



WATER DISTRIBUTION
&
WASTEWATER COLLECTION

WATER UTILITIES MANUAL
of
SPECIFICATIONS

CITY OF DAVENPORT

1318 By Gosh

Davenport, FL 33837

Phone: (863) 419-3300

INTRODUCTION

INTRODUCTION

DOCUMENT TITLE

The title of this document is “Water Utilities Manual of Standards and Specifications for Design and Construction”.

JURISDICTION

This Chapter shall apply to all proposed water, wastewater mains to be owned, operated or maintained by the City of Davenport, Water Distribution and Wastewater Collection Division. In addition, other permitting and regulatory agencies may have jurisdiction, and regulations which supplement or supplant the requirements outlined in this manual.

PURPOSE

These standards and specifications are adopted to establish minimum acceptable standards for the design and construction of water distribution and transmission facilities and wastewater collection and transmission facilities within the City of Davenport service area. Such facilities include water mains, gravity sewers, wastewater force mains, wastewater pump stations, and miscellaneous related appurtenances associated with such systems.

SCOPE

This Document is divided into three parts. Part 1 - Standards includes Divisions I and II. Division I presents general requirements governing review and approval of plans, and construction inspection and acceptance. Division II presents design standards for wastewater, and water main facilities.

Part 2 of this document, Specifications, includes Division III, IV and V. These three Divisions contain detailed technical specifications governing construction of water and wastewater main facilities within the City of Davenport.

Part 3 of this document is Standard Details. This part contains drawings showing standard details associated with the installation of wastewater and water main facilities.

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SECTION 1.2. **DEFINITIONS**

1.2. **DEFINITIONS**

Except where specific definitions are used within a specific section, the following terms, phrases, words, and their derivation shall have the meaning given herein when consistent with the context. Words used in the present tense include the future tense, words in the plural number include the singular number and words in the singular number include the plural number. The word Ashall@ is mandatory, and the word Amay@ is permissive.

AASHTO - means American Association of State Highway and Transportation Officials. Any reference to AASHTO standards shall be taken to mean the most recently published revision unless otherwise specified.

ANSI - means American National Standards Institute. Any reference to ANSI standards shall be taken to mean the most recently published revision unless otherwise specified.

ASTM - means American Society for Testing Materials. Any reference to ASTM standards shall be taken to mean the most recently published revision unless otherwise specified.

AWWA - means American Water Works Association. Any reference to AWWA Standards shall be taken to mean the most recently published revision unless otherwise specified.

CITY - means the City OF Davenport , Florida.

CONTRACTOR - means the person, firm, or corporation with whom the Owner, the Developer or the CITY has made the contract for work.

DEVELOPER - means the person, firm, or corporation engaged in developing or improving real estate for use or occupancy.

DEVELOPER=s ENGINEER - means an engineer or engineering firm registered with the State of Florida Department of Professional Regulation, retained by the DEVELOPER to provide professional engineering services for a project.

DIPRA - means Ductile Iron Pipe Research Association.

DIRECTOR - means the Public Works/Utilities Director of the City OF Davenport , Florida, acting directly or through an assistant or other representative authorized by him.

DRAWINGS - means engineering drawings prepared by an ENGINEER to show the proposed construction.

ENGINEER - means an engineer or engineering firm registered with the State of Florida Department of Professional Regulation.

FDOT - means the Department of Transportation, State of Florida.

GEOTECHNICAL/SOILS ENGINEER - means a Registered Florida Engineer who provides services related to terrain evaluation and site selection, subsurface exploration and sampling, determination of soil and rock properties, foundation engineering, settlement and seepage analysis, design of earth and earth retaining structures, the design of subsurface drainage systems and the improvement of soil properties and foundation conditions, and testing and evaluation of construction materials.

MANUAL - means this City OF Davenport Manual of Standards and Specifications for Wastewater, reuse water and Water Main Construction.

MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES - means the United States Department of Transportation Manual on Traffic Control Devices, latest edition.

NEMA - means National Electrical Manufacturers Association. Any reference to NEMA Standards shall be taken to mean the most recently published revision unless otherwise specified.

NSF - means National Sanitation Test Laboratory Foundation. Any reference to NSF Standards shall be taken to mean the most recently published revision unless otherwise specified.

CITY OF DAVENPORT - means City OF Davenport , Florida.

OSHA - means the Federal Occupational Safety and Health Administration.

OWNER - means the person, firm, corporation, or governmental unit holding right of possession of the real estate upon which construction is to take place.

PLANS - means DRAWINGS as defined herein above.

STANDARDS - means the minimum design standards contained in Part 1 of the MANUAL.

STANDARD DRAWINGS - means the detailed drawings in Part 3 of this MANUAL related to water, reuse and wastewater main materials and installation.

STANDARD SPECIFICATIONS - means the Department of Transportation, State of Florida, Standard Specification for Road and Bridge Construction, latest edition.

SUBDIVISION REGULATIONS - means the City OF Davenport Subdivision Regulations, latest edition.

TRAFFIC CONTROL AND SAFE PRACTICES MANUAL - means the State of Florida Department of Transportation Manual on Traffic Control and Safe Practices for Street and Highway Construction, Maintenance and Utility operation, latest edition

UTILITY ACCOMMODATION GUIDE - means the State of Florida Department of Transportation Utility Accommodation Guide, latest edition.

WATER MAINS - means water transmission mains, distribution mains, pipes, fittings, valves, hydrants, services, meters and miscellaneous related appurtenances.

WASTEWATER MAINS - means wastewater gravity sewers, force mains, pump stations, fittings, valves, service laterals, and miscellaneous related appurtenances.

WORK - means the labor, materials, equipment, supplies, services and other items necessary for the execution, completion and fulfillment of the contract.

ARTICLE 7. – PART 3 STANDARD DETAILS FOR WATER UTILITIES

<u>DETAIL</u>	<u>REVISION DATE</u>
150010 – Typical Water Service	11/22/18
150020 – Multiple Water Service Connection	11/22/18
150030 – Typical Cul-De-Sac Water Piping	11/22/18
150040 – Sanitary Lateral Detail	11/22/18
150050 – Sanitary Cleanout Detail	11/22/18
150060 – Standard Manhole Detail	11/22/18
150070 – Standard Ring and Cover (Manhole)	11/22/18
150075 – Lockable Ring and Cover (Manhole)	11/22/18
150080 – Standard Outside Drop to Manhole	11/22/18
150090 – Sand and Mud Trap	11/22/18
150100 – Oil Interceptor	11/22/18
150110 – Grease Trap Detail	11/22/18
150120 – Detail Deleted	
150130 – Typical Pipe Trench Section	11/22/18
150140 – Open Cut Detail	11/22/18
150150 – Piping Clearance	11/22/18
150160 – Gear Operated Valve and Box Detail	11/22/18
150170 – Gate Valve and Box Detail	11/22/18
150171 – Valve Markings	11/22/18
150180 – Air/Vacuum Relief Valve and Vault Detail	11/22/18
150190 – Thrust Restraint Detail	11/22/18
150200 – Restrained Joint Table	11/22/18
150210 – Jack and Bore Detail	11/22/18
150220 – High Risk Temporary Reuse Reduced Pressure Zone	11/22/18
150230 – High Risk Water Service and Commercial Reuse Reduced Pressure Zone	11/22/18
150231 – Commercial ¾” – 1” Backflow Assembly and Water Meter	11/22/18
150232 – Detail Deleted	
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150240 – Fire Hydrant Detail	11/22/18
150245 – Main Fire Line Reduced Pressure Zone	11/22/18
150250 – Blow Off / Automatic Flushing Device	11/22/18
150255 – Water Sampling Station	11/22/18
150260 – Monitoring Well	11/22/18
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150290 – Bollard Detail	11/22/18
150300 – Duplex Lift Station and 230 and 480Vac Control Panel	11/22/18
150310 – 230Vac Control Panel Specifications	11/22/18
150315 – 480Vac Control Panel Specifications	11/22/18
150320 – Temporary Jumper Detail	11/22/18
150330 – Detail Deleted	
150340 – Detail Deleted	
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SECTION 1.3.

PLAN REVIEW, APPROVAL, CONSTRUCTION, AND ACCEPTANCE OF WATER AND WASTEWATER IMPROVEMENTS

1.3.1. PLANS AND SPECIFICATIONS

1.3.1.1. GENERAL

All submitted plans shall be standard size sheet (24" x 36" and on a CD in PDF format) with title block. Graphic scale (s) shall be provided on each sheet and all lettering shall be 1/8" or larger to permit photographic reproduction. Submittal of specifications is required. ALL PLANS sheets and the title page of submitted specifications must be signed, Sealed and dated by the DEVELOPER's ENGINEER.

The city shall be notified in advance of proposed construction of streets and utility improvements or stages thereof within the subdivision or development. During construction, designated city inspectors shall visit the project at appropriated stages to assure that construction is in accordance with plans and specifications, and may halt construction until defects of defaults are corrected to their satisfaction. Should construction continue without city approval, the contractor and developer shall be subject to legal action as provided for in the Land Development Regulations.

CONTRACTOR's are required to have a complete set of signed approved plans and permits by the CITY on site at all time for the duration of the project.

1.3.1.2. MASTER PLAN

Whenever possible, the entire water and wastewater systems shall be shown on a single Master Plan. The Master Plan shall indicate the general locations of all mains, manholes, valves, hydrants, services and service laterals with respect to the proposed development improvements and the existing water, reuse and wastewater systems. Main sizes shall be indicated in the Master Plan.

1.3.1.3. PLAN AND PROFILE

All mains shall be drawn in plan and profile.

Whenever possible, on-site water, reuse and wastewater systems shall be shown on the same PLANS sheet. As a minimum, the plan and profile drawings shall include the following information:

- a. General information such as north arrow, names of designer and engineer, revision block with dates, graphic scale (s) and sheet number.
- b. Profiles with elevations at 100 foot interval, or more frequently if required by good design practice.
- c. Development layout with horizontal and vertical controls.

- d. All conflicts with other utility and drainage systems.
- e. All manhole locations and rim elevations for manholes.
- f. Pipe data including size, lengths, material, and slopes.
- g. Size, type, and locations of fittings, valves, hydrants, air release/vacuum relief, and other related appurtenance.
- h. Limits of pipe deflection.
- i. Limits of special exterior coatings.
- j. Limits of special bedding requirements.
- k. Pipe restraint requirements.
- l. Details of connection to existing systems.
- m. Locations (s) and general layout of wastewater pumping station.
- n. Construction notes regarding cover, horizontal and vertical control, special construction requirements, and references to standard and special details.
- o. Other details and notes required to construct utilities.

1.3.1.4. DETAILS

The Plans shall include the latest revision and/or latest edition of the STANDARD DETAILS as shown in Part 3 of this MANUAL. Special details shall be prepared by the DEVELOPERs ENGINEER for aerial and underwater crossings of rivers, streams, canals and ditches. Other special details shall be prepared by the DEVELOPER's ENGINEER as required.

1.3.1.5. SCALE

The master plan shall be prepared at a scale not to exceed 1" to 200'. Plan and profile sheets shall not exceed a scale of 1" to 50'. Special details shall be of sufficiently large scale to show pertinent construction information.

1.3.2. SUBDIVISION RELATED WATER AND WASTEWATER IMPROVEMENTS

1.3.2.1. GENERAL

This section covers all water, reuse and wastewater improvements that are dedicated to City of Davenport and constructed in compliance with City of Davenport land Development Regulations.

1.3.2.2. DESIGN AND PLAN REVIEW

Design of water, and wastewater improvements associated with City of Davenport approved subdivisions shall be in compliance with the applicable City or County design. Standards and the specifications outlined in Divisions III, IV, and V of this MANUAL. PLANS will be reviewed and approved by the City of Davenport as part of the subdivision review and approval process. Refer to the applicable subdivision regulations for other requirements governing plan review and approval.

1.3.2.3. CONSTRUCTION INSPECTION

Inspection of improvements shall be in accordance with criteria established in the Water Utilities Manual. The designated representative of the Water Distribution and Wastewater Collection Division shall inspect the water, reuse, and wastewater improvements to ensure their compliance with requirements in Divisions II, III, IV and V of this MANUAL.

1.3.2.4. APPROVAL AND ACCEPTANCE

Approval and acceptance of water reuse and wastewater improvements shall be in accordance with the criteria established in this manual and miscellaneous requirements of the City of Davenport Subdivision Regulations.

1.3.3. WATER AND WASTEWATER IMPROVEMENTS ASSOCIATED WITH SITE DEVELOPMENT WITHIN THE CITY OF DAVENPORT SERVICE AREA

1.3.3.1. GENERAL

All water and wastewater improvements that are to be dedicated to City of Davenport shall be designed, reviewed, constructed and accepted in accordance with the criteria established in this manual.

1.3.3.2. DESIGN AND PLAN REVIEW

Design of water and wastewater improvements shall be in compliance with the design standards in Division II and the specifications outlined in Divisions III, IV and V of this MANUAL. PLANS will be reviewed and approved by the City of Davenport Engineering Division. Any changes done to the PLANS after construction has started must be resubmitted for approval to the CITY, before they will be allowed to be used on the construction site.

1.3.3.3. CONSTRUCTION INSPECTION

The DIRECTOR or his designated representative (s) shall periodically inspect all construction subject to these standards and specifications. After all required improvements have been installed and tested, the DEVELOPER's ENGINEER shall submit certification to the CITY that the improvements have been constructed substantially according to approved plans and specifications. Non-compliance with approved plans or specifications or evidence of faulty materials or workmanship shall be called to the attention of the DEVELOPER or DEVELOPER's ENGINEER and if not corrected in an expeditious manner, all work on the project will be suspended and/or water services withheld. Additional laboratory tests shall be required when appropriate. 1-9

1.3.3.4. MAINTENANCE, MATERIALS, AND WORKMANSHIP WARRANTY BOND

A letter of credit or bond shall be posted by the DEVELOPER and executed by a company authorized to do business in the State of Florida that is satisfactory to the CITY, payable to City of Davenport in the amount of ten (10) percent of the estimated construction cost of all required water and wastewater improvements to be owned and maintained by the CITY. Such bond shall guarantee maintenance of all improvements intended to be owned and maintained by the CITY for a one (1) year period, and the materials, workmanship and structural integrity of water, reuse and wastewater systems, and miscellaneous related facilities, excluding mechanical equipment for a one (1) year period, commencing after Certificates of Completion and Project Acceptance have been issued by the CITY.

See Appendix A for required forms. The manufacturer's warranty will be acceptable for mechanical equipment. As an alternative to the provision of a surety bond, the DEVELOPER may provide for the deposit of cash in an escrow account or a letter of credit acceptable to the CITY.

1.3.3.5. CERTIFICATE OF COMPLETION/APPROVAL FOR MAINTENANCE

After successful completion of all water and wastewater improvements, and after receipt of the required documents outlined in Appendix A, page A-3, the CITY will provide a "Certificate of Completion" verifying the satisfactory construction of all improvements intended to be owned and maintained by the CITY. After the one (1) year Warranty Period and verification by the CITY of satisfactory performance of all water and wastewater improvements, the CITY will issue the "Approval for Maintenance", thereby releasing the DEVELOPER from further responsibilities. See form on page A-4 in Appendix A.

1.3.4. MISCELLANEOUS WATER, REUSE AND WASTEWATER IMPROVEMENTS

All water, reuse and wastewater improvements constructed which are intended to be owned, operated or maintained by the CITY, excluding the improvements discussed in Sections 1.2 and 1.3, shall be designed, reviewed, inspected and accepted in strict compliance with the criteria established in Section 1.3.3,.

1.3.5. COMPLIANCE WITH OTHER REGULATORY REQUIREMENTS

It shall be the responsibility of the DEVELOPER to obtain and comply with all applicable Federal, State and Local regulatory, and Right-of-Way Utilization permits.

1.3.6. RECORD DRAWINGS

The DEVELOPER's ENGINEER shall submit a certified set of Record Drawings to the CITY prior to issuance of Certificate of Completion for the improvements. The DEVELOPER's ENGINEER shall be responsible for recording information on the approved PLANS concurrently with construction progress. Record Drawings submitted to the CITY, as part of the project acceptance shall comply with the following requirements:

1. Drawings shall be legibly marked to record actual construction.
2. Drawings shall show actual location of all underground and above ground water, reuse and wastewater piping related appurtenances. All changes to piping location including horizontal and vertical locations of utilities and appurtenances shall be clearly shown and referenced to permanent surface improvements. Drawings shall also show actual installed pipe material, class, etc.
3. Drawings shall clearly show all field changes of dimension and detail including changes made by field order or by change order.
4. Drawing shall clearly show all details not on original contract drawings but constructed in the field. All equipment and piping relocation shall be clearly shown.
5. Location of all manholes, hydrants, valves, and valve boxes shall be shown. All valves shall be referenced from at least two preferably three permanent points.
6. Dimensions between all manholes shall be field verified and shown. The inverts and grade elevation of all manholes shall be shown.
7. Each sheet of the PLANS shall be signed, sealed and dated by the DEVELOPER's ENGINEER as being "As-Built" or "Record Drawings". Construction PLANS simply stamped "As-Built" or "Record Drawings" and lacking in above requirements will not be accepted, and will be returned to the DEVELOPER's ENGINEER. The "Certificate of Completion" will not be issued until correct "Record Drawings" have been submitted.
8. The DEVELOPER's ENGINEER shall provide two complete set of "Record Drawings", also a complete set of record documents, in computerized form to the CITY. This documentation shall be on compact disk (CD) in AUTOCAD version 14 or above or DXF format and in **FLORIDA STATE PLAIN PLAIN (NAD83 WEST)** in addition to the compact disk the engineer shall provide a document listing the layers and color/linetype utilized in preparation on the drawing. These computer files shall contain all the information shown on the "Record Drawings"
9. The DEVELOPER's ENGINEER shall provide ESRI shape files on compact disk (CD) for the Water valves, Sewer manholes, and Sewer service laterals, Storm water manholes, and Force main valves. In **FLORIDA STATE PLAIN (NAD83 WEST)** projection.

1.3.7 LIST OF MATERIAL AND APPROVED MANUFACTURERS

A list of Materials and Approved Manufacturers for the various products specified in this MANUAL is included in Appendix 'B'. It is the intent of the CITY to review and update Appendix 'B' as appropriate to ensure efficient operation of the services and facilities under the jurisdiction of this MANUAL. For this purpose, the CITY shall evaluate technical submittals from interested manufacturers or suppliers at least once every three years.

DIVISION II
DESIGN STANDARDS

SECTION 1.4 GRAVITY SEWERS

Sec. 1.4.1. GENERAL CONSIDERATIONS

1.4.1.1. TYPE OF SEWERS

The CITY will approve PLANS for new sewer systems and extensions only when designed as separate system in which precipitation, runoff and groundwater are excluded.

1.4.1.2. DESIGN PERIOD

Sewer systems should be designed for the estimated ultimate tributary population, as delineated in the approved City of Davenport Wastewater Master Plan (latest edition) except in considering parts of the systems that can be readily increased in capacity.

1.4.1.3. LOCATION

Gravity sewers shall be located in dedicated right-of ways or utility easements. Whenever possible, sewers shall be located under pavement in dedicated right-of ways. All sewers located outside of dedicated right-of-ways shall require a minimum 15 foot easement. Additional easement widths shall be provided when the pipe size or depth of cover so dictate. If a gravity sewer is located adjacent to a road right-of-way, a minimum 10 foot easement shall be provided. Additional easement widths shall be provided if the pipe size or depth of cover is so dictated. No gravity sewers shall be placed under retention ponds, tennis courts, or other structures. In general, gravity sewers shall not be located along side or rear lot lines. Placement of a gravity sewer along side or rear lot line may be allowed on a case by case basis if such a sewer configuration results in efficient placement and utilization of the sewer system. This criteria shall also apply to sewer placement in retention pond berms. In any event, no manholes shall be placed along side or rear lot lines.

Sec 1.4.2. DESIGN BASIS

1.4.2.1. AVERAGE DAILY FLOW

The gravity sewer design shall be based on full ultimate development as known, or projected. Average daily wastewater flow shall be calculated by the current City of Davenport, Flow Rate Table as outlined in Administration and Procedures Manual - Chapter 7, Article 5.

1.4.2.2. PEAK DESIGN FLOW

Gravity sewers shall be designed on the basis of ultimate development maximum rates of flow, which shall be the product of selected peak factors times the accumulative average daily flow as calculated above.

In general, the following minimum peak factors shall be applicable for the range of average daily flow rates.

