16120
WIRES AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following:
   1. Low-Voltage Wire and Cable.
   2. Instrument Cable.
   3. Multiconductor Control Cable.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings covering the items included under this Section. Include Shop Drawings of wires, cables, connectors, splice kits, and termination assemblies.

1.03 QUALITY ASSURANCE

A. UL Compliance: Provide components which are listed and labeled by UL. For cables intended for use in air handling space comply with applicable requirements of UL Standard 710, "Test Method for Fire and Smoke characteristics of cables used in Air Handling Spaces."

B. NEMA/ICEA Compliance: Provide components which comply with following standards:

C. Labeling: Handwritten labels are not acceptable. All labels shall be machine printed on clear or opaque tape, stenciled onto adhesive labels, or typewritten onto adhesive labels. The font shall be at least 1/8 inch in height, block characters, and legible. The text shall be of a color contrasting with the label such that it may be easily read. If labeling tape is utilized, the font color shall contrast with the background. Patch panels shall exhibit workstation numbers or some type of location identifier, in sequential order, for all workstations or devices attached. Each Network cable segment shall be labeled at each end with its respective identifier.
PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:

1. Low-Voltage Wire and Cable:
   a. American Insulated Wire Corp.
   b. General Cable.
   c. The Okonite Co.
   d. Southwire Co.

2. Connectors for Low-Voltage Wires and Cable Conductors:
   a. AMP.
   b. O-Z/Gedney Co.
   c. Square D Company.
   d. 3M Company.

3. Instrument Cable:
   a. Belden (Trade Nos. 1120A and 1118A).

2.02 LOW-VOLTAGE WIRES AND CABLES

A. Conductors: Provide stranded conductors conforming to ASTM Standards for concentric stranding, Class B. Construction of wire and cable shall be single conductor (1/c) unless multiconductor cable is shown by notation in form (x/c) where x indicates the number of separate insulated conductors per cable.

B. Conductor Material: Copper. Minimum size power wire shall be No. 12 AWG.

C. Insulation: Provide RHW/USE insulation for power conductors used in single- and 3-phase circuits with more than 120 volts to ground. Provide RHW/USE, XHHW, or THWN/THHN insulation for power conductors used in single- and 3-phase circuits with 120 volts or less to ground.

2.03 CONNECTORS FOR LOW-VOLTAGE WIRES AND CABLES

A. Provide UL listed factory fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types, and classes for applications and services indicated. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.
2.04 INSTRUMENT CABLE

A. Instrument Cable: 600-volt minimum insulated shielded cable with two or more twisted No. 16 or No. 18AWG stranded copper conductors; PVC, nylon, or polyethylene outer jacket; and 100 percent foil shielding.

2.05 MULTICONDUCTOR CONTROL CABLE

A. Multiconductor Control Cable: Concentrically cabled No. 14 AWG stranded copper conductors with saturated interstitial fillers; overall binder of nylon or similar material; and PVC jacket. Quantity of conductors shall be as indicated on Drawings. Provide Type 2010 individual conductor insulation unless otherwise indicated on Drawings as one of the following:

1. Type ISS: 15 mils polyethylene with 5 mils nylon.
2. Type 2010: 20 mils polyethylene with 10 mils PVC.
3. Type 3015: 30 mils polyethylene with 15 mils PVC.

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

A. Reports (non-LAN cable): Testing organization shall maintain a written record of observations and tests, report defective materials and workmanship, and retest corrected defective items. Testing organization shall submit written reports to ENGINEER.

END OF SECTION
SECTION 16130

RACEWAYS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Raceways for electrical wiring. Types of raceways in this Section include the following:

1. Metal Conduit
2. Liquidtight flexible conduit.
3. Conduit bodies.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:

1. Product data for the following products:
   a. Wireway and fittings.
   b. Conduit.
   c. Conduit bodies.

1.03 QUALITY ASSURANCE

A. Codes and Standards:

1. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.

2. UL Compliance and Labeling: Comply with applicable requirements of UL standards pertaining to electrical raceway systems. Provide raceway products and components listed and labeled by UL, ETL, or CSA.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in Work include:
1. Conduit:
   
a. Allied Tube.
b. Carlon.
c. Johns Manville.
d. Occidental Coatings.
e. Orangeburg.
f. Perma-Cote Industries.
g. Republic Steel.
h. Robroy Industries.
i. Steelduct Co.
j. Triangle Conduit.
k. Wheatland Tube.
l. Youngstown Sheet and Tube.

2. Liquidtight Conduit:
   
a. Anamet, Inc.
b. Carlon.
c. Electric-Flex.
d. Thomas and Betts.

3. Conduit Bodies:
   
a. Adalet-PLM.
c. Appleton Electric Co.
d. Carlon.
e. Crouse-Hinds Division, Cooper Industries, Inc.
f. Delta Industrial Products.
g. Killark Electric Mfg. Co.
h. Kraloy Products Co.
i. O-Z/Gedney Co.
j. Perma-Cote Industries.
k. Robroy Industries.
l. Spring City Electrical Mfg. Co.

4. Conduit Thread Paint:
   
a. CRC Chemicals, USA.
b. Sherwin Williams.
c. ZRC Chemical Products Co.

2.02 METAL CONDUIT AND TUBING

A. Rigid aluminium conduit: Meet requirements of ANSI C80.5 and UL 6. Material: Type 6063, copper-free aluminum alloy.
B. Liquidtight Flexible Metal Conduit and Fittings: UL 360. Fittings shall be specifically approved for use with this raceway.

2.03 CONDUIT BODIES

A. Provide matching gasketed covers secured with corrosion-resistant screws. Use nonmetallic covers in NEMA 4X areas and threaded, ground joint covers in NEMA 7 and NEMA 9 areas.

PART 3 – EXECUTION (NOT USED)

END OF SECTION
SECTION 16220
MOTORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section applies, in general, to all electric or DC motor-driven equipment provided under Divisions 2 through 16 Sections. This Section shall supplement the detailed Equipment Specifications, but in cases of conflict, the Specifications indicated in this Section shall govern.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01 340, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Submittals for motors shall accompany the specific equipment the motor is to be supplied with.
   2. Submit product literature for each motor.

B. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 01600, operation and maintenance manuals for items included under this Section.

1.03 QUALITY ASSURANCE

A. Electrical Codes, Ordinances, and Industrial Standards: The design, testing, assembly, and methods of installation of the wiring materials, electrical equipment, and accessories proposed under this Contract shall conform to the National Electrical Code and to applicable State and local requirements. UL listing and labeling shall be adhered to under this Contract. Any equipment that does not have a UL, FM, CSA, or other listed testing laboratory label, shall be furnished with a notarized letter signed by the supplier stating that the equipment furnished has been manufactured in accordance with the National Electrical Code and OSHA requirements. Any additional cost resulting from any deviation from codes or local requirements shall be borne by CONTRACTOR.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, motors shall be standard design and construction. Manufacturers offering products which may be incorporated in Work include:
   1. Motors:
      a. Marathon Blue Chip Series.
      b. Siemens, Inc.
      c. General Electric Co.
      d. Reliance Electric Co.
e. U.S. Electric Motors.

B. For motors that are integrally constructed as a piece of equipment, such as appliances, hand tools, etc., and where manufacturer would be required to redesign equipment to meet these general specifications, it is the intent to allow such standard motors to be used, provided they do not exceed 1-1/2 horsepower and are suitable for use on standard power systems.

2.02 MATERIALS

A. Shop primers shall be Tnemec "77 Chem-Prime," or equal.

B. Rust preventive compound shall be equal to Dearborn Chemical "No-Ox-ID2W," Houghton "Rust Veto 344," or Rust-Oleum "R-9".

2.03 MANUFACTURED UNITS

A. Electrical Motors: Motor design and application shall comply with current ANSI, IEEE, NEMA, and AFBMA standards and with the NEC where applicable. They shall be squirrel cage induction motors rated 60 hertz, continuous duty for use in 40 degrees C ambient temperature. Motors shall comply with NEMA MG1-1993, Rev. 1, Part 31, Definite Purpose Inverter-Fed Motors whether used with variable frequency drives or not.

1. The motors shall be sized within their rated loads under the specified conditions without utilizing the top 15 percent of the 1.0 or 1.15 service factor. Motor sizing measured at the motor output shaft shall include all loadings on the motor. Motor loadings shall include the maximum or specified load condition of the driven equipment plus all drive losses of components, located between the motor and the driven equipment.

2. The motor winding temperature rise shall be NEMA Standard for the class of insulation used at the rated service factor load.

3. The motors shall be capable of handling unfiltered voltage peaks of up to 1600 volts, and rise times of 0.1 micro-seconds.

B. Motors 50 horsepower and larger shall have embedded passive temperature switches in the windings for use in the motor control circuit that will limit the winding temperature as defined by NEMA Standard MG1-12.53 Type 1. The contact shall be normally closed and rated to operate a 120 volt AC control relay (40 VA).

C. All integral horsepower motors shall have oversize conduit boxes with clamp-type grounding terminals inside which are effectively connected to all noncurrent-carrying motor parts.

D. All explosion-proof motors shall meet NEC Class 1, Division I, Group D, requirements with T2A temperature rating.

E. Unless these general specifications are supplanted by the detailed equipment specifications, motors shall be rated and constructed as follows:

1. Below 1/2 Horsepower: Motors shall be rated 115/230 volts, single phase, but shall be suitable for use on 208 volt power system. They shall have permanently lubricated sealed bearings (antifriction type where high radial or axial thrusts are produced by the driven equipment). Standard motors shall be totally enclosed fan cooled, totally enclosed air-over, or totally...
enclosed nonventilated capacitor start type as shown on Equipment Schedule(s) or specified in the equipment specifications. Totally enclosed explosion-proof motors shall be provided where required per equipment specifications section.

2. From 1/2 to 1-1/2 Horsepower: Motors shall be rated 115/230 volts single phase or shall be rated 230/460 volts 3-phase as indicated by Equipment Schedule(s). In either case they shall be suitable for use on 208 volt power systems under their given load conditions. They shall have bearings as in 2.03 F.1. The standard enclosures shall be totally enclosed fan cooled, totally enclosed nonventilated, totally enclosed explosion-proof, or open drip-proof as shown on Equipment Schedule(s) or specified in the equipment specifications.

3. From 2 to 200 Horsepower: Motors shall be rated 230/460 or 460 volt, 3-phase. They shall be grease lubricated, ball bearing, Class B insulated, minimum or as specified. Horizontal motors shall be open drip-proof, totally enclosed fan-cooled or totally enclosed explosion-proof (NEC, Class I, Group D) as shown on Equipment Schedule(s) or specified in the equipment specifications. Vertical motors shall meet NEMA standard open drip-proof specifications as a vertical motor when called for or totally enclosed fan cooled or totally enclosed explosion-proof as shown on Equipment Schedule(s).

F. Horizontal and vertical motors may also be weather protected, Type I, and shall have encapsulated or sealed windings.

G. Open drip-proof type motors shall have encapsulated or sealed windings when called for on Drawings or Equipment Schedules.

H. Special duty and severe environment application shall have motors which are designed specifically to meet the special conditions as specified.

I. The following symbols will be employed on Equipment Schedule(s) to indicate the required motor enclosure and construction features:
   1. TE  Totally Enclosed, may be nonventilated, fan-cooled or air-over type.
   2. TENV  Totally Enclosed Nonventilated.
   3. TEFC  Totally Enclosed Fan-cooled.
   4. TEEP  Totally Enclosed Explosion-proof, Class I, Div. I, Group D.
   5. ODP  Open Drip-proof.
   6. WPI  Weather Protected Type I.
   7. E/S  Encapsulated or Sealed Windings.
      a. All motors with encapsulation or sealed windings shall have a water-tight conduit box.

J. See NEMA Standard MG1 for definition of above terms.

K. Motor Efficiency: Where Equipment Schedule(s) indicate that motors shall be designed for high efficiency, they shall meet or exceed the Motor Operating Characteristics shown on High Efficiency Motor Schedule No. 16220.2, appended to this Section. Guaranteed minimum efficiency at full load shall be based on IEEE Standard 112, Test Method B. Nominal motor efficiencies are average expected values. Manufacturer's motor Shop Drawings shall indicate full compliance with the High Efficiency Motor Schedule No. 16220.2.
2.04 FABRICATION

A. Electric motors shall be shop-finished with 2 coats of enamel paint per manufacturer's recommendations.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's written installation and alignment instructions.

B. Lubricate oil-lubricated bearings.

C. Provide electrical wiring and connections as specified in Division 16 Sections.

3.02 FIELD QUALITY CONTROL

A. Inspect all terminations for proper connection.

B. Check motor for proper rotation.

3.03 INSTALLATION CHECK

A. Installation Check: Manufacturer shall provide the services of a factory-trained representative to check the installation of all equipment installed in this Section. Equipment supplier's representative shall revisit Site as often as necessary until all trouble is corrected and equipment installation and operation is satisfactory to ENGINEER.

B. Manufacturer's representative shall provide all necessary tools and testing equipment required including noise level and vibration sensing equipment.

C. Inspection Report: A written report of the installation check shall be submitted to ENGINEER. The report shall certify that the equipment:
   1. Has been properly installed and lubricated;
   2. Is in accurate alignment;
   3. Is free from any undue stress imposed by any connection or anchor bolts;
   4. Has been operated under full load condition and that it operated satisfactorily to ENGINEER; and
   5. That OWNER's representative has been instructed in the proper maintenance and operation of the equipment.
   6. Furnish OWNER a copy of all test data recorded during the installation check including noise level and vibration readings.
### HIGH EFFICIENCY MOTOR SCHEDULE NO. 16220.2

**MOTOR OPERATING CHARACTERISTICS**

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END OF SECTION
SECTION 16410
CIRCUIT AND MOTOR DISCONNECTS

PART 1 - GENERAL

1.01 SUBMITTALS

A. Shop Drawings: Submit shop drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Product data for each type of product specified.

B. Operation and Maintenance Manuals: Submit operation and maintenance manuals for items included under this Section, including circuits and motor disconnects.

1.02 QUALITY ASSURANCE

A. Codes and Standards:
   1. Electrical Component Standards: Provide components which are listed and labeled by UL. Comply with UL Standard 98 and NEMA Standard KS 1.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
   1. Square D Company.

2.02 CIRCUIT AND MOTOR DISCONNECT SWITCHES

A. Provide 316 SS NEMA 4X enclosure to match the rating of the area in which switch is installed. For motor and motor starter disconnects through 100 horsepower, provide units with horsepower ratings suitable to loads.

2.03 ACCESSORIES

A. Special Enclosure Material: Provide special enclosure material as follows for switches indicated:
   1. 316 Stainless Steel for NEMA 4X switches.

PART 3 – EXECUTION (NOT USED)

END OF SECTION
SECTION 16420
MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Types of motor controllers, including:

1. Solid-State Reduced Voltage Controllers.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:

1. Shop Drawings: Submit Shop Drawings of motor controllers showing dimensions and sizes.

2. Product Data: Submit manufacturer’s data and installation instructions on motor controllers.

3. Wiring Diagrams: Submit power and control wiring diagrams for motor controllers.

1.03 QUALITY ASSURANCE

A. Codes and Standards:

1. UL Compliance: Comply with applicable requirements of UL 486A and B, and UL 508, pertaining to installation of motor controllers. Provide controllers and components which are UL listed and labeled.

2. NEMA Compliance: Comply with applicable requirements of NEMA Standards ICS 2, "Industrial Control Devices, Controllers and Assemblies," and Pub No. 250, "Enclosures for Electrical Equipment (1,000 Volts Maximum)," pertaining to motor controllers and enclosures.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
1. Square D Company.
   a. Solid-State Reduced Voltage: ABB Type PSE

2.02 MOTOR CONTROLLERS

A. Except as otherwise indicated, provide motor controllers and ancillary components which comply with manufacturer's standard materials, design, and construction in accordance with published product information and as required for a complete installation.

B. Solid-State Reduced Voltage Controllers: Provide 3-phase, solid-state, reduced voltage motor controllers of sizes and ratings indicated.

1. The controller shall be microprocessor-based and shall provide as a minimum the following modes of operation.
   a. Soft start with selectable kick-start.
   b. Soft stop.
   c. Current limit.
   d. Full voltage.

2. The controller shall be self-calibrating and shall automatically adjust itself for line voltage, frequency and current fluctuations. It shall have adjustable starting acceleration and stopping deceleration. Provide transient protection for all controllers furnished.

C. Control and Pilot Devices: Provide an individually fused control power transformer in each starter unit. Provide 2 fuses in the transformer primary circuit and 1 in transformer secondary circuit. Size transformers such that they can supply 100VA in excess of the unit requirements or provide 150VA rated transformer, whichever is greater. Provide 300 volt rated, oil tight type pilot lights, push buttons with extended guard and black color insert. Equip stop push buttons with half guard and red color insert. Provide 120/6 volt transformer type push-to-test pilot lights with lens color indicated. Provide machine tool type relays, each with 1 spare N.O. contact. Provide 6-digit elapsed time indicators with one-tenth hour increments. When timers are required, they shall be synchronous type.

PART 3 – EXECUTION (NOT USED)

END OF SECTION
Subsurface Soil Exploration and Geotechnical Engineering Evaluation
Proposed Pipeline Improvements
New Smyrna Beach, Volusia 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
Dear Mr. Thatcher:

As requested and authorized, we have completed a shallow subsurface soil exploration for the subject project. The purposes of performing this exploration were to evaluate the general subsurface conditions along the proposed water main and force main improvements along Quay Assisi and to provide recommendations for pipeline support for the open cut and cover pipeline portion. In addition, we have explored soil stratigraphy and groundwater level for the directional drill location along Quay Assisi and the directional drill location for the reclaimed water main extension along N. Causeway. We have also estimated the normal seasonal high groundwater level at the boring locations. This report documents our findings and presents our engineering recommendations.