<u>Flow Range</u>	<u>Minimum Peak Factor</u>
Flows to 100,000 GPD	4.0
100,000 GPD 250,000 GPD	3.5
250,000 GPD to 1,000,000 GPD	3.0
Flows greater than 1,000,000 GPD	2.5

For design average daily flows above 2,000,000 GPD, peaking factors less than 2.5 may be considered if substantiated by extensive data. Under no circumstances shall peaking factors less than 2.0 be allowed.

1.4.2.3. DESIGN CALCULATIONS

DEVELOPER=s ENGINEER shall submit signed, sealed and dated design calculations with the PLANS for all sewer projects. Calculations shall show that sewers will have sufficient hydraulic capacity to transport all design flows.

Sec. 1.4.3. DETAILS OF DESIGN AND CONSTRUCTION

1.4.3.1. MINIMUM SIZE

No gravity sewer main conveying wastewater shall be less than 8 inches in diameter.

1.4.3.2. MINIMUM COVER

The minimum cover over gravity sewers shall be no less than 3 feet calculated from the finished grade. Exceptions to this requirement may be made for a short length of pipe where structural considerations are incorporated in the design.

1.4.3.3. SLOPE

All sewers shall be designed and constructed to give minimum velocities, when flowing full*, of not less than 2.0 feet per second. The following minimum slopes shall be provided; however, slopes greater than these are desirable:

- * Gravity main capacity for design purposes shall be calculated at 50% full for pipe up to 15 inch diameter and 75% for pipe 18 inch diameter and greater.

<u>Sewer Size</u>	<u>Minimum Slope in Feet Per 100 Feet</u>
6 inch	0.57
8 inch	0.40
10 inch	0.24
12 inch	0.19
15 inch	0.15
18 inch	0.11
21 inch	0.09
24 inch	0.08
27 inch	0.07
30 inch	0.06
36 inch	0.05

Sewers shall be laid with uniform slope between manholes.

1.4.3.4. SIZE AND ALIGNMENTS

Size conversion between manholes shall not be allowed. All sewers shall be laid with straight alignment and uniform slope between manholes.

1.4.3.5. ADDITIONAL REQUIREMENTS

Main drain and backwash systems for pools and spas and storm drain systems shall not connect to the gravity sewer system.

In general, all sewer extensions for future connections shall terminate at a manhole. The City may allow such extensions without a terminal manhole on a case by case basis subject to all of the following conditions:

1. Total sewer extension length shall be limited to 50 feet.
2. Sewer extension location at the initiating manhole shall be mechanically plugged to the satisfaction of the CITY.
3. Such sewer extensions shall not be a part of the accepted sewer facilities. This shall be clearly delineated on the PLANS.
4. All such sewer extensions shall be inspected and accepted as part of the future construction phase.

Sec. 1.4.4. MANHOLES

1.4.4.1. LOCATION

Manholes shall be installed at the end of each gravity sewer; at all changes in grade, size or alignment; at all sewer intersections; and at distances not greater than 400 feet. Private sewer systems must be separated from the CITY sewer system by a manhole located at the right-of-way line.

Collection manholes are required at the end of the gravity system, before the wastewater pump station. (See **STANDRAD DETAIL NUMBER 950300**)

1.4.4.2. TYPE

A drop manhole connection as shown on the STANDARD DETAILS shall be provided for a sewer entering a manhole where its invert elevation is 24 inches or more above the exiting invert.

Where the difference in elevation between the incoming sewer invert and the manhole invert is less than 24 inches, the manhole invert shall be filleted to prevent solids deposition.

1.4.4.3. DIAMETER

For sewer 24 inches in diameter and smaller, the minimum inside diameter of manholes shall be 48 inches. For sewers greater than 24 inches and up to 36 inches, the minimum inside diameter shall be 60 inches. For sewers larger than 36 inches in diameter, a 72 inch inside diameter manhole shall be provided.

Minimum manhole inside diameter shall be 48 inches for up to 12 feet deep, 60 inches for up to 18 feet deep, 72 inches for greater depths.

A minimum overall access opening diameter of 30 inches shall be provided.

Access cover shall be double cover style; center access cover shall be 20" minimum diameter.

1.4.4.4. FLOW CHANNEL

The flow channel through manholes shall be made to conform in shape and slope to that of the sewers. Flow direction changes in excess of 90 degrees shall not be included in sewer alignments without special consideration. When directional changes exceeding 45 degrees occur, an additional flow line elevation drop of 0.1 foot across manholes shall be provided. Benching shall be provided which shall have a minimum slope of 2 inches per foot. At all changes in pipe sizes, the crown elevations of the pipes shall match.

1.4.4.5. MATERIALS

Manholes shall be constructed of precast units as specified in Section 9.16. Brick manholes shall not be permitted. Cast-in-place manholes may be accepted on a case by case basis for conflict resolution.

1.4.4.6. CASTINGS

Cast iron frames and covers shall be as specified in Section 9.16.3. Bolt down and /or gasket covers shall be provided where manholes are allowed by the City to be located in areas subject to ponding of flooding.

1.4.4.7. ACCESS

A 10 foot wide access road shall be provided for all manholes which are located outside of roadways. The top 8" inches of the access road shall be stabilized to a Florida Bearing value of 50 psi, and compacted to 95% of AASHTO T-180.

Sec. 1.4.5. SERVICE CONNECTIONS

1.4.5.1. GENERAL

Service connection shall be through a lateral and miscellaneous appurtenances, as shown on the STANDARD DETAILS, to connect the gravity sewer to the house or establishment served.

1.4.5.2. SIZE AND LENGTH

Service laterals and fittings shall be a minimum of 6 inches in diameter. All service laterals shall be less than 50 feet in length.

1.4.5.3. SLOPE

Service laterals shall have a minimum slope of 1%.

1.4.5.4. CONNECTION

In general, service laterals shall not be allowed to discharge into sanitary manholes, except at terminal manholes.

Sec. 1.4.6. GREASE TRAPS AND INTERCEPTORS

1.4.6.1. GENERAL

All Food Preparation/Service Establishments shall have outside grease traps sized as discussed herein. All wastewater flow from the kitchen areas of these establishments must flow through approved grease traps prior to entering the CITY system.

Grease traps and interceptors shall be provided when they are necessary for the proper handling of wastes containing ingredients harmful to the public sewer or sewage treatment plant or processes.

The minimum grease trap size shall be 750 gallons, two compartment type, as shown in the STANDARD DETAILS.

Interceptors shall be required for all automobile service/repair establishments, car wash and car wash structures, gasoline service stations, businesses or industries that use petroleum based, metal or sand products in their day to day activities, where a hazard exists, or where oils or other flammable items can be introduced or admitted into the sewer system by accident or otherwise.

The minimum interceptor size shall be 750 gallons, two compartment type with vent as shown in the STANDARD DRAWINGS.

All grease traps and interceptors shall be provided with an approved sampling station located down stream of the grease trap or interceptor and prior to connection with human waste lines.

The owner shall be responsible for proper and regular maintenance. The owner shall provide ingress and egress to the City for periodic inspection of the industrial waste system.

1.4.6.2. FAST FOOD RESTAURANTS

Grease trap capacity shall be 5 gallons per seat.

1.4.6.3. GENERAL RESTAURANTS

Grease trap capacity shall be sized at the rate of 10 gallons per seat.

1.4.6.4. 24-HOUR RESTAURANTS

Grease trap capacity shall be sized at the rate of 15 gallons per seat.

1.4.6.5. CONVENTION CENTER/MANUFACTURING CAFETERIAS

Single grease trap capacity shall be sized at the rate of 1.5 gallons, per meal.

1.4.6.6. MISCELLANEOUS FOOD PREPARATION/SERVICE ESTABLISHMENTS

Grease trap capacity shall be sized at the rate of 1.5 gallons per meal.

1.4.6.7. LOCATION

Each grease trap or interceptor shall be so located as to provide ready accessibility to the cover and means for servicing and maintaining the structure in working and operating condition.

1.4.6.8. GRIT INTERCEPTORS

Sand and mud traps shall be a minimum of 4' in diameter and constructed as shown in the STANDARD DETAILS.

1.4.6.9. LAUNDRIES

Commercial laundry and Laundromats shall be equipped with lint traps or their interceptors shall have a removal basket, or similar device, that will prevent strings, rags, buttons, or other material detrimental to the sewer system from passing into the City wastewater system.

1.4.6.10. HAZARDOUS MATERIALS

Any establishment that used hazardous material for all or any portion of its day-to-day operation is required to submit two (2) copies of the Materials Safety Data sheet for each hazardous product in use on site and two (2) copies of the proposed method of pre-treatment for review and approval.

In no case shall corrosive liquids, spent acids, or other harmful or hazardous waste which may destroy or injure the sewer system, or which might create noxious or toxic fumes, discharge into the City sewer system without being thoroughly diluted or neutralized by passing through a properly constructed and acceptable dilution or neutralizing device.

This Department and the appropriate Fire Department Official shall be immediately notified when an unauthorized discharge occurs which becomes reportable under State, Federal, and/or local regulations, or if people, animal, plants or the environment are otherwise possibly at risk.

Sec. 1.4.7. MATERIALS, INSTALLATION AND TESTING

Applicable provisions of Article 5, 6, and 7 shall apply.

SECTION 1.5. WASTEWATER FORCE MAINS

Sec. 1.5.1. GENERAL CONSIDERATIONS

1.5.1.1. DESIGN PERIOD

Force main systems shall be designed for the estimated ultimate tributary population, as delineated in the approved City of Davenport Wastewater Master Plan latest edition except in considering parts of the systems that can be readily increased in capacity

1.5.1.2. LOCATION

Force mains shall be located in dedicated rights-of-ways or utility easements. When installed in rights-of-way, force mains shall maintain a consistent alignment with respect to the centerline of the road. All force mains located outside of dedicated rights-of-way shall require a minimum 15 foot easement. Additional easement widths shall be provided when the pipe size or depth of cover so dictate. If a force main is located adjacent to a road right-of-way, a minimum 10 foot easement shall be provided. Additional easement widths shall be provided if the pipe size or depths of cover so dictate. Force mains shall not be placed under retention ponds, tennis courts or under structures. In general force mains shall not be located along side or rear lot lines. Placement of a force main along side or rear lot line may be allowed on a case by case basis if such a force main configuration results in efficient placement and utilization of the sewer system. These criteria shall also apply to force mains in retention pond berms.

1.5.1.3. REPLACEMENT OF LINE

If the existing force main is NOT made of AWWA standard C900 or Ductile Iron Pipe (DIP) the CONTACTOR shall be required to replace the existing line within the project limits. Valves shall be installed at each end of the line to be replaced. If the existing line is on the opposite side of the road NO replacement is required.

Sec. 1.5.2. DESIGN BASIS

1.5.2.1. AVERAGE DAILY FLOW

Provisions of Section 1.6.2.2.2. shall apply.

1.5.2.2. PEAK DESIGN FLOWS

Provision of Section 1.6.2.1. shall generally apply. Consideration must be given to a 2 fps minimum velocity and a compatible head pressure for manifolded systems.

1.5.2.3. DESIGN OR CALCULATIONS

DESIGN or DEVELOPER's ENGINEER shall submit signed, sealed and dated design calculations with the PLANS for all force main projects. Calculations shall show that force mains will have sufficient hydraulic capacity to transport all design flows.

Sec. 1.5.3. DETAILS OF DESIGN AND CONSTRUCTION

1.5.3.1. VELOCITY AND DIAMETER

At design pumping rates, a cleansing velocity of at least 2 feet per second should be maintained. Maximum velocity at design pumping rates should generally not exceed 7 feet per second. The minimum force main diameter shall be 4 inches. Only 4", 6", 8", 10", 12", 16", 20", 24", 30", 36", 42", 48" and 54" diameter force mains shall be permitted.

1.5.3.2. DESIGN FRICTION LOSSES

Friction losses through force mains shall be based on the Hazen and Williams formula. In the use of Hazen and Williams formula, the value for "C" shall be 100.

When initially installed, force mains may have a significantly higher "C" factor. The higher "C" factor should be considered only in calculating maximum power requirements and duty cycle time of the motor.

1.5.3.3. DESIGN PRESSURE AND RESTRAINT

The force main and fittings, including all restrained joint fittings shall be designed to withstand pump operating pressures and pressure surges, but not less than 100 psi.

Only restrained joint devices shall generally be allowed. The number of restrained joints shall be calculated by a professional engineer, registered in the State of Florida or shall be in accordance with the "Restrained Joint Table" on the Standard Details.

1.5.3.4. TERMINATION

Force mains shall not terminate directly into a gravity sewer line. Force mains shall enter the gravity sewer system at a drop type connection to a manhole as shown on the Standard Details. Lined two manholes down stream

1.5.3.5. AIR RELEASE AND VACUUM RELIEF VALVES

Air release valves, or air/vacuum relief valves, shall be provided, as necessary, to prevent air locking and vacuum formation. All such valves shall be clearly delineated on the force main plan and profile in the DRAWINGS. The DEVELOPER's ENGINEER shall submit calculations to the CITY justifying the valve sizing. See additional requirements in Section 9.19.6.

1.5.3.6. AERIAL CROSSINGS

STRUCTURAL SUPPORT

Support shall be provided for all joints in pipes utilized for aerial crossings. The supports shall be designed to prevent overturning and settlement.

EXPANSION PROTECTION

Expansion joints shall be provided as required.

FLOOD CLEARANCE

For aerial stream crossings, the impact of flood waters and debris shall be considered. The bottom of the pipe shall be placed no lower than 1 foot above the 100 year flood elevation.

PIPE MATERIAL AND JOINTS

Flanged joints shall be used. Pipe and flange material shall be ductile iron, minimum class 53. All above ground pipe shall be painted as specified in Section 1.19.4.4. for aboveground wastewater force mains. Use of epoxy coated steel pipe may be allowed on a case by case basis.

VALVES

Underground valves shall be provided at both ends of the crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding. An air release/vacuum relief valve shall be installed at the high point of the crossing.

GUARDS

Appropriate guards shall be installed at both ends of the crossing to prevent pipe access to the public.

PERMITS AND REQUIREMENTS OF OTHER AGENCIES

It shall be the responsibility of the DEVELOPER to obtain all applicable regulatory permits. When the Aerial Crossing is accomplished by attachment to a bridge or drainage structure, the DEVELOPER shall meet all requirements of the Agencies who own or have jurisdiction over such structures.

1.5.3.7. UNDERWATER CROSSINGS

PIPE MATERIAL AND COVER

A minimum cover of three feet plus a 6" concrete slab shall be provided over the pipe. The pipe material shall meet appropriate AWWA Standards for use in submerged conditions.

VALVES

Valves shall be provide at both ends of the water crossings so that the section can be isolated for testing or repair. The valves shall be easily accessible, and not subject to flooding. Both valves shall be provided in a manhole or a valve vault.

PERMITS

It shall be the responsibility of the DEVELOPER to obtain all applicable regulatory permits, including dredge and fill permits.

1.5.3.8. VALVES

Sufficient valves shall be provided on force main systems to facilitate effective isolation of the pipe system for repairs and maintenance. On straight runs of force mains, valve spacing shall not exceed 2000 feet. Additional valves shall be provided at inlets of fittings where force mains intersect to facilitate isolation of pipe segments.

Sec. 1.5.4. MATERIAL, INSTALLATION AND TESTING

Applicable provisions of Article 4, 5, and 6 shall apply.

Sec. 1.5.5. LOCATION AND IDENTIFICATION

A means for locating and identifying all force mains and valves shall be provided in accordance with the provisions in Article 6. and the STANDARD DETAILS.

Sec. 1.5.6. ADDITIONAL REQUIREMENTS

While designing force main systems, consideration shall be given to possible future connecting pumping stations. If applicable, this requirement shall be reviewed with the CITY prior to finalization of the design

SECTION 1.6 WASTEWATER PUMP STATIONS

Sec. 1.6.1. GENERAL REQUIREMENTS

The design standards outlined in this section apply to wastewater pump stations discharging a peak flow of 3000 gallons per minute or less. All such pump stations shall be a submersible. For designing pump stations discharging more than 3000 gallons per minute, the type of pump station and the Basis of Design shall be reviewed with the CITY and approval obtained before proceeding with the design.

Sec. 1.6.2 DESIGN BASIS

1.6.2.1. DESIGN FLOWS

Design flow shall be based upon the total ultimate development flow from all contributory areas to the pump station. The design average daily flow shall be computed as outlined in Section 1.2.1. The design pumping capability of the station shall be based upon the peak design flow which shall be calculated by multiplying the design average flow with the applicable minimum peaking factors as outlined below:

<u>Design Average Daily Flow</u>	<u>Minimum Peaking Factor For Peak Design Flow</u>
Flows to 100,000 GPD	4.0
100,000 GPD to 250,000 GPD	3.5
250,000 GPD to 1,000,000 GPD	3.0
Flows greater than 1,000,000 GPD	2.5

For design average daily flows above 2,000,000 GPD, peaking factors less than 2.5 may be considered if substantiated by extensive data. Under no circumstances shall peaking factors less than 2.0 be allowed.

1.6.2.2. NUMBER OF PUMPS

For pump stations with a peak design flow of 1500 GPM or less, a minimum of two pump units shall be provided. Where the peak design flow exceeds 1500 GPM, three or more units shall be provided. See Section 1.2.2.1.3. for standby requirements.

1.6.2.3. PUMP AND MOTOR SELECTION

Pump station shall be capable of pumping the peak design flow with the largest pumping unit out of service. Pumps shall be capable of meeting all system hydraulic conditions without overloading the motors. In addition a minimum 5 HP motor shall be required. Total dynamic head and flow capacity curves shall be prepared and submitted to the CITY along with the pump station plans.

Such curves shall be based upon the static head friction losses outlined in Section 1.3.2. of these specifications. Head capacity curves shall verify that the pumps are operating at peak efficiency and are suitable for the design flow application. Pump and motor selection and total dynamic head and flow capacity curves shall reflect hydraulic conditions in cases where receiving force main systems are interconnected to additional pumping stations.

1.6.2.4. DESIGN CALCULATION

DEVELOPER=s ENGINEER shall submit signed, sealed and dated design calculations for all wastewater pump stations. Calculations shall include total dynamic head and flow capacity curves with copies of manufacturers pump curves, hydraulic analysis of force main system, operating cycle calculations with wet well sizing, and buoyancy calculations.

Sec. 1.6.3. DETAILS OF DESIGN AND CONSTRUCTION

1.6.3.1. FLOODING

Wastewater pumping station structures and electrical and mechanical equipment shall be protected from physical damage by the 100 year flood. Wastewater pumping stations should remain fully operational and accessible during the 100-year flood. Regulations of Local, State and Federal agencies regarding flood plain obstructions shall be considered.

1.6.3.2. ACCESSIBILITY

The pumping station shall be readily accessible by maintenance vehicles during all weather conditions. The access road to the pumping station shall be paved. The facility shall not be located in road rights-of-way.

In a phased development, a stabilized access road may be accepted during the initial phase with paving to be accomplished in the later phase.

1.6.3.3. BUOYANCY

Buoyancy of the pump station structures shall be considered and adequate provisions shall be made for protection against flotation.

1.6.3.4. PUMP REQUIREMENTS

Submersible wastewater pump stations shall comply with the requirements spelled out in Section 1.21. Only approved pumps listed in Appendix D shall be allowed. Submersible pumps and motors shall be designed specifically for raw sewage use, including totally submerged operation during a portion of each pumping cycle. Submersible pumps shall be readily removable and replaceable without dewatering the wet well or disconnecting any piping in the wet well.

Pumps shall be capable of handling raw sewage and passing spheres of at least 3 inches in diameter. Pump suction and discharge openings shall be at least 4 inches in diameter.

1.6.3.5. WET WELL REQUIREMENTS

Wet well shall be minimum 6-foot diameter and shall have a minimum 4.5 foot depth below the inlet invert. Additional depth shall be provided based on station design and cycle time, and potential.

Pumping levels shall be set to provide a minimum capacity between operational water levels sufficient to allow a minimum of five (5) minutes between successive starts of the pump.

Pump-off water levels shall provide adequate submergence to preclude pump inlet vortexing, or air binding. Operational maximum water levels shall not exceed the invert elevation of the influent pipe.

The wet well floor shall have a minimum slope of 1 to 1 to the hooper bottom. The horizontal area of the hopper bottom shall be no greater than necessary for proper installation and function of the pump inlet.

No interior ladders shall be permitted in the wet well.

Only one inlet connection shall be permitted to a wet well. Provide a tee on the inlet, to direct the influent downward.

1.6.3.6. PUMP STATION WATER SYSTEM

All wastewater pump stations shall be provided with a water system with adequate capacity and pressure for station wash down and other requirements. The station water system shall be completely separated from the potable water supply by means of a reduced pressure type backflow preventer or other CITY approved system.

1.6.3.7. ELECTRICAL EQUIPMENT, POWER SUPPLY AND POWER CORDS

Requirements in Sections 1.21 and 1.22 shall apply.

1.6.3.8. CONTROLS

Requirements in Section 1.22 shall apply.

1.6.3.9. SITE SIZING AND EASEMENT REQUIREMENTS

Pump station sites shall be sized as delineated on the Lift Station Yard Plan in the DRAWINGS. The DEVELOPER shall dedicate pump station site by warranty deed or plat to the CITY. Dedicated easements shall also be required around the site as delineated on the Lift Station Yard Plan in the DRAWINGS. In general, the site for the paved access road shall also be dedicated to the CITY by Warranty deed or plat. An exception to this requirement may be allowed on a case by case basis in the form of an ingress/egress easement for the access road.

1.6.3.10. SITE FENCING

Fencing at the pump station site perimeter shall comply with the technical criteria established in Section 1.20. In general, all pump station sites shall be fenced. However, exception to this requirement may be made for pump stations serving residential areas only, on a case by case basis and subject to sufficient landscape screening.

Sec. 1.6.4. FLOW METER

Indicating, totalizing and recording flow measurement shall be provided at pumping stations designed to handle peak flows of 1500 GPM or more. Applicable provisions of Section 1.20. shall apply.

Bypass piping around the meter shall be provided for all stations with flow meters to facilitate meter maintenance.

Sec. 1.6.5. EMERGENCY OPERATION

All wastewater pump stations shall be provided with stand-by emergency diesel generators. Such stand-by generator shall comply with the requirements spelled out in Section 1.20. All such generators shall be rated and designed to operate the pump station under design conditions. (See appendix B for generator suppliers)

Sec. 1.6.6. ODOR CONTROL

An odor control system shall be provided for all pump stations over 1500 GPM peak flow.

Sec. 1.6.7 COLLECTION MANHOLE

Requirements in Section 1.4 shall apply.

SECTION 1.7 WATER MAINS

Sec. 1.7.1. GENERAL CONSIDERATIONS

1.7.1.1. TYPE OF WATER MAINS

The CITY will approve PLANS for water supply mains and extensions only when such mains are designed and constructed in accordance with the criteria set forth in this MANUAL.

1.7.1.2. DESIGN PERIOD

Water mains should be designed for the estimated ultimate tributary population, as delineated in the approved City of Davenport Water Master Plan (latest edition) except in considering parts of the system that can be readily increased in capacity. Water systems shall be designed to satisfy the domestic water demand and fire protection requirements for the area.

1.7.1.3. LOCATION

Water mains shall be located in dedicated rights-of-way or utility easements. When installed in rights-of-way, water mains shall, in general, maintain a consistent alignment with respect to the centerline of the road. All water mains located outside of dedicated rights-of-way shall require a minimum 15 foot easement. Additional easement widths shall be provided when the pipe size or depth of cover so dictate. If a water main is located adjacent to a road right-of-way, a minimum 10 foot easement shall be provided abutting the right-of-way. Additional easement widths shall be provided if the pipe size or depth of cover so dictate. Water mains shall not be placed under retention ponds, tennis courts, or other structures. In general, water mains shall not be located along side or rear lot lines. Placement of a water main along side or rear lot line may be allowed on a case by case basis if such a water main configuration results in efficient placement and utilization of the water main network. The criteria shall also apply to water mains in retention pond berms.

1.7.1.4. REPLACEMENT OF LINE

If the existing water main is NOT made of AWWA standard C900 or Ductile Iron Pipe (DIP) the CONTACTOR shall be required to replace the existing line within the project limits. Valves shall be installed at each end of the line to be replaced. If the existing line is on the opposite side of the road NO replacement is required.

Sec. 1.7.2. DESIGN BASIS

1.7.2.1. AVERAGE DAILY FLOW AND PEAK FLOWS

Average daily water flow shall be calculated by referencing the flow rates as outlined in Appendix A. Appendix A is subject to revision. Maximum daily and peak hourly water flow rates shall be calculated by referencing the service area peaking factors in Appendix B.

1.7.2.2. FIRE FLOW REQUIREMENTS

Fire flow requirements shall be determined in accordance with applicable City or County Fire Department Codes. Where fire flow requirements exceed the anticipated available fire flow from the central water system, on-site fire protection system or other Fire Department approved mitigation measures shall be utilized. (Minimum requirement as per AWWA M31 is 500 gpm at a residual pressure of 20psi).

Sec. 1.7.3. DETAILS OF DESIGN AND CONSTRUCTION

1.7.3.1. DESIGN PRESSURE AND RESTRAINT

The water main and fittings, including all restrained joint fitting shall be designed to withstand pump operating pressures and pressure surges, but not less than 150 psi.

Only restrained joint devices shall generally be allowed. The number of restrained joints shall be calculated by a Professional Engineer, registered in the State of Florida or shall be in accordance with the "Restrained Joint Table" in the STANDARD DETAILS.

1.7.3.2. DIAMETER

Only 4", 6", 8", 10", 12", 16", 20", 24", 30", 36", 42", 48" and 54" diameter water mains shall be permitted. At the end of cul-de-sac areas, a 4" looped connection as shown on the STANDARD DETAILS will be allowed to prevent dead ends. As a minimum, six (6) inch looped systems shall be required in low density residential projects. Where looping of mains is not practical, minimum eight (8) inch mains shall be required, unless detailed calculations are submitted to substantiate the sufficiency of a 6 inch main.

In commercial, industrial, and high density residential areas, minimum eight (8) inch looped mains shall be required. Larger size mains shall be required if necessary to allow the withdrawal of the required fire flow while maintaining the minimum residual pressure specified in Section 21.

1.7.3.3. FIRE HYDRANT LOCATION AND SPACING

As a minimum, specifications outlined in the latest version of City of Davenport Land Development Regulations and applicable City of Davenport Fire Departments Codes shall apply. As a minimum, hydrants shall be placed at 500 foot intervals to provide for proper flushing for all off-site mains.

1.7.3.4. DEAD ENDS

In order to provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins whenever practical, as determined by the CITY. Where dead-end mains occur, they shall be provided with a fire hydrant or with an approved blow-off for flushing purposes. No flushing device shall be directly connected to any sewer.

1.7.3.5. VALVES

Sufficient valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. Valves shall be located at not more than 500 foot intervals in commercial, industrial and high density residential areas and at not more than 1000 foot intervals in all other areas. Appropriate valving shall also be provided at the downstream sides of tees and crosses to ensure effective isolation of water lines for repair, maintenance or future extension. This shall include all sides of tees and crosses within looped systems, where flow is potentially multidirectional.

1.7.3.6. SEPARATION OF WATER MAINS AND SEWERS

Refer to Section 1.5.3.7 of these specifications for applicable requirements. No water pipe shall pass through or come in contact with any part of a sewer manhole.

Extreme caution should be exercised when locating water mains at or near certain sites such as sewer treatment plants or industrial complexes. Individual septic tanks must be located and avoided.

1.7.3.7. SURFACE WATER CROSSINGS

The CITY shall be consulted before final PLANS are prepared. Requirements outlined in Sections 1.5.3.6 and 1.5.3.7 shall apply. All above ground pipe shall be painted as specified in Section 1.23.4.4. for water mains.

1.7.3.8. AIR RELIEF VALVES

At high points in water mains where air can accumulate, provisions shall be made to remove the air by means of automatic air relief valves. Automatic air relief valves shall not be used in situations where flooding of the manhole or chamber may occur. See details in STANDARD DETAILS.

1.7.3.9. CHAMBER DRAINAGE

Chambers, pits or manholes containing valves, blow-offs, meters, or other such appurtenances to a distribution system shall not be connected directly to any storm drain or sanitary sewer, nor shall blow-offs or air relief valves be connected directly to any sewer.

1.7.3.10. DISINFECTION FOLLOWING REPAIR OR REPLACEMENT

Any part of the CITY water system, which has direct contact with, finished water and has been out of service for repair, alteration, or replacement shall be disinfected as outlined in Section 1.24.6 of these specifications.

Sec. 1.7.4. WATER SERVICES AND CONNECTIONS

Water services and connections shall conform to the applicable provisions of Section 50 and 51 and the STANDARD DETAILS. Only 3/4", 1", 1-1/2", 2", 3", 4", 6", 8" and 12" services will be permitted. Where water services greater than 12" are required dual services shall be provided.

Sec. 1.7.5. WATER METERING

1.7.5.1. GENERAL

All water service connections shall be metered. In general, the method of metering will follow the guidelines listed below. However, the DEVELOPER's ENGINEER must obtain approval before finalizing the design of the metering system.

1.7.5.2. SINGLE FAMILY, DUPLEX, AND MULTI-FAMILY SUBDIVISION WITH PUBLIC RIGHTS OF WAY

Each unit shall be individually metered. Single and Double services shall be installed at property lines as indicated by the STANDARD DETAILS.

1.7.5.3. SINGLE FAMILY AND DUPLEX SUBDIVISIONS WITH PRIVATE STREETS

Individual meters may be permitted in accordance with Section 1.7.5.2 if the private streets are designed to CITY Standards and easements are dedicated over the entire private street common areas. In addition, sufficient area must be available outside of paved areas to locate water mains, services, and meters. If the above criteria cannot be met, the subdivision shall be metered pursuant to Section 1.7.5.5.

1.7.5.4. COMMERCIAL, INDUSTRIAL, AND INSTITUTIONAL PROJECTS WITHOUT PRIVATE FIRE LINES

Each building shall be individually metered. Meter (s) shall be located in the public rights of way at the property line.

1.7.5.5. COMMERCIAL, INDUSTRIAL, INSTITUTIONAL, MULTI-FAMILY WITH PRIVATE STREETS, APARTMENTS, AND CONDOMINIUM PROJECTS WITH PRIVATE FIRE LINES

In general, all such projects shall require installation of a fire line master meter. Where on-site fire systems contain less than 75 feet of main, a dual system (separate domestic and fire lines) may be considered. Dual systems shall require installation of a detector check or double detector check as determined by the CITY. Individual meters to each unit may be considered on a case-by-case basis subject DEVELOPER executing a Meter Installation and Easement Agreement.

1.7.5.6. SHOPPING CENTERS

In general, shopping centers shall require installation of a fire line master meter. Individual meters to each unit will be considered subject to the DEVELOPER executing an Easement Agreement.

1.7.5.7. METER INSTALLATION

All meters will be installed by the CITY after payment of applicable fees and charges. All meters less than two inch in size will be installed underground in an approved meter box. Meters two inch and larger shall be installed above ground and as shown in the STANDARD DETAILS. In general, meters two inch and larger shall be located in a meter easement located adjacent to the public right of way.

1.7.5.8. METER SIZING

Size of all meters shall be determined by the Developer. The DEVELOPER's ENGINEER shall provide sufficient information on estimated peak flows and low flows so that meter size can be verified correct. The DEVELOPER's ENGINEER shall include head losses through metering device when designing the water system.

Sec. 1.7.6. MATERIAL, INSTALLATION AND TESTING

Applicable provisions of Divisions III, IV, and V shall apply.

Sec. 1.7.7. LOCATION AND IDENTIFICATION

A means for locating and identifying all water mains and valves shall be provided in accordance with Sections 1.23, 1.24 and the STANDARD DETAILS.

Sec. 1.7.8 CROSS CONNECTION CONTROL

1.7.8.1. GENERAL

In order to protect the public water supply system from contamination due to cross-connections, the DEVELOPER shall install CITY approved backflow prevention devices where there is the potential of a non-potable substance coming into contact with the public water system, for services over 3/4". Some of the common instances requiring installation of the cross connection control devices are listed below. However, the DEVELOPER's ENGINEER must obtain CITY approval before finalizing the design of a Cross Connection Control Device. The City provides double-check backflow preventers for 3/4" domestics services only.

1.7.8.2. COMMERCIAL, INDUSTRIAL AND MULTI-FAMILY RESIDENTIAL

All commercial and industrial projects shall, as a minimum, require installation of approved double check valve assembly. Projects with a higher degree of hazard may be required to install an approved reduced pressure principle assembly.

All projects with fire sprinkler and standpipe systems, and projects with extensive on-site water systems shall be required, as a minimum, to install an approved double check detection assembly.

All systems shall be designed in accordance with the latest edition of the City of Davenport's "Cross-Connection Control Manual".

1.7.8.3. IRRIGATION SYSTEMS

Pressure-type vacuum breakers or reduced pressure principle (RPZ) assembly shall be utilized on all irrigation systems.

1.7.8.4. LOCATION AND INSTALLATION

In general, all backflow prevention devices are to be located directly following the water meter on DEVELOPER's property. Backflow prevention devices shall be installed to facilitate maintenance and testing. It shall be the DEVELOPER's responsibility to pay for, install and maintain all backflow prevention devices. Refer to the STANDARD DETAILS for specific recommended installation of various services.

GENERAL

Sec. 1.8.1. GRADES, SURVEY LINES, AND PROTECTION OF MONUMENTS

1.8.1.1. GRADE

All work shall be constructed in accordance with the lines and grades shown on the PLANS. The full responsibility for keeping alignment and grade shall rest upon the CONTRACTOR.

Maximum distance between temporary Bench Marks is one thousand (1,000) feet, and shall be in close proximity to construction.

All bench Marks shall be clearly marked and protected thought-out construction. Make no changes or relocations without prior written notice to engineer.

Surveyor shall replace any control points which may be lost or destroyed at no additional cost to the City. Establish all replacement points based on original control.

1.8.1.2. SURVEYS

The CONTRACTOR shall furnish and maintain, at his own expense, stakes and other such materials and give such assistance, including qualified helpers, for setting reference marks to the satisfaction of the CITY and the ENGINEER. The CONTRACTOR shall check such reference marks by such means as he may deem necessary and, before using these, shall call the CITY=s attention to any inaccuracies. The CONTRACTOR shall, at his own expense, establish all working or construction lines and grades as required from the reference marks and shall be solely responsible for the accuracy thereof. The CONTRACTOR shall, however, be subject to the check and review of the CITY.

1.8.1.3. MONUMENT PRESERVATION

Property corners and survey monuments (including G.I.S. Monuments) shall be preserved using care not to disturb or destroy them. If a property corner or survey monument is disturbed or destroyed during construction, for any reason said property corner or survey monument shall be restored by a land surveyor registered in the State of Florida. All costs for this work shall be paid for by the CONTRACTOR.

Sec. 1.8.2. UTILITY COORDINATION

1.8.2.1. LOCATION OF UTILITIES

Prior to proceeding with trench excavation, the CONTRACTOR shall contact all utility companies in the area to aid in locating their underground services. It shall be the CONTRACTORS responsibility to contact utility companies at least three (3) normal

working days before starting construction. The CONTRACTOR shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground utilities may be determined.

The CONTRACTOR shall take all reasonable precautions against damage to existing utilities. However, in the event of a break in an existing water and reuse mains, gas main, sewer or underground cable, the CONTRACTOR shall immediately notify the responsible official of the organization operating the interrupted utility. The CONTRACTOR shall lend all possible assistance in restoring services and shall assume all costs, charges, or claims connected with the interruption and repair of such services.

1.8.2.2. DEVIATIONS OCCASIONED BY STRUCTURES OR UTILITIES

Wherever obstructions are encountered during the progress of the WORK and interfere to such an extent that an alteration in the PLANS is required, the CITY shall have the authority to order a deviation from the line and grade or arrange with the owners of the structures for the removal, relocation or reconstruction of the obstructions.

Where gas, water, telephone, electrical or other existing utilities are an impediment to the vertical or horizontal alignment of the proposed pipe line, the CITY shall order a change in grade or alignment or shall direct the CONTRACTOR to arrange with the owners of the utilities for their relocation. If a change in line or grade of a gravity sewer is necessary, the CITY will require the addition of any manholes needed to maintain the integrity of the sewer system.

1.8.2.3. TEST PITS

Test pits for the purpose of locating underground pipeline, utilities, 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 authority having jurisdiction. The costs for such test pits shall be borne by the CONTRACTOR.

Sec. 1.8.3. MAINTENANCE OF TRAFFIC AND CLOSING OF STREETS

The CONTRACTOR shall carry on the WORK in a manner which will cause a minimum of interruption to traffic. Where traffic must cross open trenches, the CONTRACTOR shall provide suitable bridges at street intersections and driveways. The CONTRACTOR shall post suitable signs indicating that a street is closed and necessary detour signs for the proper maintenance of traffic. Prior to closing of any streets, CONTRACTOR shall notify and obtain the approval of responsible authorities and the CITY.

Unless permission to close a street is received in writing from the proper authority (CITY, COUNTY, FDOT, etc.), all excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the CONTRACTORS 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 authority having jurisdiction.

Detours around construction will be subject to the approval of the authority having jurisdiction and the CITY. 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.

Periods when traffic is being detoured will be strictly controlled by the CITY. It shall be the sole responsibility of the CONTRACTOR to 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.

Sec. 1.8.4. PROTECTION OF PUBLIC AND PROPERTY

1.8.4.1. BARRICADES, GUARDS AND SAFETY PROVISIONS

The CONTRACTOR shall be solely responsible for adhering to the rules and regulations of OSHA and other appropriate authorities regarding safety provisions. To protect persons from injury and to avoid property damage, adequate barricades, construction signs, lights and guards as required shall be placed and maintained by the CONTRACTOR at his expense during the progress of the WORK and until it is safe for traffic to use the roads and streets.

All material piles, equipment and pipe which may serve as obstructions to traffic shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor.

All signage and barricades shall be in accordance with the MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES and the TRAFFIC CONTROL AND SAFE PRACTICES MANUAL.

1.8.4.2. PROTECTION OF UTILITY STRUCTURES

Temporary support, adequate protection and maintenance of all underground and surface utility structures, including drains, sewers, manholes, hydrants, valves, valve covers, power poles and miscellaneous other utility structures encountered in the progress of the WORK shall be furnished by the CONTRACTOR at his expense. Any such structures which may have been disturbed shall be restored upon completion of the WORK.

1.8.4.3. OPEN EXCAVATION

All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. The CONTRACTOR shall, at his own expense, provide suitable and safe bridges with hand railings and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required.

The length of open trench will be controlled by the particular surrounding conditions, but shall be limited to 300 feet unless otherwise approval by the CITY. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the CITY may require special construction procedures, such as limiting the length of open trench, fencing, prohibiting excavated material in the street and requiring that the trench shall not remain open overnight. The CONTRACTOR shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment or other obstacles which could be dangerous to the public shall be well lighted at night.

1.8.4.4. PROTECTION OF TREES AND SHRUBS

All trees and shrubs not shown to be removed on the PLANS shall be protected by the CONTRACTOR at his expense. No excavated materials shall be placed so as to injure such trees or shrubs. Trees or shrubs destroyed by negligence of the CONTRACTOR or his employees shall be replaced by him with new stock of similar size and age at the sole expense of the CONTRACTOR.

1.8.4.5. PROTECTION OF LAWN AREAS

Lawn areas shall be left in as good or better condition as before starting of the WORK. Where sod is to be removed, it shall be carefully restored with new sod of the same type.

1.8.4.6. RESTORATION OF FENCES

Any fence, or part thereof, that is damaged or removed during the course of the WORK shall be replaced or repaired by the CONTRACTOR and shall be left in as good a condition as before the starting of the WORK. The manner in which the fence is repaired or replaced and the materials used shall be subject to the approval of the CITY.

1.8.4.7. PROTECTION AGAINST SILTATION AND BANK EROSION

The CONTRACTOR shall arrange his operations to minimize siltation and bank erosion on construction sites and on existing or proposed water courses and drainage ditches. The CONTRACTOR, at his own expense, shall remove any siltation deposits and restore to original grade.

Sec. 1.8.5. ACCESS TO THE PUBLIC SERVICES

Neither the materials excavated nor the materials or equipment used in the construction of the WORK shall be so placed as to prevent free access to public services. All excavated material shall be piled in a manner that will not endanger the WORK and that will avoid obstructing streets, sidewalks and driveways. Excavated material suitable for backfilling shall be stockpiled separately on the site. No material shall be placed closer than 2' 0" from the edge of an excavation. Fire hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, or other utility controls shall be left unobstructed and accessible until the WORK is completed.

Gutters shall be kept clear or other satisfactory provisions make for street drainage. Natural water courses shall not be obstructed or polluted. Surplus material and excavated material unsuitable for backfilling shall be transported and disposed of off the site in disposal areas obtained by the CONTRACTOR.