SITE LOCATION AND SITE DESCRIPTION

The proposed pipeline improvements are in New Smyrna Beach, Volusia County, Florida (Section 41, Township 17 South, Range 34 East). The proposed water main and force main extend from the intersection of N. Causeway and Quay Assisi approximately 2,540 linear feet northwest and then northeast along Quay Assisi. The reclaimed water main extension is located at the N. Causeway water crossing that is approximately 900 feet northeast of the intersection of N. Causeway and Quay Assisi. The general site location is shown superimposed on the New Smyrna Beach, Florida U.S.G.S. quadrangle map presented on Figure 1.

We understand that proposed pipelines along Quay Assisi will be under the roadway along portions of the pipe alignments. The directional drill portion of the pipelines along Quay Assisi will extend beneath the culvert near the location of Boring TH-2 as shown on Figure 2 and the reclaimed water main extension along N. Causeway will be beneath the waterway near Boring TH-1.
PROPOSED CONSTRUCTION

It is our understanding that both the proposed water main and force main will extend along Quay Assisi approximately 2,540 linear feet and will be constructed using open cut and/or directional drill methodologies. The reclaimed water main along N. Causeway will be constructed using directional drill methodology.

We understand that the pipelines will be placed with up to 5 feet of soil cover for the open cut portions. The directional drill portions will be constructed to depths up to 20 feet below existing ground surface.

We note that since the directional drill installation methods are proprietary in nature, the soil boring information relative to these portions of the pipelines are provided for informational purposes only. Geotechnical engineering evaluation and recommendations relative to directional drilling is beyond the scope of our services for this project.

REVIEW OF SOIL SURVEY MAPS

Based on the 1980 Soil Survey for Volusia County, Florida, as prepared by the U.S. Department of Agriculture Soil Conservation Service, the site is located in an area mapped as the “Turnbull Variant sand” soil series. The “Turnbull Variant sand” consists of mixed sandy and shelly material dredged from the Intracoastal Waterway and placed in narrow strips along the waterway. The underlying material consists of organic layers and layers of clayey and sandy estuarine deposits. Areas are mostly in tidal marshes associated with the Intracoastal Waterway. The water table for the “Turnbull Variant sand” is typically at a depth of about 40 inches, or at the base of the overburden.

FIELD EXPLORATION PROGRAM

SPT and Auger Borings

The field exploration program included performing 2 Standard Penetration Test (SPT) borings and 6 auger borings. The SPT borings were advanced to a depth of 30 feet below the ground surface using the methodology outlined in ASTM D-1586. A summary of this field procedure is included in the Appendix. Split-spoon soil samples recovered during performance of the borings were visually classified in the field and representative portions of the samples were transported to our laboratory in sealed sample jars.

The auger borings were drilled using a truck-mounted, 4-inch diameter, continuous flight auger to depths of 10 to 12 feet below the ground surface. A summary of this field procedure is included in the Appendix. Representative soil samples were recovered from the auger borings and transported to our laboratory for further analysis.
The groundwater level at each of the boring locations was measured during drilling. The borings were backfilled with soil cuttings upon completion.

Test Locations

The approximate locations of the borings are schematically illustrated on aerial photographs shown on Figure 2. These locations were determined in the field by tape measuring/estimating distances from existing site features and should be considered accurate only to the degree implied by the method of measurement used.

LABORATORY PROGRAM

Representative soil samples obtained during our field sampling operation were packaged and transferred to our laboratory for further visual examination and classification. The soil samples were visually classified in general accordance with the Unified Soil Classification System (ASTM D-2488). The resulting soil descriptions are shown on the soil boring profiles presented on Figure 2.

In addition, we conducted 1 natural moisture content test (ASTM D2216) and 4 percent fines analyses (ASTM D1140) on selected soil samples obtained from the borings. The results of these tests are presented adjacent to the sample depth on the boring profiles on Figures 3 and 4.

GENERAL SUBSURFACE CONDITIONS

General Soil Profile

The results of the field exploration and laboratory programs are graphically summarized on the soil boring profiles presented on Figures 3 and 4. The stratification of the boring profiles represents our interpretation of the field boring logs and the results of laboratory examinations of the recovered samples. The stratification lines represent the approximate boundary between soil types. The actual transitions may be more gradual than implied.

The results of the borings indicate the following general soil profile:
# Water Main and Force Main (Quay Assisi)

<table>
<thead>
<tr>
<th>Depth Below Ground Surface (feet)</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>From 0 to To 3</td>
<td>Fine sand to fine sand with silt (A-3), some with shell. The asphaltic concrete and limerock base encountered at the ground surface in Boring AB-5 were approximately 1 inch and 6 inches thick, respectively.</td>
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<tr>
<td>From 3 to To 10</td>
<td>Fine sand and fine sand with silt (A-3), fine sand with silt to silty fine sand (A-2-4), fine sand with clay to clayey fine sand (A-2-4) and clayey fine sand to sandy clay (A-2-6, A-6, A-7-6), some shell.</td>
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<tr>
<td>From 10 to To 30</td>
<td>Loose to medium dense fine sand to fine sand with silt (A-3), some with shell.</td>
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# Reclaimed Water Main (N. Causeway)

<table>
<thead>
<tr>
<th>Depth Below Ground Surface (feet)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>From 0 to To 30</td>
<td>Loose to dense fine sand to fine sand with silt (A-3), some with shell.</td>
</tr>
</tbody>
</table>

The above soil profile is outlined in general terms only. Please refer to Figures 3 and 4 for soil profile details.

## Groundwater Level

The groundwater level was measured in the boreholes during drilling. As shown on Figures 3 and 4, groundwater was encountered at depths that ranged from 3 to 7½ feet below the existing ground surface on the date indicated. Fluctuations in groundwater levels should be anticipated throughout the year primarily due to seasonal variations in rainfall and other factors that may vary from the time the borings were conducted.
NORMAL SEASONAL HIGH GROUNDWATER LEVEL

The normal seasonal high groundwater level each year is the level in the August-September period at the end of the rainy season during a year of normal (average) rainfall. The water table elevations associated with a higher than normal rainfall and in the extreme case, flood, would be higher to much higher than the normal seasonal high groundwater level. The normal high water levels would more approximate the normal seasonal high groundwater levels.

The seasonal high groundwater level is affected by a number of factors. The drainage characteristics of the soils, the land surface elevation, relief points such as drainage ditches, lakes, rivers, swamp areas, etc., and distance to relief points are some of the more important factors influencing the seasonal high groundwater level.

Based on our interpretation of the site conditions using our boring logs, we estimate the normal seasonal high groundwater level at the boring locations to be approximately 2 feet above the groundwater levels measured at the time of our field exploration.

ENGINEERING EVALUATION AND RECOMMENDATIONS

General

The results of our exploration indicate that, with proper site preparation as recommended in this report, the existing soils are suitable for supporting the proposed cut and cover installed pipelines. We caution that clayey soils may be encountered near the foundation elevation for the pipelines. The clayey soil will be very difficult to moisture condition and compact. If moisture conditions preclude compaction of the clayey soil, to facilitate construction, you may wish to over-excavate approximately 1 to 2 feet below the proposed foundation bottom and backfill the excavation with compacted gravel.

The following are our recommendations for overall site preparation and foundation support which we feel are best suited for the proposed cut and covered installed pipelines relative to the soil conditions encountered in the borings. The recommendations are made as a guide for the design engineer, parts of which should be incorporated into the project's specifications.

We note that no recommendations are made relative to directional drill portions of the pipelines since these construction methods are proprietary in nature.

Excavation

Based on the conditions encountered during the field exploration, we anticipate that the majority of the sandy soils as encountered in the borings can be excavated with standard earth moving equipment (i.e., front-end loaders and backhoes).
The soils below the bottom of the excavations should not be disturbed by the excavation process. If soils become disturbed and difficult to compact, they should be overexcavated to a depth necessary to remove all disturbed soils. Overexcavated areas should be replaced with compacted backfill meeting the “Backfill Requirements” presented in a following report section.

Excavation should be safely braced to prevent injury to personnel or damage to equipment. Temporary safe slopes in dewatered ground should be cut at a minimum 1.5 Horizontal (H) to 1 Vertical (V) in accordance with OSHA, 29 CFR Part 1926 Final Rule, Excavation Requirements or successor regulations. Flatter slopes should be used if deemed necessary. Surcharge loads should be kept at least 5 feet from excavations. Spoil banks adjacent to excavations should be sloped no steeper than 2.0H to 1.0V. Provisions for maintaining workers’ safety within excavations is the sole responsibility of the Contractor.

Dewatering

The control of the groundwater will be required to achieve the necessary depths of excavation and subsequent construction and backfilling and compaction requirements presented in the following sections. The actual method(s) of dewatering should be determined by the Contractor, however, regardless of the method(s) used, we suggest drawing down the water table sufficiently, say 2 to 3 feet, below the bottom of the excavation(s) to preclude "pumping" and/or compaction-related problems with the foundation soils.

The contractor should be aware that cuts may expose and/or be close to confined aquifers where relatively permeable sandy soils underlie less permeable zones of clayey soils. These relatively permeable zones may require dewatering efforts to include relatively deep full aquifer penetrating wells, airlift of water from wells, trench drains, seepage barriers, etc.

Pipeline Bedding

Pipe bedding material should be compacted as necessary to achieve a density equivalent to 95 percent of the maximum dry density, as determined by the Modified Proctor (ASTM D-1557), to a minimum depth of 6 inches below the bottom of the pipe (compact deeper if recommended by the pipe manufacturer).

It is our recommendation that the bedding for the pipe be preshaped by means of a template, prior to placement of the structure, to ensure that the upward reaction on the bottom of the pipe will be well distributed over the width of the bedding contact. Based on the cost involved with preshaping the bedding material, and the construction time requirements, an alternative procedure may be to utilize a level bed for the pipe and require a higher pipe strength class which will adequately carry the load on a lower class of bedding. It would be prudent to perform an economic analysis of the two alternatives, or specify both design conditions within the contract documents, and allow the Contractor to decide the most efficient method.
If level bedding is utilized, it will be necessary to place and compact the haunching backfill (backfill between the bedding and the centerline of the pipe) to the centerline of the pipe. This material should be placed in simultaneous layers on each side of the pipe and must be compacted in such a manner as to ensure an intimate contact with the sides of the pipe. Do not use blocking to raise the pipe to grade. Provide bell holes at each joint to permit the joint to be assembled while maintaining uniform pipe support.

Backfill Requirements

As a general guide to aid the Contractor, we recommend using fill with less than 12 percent by dry weight of material passing the U.S. Standard No. 200 sieve size. Soils with more than 12 percent passing the No. 200 sieve will be more difficult to compact due to their inherent nature to retain soil moisture. Based on the soil samples obtained during our subsurface investigation, the fine sand (Stratum 1 on Figures 3 and 4) without organics and roots appears suitable for use as structural backfill. We note that material removed from below the groundwater table will be wet and will require time to dry sufficiently.

Strata 2 and 3 on Figures 3 and 4 soils with less than 20 percent fines (i.e., percent by dry weight passing the No. 200 standard sieve) may be used as backfill however; these soils will be more difficult to moisture condition and compact than Stratum 1 soils due to their relatively high fines content. They may be used as backfill if it is possible to achieve the required degree of compaction. However, extensive moisture conditioning would likely be required.

Strata 4 and 5 soils on Figures 2 and 3 having more than 20 percent fines are generally considered unsuitable for use as structural fill because of the extreme difficulty in moisture conditioning and compacting these soils. We caution that import soils may be required to replace silty or clayey soils if these existing soils cannot be moisture conditioned and compacted efficiently.