Sec. 1.8.6. PUBLIC NUISANCE

The CONTRACTOR shall not create a public nuisance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, or excessive noise or dust. The CONTRACTOR shall eliminate noise to as great an extent as practicable at all times.

Sec. 1.8.7. CONSTRUCTION HOURS

No WORK shall be done between the hours of 7:00 p.m. and 7:00 a.m., or on Saturday, Sundays and legal holidays of the City unless the proper and efficient prosecution of the WORK requires operations during the night, weekend or holidays. Written notification for doing untimely WORK shall be provided to the CITY a minimum 24 hours before starting such items of the WORK.

Sec. 1.8.8. CONSTRUCTION IN EASEMENTS AND RIGHTS-OF-WAY

1.8.8.1. CONSTRUCTION IN EASEMENTS

In easements across private property, the CONTRACTOR shall confine all operations within the easement area and shall be responsible and liable for all damage outside of the easement area. Trees, fences, shrubbery or other type of surface improvements located in easements will require protection during construction. Precautions shall be taken by adequate sheeting or other approved method to prevent any cave-in or subsidence beyond the easement limits or damage to improvements within the easement. In general, the easement area is intended to provide reasonable access and working area for efficient operation by the CONTRACTOR. Where easement space for efficient operation is not provided, the CONTRACTOR shall be responsible for organizing his operations to perform within the restrictions shown on the PLANS.

1.8.8.2. CONSTRUCTION IN FLORIDA DEPARTMENT OF TRANSPORTATION
RIGHT-OF-WAY

The CONTRACTOR shall strictly adhere to the requirements of the Florida Department of Transportation where construction work is in a right-of-way under the jurisdiction of the State of Florida and shall take care to avoid any unreasonable traffic conflicts due to the WORK in road right-of-way.

1.8.8.3. CONSTRUCTION IN POLK COUNTY RIGHT-OF-WAY

WORK shall be governed by the Polk County right-of-way regulations.

1.8.8.4. CONSTRUCTION IN CITY RIGHT-OF-WAY

Work shall be governed by the City of Davenport, Public Works Department regulations.

Sec. 1.8.9. SUSPENSION OF WORK DUE TO WEATHER

During inclement weather, all WORK which might be damaged or rendered inferior by such weather conditions shall be suspended. During suspension of the WORK from any cause, the WORK shall be suitably covered and protected so as to preserve it from injury by the weather or otherwise.

Sec. 1.8.10. USE OF CHEMICALS

All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either United States Environmental Protection Agency or United States Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict conformance with label instructions.

Sec. 1.8.11. COOPERATION WITH OTHER CONTRACTORS AND FORCES

During construction progress, it may be necessary for other contractors and persons employed by the CITY to work in or about the site. The CITY reserves the right to put such other contractors to work and to afford such access to the construction site and at such times as the CITY deems proper. The CONTRACTOR shall not impede or interfere with the work of such other contractors and shall cooperate with the other contractor (s) for proper prosecution of the work.

Sec. 1.8.12. SUBSURFACE EXPLORATION

The CONTRACTOR shall make such subsurface explorations as he believes necessary to perform the WORK.

Sec. 1.8.13. CLEANING

1.8.13.1. DURING CONSTRUCTION

During construction, the CONTRACTOR shall, at all times, keep the construction site and adjacent premises as free from material, debris and rubbish as is practicable and shall remove the same from any portion of the site if, in the opinion of the CITY, such material, debris, or rubbish constitutes a nuisance or is objectionable.

1.8.13.2. FINAL CLEANING

At the conclusion of the WORK, all tools, temporary structures and materials belonging to the CONTRACTOR shall be promptly taken away. The CONTRACTOR shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances.

Sec. 1.8.14. SALVAGE

Any existing CITY-owned equipment or material including but not limited to valves, pipes fittings, couplings, etc., which is removed or replaced as a result of construction may be designated as salvage by the CITY and, if so, shall be carefully excavated if necessary and delivered to the CITY at a location within the City.

Sec. 1.8.15. UTILITY SERVICE INTERRUPTION

No foreseeable work shall interrupt customer service without prior approval and direct coordination by the City. Written proposal shall be provided to the City for approval a minimum 96 hours before the proposed work. The Contractor shall notify in writing all affected customers a minimum 48 hours before the proposed work. The City shall maintain the ultimate authority to cease the work and reinstate customer service at any time during the shutdown if the approved scope of the work is not strictly adhered to.

Sec. 1.8.16. SHOP DRAWING AND SAMPLES

Prior to construction the CONTRACTOR shall submit three (3) copies of the shop drawings, signed by the DEVELOPER'S ENGINEER, to the CITY. The data shown on the shop drawings shall be complete with respect to dimensions, design criteria, materials of construction and the like to enable review of the information as required.

The CONTRACTOR shall, if requested by the CITY, furnish certificates, affidavits of compliance, test reports, or samples for check analysis for any of the materials specified in this MANUAL.

SECTION 1.19. WASTEWATER FORCE MAINS

Sec. 1.19.1. GENERAL

These specifications cover the pipe, fittings, and accessory items used for wastewater force main systems.

Pipe used in wastewater force main systems shall be either Polyvinyl Chloride (PVC), or Ductile Iron Pipe (DIP). Above ground pipe and buried pipe with less than 30" of cover or 6" of clearance shall be ductile iron.

The CONTRACTOR shall be responsible for all materials furnished and stored, until the date of project completion. He shall replace at his expense all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by the CITY, furnish certificates, affidavits of compliance, test reports, or samples for 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.

Sec. .19.2. PIPE INSPECTION AND TEST

Requirements specified in Article 6 shall apply.

Sec. 1.19.3. PVC PIPE

1.19.3.1. PVC PIPE

Shall not be allowed; except on side streets and exclusive easements.

All PVC pipe of nominal diameter four (4) through twelve (12) inches shall be manufactured in accordance with AWWA standard C900. The PVC pipe shall have a minimum working pressure rating of 100 psi and shall have a dimension ratio (DR) of 25. Pipe shall have the same O.D. as ductile iron pipe.

1.19.3.2. JOINTS

PVC pipe shall be integral bell, push on, type joints.

1.19.3.3. FITTINGS

Fittings used with PVC pipe shall conform to Section 9.19.4.

Sec. 1.19.4. DUCTILE IRON PIPE AND FITTINGS

1.19.4.1. DUCTILE IRON PIPE

All ductile iron pipe of nominal diameter four (4) through fifty four (54) inches shall conform to ANSI/AWWA A21.51/C151. A minimum of pressure Class 150 pipe shall be supplied for all sizes of pipe unless a higher class pipe is specifically called out in the DRAWINGS, or required by the CITY.

1.19.4.2. FITTINGS

All fittings shall be mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A21.10/C110, 250 psi minimum pressure rating, or ductile iron compact fittings four (4) through twelve (12) inches in accordance with ANSI/AWWA A21.53/C123.

1.19.4.3. JOINTS

Joints for ductile iron pipe shall be push-on or mechanical joints and joints for fittings shall be mechanical joints conforming to ANSI/AWWA A21.11/C111, unless otherwise called for on the DRAWINGS. Where called for on the Drawings, restrained or flanged joints shall be provided. Above ground joints shall be flanged with galvanized bolts, nut and washers. Flanged joints shall conform to ANSI Standard B16.1-124 LB. Restrained joints shall conform to Article 5 of these STANDARDS.

1.19.4.4. COATINGS AND LININGS

Where ductile iron pipe and fittings are to be below ground or installed in a casing pipe the coating shall be a minimum 1.0 mil thick in accordance with ANSI/AWWA A21.51/C151. Where ductile iron pipe and fittings are to be installed above ground, pipe, fittings and valves shall be thoroughly cleaned and given one field coat (minimum 1.5 mils dry thickness) of rust inhibitor primer.

Intermediate and finished field coats of Alkyd shall also be applied by the CONTRACTOR (minimum 1.5 mils dry thickness each coat). Primer and field coats shall be compatible and shall be applied in accordance with the manufacturers recommendations. (See approved manufacturers' list in appendix.) Final field coat color shall be as directed by the CITY.

All ducticle iron pipe and fittings shall have an interior protective lining of "Protecto 401" epoxy or equal with a minimum dry film thickness of 40 mils applied by the pipe manufacturer.

1.19.4.5. POLYETHYLENE ENCASEMENT

The pipe shall be polyethylene encased (8 mil) where shown on the DRAWINGS, in accordance with ANSI/AWWA A21.51/C105.

Sec. 1.19.5. PIPE HANDLING

Requirements specified in Section 1.24.2. shall apply.

Sec. 1.19.6. AIR AND VACUUM RELEASE VALVES

.19.6.1. GENERAL

Wastewater force mains shall be equipped with air/vacuum release valves located at piping high points immediately upstream of dips, or other elevation declines. Valves shall be located in an enclosure as shown on the STANDARD DETAILS.

The valves shall be as described below.

1.19.6.2. WASTEWATER AIR/VACUUM VALVE

The valve body shall be of cast iron; the floats float guide and stem shall be of stainless steel. The valve shall be suitable for 100 psi working pressure. Valve shall have standard two (2) inch NPT inlet and outlet ports unless otherwise shown on the DRAWINGS. Provide back-flushing accessories.

Sec. 1.19.7. NOTIFICATION AND CONNECTION TO EXISTING MAINS

Sec. 1.19.8. VALVES

1.19.8.1. GENERAL

Valves smaller than 24" shall be resilient wedge gate valves.

Valves 24" and larger shall be resilient faced, eccentric valves.

Valves shall hold the test pressure, when applied in either direction.

All valves for Force Mains must have stainless steel stems and bonnet bolts.

1.19.8.2. VALVE CONSTRUCTION

1.19.8.2.1. Resilient Wedge Gate Valves shall be in accordance with AWWA C509.

- * Shall have fusion bond epoxy coating.
- * Shall have a synthetic rubber encapsulated gate.
- * Shall have oil impregnated bronze mechanical components, for permanent lubrication.
- * Shall have stainless steel stems and bonnet bolts.

Above ground service - flanged, O.S. & Y, handwheel.

Buried service - mechanical joint, NRS and nut.

Submerged or otherwise inaccessible, above ground service - flanged, NRS, floor stand or suitable operator.

1.19.8.2.2. Resilient Faced Eccentric Valves shall be in accordance with AWWA C-540 and C-507.

- * Shall have a synthetic rubber encapsulated plug.
- * Shall be permanently lubricated.
- * Shall have welded, highnickel content, seat overlay.

Above ground service - flanged, handwheel.

Buried service - mechanical joint, totally enclosed operator, nut with extension.

Submerged or otherwise inaccessible, above ground.

Service - flanged, totally enclosed operator, floor stand or suitable equal.

Sec. 1.19.9. VALVE BOXES

Sec. 1.19.10. SEPARATION OF FORCE MAINS AND WATER MAINS

Requirements 10 feet horizontally from pipes carrying raw wastewater or storm water.

Sec. 1.19.11. FORCE MAIN CONSTRUCTION

Requirements specified in Section 1.23.5. shall apply.

Sec. 1.19.12. HYDROSTATIC TESTS

Requirements specified in Section 1.24.5. shall apply except that all pipe sections to be tested shall be subjected to a hydrostatic pressure of 150 psi.

Sec. 1.19.13. FINAL CLEANING

Prior to final inspection and acceptance of the force main by the CITY, CONTRACTOR shall remove all parts of the system. Flushing and cleaning shall remove all accumulated foreign material from the sewer system.

Sec. 1.19.14. LOCATION AND IDENTIFICATION

All force mains shall be installed with a continuous, insulated 10 gauge solid copper wire (Tracer Wire) taped directly on top of the pipe for location purposes. Terminate insulated locator wires, capable of extending 12 inches above top of box, at each valve box pad.

All force mains shall be green in color or marked with a continuous stripe located within the top 90 degrees of the pipe. Said stripe shall be a minimum 2 inches in width and shall be green in color. Paint should be touch-dry before backfilling. Warning tape shall be placed 12 to 18 inches above all pipe.

SECTION 1.10. EXCAVATION, BACKFILL, COMPACTION AND GRADING

Sec. 1.10.1. GENERAL

This Section covers excavation, backfill, fill and grading associated with utility trench and structural construction. All such WORK shall be performed by the CONTRACTOR concurrently with the WORK specified in Divisions IV and V of these specifications. The CONTRACTOR shall furnish all labor, materials, equipment and incidentals necessary to perform all excavation, backfill, fill, compaction, grading and slope protection required to complete the WORK shown on the DRAWINGS and specified herein. The WORK shall include, but not necessarily be limited to: pump stations, manholes, vaults, conduit, pipe, roadways and paving; all backfilling, fill and required borrow; grading; disposal of surplus and unsuitable materials; and all related WORK such as sheeting, bracing water handling.

Sec. 1.10.2. SOIL BORINGS AND SUBSURFACE INVESTIGATIONS

The CONTRACTOR shall examine the site and undertake subsurface investigations, including soil borings, before commencing the WORK. The CITY will not be responsible for presumed or existing soil conditions in the WORK area.

Sec. 1.10.3. EXISTING UTILITIES

CONTRACTOR shall locate existing utilities in the areas of WORK. If utilities are to remain in place, the CONTRACTOR shall provide adequate means of protection during earthwork operations. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, the CONTRACTOR shall consult the owner of such piping or utility immediately for directions. Payment for damage and repair to such piping or utilities is the CONTRACTORS responsibility. Refer to Section 1.8.2 for utility coordination requirements.

Sec. 1.10.4. MATERIAL

1.10.4.1. GENERAL

Materials for use as bedding and backfill, whether insituted or borrow, shall be as described under this section. The CONTRACTOR shall, upon request by the CITY, make an appropriate sample of this material available for testing by the CITY or its designated representative.

1.10.4.2 STRUCTURAL FILL

Materials for structural fill shall be bedding rock or select common fill as specified herein or other suitable material as approved by the CITY.

1.10.4.3. COMMON FILL

Shall be local materials as defined in the Florida Department of Transportation, Standard Specifications for Road and Bridge Construction, Section 902, Article 902-6.

Material falling within the above specifications, encountered during the excavation, may be stored in segregated stockpiles for reuse. All Material which, in the option of the CITY, is not suitable for reuse, shall be spoiled as specified herein for disposal of unsuitable materials.

1.10.4.4. SELECT COMMON FILL

Select common fill shall be as specified above from common fill, except that the material shall contain no stones larger than 2 inch in largest dimension, and shall be no more than 5 percent by weight finer than the No. mesh sieve.

1.10.4.5. BEDDING ROCK

Shall be FDOT, size no. 89 as defined in the Florida Department of Transportation, Standard Specifications for Road and Bridge Construction, Section 901, Article 901-1.4, Table 1.

Sec. 1.10.5. SHEETING AND BRACING IN EXCAVATIONS

1.10.5.1. GENERAL

If required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction and to protect adjacent structures, existing piping and/or foundation material from disturbance, undermining or other damage, the CONTRACTOR shall construct and maintain sheeting and bracing. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.

1.10.5.2 MISCELLANEOUS REQUIREMENTS

For trench sheeting for pipes, no sheeting is to be withdrawn if driven below mid-diameter of any pipe and no wood sheeting shall be cut off at a level lower than one foot above the top of any pipe unless otherwise directed by the CITY. If, during the progress of the WORK, the CITY decides that additional wood sheeting should be left in place, it may direct the CONTRACTOR to do so. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given by the CITY for an alternate method of removal. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction of other structures, utilities, existing piping or property. Unless otherwise approved or indicated on the Drawings or in the Specifications, all sheeting and bracing shall be removed after completion of the substructure. All voids left or caused by withdrawal

of sheeting shall be immediately refilled with sand by ramming with tools specially adapted to that purpose, by watering or otherwise as may be directed.

The operations shall not cause injury to any portion of the WORK completed, or in progress, or to the surface of streets, or to private property. The dewatering operation shall comply with the requirements of appropriate regulatory agencies. Additionally, where private property will be involved, advance permission shall be obtained by the CONTRACTOR. Permission shall be obtained prior to discharging into storm drains. Discharging into sanitary sewer systems shall not be permitted.

1.10.5.3. ADDITIONAL REQUIREMENTS

The CONTRACTOR shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structure, 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 elevations.

Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

It is expected that well points will be required for predrainage of the soils prior to final excavation for some of the deeper in-ground structures, or piping and for maintaining the lowered groundwater level until construction has been completed to such an extent that the structure, pipeline or fill will not be floated or otherwise damaged. Well points shall be surrounded by suitable filter sand and negligible fines shall be removed by pumping.

The CONTRACTOR shall furnish all materials and equipment and perform all work required to install and maintain the drainage systems for handling groundwater and surface water encountered during construction of structures, pipelines and compacted fills.

During structure construction and backfilling, water levels shall be measured in observation wells located as directed by the ENGINEER.

The right of the CITY to order sheeting and bracing left in place shall not be construed as creating any obligation on its part to issue such orders, and its failure to exercise its 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.

The CONTRACTOR shall construct the cofferdams and sheeting outside the neat lines of the foundation unless indicated otherwise to the extent he deems it desirable for his method of operation. Sheeting shall be plumb and securely braced and tied in position.

Sheeting, bracing and cofferdams shall be adequate to withstand all pressures to which the structure will be subjected. Pumping, bracing and other work within the cofferdam shall be done in a manner to avoid disturbing any construction already performed. Any movement or bulging which may occur shall be corrected by the CONTRACTOR at his own expense so as to provide the clearances and dimensions.

Sec. 1.10.6 DEWATERING, DRAINAGE AND FLOTATION

1.10.6.1. GENERAL

The CONTRACTOR shall excavate, construct and place all pipelines, concrete work, fill, and bedding rock, in-the-dry. Pipe trenches and other construction excavations shall be kept dry by well pointing, rim ditch and sump, bedding rock and sump or other methods as allowed by the permitting authorities and approved by the City. For purposes of these specifications Ain-the-dry@ shall be considered as no standing water and no loose saturated soils.

Discharge water shall be clear, with no visible soil particles. Stilling ponds or other methods of filtering silt may be necessary for sumping operations. Discharge from dewatering shall be disposed of in such a manner that it will not interfere with the normal drainage of the area in which the WORK is being performed, create a public nuisance, or form ponding.

Continuous pumping will be required as long as water levels are require to be natural levels.

Electric pumps shall be utilized where practicable, in order to minimize noise. Residential type mufflers shall be used on all piston driven pumps or generators.

Sec. 1.10.7 EXCAVATION

1.10.7.1. GENERAL

Excavation consists of removal and storage or disposal of material encountered when attaining required grade elevations and in accordance with the notes shown in the Drawings.

Authorized earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, and other materials encountered that are not classified as rock excavation or unauthorized excavation. Unauthorized excavation consists of removal of material beyond the limits needed to establish required grade and subgrade elevations without specific direction of the CITY. Unauthorized excavation, as well as remedial work directed by the CITY shall be at the CONTRACTORS expense. Such remedial work shall be performed as directed by the CITY.

If requested by the CITY, when excavation has reached required subgrade elevations, a Geotechnical/Soils Engineer shall make an inspection of conditions. If the subgrade is unsuitable, CONTRACTOR shall carry excavation deeper and replace excavated material with select common fill or bedding rock, as directed by the CITY.

If the CONTRACTOR excavates below grade through error or for his own convenience or through failure to properly dewater the excavation or disturbs the subgrade before dewatering is sufficiently complete, he may be directed by the CITY to excavate below grade and refill the excavation using select common fill or bedding rock.

Sloped sides of excavations shall comply with local codes and ordinances, and with OSHA requirements. CONTRACTOR shall shore and brace where sloping is not possible due to space restrictions or instability of the material being excavated. Shoring and slopes shall be maintained in a safe condition until completion of the work.

CONTRACTOR shall stockpile satisfactory excavated materials at a location approved by the CITY until required for backfill and fill. When needed in the WORK, material shall be located and graded at the direction of a Geotechnical/Soils Engineer.

Stockpiles shall be placed and graded for proper drainage. All soil materials shall be located away from the edge of excavations. All surplus and/or unsuitable excavated material shall be legally disposed of by the CONTRACTOR. Any permits required for the hauling and disposing of this material shall be obtained by the CONTRACTOR prior to commencing hauling operations.

1.10.7.2. EXCAVATION FOR STRUCTURES

All such excavations shall conform to the elevations and dimensions shown on drawing within a tolerance of plus or minus 0.10 feet and extending a sufficient distance from footings and foundations to permit placing and removing form work, installation of services and other construction, inspection or as shown on the Drawings. 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.

1.10.7.3. TRENCH EXCAVATION

Excavation for all trenches required for the installation of utility pipes shall be made to the depths indicated on the Drawings and in such manner and to such widths as will give suitable room for laying the pipe within the trenches, for bracing and supporting and for pumping and drainage facilities.

The bottom of the excavations shall be firm and essentially dry and in all respects acceptable to the CITY.

Where pipes are to be laid in bedding rock, select common fill or encased in concrete, the trench may be excavated to or just below the designated subgrade. The material remaining in the bottom of the trench shall be no more than slightly disturbed.

Where the pipes are to be laid directly on the trench bottom, bell holes shall be made as required.

Sec. 1.10.8. BEDDING AND BACKFILL

1.10.8.1. GENERAL

Material placed in fill areas under and around structures and pipelines shall be deposited within the lines and to the grades shown on the DRAWINGS or as directed by the CITY, making due allowance for settlement of the material. Fill shall be placed only on properly prepared surfaces which have been inspected and approved by the CITY. If sufficient select common or common fill material is not available from excavation on site, the CONTRACTOR shall provide fill as may be required.

Fill shall be brought up in substantially level lifts starting in the deepest portion of the fill. The entire surface of the WORK shall be maintained free from ruts and in such condition that construction equipment can readily travel over any section.

Fill shall be placed and spread in 8" to 12" layers unless otherwise specified. Prior to the process of placing and spreading, all materials not meeting those specified under Section 9.4 shall be removed from the fill areas. The CONTRACTOR shall assign a sufficient number of men to this WORK to insure satisfactory compliance with these requirements.

If the compacted surface of any layer of material is determined to be too smooth to bond properly with the succeeding layer, it shall be loosened by harrowing or by another approved method before the succeeding layer is placed.

All fill materials shall be placed and compacted Ain-the-dry@. The CONTRACTOR shall dewater excavated areas as required to perform the work and in such a manner as to preserve the undisturbed state of the natural inorganic soils.

Prior to filling, the ground surface shall be prepared by removing vegetation, debris, unsatisfactory soil materials. CONTRACTOR shall plow, strip or break up sloped surfaces steeper than one vertical to four horizontal so that fill material will bond with the existing surface. When existing ground surface has a density less than that specified under Section 10.9 for the particular area classification, CONTRACTOR shall break up the ground surface, pulverize, moisture-condition to the optimum moisture content and compact to required depth and percentage of maximum density.

Material which is too wet shall be spread on the fill area and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits. If added moisture is required, water shall be applied by sprinkler tanks or other sprinkler

systems, which will insure uniform distribution of the water over the area to be treated and give complete and accurate control of the amount of water to be used. If too much water is added, the area shall be permitted to dry before compaction is continued. The CONTRACTOR shall supply all hose, piping, valves, sprinklers, pumps, sprinkler

tanks, hauling equipment and all other materials and equipment necessary to place water in the fill in the manner specified. CONTRACTOR shall compact each layer to required percentage of maximum dry density or relative dry density in accordance with Section 10.9. Backfill or fill material shall not be placed on surfaces that are muddy, frozen or contain frost or ice. When unavoidable wet conditions exist, bedding rock shall be used for backfilling.

1.10.8.2 BEDDING AND BACKFILL FOR STRUCTURES

Bedding rock shall be used for bedding under all precast structures as indicated on the STANDARD DETAILS. The CONTRACTOR shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed. Appropriate fill shall be used as backfill against the exterior walls of the structures. Fill shall be compacted sufficiently in accordance with Section 10.9.2. of these specifications.

Backfilling shall be carried up evenly on all walls of an individual structure. No backfilling shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength.

In locations where pipes pass through building walls, the CONTRACTOR shall take precautions to consolidate the fill up to an elevation of at least one (1) foot above the bottom of the pipes. Structural fill in such areas shall be placed for a distance of not less than three (3) feet either side of the center line of the pipe in level layers not exceeding eight (8) inches in depth.

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.

Temporary bracing shall be provided as required during construction of all structures to protect partially completed structures against all construction loads, hydraulic pressure and earth pressure. The bracing shall be capable of resisting all loads applied to the walls as a result of backfilling.

1.10.8.3. BEDDING AND BACKFILL FOR PIPES

Bedding for pipe shall be as shown on the PLANS and detailed on the STANDARD DETAILS. The CONTRACTOR shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed.

Backfilling over and around pipes shall begin as soon as practicable after the pipe has been laid, jointed and inspected. All backfilling shall be prosecuted expeditiously and as detailed on the STANDARD DETAILS.

Any space remaining between the pipe and sides of the trench shall be carefully backfilled and spread by hand or approved mechanical device and thoroughly compacted with a tamper as fast as placed, up to a level of one (1) foot above the top of the pipe. The filling shall be carried up evenly on both sides. Compaction shall be in accordance with the STANDARD DETAILS and Section 10.9.

The remainder of the trench above the compacted backfill, as just described above, shall be filled and thoroughly compacted in uniform layers. Compaction shall be in accordance with the STANDARD DETAILS and Section 10.9.

Sec. 1.10. 9. COMPACTION

1.10. 9.1. GENERAL

The CONTRACTOR shall control soil compaction during construction to provide the percentage of maximum density specified. The CONTRACTOR shall be provided copies of all soils testing reports, prepared by a GETECHNICAL/SOILS ENGINEER, demonstrating compliance with these SPECIFICATIONS.

The following minimum soils compaction requirements are applicable to all WORK unless a greater degree of compaction is required by the permitting authority or special requirement of the Engineer.

1.10. 9.2. PERCENTAGE OF MAXIMUM DENSITY REQUIREMENTS

When existing trench bottom has a density less than 95% of the maximum dry density as determined by AASHTO/T-180, the CONTRACTOR shall compact to required percentage of maximum density.

Fill or undisturbed soil from the bottom of the pipe trench to grade shall be densified to a minimum density of 95% of the maximum dry density as determined by AASHTO T-180.

Fill under and around structures and paving, and to the extent of the excavation shall be densified to a minimum density of 98% of the maximum dry density as determined by AASHTO T-180.

1.10. 9.3. COMPACTION TESTS

In general, one compaction test shall be taken for each 12" layer of fill for each 300 feet of pipe and for every 100 square feet of backfill around structures. The CITY may determine that more compaction tests are required to certify the installation depending on field conditions.

CONTRACTOR shall be liable for all costs associated with retesting of soils on Capital Projects, and Developer shall be responsible for these costs on private development projects.

Sec. 1.10.10. GRADING

All areas within the limits of construction, including transition areas, shall be uniformly graded to produce a smooth uniform surface. Areas adjacent to structures or paved surfaces shall be graded to drain away from structures and pavement. Ponding shall be prevented. The area shall be compacted to the specified depth and percentage of maximum density.

No grading shall be done in areas where there are existing utilities that may be uncovered or damaged until such lines have been relocated or otherwise protected.

Sec. 1.10.11 MAINTENANCE

CONTRACTOR shall protect his graded areas from traffic and erosion and keep them free of trash and debris. CONTRACTOR shall repair and reestablish grades in settled, eroded and rutted areas.

Sec. 1.10.12. INSPECTION AND QUALITY ASSURANCE

1.10.12.1. INSPECTION

CONTRACTOR shall examine the areas and conditions under which excavating, filling and grading are to be performed, and shall not proceed until disputed conditions have been resolved. CONTRACTOR shall examine existing grade prior to commencement of WORK and report to the CITY if elevations or existing grade vary from elevations shown on DRAWINGS.

1.10.12.2. QUALITY ASSURANCE

All work shall be performed in compliance with applicable requirements of governing authorities having jurisdiction.

The CITY shall be responsible for costs associated with soils testing and geotechnical inspection services on Capital projects. The Developer shall be responsible for costs associated with soils testing and geotechnical inspection services on private development projects.

Quality assurance testing shall be performed during construction to ensure compliance with the Contract. CONTRACTOR shall provide all assistance necessary to allow the testing service to inspect and approve fill materials and fill layers before further construction is performed. The CONTRACTOR shall at all times demonstrate compliance with the compaction requirements stipulated in the MANUAL.

SECTION 1.11. BORING AND JACKING

Sec. 1.11.1. GENERAL

The installation of a casing pipe by the method of boring and jacking shall be covered by these specifications. The overall work scope shall include, but not limited to, boring and jacking pits and equipment, sheeting, steel casing pipe, skid, steel straps, coatings, location signs as required, miscellaneous appurtenances to complete the entire WORK as shown on the STANDARD DETAILS, and restoration. Applicable provisions of Division III, IV, and V shall apply concurrently with these specifications. Boring and jacking operations shall be performed within the right-of way and/or easements shown on the DRAWINGS.

Sec. 1.11.2. PIPE MATERIALS

1.11.2.1. STEEL CASING

Steel casings shall conform to the requirements of ASTM Designation A139 (straight seam pipe only) Grade "B" with a minimum yield strength of 35,000 psi. Minimum casing pipe size and wall thickness shall be as indicated in the following table, where Polk County and D.O.T. requirements are for road crossings and CSX Transportation requirements are for railroad crossings, unless otherwise shown or specified:

<u>F.D.O.T./Polk County</u>		<u>CSX Railroad</u>		
O.D.	Wall	O.D.	Coated	Noncoated
12"	0.188"	12"	0.188"	0.251"
14"	0.188"	14"	0.219"	0.282"
16"	0.188"	16"	0.219"	0.282"
24"	0.250"	24"	0.344"	0.407"
30"	0.312"	30"	0.406"	0.469"
36"	0.375"	36"	0.469"	0.532"
42"	0.500"	42"	0.500"	0.563"

Field and shop welds of the casing pipes shall conform with the American Welding Society (AWS) standard specifications. Field welds shall be complete penetration, single-bevel groove type joints. Weld shall be airtight and continuous over the entire circumference of the pipe and shall not increase the outside pipe diameter by more than 3/4 inch.

1.11.2.2. CARRIER PIPE

The carrier pipe shall be a minimum pressure class 150 ductile iron pipe, greater if otherwise indicated. Ductile iron pipe shall comply with all areas of these specifications. Carrier pipe joints shall be individually restrained.

1.11.2.3. INSPECTION

All casing pipe to be installed may be inspected at the site of manufacture for compliance with these Specifications by an independent laboratory selected and paid for by the CITY. The manufacturer's cooperation shall be required in these inspections.

All casing pipe shall be subjected to a careful inspection prior to being installed. If the pipe fails to meet the specifications it shall be removed and replaced with a satisfactory replacement at no additional expense to the CITY.

1.11.2.4. CERTIFICATION

All casing pipe shall be accompanied by manufacturer's certification that casing meets all specified standards, with an enumeration of each parameter specified herein and such other parameters as required by the permitting authority.

Sec. 1.11.3. PIPE HANDLING

Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe shall not be dropped. All pipe shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe or coatings shall be repaired to the satisfaction of the CITY.

Sec. 1.11.4. CONSTRUCTION REQUIREMENTS

1.11.4.1. WORK COORDINATION

It shall be the CONTRACTOR's responsibility to perform the boring and jacking work in strict conformance with the requirements of the agency in whose right of way or easement the work is being performed. Any special requirements of the agency such as insurance, flagmen, etc., shall be strictly adhered to during the performance of WORK. The special requirements shall be performed by the CONTRACTOR.

1.11.4.2. DEWATERING

Dewatering through the casing during construction shall not be permitted. All dewatering methods shall be as specified in Section 1.10.

1.11.4.3. CARRIER PIPE SUPPORT

The carrier pipes shall be supported within the casing pipes so that the pipe bells do not rest directly on the casing. The load of the carrier pipes shall be distributed along the casing by casing spacers.

1.11.4.4. JACKING PITS

Excavation adjacent to the roads shall be performed in a manner to adequately support the roads. Bracing, shoring, sheeting or other supports shall be installed as needed. CONTRACTOR shall install suitable reaction blocks for the jacks as required. Jacking operations shall be continuous and precautions shall be taken to avoid interruptions which might cause the casing to “freeze” in place. Upon completion of jacking operations, the reaction blocks, braces, and all other associated construction materials shall be completely removed from the site.

1.11.4.5. MISCELLANEOUS REQUIREMENT

Correct line and grade shall be carefully maintained. Earth within the casing shall not be removed too close to the cutting edge in order to prevent the formation of voids outside the casing. If voids are formed, they shall be satisfactorily filled with grout by pumping.

The sections of steel casing shall be field welded in accordance with the applicable portions of AWWA C206 and AWS D7.0 for field welded pipe joints. CONTRACTOR shall wire brush the welded joints and paint with Inertol Quick-Drying Primer 626 by Koppers Company or approved equal. After completion of jacking, CONTRACTOR shall clean the interior of the casing of all excess material.

SEC. 1.11.5 DIRECTIONAL BORE DESIGN, REQUIREMENTS, AND POST-CONSTRUCTION STANDARDS

1.11.5.1 DESIGN / PRECONSTRUCTION REQUIREMENTS

The purpose of this standard is to provide guidelines for use by the development community and others during the design and installation of underground water mains and wastewater force mains using horizontal directional bores integral to the development of commercial, industrial, or residential subdivision properties.

1.11.5.1.1 REFERENCES

References for horizontal directional drilling include Mini-Horizontal Directional Drilling Manual (1995), North American Society of Trenchless Technology (NASTT), Chicago, IL; PPI Handbook of Polyethylene Piping (1998), Plastics Pipe Institute, Washington, D.C.; PLEXCO Polyethylene Industrial Piping Systems; “Technical Information; Technical Note: Horizontal Directional Drilling (Guided Bore) with PLEXCO Pipe”, et al.

1.11.5.1.2 ENGINEER RESPONSIBILITIES

The design ENGINEER assumes all responsibility for proper design of the directional bore.

The ENGINEER should determine if the soils at the site are suitable for directional drilling based on previous experience with the site soils or a geotechnical investigation. All existing utilities, surface and subsurface structures must be located (in three dimensions) for the design.

1.11.5.1.2.1 MINIMUM GROUND COVER

The minimum ground cover over a directionally bored water or wastewater utility line shall be 36 inches. There shall be at least 18 inches vertical clearance when crossing under any existing water main with a wastewater force main.

1.11.5.1.2.2 DESIGN CALCULATIONS

The ENGINEER should limit curvature in any direction to lessen force on the pipe during pullback. Ideally, the directional bore should lie in a vertical plane.

The ENGINEER shall submit, as part of the permits application plans submittal package, design calculations indicating predicted / permissible (maximum safe) pull force, pipe pull rating, and minimum permissible pipe bend radius. Maximum safe pull force shall be shown on the project design drawings. Some factors to be considered in calculating the safe pull force follow. Additional

discussion can be found in Appendix A. The pullback force is calculated at the leading end of the pipe behind the pulling head. The frictional resistance is highest just prior to movement and decreases with movement. When pullback ceases, frictional forces and drag forces increase due to the thixotropic nature of drilling mud. The mud starts to gel when it is undisturbed. Buoyant force pushes the pipe up against the top of the borehole, creating frictional drag between the pipe and the borehole.

Minimum curvature at the entry and exit pits is limited by the steering capabilities of the boring equipment. When the bending radius is too small, the safe pulling strength of **HDPE** pipe may be significantly reduced by the additional tensile stresses due to curvature. All bending stresses due to various curvatures in the boring path are additive and should be subtracted from the safe pull force. The “safe” pull-load is time dependent.

The ENGINEER must show the directional bore in profile view on the plans, showing the pipe as it should be installed. Maximum pull strength and minimum radius of curvature shall be listed. All existing utilities shall be shown on the plans. The ENGINEER shall provide signed and sealed “As-Built” drawings of the constructed bore path, including any abandoned in place bores. The ENGINEER shall certify that the pipe was installed within acceptable limits per the pipe specifications.

1.11.5.1.3 CONTRACTOR RESPONSIBILITIES

The CONTRACTOR shall supply all labor, supervision, tools and equipment, and materials necessary to install carrier pipe by directional bore method for potable water or wastewater systems. Installation of the carrier pipe system includes the installation of water mains or wastewater force mains and/or any other devices or materials deemed necessary for the respective systems. For CITY projects, materials may be supplied by the City.

The CONTRACTOR shall provide experienced operators to perform directional boring. The operator shall have performed at least three directional bores of similar pipe diameter and bore length.

The CONTRACTOR shall be fully responsible for placement of the pipe per the ENGINEER’s specifications. See Paragraph 2.2.7 for tolerances.

The CONTRACTOR shall supply experienced persons who have received proper training in the use of the fusion equipment according to the recommendations of the pipe manufacturer and fusion equipment supplier to perform thermal fusion of the specific HDPE pipe to be used.

1.11.5.1.4 EQUIPMENT

The directional drilling equipment shall consist of a directional-drilling rig of sufficient capacity to perform the bore and pull back the pipe.

The steerable, directional-boring equipment shall produce a stable fluid lined tunnel with a minimum burial depth of 36-inches for the carrier pipe installation.

The tunneling equipment shall employ a fluid cutting technique. The soil shall be cut by small diameter, high-pressure jets of drilling fluid. The jets shall cut the soil in advance of the boring tool, impregnating and lining the tunnel wall with drilling fluid. The drilling fluid shall be inert and pose no environmental risk, such as bentonite or a polymer-surfactant mixture producing a slurry of proper consistency.

The hydraulic power system shall be self-contained and free of leaks, with sufficient pressure and volume to power the drilling operation. Calibration of the electronic detection system shall be verified by uncovering the tool (head) at the first ten (10) foot point. The boring tool (head) shall be remotely steerable by means of an electronic detection system. The tool (head) location shall be monitored in three dimensions and logged every 10 feet from the drilling rig. The boring tool shall pull the carrier pipe through the fluid lined tunnel as it traverses the surface being crossed.

The rig shall have means to monitor and record the maximum pullback force during the pullback operation. The pulling strength of the boring equipment shall not exceed the HDPE pipe safety pull strength as per the manufacturer's recommendation.

1.11.5.1.4.1 BUTT FUSION

The butt fusion machine used to join sections of HDPE pipe shall have controls and gauges for setting pressures and temperatures used for facing, heating, and fusing.

Facing should be conducted at a pressure that produces properly faced pipe ends

Heating pressure should be set so that the pipe ends maintain contact against the heater, but are not forced against the heater (zero contact pressure).

Fusing pressure shall be as recommended by the pipe manufacturer and fusion equipment supplier.

Heater surfaces must be clean and free of contaminants such as dirt, oil, grease, and melted or charred plastic. To clean the heater, only wooden implements and clean, dry, lint-free non-synthetic cloths should be used. The heater should be checked periodically for uniform surface temperature using a surface pyrometer.

1.11.5.1.5 DIRECTIONAL BORE MATERIAL

1.11.5.1.6.1 PIPE

Pipe shall be High Density Polyethylene (HDPE) as per AWWA C906.

Carrier: HDPE pipe shall be DR 11, working pressure rating of 160 psi. The following are approved pipe manufacturers:

CRS, PolyPipe PE 3408, 4" to 24" diameter.

Plexco PE 3 408, 4" to 24" diameter.

Driscopipe 4000 Series, 4" to 24" diameter.

Material for pipes to be used for potable water application shall be approved by the National Sanitation Foundation (NSF).

All material must be inspected by Water Utilities Engineering 48 hours (two working days) before the bore begins.

1.11.5.1.6.2 FITTINGS

All fittings, sizes 4 inch and larger shall meet the requirements of AWWA Standard C 906-90 (or most recent revision).

All fittings shall be ductile iron pipe size.

All fittings shall meet the requirements of ANSI NSF Standard 61.

All fittings shall be made of materials conforming to polyethylene code designation PE 3408.

Standard dimension ratio shall be DR11.

Pressure class shall be 160 psi.

1.11.5.1.6.3 COLOR CODING

The piping shall be permanently coded to provide service identification. Stripes along the entire outside length of the pipe, 120 degrees apart, shall be made by co-extrusion or impregnation in accordance with the following schedule. Fully colored pipe co-extruded from permanently pigmented HDPE is also acceptable.

<u>SERVICE</u>	<u>STRIPED PIPE</u>	<u>SOLID COLORED PIPE</u>
Potable Water	Blue stripes	Blue
Reclaimed Water	Purple stripes	Purple
Wastewater	Green stripes	Green

Markings on the pipe shall include the following:

Nominal size and OD base.

Standard material code designation.

Dimension.

Pressure class.

AWWA designation (AWWA C906). Material test category of pipe.

1.11.5.1.7 TRACER WIRE

All piping shall be installed with a continuous, insulated, solid #10 gauge copper wire for water main or force main location purposes by means of an electronic line tracer.