The final backfill above the haunching or centerline of the pipe must extend all the way to the trench walls and should be placed in level lifts not exceeding 8 inches. Each lift should be compacted to at least 95 percent of the maximum dry density, as determined by the Modified Proctor (ASTM D-1557). Care should be taken not to damage the pipe by compacting directly above the pipe where there is insufficient cover material present. Minimum cover criteria should be in accordance with the pipe manufacturer's recommendations.

A geotechnical engineer or a designated representative from Ardaman & Associates, Inc. should observe and test all prepared and compacted areas to verify that all bedding, haunching and final backfill are prepared and compacted in accordance with the aforementioned specifications.
Resistance to Horizontal Forces on Pipeline Structures

Horizontal forces which act on structures such as thrust blocks or anchor blocks can be resisted to some extent by the earth pressures that develop in contact with the buried vertical face (buried vertical face is perpendicular and in front of the applied horizontal load) of the block structures and by shearing resistance mobilized along the base of the block structures and subgrade interface.

Allowable earth pressure resistance may be determined using an equivalent fluid density of 100 pounds per cubic foot (pcf) for moist soil and 60 pcf for submerged soils below the water table.

Equivalent fluid density (moist soil) = $K_p \gamma_m / S.F. = 100 \text{ pcf}$
Equivalent fluid density (submerged soil) = $K_p (\gamma_s - \gamma_w) / S.F. = 60 \text{ pcf}$

Where:

- $K_p = \text{effective coefficient of passive earth pressure} = 3.0$
- $S.F. = \text{safety factor} = \text{(values given above)}$
- $\gamma_m = \text{unit weight of moist soil} = 110 \text{ pcf}$
- $\gamma_s = \text{unit weight of saturated soils} = 118 \text{ pcf}$
- $\gamma_w = \text{unit weight of water} = 62.4 \text{ pcf}$

The passive earth pressures are developed from ground surface (assuming there is no excavation in the vicinity of the block structure that would reduce the available passive pressure) to the bottom of the block structure.

The values presented above presume that the block structures are surrounded by well compacted sand backfill extending at least 5 feet horizontally beyond the vertical buried face. In addition, it is presumed that the block structures can withstand horizontal movements on the order of one-quarter (1/4) to three-eighths (3/8) inch before mobilizing full passive resistance. The factors of safety assumed in the above recommendations are 2.5 for passive pressure with submerged conditions, and 3.0 for passive pressure without submerged conditions.

The sliding shearing resistance mobilized along the base of the block structure may be determined by the following formula:

$$\text{Allowable Shearing Resisting Force, } P = V \tan(2/3 \varphi) / F.S.$$
Where:

- **P** = Shearing Resistance Force (pounds)
- **V** = Net Vertical Force (total weight of block and soil overlying the structure minus uplift forces including buoyancy forces) (pounds)
- **φ** = Angle of Internal Friction of Soil = 30 degrees
- **S.F.** = Safety Factor = 1.5

The vertical earth pressures developed by the overburden weight of soil can be calculated using the following unit weights:

- Compacted moist soil = 110 pcf
- Saturated soil = 118 pcf

Vertical pressure distributions in accordance with the above do not take into account vertical forces from construction equipment, wheel loads or other surcharge loads.

**Foundation Support and Estimated Settlements - Pipeline Elements**

The permanent structures such as anchor blocks, thrust blocks, air release valves, blow offs, etc., bearing at least 18 inches below adjacent grade can be designed for the maximum vertical bearing capacities presented below.

- 1,500 psf on undisturbed natural granular soils.
- 2,000 psf on compacted natural or backfilled subgrade; this value assumes compaction of 95 percent of the standard Proctor maximum density (ASTM D-698, AASHTO T-99) for a depth of 2 feet below the structure.

Pipe settlement during and after construction should be negligible (less than ½-inch), provided the bedding and backfilling criteria in the above sections are satisfied. The volume of soil displaced by the pipe, compared to the weight of the pipe when full, will result in little if any net increase in bearing stress to the subsurface soils.
Uplift Resistance

Permanent structures submerged below the groundwater table will be subjected to uplift forces caused by buoyancy. The components resisting this buoyancy include: 1) the total weight of the pipe or structure divided by an appropriate factor of safety; 2) the buoyant weight of soil overlying the pipe or structure; and 3) the shearing forces that act on shear planes that radiate vertically upward from the perimeter of the pipe or the edges of the structure to the ground surface. The allowable unit shearing resistance may be determined by the following formula:

Allowable Unit Shearing Resistance, \( F = K_0 \gamma_m h (2/3 \tan \phi) / S.F. \) (above groundwater table)

Allowable Unit Shearing Resistance, \( F = K_o[\gamma_m h_w + \gamma_b (h-h_w)] (2/3 \tan \phi) / S.F. \) (below groundwater table)

Where:

- \( F \) = unit shearing resistance (psf)
- \( K_0 \) = coefficient of earth pressure at rest = 0.5
- \( \gamma_m \) = unit weight of moist soil = 110 pcf
- \( \gamma_b \) = buoyant unit weight of soil = 55.6 pcf
- \( h \) = vertical depth (feet) below grade at which shearing resistance is determined
- \( h_w \) = vertical depth (feet) below grade to groundwater table
- \( \phi \) = angle of internal friction of the soil = 30 degrees
- S.F. = safety factor = 2

The values given for the above parameters assume that the permanent structures are covered by clean, well compacted granular backfill that extends horizontally at least 2 feet beyond the structures.

Earth Pressure on Shoring and Bracing

If temporary shoring and bracing is required for any excavations, the system should be designed to resist lateral earth pressure. The design earth pressure will be a function of the flexibility of the shoring and bracing system. For a flexible system restrained laterally by braces placed as the excavation proceeds, the design earth pressure for shoring and bracing can be computed using a uniform earth pressure distribution with depth. It is recommended that soils be de-watered around the excavations. For such de-watered excavations, we recommended using the following uniform pressure distribution over the full braced height as follows:

Uniform Soil Pressure Distribution, \( p = 0.65K_o \gamma_s H \)
Where:

- \( p \) = uniform pressure distribution for design of braced excavation
- \( K_a \) = coefficient of active earth pressure = 0.33
- \( \gamma_s \) = unit weight of saturated soils = 118 pcf
- \( H \) = depth of excavation

An appropriate factor of safety should be applied for the design of the braced excavations.