The wire insulation shall be solid color in accordance with the coding described in 1.6.4 above. Blue coated (for water mains), or green coated (for wastewater), number 10 gauge UF (Underground Feeder per National Electric Code Article 339) solid tracer wire must be taped along all pipes. Sections of wire shall be spliced together using Pro-Trace TW Connectors. **Twisting the wires together is not acceptable.** Spools of #10 wire are available in 500-foot rolls.

Upon completion of the directional bore, the CONTRACTOR shall demonstrate to the CITY that the wire is continuous and unbroken through the entire run of the pipe by providing full signal conductivity (including splices) when energizing for the entire run in the presence of the INSPECTOR. If the wire is broken, the CONTRACTOR shall repair or replace it.

1.11.5.1.8 FITTINGS AND RESTRAINERS

1.11.5.1.8.1 PIPE FLANGE JOINTS

Pipe flange joints shall be made using a flange adapter which is butt fused to the HDPE pipe.

A back-up ring shall be fitted behind the flange adapter sealing surface flange for bolting to the mating flange. Standard back-up rings shall be AWWA C207 Class D for 160 psi and lower pressure ratings.

One edge of the back-up ring must be chamfered to fit up against the back of the sealing surface flange.

1.11.5.1.8.2 MECHAINCAL JOINTS

Mechanical joints to polyethylene pipe shall be fully constrained by compressing the pipe OD against a rigid tube or stiffener in the pipe bore. The stiffener shall be stainless steel.

Approved joint restraining devices are Mega-Lug and MJR.

1.11.5.1.9 MAINTENANCE OF TRAFFIC

The maintenance of traffic, in accordance with the governing right-of-way authority, shall be the responsibility of the CONTRACTOR.

If the CONTRACTOR has the capability within his organization, he shall provide the necessary personnel and equipment for maintenance of traffic. Persons participating in maintenance of traffic operations must be FDOT qualified and copies of their certificates verifying their qualifications shall be provided to Water Utilities Engineering prior to start of the directional work.

If the CONTRACTOR is unable to provide the required maintenance of traffic, he shall subcontract the work to supply the necessary personnel and equipment. The use of a subcontractor's personnel and equipment shall in no way transfer the responsibility for the maintenance of traffic from the CONTRACTOR.

1.11.5.2 CONSTRUCTION REQUIREMENTS

1.11.5.2.1 GENERAL

All directional bore operations shall be contained within right-of-way and / or easements shown on the DRAWINGS.

Work shall not start until the CONTRACTOR has all necessary permits from the appropriate governing regulatory agencies, including the City of Davenport Public Works Engineering group, and not until Water Utilities Engineering has been given 48 hours (two working days) prior notification to inspect construction materials. Any material may be rejected if out of specification or damaged (i.e. out-of-round, deep cuts, etc.).

CONTRACTOR shall not begin drilling operation until the INSPECTOR is present. The INSPECTOR must be present during the entire boring operation once the ground is penetrated.

1.11.5.2.1.2 INSPECTION SCHEDULES

The CONTRACTOR is to schedule the directional bore such that the INSPECTOR is on site. Boring operations will not begin before 8:00AM and the commencement of boring operations will not start after 1:00PM all boring are to be completed before 4:00PM unless approved by City of Davenport Water Utilities Department. **There will be no boring operations allowed on Friday, Saturday, Sunday or holidays.**

1.11.5.2.2 CONTRACTOR RESPONSIBILITIES

The CONTRACTOR shall provide the following materials and services for directional bore unless otherwise specified by OWNER / DEVELOPER:

- Traffic control.
- Tracer wire for carrier pipe (#10 gauge or larger, solid), per standards.
- Site preparation and excavation.
- Dewatering – Groundwater Pump or Well Point System as needed.
- Sheeting and shoring, as necessary.
- All fusion welding.
- Preliminary site restoration (fill open pits, grading).
- Site cleanup including removal and proper disposal of all waste materials and drilling fluid.

The CONTRACTOR shall record data on the bore log (see section 1.11.5.2.2.1) and shall also ensure the following items are monitored and controlled:

Calibrate locator/tracking system
Field verify calibration by field measurement of actual location of first rod
Ensure that the flow of bentonite is continuous
Ensure pulling pressure does not exceed pipe manufacturer's specifications
Fusing of pipe is within pipe manufacturer's specifications
Cool down time is calculated and complied with
Pipe is fused prior to start of extended bores (ie. Greater than 100 linear feet).

1.11.5.2.2.1 MEASUREMENT RECORDING

The CONTRACTOR shall record location and depth measurements every ten (10) feet over the course of the bore and provide that data to the CITY. Data collected by the City inspector does not relieve the Contractor from the responsibility of recording his own data. The CONTRACTOR shall log all necessary data from the locator / tracking system:

Position. Roll Angle. Tilt Angle.
Depth – Every ten (10) feet. Temperature of Data
Transmitter. Remaining Battery Life.
Pull Back Force (Maximum pull back force shall be recorded).

1.11.5.2.2.2 MATERIALS

CONTRACTOR shall supply the following materials:

All HDPE fittings, couplings, and carrier pipe (unless otherwise specified). Final site restoration (sod, seed, mulch, concrete/ asphalt repair).
Required Right-Of-Way Permits.

1.11.5.2.2.3 PERMITS AND INSPECTIONS

An INSPECTOR for the CITY shall witness and verify the CONTRACTOR'S logging of pertinent data. The INSPECTOR may log his own data in the Department's own Directional Bore Log sheet for the City's use.

CONTRACTOR shall notify all involved agencies prior to start of construction. The CONTRACTOR is responsible for verifying that all permits are current and not expired. The CONTRACTOR shall notify the ENGINEER of Record and the CITY if expired.

The CONTRACTOR shall call "Sunshine State One-Call" (phone number: 800-432-4770) 48 hours prior to performing any excavation. The CONTRACTOR shall confirm the location of utilities before starting the directional bore.

1.11.5.2.2.4 DRAWINGS

The CONTRACTOR shall perform directional bore in accordance with the approved project DRAWINGS. In no case shall the bore extend into private property unless an easement is provided prior to start of construction. Vertical tolerances shall be plus or minus 1 foot of elevations shown on drawings. Horizontal tolerances shall be plus or minus 2 feet of alignment shown in drawings. These tolerances shall be met unless required separations for other utilities must be met and puts the bore in conflict. Failure to meet tolerances, if not preapproved by ENGINEER, may be grounds for rejecting the bore. The CONTRACTOR may, at the discretion of the ENGINEER, be required to abandon the bore and re-drill a new one at CONTRACTOR's own expense.

1.11.5.2.2.5 SAFETY AND DUE CARE

The CONTRACTOR shall provide all structures, safety equipment, and professional services required for the health and safety of the general public and of personnel involved in directional boring work in accordance with the requirements of the Federal, State, and Local Authorities. This includes proof of construction personnel certificates of trench safety training at the time of construction.

The CONTRACTOR shall take all measures necessary to protect surrounding public and private property, adjacent buildings, roads, drives, sidewalks, drains, sewers, utilities, trees, structures, and appurtenances from damage due to directional bore work.

The CONTRACTOR shall exercise due care at all times and shall not apply more than the safe pull force to the carrier pipe recommended by the ENGINEER.

1.11.5.2.2.6 TRACER WIRE

The CONTRACTOR shall install a blue coated #10 gauge solid tracer wire on all water carrier pipe and green coated #10 gauge solid tracer wire on all wastewater force main carrier pipe. The CONTRACTOR will be responsible to provide a tracer wire that test positive and negative for continuity for the entire length.

The CONTRACTOR shall perform a 12-volt DC electrical continuity test on each of the wire. Test each wire with both positive and negative charge. No more than one volt of loss per 1000 feet of wire will be acceptable. The locator wire system shall pass the 12-volt DC electrical continuity test for at least one wire prior to final acceptance of the pipeline. Any cuts or breaks in the wire shall be repaired by the Contractor at his expense. Section of wire shall be spliced together using Pro-Trace TW Connectors. **Twisting the wires together is not acceptable.**

1.11.5.2.2.7 INSPECTION NOTIC

CONTRACTOR shall give 48-hour (two working days) advance notice to CITY prior to start of work. The INSPECTOR is required to inspect materials **prior to the bore** and to be on site during the boring operation and installation of the pipe.

1.11.5.2.2.8 SURFACE DEFECTS

The CONTRACTOR shall be fully responsible for all steerable, fluid lined directional boring operation. Any noticeable surface defects resulting from operation of this boring equipment shall be repaired by the CONTRACTOR at his expense. The CONTRACTOR is recommended to take preconstruction videos of the construction site to avoid unwarranted claims for damages resulting from the construction.

1.11.5. 2.2.9 INSURANCE

The CONTRACTOR shall meet all CITY insurance requirements, as defined by the City's Risk Management Department, when working in a right-of-way, using a right-of-way use permit.

1.11.5.2.3 DRILLING REQUIREMENTS

The horizontal alignment shall be as shown on the drawings, plus or minus 2 feet. The vertical alignment shall be as shown on the drawings, plus or minus 1 foot. If the CONTRACTOR cannot meet these tolerances for whatever reason, he shall confer with the ENGINEER prior to the start of the bore and the ENGINEER shall approve any changes.

The pipe shall have a minimum cover of 36 inches.

Compound curvatures should be minimized as the safe pulling strength of the pipe may be significantly reduced by the additional tensile stresses due to curvatures. This is limited by the maximum deflection as set forth by the HDPE pipe manufacturer or AWWA Standards, whichever is more stringent.

The entry angle should be 12° to 14° ideally (not to exceed 15°). Exit angle should be 6° to 12° to facilitate the pullback operation.

Erosion and sedimentation control measures and on-site containers shall be installed to prevent drilling mud from spilling out of entry and/or exit pits.

Drilling mud shall be disposed of off-site in accordance with applicable local, State and Federal requirements and/or permit conditions.

Pilot holes shall be drilled on bore path with no deviation greater than plus or minus 1 foot from the design depth over a length of 100 feet. In the event that the allowable deviation is exceeded, **the CONTRACTOR shall notify the ENGINEER/CITY, and the CITY may require the ENGINEER/DEVELOPER/CONTRACTOR to pull back and re-drill from a location along the bore path before the deviation.**

Upon successful completion of the pilot hole, the borehole shall be reamed to a minimum of 25 percent greater than the outside diameter of the pipe being installed. For bores with more than two radii of curvature (entrance and exit), the borehole should be reamed up to 50 percent larger than the outside diameter of the carrier pipe.

The CONTRACTOR shall not attempt to ream at a rate greater than the drilling equipment and mud system are designed to safely handle.

In the event of a drilling hole blowout, the CONTRACTOR shall be responsible for restoring to original condition any damaged property and cleaning up the environment in the vicinity of the blowout.

1.11.5.2.4 PIPE INSTALLTION

After reaming the borehole to the required diameter, the pipe shall be pulled through the hole. In front of the pipe shall be a swivel and barrel reamer to compact the borehole walls.

Once pullback operations have commenced, the operation shall continue without interruption until the pipe is completely pulled into the borehole. The frictional resistance is the highest just prior to movement and decreases with movement. When pullback ceases, frictional forces and drag forces increase due to the thixotropic nature of drilling mud. The mud starts to gel when it is undisturbed. Therefore, **PULLBACK SHALL NEVER BE STOPPED, EXCEPT FOR DRILLING ROD REMOVAL, UNTIL THE PIPE IS COMPLETELY PULLED INTO ITS PERMANENT POSITION.**

Adequate lengths of pipe shall be provided at both the launching and receiving ends to facilitate service connection assemblies.

After pullback, pipe may take several hours to recover from the axial strain. When pulled from the reamed borehole, the pull-nose should be pulled out 3-4 percent longer than the total length of the pull to avoid having the pull-nose sucked back below the borehole exit level due to stretch recovery and thermal contraction to an equilibrium temperature.

The pipe entry area shall be graded as needed to provide support for the pipe and to allow free movement into the borehole. The pipe shall be guided into the borehole to avoid deformation of, or damage to, the pipe.

The pipe shall be installed in a manner that does not cause upheaval, settlement, cracking, and movement or distortion of surface features. Any damages caused by the CONTRACTOR's operations shall be corrected by the CONTRACTOR.

In the event that unexpected subsurface conditions impeding drilling operations are encountered, the procedure shall be stopped and not continued until the CITY has been consulted. The pipe shall be pulled back through the borehole using the wet insertion construction technique.

If the final grade of the finished bore is not satisfactory to the CITY or any other jurisdictional entity, the pipe shall be abandoned, **full pressure grouted in place in accordance with the jurisdictional entity**, and an alternate installation shall be made. The abandoned pipe shall be properly shown on "as-built" drawings to be submitted following conclusion of the construction work.

The INSPECTOR shall inspect the installed pipe for roundness and / or damage. Evidence of over-pulling or significant surface scratching shall be brought to the attention of the ENGINEER and the CITY. Deformations of more than 10 percent may be grounds to abandon the bore and have the CONTRACTOR re-drill another line.

1.11.5.2.5 BUTT FUSION PROCEDURES

Fusion welds shall be performed by an experienced technician that has been properly trained to meet the pipe manufacturer's procedures. All welds shall meet the pipe manufacturer's recommendations.

The CONTRACTOR may do a preliminary pressure test on the completed string of pipe prior to installation. A pressure test shall be required on the completed directional bore prior to final acceptance.

1.11.5.2.5.1 PIPE JOINING

As the pipe ends are melted against the heater during the heating period, the molten plastic will swell and form melt beads around the pipe ends. The melt beads should be the same size on both pipe ends, and uniformly sized all the way around.

After melting has been completed, the ends should be separated just enough to remove the heater, observed for uniformity of the beads and quickly (within three seconds) brought together with the recommended pressure. If melted plastic sticks to heater, the two ends should not be joined. The ends should be allowed to cool and the procedure started over. Excess pressures should not be used as this will squeeze too much melt out of the fusion area and result in a weakened joint.

1.11.5.2.6 CONNECTING TWO SECTIONS OF DIRECTIONALLY BORED PIPE

If the overall length of the required utility installation can not be safely pulled using one directional bore, then the CONTRACTOR shall be required to make more than one pull to accomplish the installation.

Where two adjacent pulls meet, the CONTRACTOR shall dig a pit and join the two sections together at the elevation of the two segments as if it were a continuous pull-in.

The two sections of HDPE shall be joined together using an electrofusion coupling per the coupling manufacturer's recommendations.

1.11.5.3 POST-CONSTRUCTION

The as-built variance from the specified bore path shall not exceed plus or minus 1 foot in the vertical plane and plus or minus 2 feet in the horizontal plane.

The CONTRACTOR shall be considered as having completed the requirements of the directional bore when he has successfully completed the work, including pressure testing, to the satisfaction of the DEVELOPER/OWNER's ENGINEER and the CITY INSPECTOR.

The completed HDPE water main or force main shall be pressure tested at 150 psi minimum for two hours for final acceptance and the pressure shall not fall below 150 psi during the test period.

1.11.5.3.1 AS-BUILTS

When the directional bore is completed, the CONTRACTOR shall provide data log sheets and marked up as built drawings to the INSPECTOR, and the DEVELOPER/OWNER's ENGINEER, as required.

APPENDIX A DIRECTIONAL BORE DESIGN FACTORS

Calculations for computing the maximum safe pullback force should be submitted with the project design package.

The following equations from the PLEXCO Polyethylene Industrial Piping Systems; “Technical Information; Technical Note: Horizontal Directional Drilling (Guided Bore) with PLEXCO Pipe”, are presented for estimating some of the factors to be considered in designing a successful directional bore. They are based upon approximations and are for “ideal” conditions. They are by no means all of the considerations to be used in designing a directional bore.

The designer is totally responsible for the design of the directional bore and use of the following shall not transfer any of that responsibility to the CITY. The CITY makes no claim to the accuracy or completeness of the equations.

(a) **PULLBACK FORCE:** The pullback force is calculated at the leading end of the pipe behind the pulling head. For pipe pulled in straight level bores, the frictional resistance or required pulling force, F_p , is approximated by:

$$F_p = \mu \times W_B \times L,$$

Where μ is the coefficient of friction between pipe and ground;
 w_B is the net downward or upward force on the pipe (lb/ft); and L is length (ft).

(b) **FRictional RESISTANCE OF DRILLING MUD:** The frictional resistance is highest just prior to movement and decreases with movement. When pullback ceases, frictional forces and drag forces increase due to the thixotropic nature of drilling mud. The mud starts to gel when it is undisturbed. Therefore, pullback should never be stopped, except for drilling rod removal, until the pipe is completely pulled into its permanent position.

(c) **BOUYANT FORCE:** The pullback force will depend on whether the pipe is full deliberately weighted to reduce buoyancy. Buoyant force pushes the pipe up against the top of the borehole, creating frictional drag between the pipe and the borehole. The buoyant weight of the pipe is, Where: D = pipe outside diameter, γ_b = specific weight of the mud slurry (lb/ft³), and w_a = weight of empty pipe.

(d) **MINIMUM RADIUS OF CURVATURE:** Drill path curvature, at the entry and exit pits, is limited by the steering capabilities of the boring equipment. Drilling rod typically has a recommended bend radius of $1200 \times D_{ROD}$, where D_{ROD} is the nominal rod diameter. When the bending radius is around $150 \times D_{PIPE}$ or less, the safe pulling strength of PE pipe may be significantly reduced by the additional tensile stresses due to curvature.

(e) **CAPSTAN EFFECT:** For pipe pulled around a curve (vertical or horizontal) creating an angle, Θ (in radians), the capstan effect,
Where: μ = coefficient of friction between pipe and slurry or pipe and ground,
 w_b = net downward (or upward) force on pipe (lb/ft),
 e = natural logarithm base ($e = 2.71828$), and
L = length (ft).

(f) SAFE PULL FORCE: The safe pull stress, σ_{SP} , may be calculated by subtracting the bending stress due to curvature the allowable tensile stress:

$$\sigma_{SP} = \sigma_{allow} - \frac{(E \times D)}{2r}$$

The “safe pull force” can be found by multiplying the safe pull stress by the cross-sectional area of the pipe.

Where:, σ_{allow} = allowable tensile stress (psi), D = outer diameter of pipe (in), DR = Dimension Ratio, and E = time-dependent modulus of elasticity (psi) from tables.

(g) NET SAFE PULL FORCE: All bending stresses due to various curvatures in the boring path are additive and should be subtracted from the safe pull force.

(h) TIME DEPENDENCE: The “safe” pull-load is time dependent. See ASTM F-1804 for safe pullback values for PE pipe, less bending stresses.

For additional sources of information, the designer is referred to the following reference sources

Mini-Horizontal Directional Drilling Manual (1995), North American Society of Trenchless Technology (NASTT), Chicago, IL

PPI Handbook of Polyethylene Piping (1998), Plastics Pipe Institute, Washington, D.C.

**APPENDIX B
DIRECTIONAL BORE GUIDELINES**

Directional Bore – Safe Pull Strength (for DR11, DIP Size HDPE)

Pipe Size (inches)	Safe Pull	Minimum Bend Strength (lbs.) Depth	Wall Thickness Radius (inches)	Maximum Defect
4	7600	96	0.36	38367
6	15800	138	0.55	38362
8	27200	181	0.73	5/32
10	41000	222	0.91	38426
12	57900	264	1.1	38355

Schedule:

Schedule the bore with Water Utilities 48 hours (2 working Days) prior to boring if bore is over 100 linear feet, contractor needs to fuse pipe together the day before. Contractor needs to physically locate existing utilities, following the 48 hour sunshine One-Call Guidelines Material Inspection to be done before the bore is scheduled. Surface cuts or scratches greater or equal to maximum defect depth are not acceptable.

Blue Strip for Water

Green Strip for Sewer

#10 gauge wire attached to pipe

Preforming the Bore:

Set up the Bore Log.

Calibrate Contractor’s locator with actual depth measurements - Check the depth of the first rod.

Ream the bore hole.

Check the flow of bentonite - Must be continuous. Check the pulling pressure.

Do not allow operator to exceed safe pull strength. Mark up drawing with “As-Built” data.

Record pull back pressure.

Fuse DR11 together - minimum 440° F to maximum 460. F

Cool down time equals: Diameter ÷2

Directional Bore Log

Page: _____ of _____

Project Name: _____

Project Number: _____ Date: _____

Contractor / Site Representative: _____

Bore Location / Number: _____ Size / Material: _____

Starting Location: _____ Bore Rod Length: _____

	Total Length Bored*	Distance From Start Point	Depth	Comments
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

*Lengths to be measured in rod length increments

Inspector / City Representative: _____ Contractor: _____

SECTION 1.12. PRESSURE PIPE RESTRAINT

Sec. 1.12.1. GENERAL

All pressure pipe and fittings shall be restrained as specified in Section 1.12.2. Use of thrust blocks for pressure pipe shall generally not be allowed.

Sec. 1.12.2. RESTRAINED JOINT CONSTRUCTION

Sections of piping requiring restrained joints shall be constructed using pipe and fittings with restrained "Locked-type" joints manufactured by the pipe and fitting manufacturer and other means of mechanical restraint retainer including retainer glands, push joint restraining gaskets, etc., and the joints shall be capable of holding against withdrawal for line pressures equivalent to the test pressure. Any restrained joints that allow for elongation upon pressurization will not be allowed in those locations where the pipe comes out of the ground.

Restrained pipe joints that achieve restraint by incorporating cut out sections in the wall of the pipe shall have a minimum wall thickness at the point of cut out that corresponds with the minimum specified wall thickness for the test of the pipe.

The minimum number of restrained joints required for resisting forces at fittings and changes in direction of pipe shall be determined from the length of restrained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil.

The required number of restrained joints shall be determined by the ENGINEER or as shown in a tabular form depicted on the ARestrained Joint Table@ in the STANDARD DETAILS.

Wherever 2-45E bends are used in place of a 90E bend and the minimum restrained joints required from one 45E bend extend beyond the other 45E bend, the 2-45E bends will be considered as though a 90E bend were located midway between the 2-45E bends.

SECTION 1.13. PRESSURE CONNECTION

Sec. 1.13.1. GENERAL

Installation of pressure connections 4" and larger shall be made in accordance with this section

Sec. 1.13.2. TAPPING SLEEVES

1.13.2.1. GENERAL

Tapping sleeves shall be mechanical joint sleeves or fabricated steel sleeves as specified below. **No size on size taps shall be allowed to existing main lines.**

1.13.2.2. MECHANICAL JOINT SLEEVES

Sleeves shall be cast of gray-iron or ductile iron or ductile iron and have an outlet flange with the dimensions of the Class 125 flanges shown in ANSI B16.1 properly recessed for tapping valve. Glands shall be gray-iron or ductile iron. Gaskets shall be vulcanized natural or synthetic rubber. Bolts and nuts shall comply with ANSI A21.11/AWWA C111. Sleeves shall be capable of withstanding a 200 psi working pressure.

1.13.2.3. STEEL TAPPING SLEEVES

Sleeves shall be fabricated of minimum 3/8" carbon steel meeting ASTM A285 Grade C. Outlet flange shall meet AWWA C-207, Class "D" ANSI 150 lb. 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.

1.13.2.4. TAPPING VALVES

Tapping valves shall meet the requirements of Section 1.25.2 except that units shall be flange by mechanical joint ends. Valves shall be compatible with tapping sleeves as specified above and specifically designed for pressure connection operations.

Sec. 1.13.3. NOTIFICATION AND CONNECTION TO EXISTING MAINS

All connections to existing mains shall be made by the CONTRACTOR only after the connection procedure and his work scheduling has been reviewed and approved by the CITY.

The CONTRACTOR shall submit a written request to the CITY a minimum of five (5) working days prior to scheduling said connections. In his request he shall outline the following:

1. Points of Connection, fittings to be used, and method of flushing and disinfection if applicable.
2. Estimated construction time for said connections.

The CITY shall review the submittal within three (3) working days after receiving it and inform the CONTRACTOR regarding approval or denial of his request. If his request is rejected by the CITY, the CONTRACTOR shall resubmit his request modifying in a manner acceptable to the CITY.

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All connections shall only be made on the agreed upon date and time. All materials required to make the connection must be onsite prior to beginning the work. If the CONTRACTOR does not initiate and complete the connection work in the agreed upon manner, he shall be required to reschedule the said connection by following the procedure outlined above.

The CONTRACTOR shall not operate any valves in the system.

Sec. 1.13.4. INSTALLATION

1.13.4.1. EXCAVATION, BACKFILL, COMPACTION AND GRADING

The applicable provisions of Section 1.10 shall apply.

1.13.4.2. CONSTRUCTION DETAILS

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 shall be repaired at the CONTRACTOR's expense.

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 10% liquid chlorine prior to beginning installation for water system pressure connections.

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 leak tested at the specified test pressure to ensure that no leakage will occur.

For pressure connections through 12" diameter or less the minimum diameter cut shall be 2" less than the nominal diameter of the pipe to be attached.

For 14" through 20" installations the minimum diameter shall be 1-1/2" less; for larger taps the allowable minimum diameter shall be 2" to 3" less than the nominal diameter of the pipe being attached. After the tapping procedure is complete the CONTRACTOR shall submit the coupon to the CITY.

Restrained joint fillings shall be provided on the branch to prevent movement of the installation when test pressure is applied. Provisions of Section 1.12 shall apply.

SECTION 1.14 PIPE MATERIAL FOR GRAVITY SEWERS

Sec. 1.14.1. GENERAL

Pipe used in gravity sewer construction shall be polyvinyl chloride (PVC) or ductile iron pipe (DIP). Where reference is made to an ASTM, or AASHTO designation, it shall be the latest revision.

The CONTRACTOR shall be responsible for all materials furnished and storage of same, until the date of substantial completion. He shall replace at his expense all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by the CITY, furnish certificates, affidavits of compliance, test reports, or samples for 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.

Sec. 1.14.2. PIPE MATERIALS

1.14.2.1. PVC GRAVITY SEWER PIPE

PVC Gravity Sewer Pipe (4"-15"), ASTM D3034, SDR 35. Uniform minimum A pipe stiffness@ at five (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 Gravity Sewer Pipe (18"-27"), ASTM F679, SDR 35. Uniform Minimum A pipe stiffness@ at five (5) percent deflection shall be 46 psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D3212 and STM F477. Applicable UNI-Bell Plastic Pipe Association standard is UNI-B-7.

All PVC pipe shall bear the NSF-DW seal. The minimum standard length of pipe shall be thirteen (13) feet.

Deep Burial gravity sewer pipe shall not exceed the depth limits set by the manufacturer. Pipe wall thickness shall be upgraded accordingly.

1.14.2.2. DIP GRAVITY SEWER PIPE

Ductile iron pipe shall conform to ANSI/AWWA A21.51/C150, class thickness designed per ANSI/AWWA A21.50/C150, with push on joints. An interior protective lining of AProtecto 401" epoxy, or equal, with a minimum dry film thickness of 40 mils. Piping with less than 3 feet of cover shall be ductile iron pipe.

1.14.2.3. PIPE MARKINGS

All pipe shall have a homing mark on the spigot provided by the manufacture. On field cut pipe, CONTRACTOR shall provide homing mark on the spigot in accordance with manufacturers recommendations. Pipe shall be light green in color or shall have a continuous 2" wide, light green stripe painted on top.

Sec. .14.3. JOINT MATERIALS

1.14.3.1. PVC PIPE

PVC sewer pipe joints shall be flexible elastomeric seals per ASTM D3212.

1.14.3.2. DUCTILE IRON PIPE

Ductile iron pipe and fitting joints shall be Apush-on@ or mechanical joints conforming to ANSI A21.11.

1.14.3.3. JOINTS FOR DISSIMILAR PIPE

Joints between pipes of different materials shall be made with a flexible mechanical compression coupling with No. 304 stainless steel bands. (See approved manufacturer=s list in appendix.)

Sec. 1.14.4. FITTINGS

Unless otherwise specified, wye branches shall be provided in the gravity sewer main for service lateral connections. Branches shall be minimum six (6) inches inside diameter, unless otherwise approved by the CITY. All fittings, including adaptors, shall be of the same material as the pipe being installed.

Plugs for stub outs shall be of the same material as the pipe, and gasketed with the same gasket material as the pipe joint, or be of material approved by the CITY. The plug shall be secured to withstand test pressures specified in Section 1.18 of these specifications.

Sec. 1.14.5. INSPECTION AND TESTING

1.14.5.1 GENERAL

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 marked clearly is subject to rejection. All rejected pipe shall be promptly removed from the project site by the CONTRACTOR.

1.14.5.2. MISCELLANEOUS INSPECTION AND TESTING REQUIREMENTS

All pipe and accessories to be installed under this Contract shall be inspected and tested at the place of manufacture by the manufacturer as required by the Standard Specifications to which the material is manufactured.

Each length of pipe shall be subject to inspection and approval at the factory, point of delivery, and site of work. If requested by the CITY, a sample of pipe to be tested shall be selected at random by the CITY or the testing laboratory hired by the CITY

When the specimens tested conform to applicable standards, all pipe represented by such specimens shall be considered acceptable based on the test parameters measured. Copies of test reports shall be available before the pipe is installed in the project.

In the event that any of the test specimens fail to meet the applicable standards, all pipe represented by such tests shall be subject to rejection. The CONTRACTOR may furnish two additional test specimens from the same shipment or delivery, for each specimen that failed and the pipe will be considered acceptable if all of these additional specimens meet the requirements of the applicable standards. All such retesting shall be at the CONTRACTOR's expense.

Pipe which has been rejected by the CITY shall be removed from the site of the work by the CONTRACTOR and replaced with pipe which meets these specifications.

SECTION 1.15 GRAVITY SEWER PIPE LAYING, JOINTING, AND MISCELLANEOUS CONSTRUCTION DETAILS

Sec. 1.15.1. SURVEY LINE AND GRADE

The CONTRACTOR shall set Temporary Bench Marks (TBM=S) at a maximum 500 foot interval. The CONTRACTOR shall constantly check line and grade of the pipe by laser beam method. In the event line and grade do not meet specified limits described hereinafter, the WORK shall be immediately stopped, the CITY notified, and the cause remedied before proceeding with the WORK.

Sec. 1.15.2. PIPE PREPARATION AND HANDLING

All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken, or otherwise defective materials are being used. The CONTRACTOR shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after laying.

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.

Sec. 1.15.3. SEWER PIPE LAYING

Laying of sewer pipe shall be accomplished to line and grade in the trench only after it has been dewatered and the trench has been prepared in accordance with specifications outlined in Division III. Refer to Section 1.15.4. for additional bedding requirements. Mud, silt, gravel and other foreign material shall be kept out of the pipe and off the jointing surface. All pipe laid shall be retained in position so as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. All pipe shall be laid to conform to the line and grade shown on the PLANS.

Variance from established line and grade, at any point along the length of the pipe, shall not be greater than one thirty-second (1/32) of an inch per inch of pipe diameter and not to exceed one-half (2) inch, provided that any such variation does not result in a level or reverse sloping invert.

The sewer pipe, unless otherwise approved by the CITY, shall be laid up grade from point of connection on the existing sewer or from a designated starting point. The sewer pipe shall be installed with the bell end forward or upgrade. When pipe laying is not in progress the open end of the pipe shall be kept tightly closed with an approved temporary plug. Pipe laying shall not begin until approved temporary plug is on site.

All PVC pipe shall be installed in accordance with the pipe manufacturer=s written recommendations as approved by the CITY. Laying of Ductile Iron Pipe shall conform to the specifications outlined in Section 1.24.4.7.

Sec. 1.15.4. TRENCH PREPARATION AND PIPE BEDDING

1.15.4.1. TRENCH EXCAVATION, DEWATERING, BEDDING MATERIAL, BACKFILL, COMPACTION, FILL AND GRADING

Applicable provisions of Section 1.10. shall apply. Also refer to STANDARD DETAILS.

1.15.4.2. PLACEMENT OF PIPE BEDDING MATERIAL

CONTRACTOR shall hand-grade bedding to proper grade ahead of pipe laying operation. Bedding shall provide a firm, unyielding support along the entire pipe length.

If without direction from the CITY, the trench has been excavated below the required depth for pipe bedding material placement, CONTRACTOR shall fill the excess depth with pipe bedding material to the proper grade.

CONTRACTOR shall excavate bell holes at each joint to permit proper assembly and inspection of the entire joint.

1.15.4.3. DEPTH OF BEDDING MATERIAL

CONTRACTOR shall provide pipe bedding material in accordance with the STANDARD DETAILS.

Sec. 1.15.5. GRAVITY PIPE AND WATER SEPARATION

Gravity sewers that are laid in the vicinity of pipe lines designated to carry potable or reuse water shall meet the conditions set forth in Section 1.24.3.

Sec. 1.15.6. PLUGS AND CONNECTIONS

Plugs for pipe branches; stubs or other open end which are not to be immediately connected shall be made of an approved material and shall be secured in place with a joint comparable to the main line joint.

Sec. 1.15.7 PIPE JOINTING

All pipes shall be installed to the homing mark on the spigot. The City shall be given an opportunity to check all joints in this manner before backfilling. Type of joint to be used will conform to the requirements of Sections 1.14.3. All pipe and jointing for gravity sewers shall be subject to the tests specified in Section 1.18.

SECTION 1.17. SERVICE LATERALS

Sec. 1.17.1. GENERAL

A service lateral is a branch gravity sewer constructed from the main gravity sewer to the right-of-way line or to a point established by the CITY.

The general requirements for construction of gravity sewers in Sections 1-14 and 1-15 of these Specifications shall apply for service laterals unless they are inconsistent with the provisions of this section.

Service laterals and fittings shall be a minimum of 6 inches in diameter. All service laterals shall be less than 50 feet in length.

Sec. 1.17.2. MATERIALS

PIPE, FITTINGS, AND JOINTS

Pipe, fittings and joints shall be PVC or DI pipe and shall conform to the requirement for gravity sewer construction in Section 1-14 of these specifications.

Service laterals shall be connected to the wye, provided in the gravity sewer where such is available, utilizing approved fittings or adapters.

On existing mains where no wye is provided or cut-in suitable, connection shall be made by either a machine-made tap and saddle, or a cast-in-place manhole as referenced in Section 1.4.4.

Sec. 1.17.3. CONSTRUCTION DETAILS

1.17.3.1. GENERAL

Service lateral connections shall conform to these specifications and the STANDARD DETAILS. All necessary approvals for service sewer construction shall be obtained prior to beginning the work.

1.17.3.2. EXCAVATION AND BACKFILL

Excavation and backfilling for service sewers shall conform to the requirements of Section 1.10. and 1.15. excepting that no backfill in excess of that required to hold the pipe in true alignment shall be placed prior to inspection.

1.17.3.3. PIPE LAYING AND JOINTING

Pipe laying and jointing, except as hereinafter provided, shall in general conform to the requirements of Section 1.15. During the pipe laying and jointing, the service lateral shall be kept free of any water, dirt or objectionable matter.

1.17.3.4. LINE AND GRADE

Pipe shall be laid with a minimum gradient of one foot per 100 feet. The CONTRACTOR shall establish such alignment and grade control as is necessary to properly install the service sewer. Pipe shall be laid in a straight line at a uniform grade between fittings.

Sec. 1.17.4. TERMINATION OF SERVICE LATERALS

Service laterals shall terminate at the right-of-way line in accordance with the STANDARD DETAILS. Water-tight factory made plug (s) shall be installed at the end of each service lateral.

Sec. 1.17.5. INSPECTION

Service sewers shall meet the inspection requirements specified in Section 1.14.

Sec. 1.17.6. RESTORATION, FINISHING AND CLEANUP

The CONTRACTOR shall restore all paved surface, curbing, sidewalks or other surfaces to their original condition in such manner as to meet the requirements established in Division III of these specifications. All surplus material and temporary structures, as well as all excess excavation shall be removed and the entire site shall be left in a neat and clean condition.

Sec. 1.17.7 LOCATION

The exact location of the termination point of each installed service lateral shall be marked. On curbed streets the exact location for each installed service shall be marked by indenting the letter "S" into the wet concrete curb. **No Saw Cuts** will be allowed to indicate location of service. Where no curb exists, locations shall be adequately marked by a 4" x 4" x 18" concrete marker with "S" indented into the top of the wet concrete pad **No Saw Cuts** will be allowed to indicate service.

SECTION .18. TESTING AND INSPECTION FOR ACCEPTANCE OF GRAVITY SEWERS

Sec. 1.18.1. GENERAL

Before Gravity sewer testing can be done road base MUST be in place.

All gravity sewers shall be tested for alignment, deflection and integrity prior to acceptance. In addition, a leakage test shall be required for gravity sewers. The leakage testing shall be performed by the CONTRACTOR who shall be responsible for furnishing all necessary labor and equipment to conduct such testing. In unusual situations where the new sewer main must necessarily be connected to active service as it is being installed, alignment, deflection and integrity testing shall be witnessed by the CITY.

Sec. 1.18.2. TESTING FOR LEAKAGE

1.18.2.1. TYPE OF TEST

Gravity sewers shall be required to pass a leakage test before acceptance. Leakage tests shall be by the low-pressure air test as described below.

1.18.2.2. SELECTION OF TEST SECTIONS

Each section shall be tested between consecutive manholes.

1.18.2.3. PREPARATION AND COORDINATION FOR TESTING

The CONTRACTOR shall flush all sewers with water sufficient in volume to obtain free flow through each line. Flushing water and debris shall not enter any pump station wet well or existing sewer. Water will be pumped from the sewer system during flushing to an acceptable discharge location. A visual inspection shall be made and all obstructions removed.

The CONTRACTOR shall notify the CITY Inspector 48 hours to schedule any leakage testing.

1.18.2.4. LEAKAGE TEST

Leakage testing shall be conducted in accordance with the procedure for “Recommended Practice For Low Pressure Air Testing of Installed Sewer Pipe” as established by the Uni-Bell PVC Pipe Association.

Sec. 1.18.3. INSPECTION FOR ALIGNMENT, DEFLECTION AND INTEGRITY

A video inspection shall be used to check for cracked, broken or otherwise defective pipe, and overall pipe integrity.

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. A video inspection of the gravity sewer pipe may also be performed before the end of the one year warranty period.

If any video inspection reveals cracked, broken, or defective pipe, pipe misalignment, or sags in excess of 1/2" and in the case of PVC pipe a ring deflection in excess of 5%, the CONTRACTOR shall be required to repair or replace the pipeline. The CITY reserves the right to pass a mandrel through the PVC pipe to determine ring deflection.

Successful passage of the leakage test and/or the video inspection is required before acceptance by the CITY. Video inspection shall be provided on Digital Compact Disk (DVD) for review.

Prior to repair or replacement of failed sewer pipe, the method of repair or replacement shall be submitted to the CITY for approval. Pressure grouting of pipe or manholes shall not be considered as an acceptable method of repair. Repair clamps shall not be considered an acceptable method of repair.

SECTION 1.19. WASTEWATER FORCE MAINS

Sec. 1.19.1. GENERAL

These specifications cover the pipe, fittings, and accessory items used for wastewater force main systems.

Pipe used in wastewater force main systems shall be either Polyvinyl Chloride (PVC), or Ductile Iron Pipe (DIP). Above ground pipe and buried pipe with less than 30" of cover or 6" of clearance shall be ductile iron.

The CONTRACTOR shall be responsible for all materials furnished and stored, until the date of project completion. He shall replace at his expense all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by the CITY, furnish certificates, affidavits of compliance, test reports, or samples for 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.

Sec. 1.19.2. PIPE INSPECTION AND TEST

Requirements specified in Article 6 shall apply.

Sec. 1.19.3. PVC PIPE

1.19.3.1. PVC PIPE

Shall not be allowed; except on side streets and exclusive easements.

All PVC pipe of nominal diameter four (4) through twelve (12) inches shall be manufactured in accordance with AWWA standard C900. The PVC pipe shall have a minimum working pressure rating of 100 psi and shall have a dimension ratio (DR) of 25. Pipe shall have the same O.D. as ductile iron pipe.

1.19.3.2. JOINTS

PVC pipe shall be integral bell, push on, type joints. **NO pipe Deflection, must use fittings**

1.19.3.3. FITTINGS

Fittings used with PVC pipe shall conform to Section 1.19.4.

Sec. 1.19.4. DUCTILE IRON PIPE AND FITTINGS

1.19.4.1. DUCTILE IRON PIPE

All ductile iron pipe of nominal diameter four (4) through fifty four (54) inches shall conform to ANSI/AWWA A21.51/C151. A minimum of pressure Class 150 pipe shall be supplied for all sizes of pipe unless a higher class pipe is specifically called out in the DRAWINGS, or required by the CITY.

1.19.4.2. FITTINGS

All fittings shall be mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A21.10/C110, 250 psi minimum pressure rating, or ductile iron compact fittings four (4) through twelve (12) inches in accordance with ANSI/AWWA A21.53/C123.