Lateral pressure distributions determined in accordance with the above do not take hydrostatic pressures or surcharge loads into account. To the extent that such pressures and forces may act on the walls, they should be included in the design.

Construction equipment and excavated fill should be kept a minimum distance of 5 feet from the edge of the braced or shored excavation. Backfill material placed adjacent to (maintaining a minimum 5-foot horizontal clearance) the braced or shored excavation should have a minimum slope of 2.0H:1.0V, or flatter if required by site specific conditions and/or to meet OSHA requirements.

Means and methods of excavation and bracing should be the responsibility of the Contractor; however, excavation and/or bracing should at a minimum adhere to the requirements of the Occupational Safety Health Administration (OSHA).

### Lateral Earth Pressures

Lateral loads acting on the embedded structure will include at-rest earth pressures as well as hydrostatic pressures and surcharge loads. The lateral earth pressure will be a function of both the depth below ground surface and the soil unit weight (submerged or moist) plus hydrostatic pressure (if applicable). The following equations can be used to determine the lateral at-rest earth pressure:

\[
\sigma_h = K_o \gamma_m h \quad \text{above groundwater table}
\]

\[
\sigma_h = K_o \left[ \gamma_m h_w + \gamma_b (h - h_w) \right] \quad \text{below groundwater table}
\]

Where:

- \( \sigma_h \) = lateral earth pressure (psf)
- \( K_o \) = coefficient of at rest earth pressure (0.5) (this value assumes that the backfill is lightly compacted yet not overcompacted)
- \( \gamma_m \) = effective moist unit weight of soil = 110 pcf for compacted moist soil above the water table.
- \( \gamma_b \) = buoyant unit weight of soil = 55.6 pcf for compacted saturated soil below the water table.
- \( h \) = vertical depth (feet) below grade at which lateral earth pressure is determined
- \( h_w \) = vertical depth (feet) below grade to groundwater table
For design, an appropriate factor of safety should be applied to the lateral earth pressure calculated using the above equation. Lateral pressure distributions determined in accordance with the above do not include hydrostatic pressures or surcharge loads. Where applicable, they should be incorporated in the design.

QUALITY CONTROL

We recommend establishing a comprehensive quality control program to verify that all excavation, bedding, and backfilling are conducted in accordance with the appropriate plans and specifications. Materials testing and inspection services should be provided by Ardaman & Associates, Inc.

In-situ density tests should be conducted during bedding and backfilling activities to verify that the required densities are achieved. Backfill for the proposed pipeline should be tested at a minimum frequency of one in-place density test for each 12-inch lift for each 200 linear feet of pipe. Additional tests should be performed beneath foundations and in backfill for other associated structures. In-situ density values should be compared to laboratory Proctor moisture-density results for each of the different natural and fill soils encountered. Also, we recommend inspecting and testing the construction materials and other structural components.

CLOSURE

The analyses and recommendations submitted herein are based on the data obtained from the soil borings presented on Figures 3 and 4. This report does not reflect any variations which may occur adjacent to or between the borings. The nature and extent of the variations between the borings may not become evident until during construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations presented in this report after performing on-site observations during the construction period and noting the characteristics of the variations.

In the event any changes occur in the design, nature, or location of the proposed pipelines, we should review the applicability of conclusions and recommendations in this report. We recommend a general review of final design and specifications by our office to verify that earthwork and foundation recommendations are properly interpreted and implemented in the design specifications. Ardaman and Associates should attend the pre-bid and preconstruction meetings to verify that the bidders/contractor understand the recommendations contained in this report.

This study is based on a relatively shallow exploration and is not intended to be an evaluation for sinkhole potential. This study does not include an evaluation of the environmental (ecological or hazardous/toxic material related) condition of the site and subsurface.

This report has been prepared for the exclusive use of Tetra Tech, Inc. in accordance with generally accepted geotechnical engineering practices for the purpose of assisting with the proposed pipeline designs. No other warranty, expressed or implied, is made.
We are pleased to be of assistance to you on this phase of the project. When we may be of further service to you or should you have any questions, please contact us.

Very truly yours,
ARDAMAN & ASSOCIATES, INC.
Certificate of Authorization No. 5950

Eric C. Balog, E.I.
Assistant Project Engineer

Charles H. Cunningham, P.E.
Orlando Branch Manager
Florida License No. 38189

ECB/CHC/nfm/jj
18-6500 Pipeline N. Causeway and Quay Assisi.docx(Geo 2018)
STANDARD PENETRATION TEST (SPT) BORING LOCATION
AUGER BORING LOCATION

DESIGNATED BORING LOCATIONS ON THE PARTICULAR DATE DRILLED.

SOIL DESCRIPTIONS

- FINE SAND TO FINE SAND WITH SILT (A-3)
- FINE SAND WITH SILT TO SILTY FINE SAND (A-2-4)
- FINE SAND WITH CLAY TO CLAYEY FINE SAND (A-2-4)
- CLAYEY FINE SAND (A-2-4)
- CLAYEY FINE SAND TO SANDY CLAY (A-6, A-7-6)
- ASPHALTIC CONCRETE AND BASE

COLORS

- GRAYISH BROWN
- LIGHT BROWN TO BROWN
- LIGHT GRAY TO GRAY
- DARK BROWN
- DARK GRAY

NOTES:

1. UPON COMPLETION OF EACH BORING, THE BOREHOLE WAS BACKFILLED WITH SOIL CUTTINGS.
2. ALL SPT BORINGS WERE PERFORMED USING A SAFETY HAMMER TO THE BORING TERMINATION DEPTH.
3. THICKNESS OF ASPHALTIC CONCRETE AND BASE IS A ROUGH APPROXIMATION.

ENGINEERING CLASSIFICATION

I. COHESIONLESS SOILS

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>BLOW COUNT &quot;N&quot;</th>
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<tbody>
<tr>
<td>VERY LOOSE</td>
<td>&gt;100</td>
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<tr>
<td>LOOSE</td>
<td>4 TO 10</td>
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<tr>
<td>MEDIUM DENSE</td>
<td>15 TO 30</td>
</tr>
<tr>
<td>DENSE</td>
<td>30 TO 50</td>
</tr>
<tr>
<td>VERY DENSE</td>
<td>&gt;50</td>
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</table>

II. COHESIVE SOILS

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
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<th>BLOW COUNT &quot;N&quot;</th>
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</thead>
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<tr>
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<tr>
<td>SEMI STIFF</td>
<td>1 TO 2</td>
<td>4 TO 10</td>
</tr>
<tr>
<td>STIFF</td>
<td>1 TO 2</td>
<td>8 TO 15</td>
</tr>
<tr>
<td>VERY STIFF</td>
<td>2 TO 4</td>
<td>15 TO 30</td>
</tr>
<tr>
<td>HARD</td>
<td>&gt;4</td>
<td>&gt;30</td>
</tr>
</tbody>
</table>

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 LOGS AND RELATED INFORMATION ARE BASED ON THE DRILLER S LOGS AND VISUAL EXAMINATION OF SELECTED SAMPLES IN THE LABORATORY. THE DELINEATION BETWEEN SOIL TYPES SHOWN ON THE LOGS IS APPROXIMATE AND THE DESCRIPTION REPRESENTS OUR INTERPRETATION OF SUBSURFACE CONDITIONS AT THE DESIGNATED BORING LOCATIONS ON THE PARTICULAR DATE DRILLED. GROUNDWATER ELEVATIONS SHOWN ON THE BORING LOGS REPRESENT GROUNDWATER SURFACES ENCOUNTERED ON THE DATES SHOWN. FLUCTUATIONS IN WATER TABLE LEVELS SHOULD BE ANTICIPATED THROUGHOUT THE YEAR.

SHELL CONTENT

- TRACE: <5%
- MOSTLY: 50 TO 100%
- VERY STIFF: 8 TO 15
- LIGHT BROWN TO BROWN: 2 TO 4
- LIGHT GRAY TO GRAY: 4 TO 10
- DARK BROWN: 15 TO 30
- DARK GRAY: >30
SOIL DESCRIPTIONS

- FINE SAND TO FINE SAND WITH SILT (A-3)
- FINE SAND WITH SILT TO SILTY FINE SAND (A-2-4)
- FINE SAND WITH CLAY TO CLAYEY FINE SAND (A-2-4)
- CLAYEY FINE SAND (A-2-4)
- CLAYEY FINE SAND TO SANDY CLAY (A-6, A-7-6)
- ASPHALTIC CONCRETE AND BASE

LEGEND

COLORS

- GRAYISH BROWN
- LIGHT BROWN TO BROWN
- LIGHT GRAY TO GRAY
- DARK BROWN
- DARK GRAY

AUGER BORING

- NATURAL MOISTURE CONTENT IN PERCENT (ASTM D-2216)
- PERCENT PASSING NO. 200 SIEVE SIZE (PERCENT FINES) (ASTM D-1140)
- GROUNDWATER LEVEL MEASURED ON DATE DRILLED

A-2-4-4, A-2-4-7-4

ASHTO SOIL CLASSIFICATION SYSTEM (ASTM D-3282)

NOTES:
1. UPON COMPLETION OF EACH BORING, THE BOREHOLE WAS BACKFILLED WITH SOIL CUTTINGS.
2. THICKNESS OF ASPHALTIC CONCRETE AND BASE IS A ROUGH APPROXIMATION.

SHELL CONTENT

- TRACE: <5%
- FEW: 5 TO 15%
- LITTLE: 15 TO 25%
- SOME: 30 TO 45%
- MOSTLY: 50 TO 100%

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 LOGS AND RELATED INFORMATION ARE BASED ON THE DRILLER'S LOGS AND VISUAL EXAMINATION OF SELECTED SAMPLES IN THE LABORATORY. THE DELINEATION BETWEEN SOIL TYPES SHOWN ON THE LOGS IS APPROXIMATE AND THE DESCRIPTION REPRESENTS OUR INTERPRETATION OF SUBSURFACE CONDITIONS AT THE DESIGNATED BORING LOCATIONS ON THE PARTICULAR DATE DRILLED.

GROUNDWATER ELEVATIONS SHOWN ON THE BORING LOGS REPRESENT GROUNDWATER SURFACES ENCOUNTERED ON THE DATES SHOWN. FLUCTUATIONS IN WATER TABLE LEVELS SHOULD BE ANTICIPATED THROUGHOUT THE YEAR.
APPENDIX

Standard Penetration Test and Auger Boring Procedures
STANDARD PENETRATION TEST

The standard penetration test is a widely accepted test method of *in situ* testing of foundation soils (ASTM D 1586). A 2-foot long, 2-inch O.D. split-barrel sampler attached to the end of a string of drilling rods is driven 18 inches into the ground by successive blows of a 140-pound hammer freely dropping 30 inches. The number of blows needed for each 6 inches of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch increments of penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual examination and classification 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 tests are usually performed at 5-foot intervals. 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 a 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, NX-size 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.

Representative split-spoon samples from the soils are brought to our laboratory in air-tight jars for further evaluation and testing, if necessary. Samples not used in testing are stored for 30 days prior to being discarded.
AUGER BORINGS

Auger borings are used when continuous sampling of soil strata close to ground surface is desired. A 4-inch diameter, continuous flite, helical auger with a cutting head at its end is screwed into the ground in 5-foot sections. It is powered by the rotating action of the Kelly bar of a rotary drill rig. The sample is recovered by withdrawing the auger out of the ground without rotating it. The soil sample so obtained, is classified and representative samples put in bags or jars and brought back to the laboratory for classification testing.