1.19.4.3. JOINTS

Joints for ductile iron pipe shall be push-on or mechanical joints and joints for fittings shall be mechanical joints conforming to ANSI/AWWA A21.11/C111, unless otherwise called for on the DRAWINGS. Where called for on the Drawings, restrained or flanged joints shall be provided. Above ground joints shall be flanged with galvanized bolts, nut and washers. Flanged joints shall conform to ANSI Standard B16.1-124 LB. Restrained joints shall conform to Article 5 of these STANDARDS.

1.19.4.4. COATINGS AND LININGS

Where ductile iron pipe and fittings are to be below ground or installed in a casing pipe the coating shall be a minimum 1.0 mil thick in accordance with ANSI/AWWA A21.51/C151. Where ductile iron pipe and fittings are to be installed above ground, pipe, fittings and valves shall be thoroughly cleaned and given one field coat (minimum 1.5 mils dry thickness) of rust inhibitor primer.

Intermediate and finished field coats of Alkyd shall also be applied by the CONTRACTOR (minimum 1.5 mils dry thickness each coat). Primer and field coats shall be compatible and shall be applied in accordance with the manufacturers recommendations. (See approved manufacturers' list in appendix.) Final field coat color shall be as directed by the CITY.

All ducticle iron pipe and fittings shall have an interior protective lining of "Protecto 401" epoxy or equal with a minimum dry film thickness of 40 mils applied by the pipe manufacturer.

1.19.4.5. POLYETHYLENE ENCASEMENT

The pipe shall be polyethylene encased (8 mil) where shown on the DRAWINGS, in accordance with ANSI/AWWA A21.51/C105.

Sec. 1.19.5. PIPE HANDLING

Requirements specified in Section 1.24.2. shall apply.

Sec. 1.19.6. AIR AND VACUUM RELEASE VALVES

1.19.6.1. GENERAL

Wastewater force mains shall be equipped with air/vacuum release valves located at piping high points immediately upstream of dips, or other elevation declines. Valves shall be located in an enclosure as shown on the STANDARD DETAILS.

The valves shall be as described below.

1.19.6.2. WASTEWATER AIR/VACUUM VALVE

The valve body shall be of cast iron; the floats float guide and stem shall be of stainless steel. The valve shall be suitable for 100 psi working pressure. Valve shall have standard two (2) inch NPT inlet and outlet ports unless otherwise shown on the DRAWINGS. Provide back-flushing accessories.

Sec. 1.19.7. NOTIFICATION AND CONNECTION TO EXISTING MAINS

Sec. 1.19.8. VALVES

1.19.8.1. GENERAL

Valves smaller than 24" shall be resilient wedge gate valves.

Valves 24" and larger shall be resilient faced, eccentric valves.

Valves shall hold the test pressure, when applied in either direction.

All valves for Force Mains must have stainless steel stems and bonnet bolts.

1.19.8.2. VALVE CONSTRUCTION

1.19.8.2.1. Resilient Wedge Gate Valves shall be in accordance with AWWA C509.

- * Shall have fusion bond epoxy coating.
- * Shall have a synthetic rubber encapsulated gate.
- * Shall have oil impregnated bronze mechanical components, for permanent lubrication.
- * Shall have stainless steel stems and bonnet bolts.

Above ground service - flanged, O.S. & Y, handwheel.

Buried service - mechanical joint, NRS and nut.

Submerged or otherwise inaccessible, above ground service - flanged, NRS, floor stand or suitable operator.

1.19.8.2.2. Resilient Faced Eccentric Valves shall be in accordance with AWWA C-540 and C-507.

- * Shall have a synthetic rubber encapsulated plug.
- * Shall be permanently lubricated.
- * Shall have welded, highnickel content, seat overlay.

Above ground service - flanged, handwheel.

Buried service - mechanical joint, totally enclosed operator, nut with extension.

Submerged or otherwise inaccessible, above ground.

Service - flanged, totally enclosed operator, floor stand or suitable equal.

Sec. 1.19.9. VALVE BOXES

Sec. 1.19.10. SEPARATION OF FORCE MAINS AND WATER MAINS

Requirements 10 feet horizontally from pipes carrying raw wastewater or storm water.

Sec. 1.19.11. FORCE MAIN CONSTRUCTION

Requirements specified in Section 1.23.5. shall apply.

Sec. 1.19.12. HYDROSTATIC TESTS

Requirements specified in Section 1.24.5. shall apply except that all pipe sections to be tested shall be subjected to a hydrostatic pressure of 150 psi.

Sec. 1.19.13. FINAL CLEANING

Prior to final inspection and acceptance of the force main by the CITY, CONTRACTOR shall remove all parts of the system. Flushing and cleaning shall remove all accumulated foreign material from the sewer system.

Sec. 1.19.14. LOCATION AND IDENTIFICATION

All force mains shall be installed with a continuous, insulated 10 gauge solid copper wire (Tracer Wire) taped directly on top of the pipe for location purposes. Terminate insulated locator wires, capable of extending 12 inches above top of box, at each valve box pad.

All force mains shall be green in color or marked with a continuous stripe located within the top 90 degrees of the pipe. Said stripe shall be a minimum 2 inches in width and shall be green in color. Paint should be touch-dry before backfilling. Warning tape shall be placed 12 to 18 inches above all pipe.

SECTION 1.20. WASTEWATER PUMP STATION

Sec. 1.20.1. GENERAL

This Section includes the specifications for equipment, materials, site work, fences and appurtenances for the installation of wastewater pump stations.

Sec. 1.20.2. WET WELL AND VALVE SLAB

Wet well and valve slab shall be constructed as shown on the STANDARD DETAIL entitled "Lift Station".

Sec. 1.20.3. ACCESS FRAMES AND COVERS

The wet well shall be furnished with aluminum access frames and covers. Equipment furnished shall include 1 ½" nominal diameter aluminum grab rail, stainless steel upper guide holder and level sensor cable holder. Doors shall be of aluminum checkered plate. The access cover and frame shall be sized as shown on the DETAILS.

Sec. 1.20.4. PUMPS AND CONTROLS

Pumps and miscellaneous accessories shall be as specified in Section (1.21.). Controls and miscellaneous accessories shall be as specified in Section 1.22.

Sec. 1.20.5. PIPING, VALVES AND ACCESSORIES

1.20.5.1. PIPING

In fluent piping to the wet well shall meet the requirements of Section 1.14. and 1.19. Flexible boot connection shall be provided at underground wall penetrations. All pipe inside the wet well and the valve vault shall be as shown on the STANDARD DETAIL entitled "Lift Station".

1.20.5.2. VALVES

Valves shall meet the requirements of Section 1.19.8. (wastewater force mains) (valves)

1.20.5.3. CHECK VALVES

Check valves for ductile iron pipelines shall be swing type and shall meet the material requirements of AWWA C500. The valves shall be iron body, bronze mounted, single disc, 150 psi working water pressure, nonshock, and hydrostatically tested at 300 psi. Ends shall be 125 pound ANSI B16.1 flanges.

When there is no flow through the line the disc shall hang lightly against its seat in practically a vertical position. When open, the disc shall swing clear of the waterway. Check valves shall have bronze seat and body rings, extended bronze hinge pins and stainless steel nuts on the bolts of bolted covers.

Valves shall be so constructed that disc and body seat may easily be removed and replaced without removing the valve from the line. Valves shall be fitted with an extended hinge arm with outside lever and weight. If pump shut off head exceeds 77 feet, then an air cushioned assembly shall be installed.

1.20.5.4. PRESSURE GAUGES

Pressure gauges shall be installed on the discharge pipe as indicated on the STANDARD DETAILS. Each pressure gauge shall be direct mounted, 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, shut-off (isolation) cock or valve. All gauges shall be weatherproofed. The face dial shall be white finished aluminum with jet black graduations and figures. The face dial shall indicate the units of pressure measured in psi, with a 0-60 psi range.

Pressure gauges shall not be installed until after the substantial completion date unless otherwise requested by the CITY.

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Sec 1.20.6 – STANDBY POWER GENERATOR SYSTEM

Sec 1.20.6.1 GENERAL

A standby power generator system shall be installed at pump stations as required by Section 1.6.5. for electrical power during the loss of normal power.

The Scope of Work herein described is for a land developer to furnish and install a complete standby power system, including all equipment material and appurtenances, tested and accepted by the City. These terms shall convey the following meanings.

Vender, contractor, and developer shall represent the group of parties collectively providing the equipment and appurtenances, installing the materials into a complete standby power system and turning that system over to the City of Davenport. No distinction is intended to limit responsibilities between the individual members of this group.

City and Owner shall mean the City of Davenport Utilities Department.

Owner's land shall mean land over which the City owns in fee simple, land over which the City holds an exclusive easement or over which the development plans indicate a developer commitment to convey land in fee simple or an exclusive easement.

Sec 1.20.6.2 SPECIFICATION

These technical specifications were prepared by the City of Davenport Utilities Division.

1.20.6.2.1 FINAL ACCEPTANCE

Final acceptance shall take place after installation, start-up, and FDEP certification is receive for the lift station system.

Sec 1.20.6.3 TECHNICAL REQUIREMENTS

1.20.6.3.1 QUALIFICATIONS

The engine-generator set shall be the standard product, as modified by these specifications, of a MANUFACTURER regularly engaged in the production of this type of equipment. The unit to be furnished shall be of proven ability and shall be designed, constructed, and installed in accordance with best practices and methods. The dealer shall have a minimum of ten (10) years' experience in the field of power generation. It is the intent of this specification to secure a generator system that has been prototype tested, factory built, production tested, site tested and of the latest commercial design, together with all accessories necessary for a complete installation as shown on the plans and drawings, and specifications herein. The equipment supplied and installed shall meet the requirements of the NEC, along with all applicable local codes and regulations. All equipment shall be new, of current production of a national firm which manufactures the engine/generator and controls, and assembles the generator system as a matched unit so that there is one-source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen.

The unit shall be shipped to the jobsite by an authorized engine dealer having a parts and service facility within a 50-mile radius of the jobsite. The unit must be of such physical dimensions as to make a good installation in the opinion of the ENGINEER, in the space provided as indicated on the Drawings.

The unit shall be assembled in the U.S. with over 50% of the components such as the engine, generator, auxiliary equipment, etc., manufactured in the U.S. by a MANUFACTURER currently engaged in the production of such equipment.

Sec 1.20.6.4 GENERATOR SET

1.20.6.4.1 GENERAL

The equipment supplied and installed shall meet the requirements of the National Electric Code and all applicable local codes and regulations. All equipment shall be new, of current production by a firm which manufactures the generator and controls, transfer switch, and assembles the generator set as a matched unit so that there is one-source responsibility for warranty, parts, and service through a local representative with factory-trained service personnel. Entire unit shall meet UL 2200 requirements.

1.20.6.4.2 SUBMITTAL

As a minimum for all equipment specified and provided, for each site, submit the following in pdf to City of Davenport Wastewater Utilities Department. Submittal shall include specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number each required interconnection between the generator set, the transfer switch, and other remote devices if included elsewhere in these specifications. The complete installation manual shall be delivered with the submittal. **No equipment is to be ordered until the submittal is approved**

1.20.6.4.3 PRODUCTS

The standby generator set shall be rated standby power (defined as continuous operation for the duration of any power outage), 500 feet altitude, and temperature range from 72 °F (22.2 °C) minimum to 122°F (50°C) maximum as manufactured by Blue Star Power Systems and Gillette Generators, or prior approved equal. The standby generator shall be sized to operate all pumps starting sequentially plus all appurtenances. The generator main breakers, power panel and pump station main breaker and transfer switch main breaker shall be equally sized. The standby generator shall not be de-rated when variable frequency drive (VFD) or reduced voltage (soft start) motor starters are used. If the belly tank exceeds 36"- 0" in height, then an aluminum catwalk or attached step located on the fuel tank shall be provided to access the controller and breakers.

Any request for approval of an alternate product or supplier must be received and acknowledged by the City of Davenport. This request must include a paragraph by paragraph statement of compliance or deviation to the written specification. Any requests for deviations to the specification must include adequate data to warrant approval. Any request for approval of a different supplier other than that specified above must include a complete

history of past performance and references detailing past success in furnishing a unit of the size specified.

A minimum of three references shall be furnished along with contact person's name and contact number. Requests for approval that are incomplete or that cause the specified to ponder as to what is being offered will be rejected. There are no exceptions to these requirements.

Sec 1.20.6.5 ENGINE AND COMPONENTS

1.20.6.5.1 Starting System

The engine shall be a liquid cooled, diesel fueled, turbocharged after-cooled engine of 4-stroke cycle design.

The engine shall be cooled with a unit mounted radiator, fan, water pump, and closed coolant recovery system providing visual diagnostic means to determine if the system is operating with a normal engine coolant level. The radiator shall be designed for operation in 110-degrees Fahrenheit temperature.

The intake air filter(s) with replaceable paper element(s) shall be mounted on the unit. Full pressure lubrication shall be supplied by a positive displacement lubrication oil pump. The engine shall have a replaceable oil filter(s) with an internal bypass. Engine coolant and oil drain extensions, equipped with pipe plugs, and shall be provided to outside of the engine mounting base for cleaner and more convenient engine servicing. A fan guard shall be installed for personnel safety.

The engine shall have a battery charging direct current (DC) alternator with a transistorized voltage regulator. Remote 2-wire starting shall be by a solenoid shift, electric starter motor.

Engine speed shall be controlled by an isochronous governor to maintain alternator frequency within 0.5% from no load to full load alternator output. Steady state regulation shall be 0.25%.

The engine fuel system shall be designed for operation on No. 2 diesel fuel. A primary fuel filter, water separator, manual fuel priming pump, fuel shutoff solenoid and all fuel lines shall be installed at the factory. The primary diesel fuel filter element shall be replaceable and capable of removing contaminants of 10-microns.

The engine shall have a thermostatically controlled water jacket heater unit(s) to aid in quick starting with wattage as recommended by the manufacturer. The contractor shall provide proper branch circuit from normal utility power source. See Details 35 A and B. Line voltage of the jacket heater shall be the same as the main service voltage. Adding transformers is not acceptable. Sensing elements shall be located on the engine for low oil pressure shutdown, high coolant temperature shutdown, low coolant level shutdown, over-speed shutdown and over-crank shutdown.

These sensors shall be connected to the control panel using a wiring harness with the following features: wire number labeling on each end of the wire run for easy identification, a molded rubber boot to cover the electrical connection on each sensor to prevent corrosion and

all wiring to be run in flexible conduit for protection from the environment and any moving objects.

Sec 1.20.6.6 FUEL SYSTEM - DIESEL

The fuel storage tank, fittings, gauges and piping shall be supplied by the generator set manufacturer in accordance with NFPA and applicable local codes and as specified. Flexible fuel connectors shall be supplied to isolate vibration at the engine.

Sec 1.20.6.7 COOLING SYSTEM

A unit mounted radiator will be furnished complete with a blower fan and glycol coolant. The maximum radiator airflow restriction of 0.5 " WC must be taken in account when sizing the cooling system. The cooling system will be sized to maintain a safe engine temperature at the appropriate ambient conditions. Proper ducting must be used to prevent overheating.

Crankcase fumes disposal shall terminate in front of the radiator to prevent oil from collecting on the radiator core and reducing cooling capacity.

Sec 1.20.6.8 EXHAUST SYSTEM

An Exhaust silencer shall be furnished of industrial standard construction, all welded, for stationary engine application. **The silencer shall attenuate exhaust noise to a critical level.** A seamless, stainless, convoluted flexible exhaust connector shall be provided. The entire exhaust system and silencer shall be supported independently of the generator set to prevent transmission of vibration and allow for thermal expansion. Long radius, low restriction fittings will be used throughout, and pipe size will be sufficiently large to handle the engine exhaust flow at full load without causing back pressure in excess of that allowed by the engine manufacturer.

Sec 1.20.6.9 ENGINE LUBRICATION SYSTEM

The engine shall be furnished with a gear type lube pump that will furnish oil under pressure to moving parts. Full flow lube oil filters shall be provided in addition to a bypass valve that will allow lube oil circulation in the event of a failure of the filtering system.

Sec 1.20.6.10 GOVERNING SYSTEM

ISOCHRONOUS ZERO SPEED DROOP GOVERNING SYSTEM:

The engine generator set shall be provided with a precision electronic governor of the constant speed type. The governor shall be capable of maintaining a steady state bandwidth of not more than $\pm 0.25\%$, at any constant load, from no load to full load. The governor shall maintain governed speed at 60 Hertz at any load, from no load to full load.

Sec 1.20.6.11 BATTERY

A lead-acid, heavy duty battery shall be furnished of sufficient capacity to provide a minimum of five full cycle starts for ten seconds crank with ten second rest periods between cranks. The lead acid battery will be 12 volt or 24 volt as required by the engine specification. The commercial type lead acid battery will include a manifold vent which eliminates corrosion gases away from the terminals and cables. The cells of the battery will be bonded and the partition inter-cell connectors will create a shorter current path to deliver more power to the terminals.

Sec 1.20.6.12 BATTERY CHARGER

1.20.6.12.1 Battery Charger Design Guidelines

Charger shall be designed for heavy-duty industrial service and capable of full-rated output indefinitely at temperatures between -10° C and +50° C. Charger shall be capable of recharging a fully discharged battery of the maintenance-free lead acid, conventional (wet) lead acid or nickel-cadmium type. Charger shall maintain the battery automatically and minimize the need for battery electrolyte replenishment. Conservatively rated SCRs and diodes in full-wave bridge shall be used. A crank disconnect relay shall not be required to protect the charger from overload. Charger shall be unit mounted and natural convection cooled. The housing shall be constructed of rustproof metal (e.g. aluminum) and treated with a protective coating.

1.20.6.12.2 Battery Charger Output

General Characteristics

Output voltage shall be (12 or 24) volts nominal. Float voltage shall be adjustable from 100% to 120% of nominal. Equalize voltage shall be adjustable up to 15% above float voltage. Output voltage adjustments shall be on separate potentiometers in the charger. Charger shall incorporate automatic current limiting with a rectangular current limit characteristic, and shall be capable of operating into a short circuit or dead battery indefinitely without damage or overheating. Charger shall be equipped with output fuses or circuit breakers on the charging leads to prevent charging errors due to long cable runs.

Float/Equalize Control

Charger shall include an automatic equalize feature that is activated when the battery's state of charge is reduced. Individual adjustment potentiometers shall be provided for float voltage, boost voltage and alarm voltages. User interface shall include digital meter: Automatic meter alternately displays output volts, amps.

Sec 1.20.6.13 ENGINE BLOCK HEATER

Block heater of proper wattage and voltage shall be provided which will be thermostatically controlled to maintain the engine block at a suitable temperature to assure rapid to meet the start-up requirement of NFPA-99 or NFPA-110 Regulations. The heater will be of the

industrial tank type with thermo-syphon circulation.

Sec 1.20.6.14 GENERATOR AND COMPONENTS

1.20.6.14.1 Mainline Circuit Breaker Generator Mounted

Provide a generator UL listed main circuit breaker. This breaker is to be set mounted and wired, molded case thermal-magnetic 80% rated for proper generator set operation. It must be mounted in a NEMA rated enclosure at the manufacturers factory prior to shipment. The line side connections are to be made at the factory. A system utilizing a manual reset field circuit breaker and current transformers is unacceptable.

1.20.6.14.2 Construction-PMG Design

Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable 12 leads type for 3 phase alternators.

The power generator will be of the salient pole synchronous type. The generator will be rated at 60 Hertz. The generator will be equipped with armature windings for efficient paralleling. The generator will be equipped with bearing flange-mounted design. The bearing will be a sealed, frictionless, cartridge type. The coupling will be a laminated, steel, semi-flexible, piloting type. The exciter will be direct connected brushless design. Insulation class will be in accordance with the most recent NEMA-MG-1.22.40 requirements for the generator. The generator will be provided with a power terminal cabinet of adequate size for connection of load conductors.

The alternator shall be capable of sustaining at least 300% of rated current for at least 10 seconds under a 3 phase symmetrical short by inherent design or by the addition of an optional current boost system. PMG excitation must be of the true PMG design. The alternator shall be rated at the stated output with a maximum temperature rise of 130 deg.C.. The alternator shall be capable of accepting the loads and instantaneous voltage dip when loads are started as specified. Factory documentation of these requirements shall be made a part of the approval submittals prior to release to production. **3600 rpm alternators will not be accepted.** No exception to these requirements will be allowed.

1.20.6.14.3 Generator Voltage Regulator

The voltage regulator shall be a digital, microprocessor design with solid state voltage build-up. No voltage build-up relay or other relays are acceptable. The unit shall be encapsulated for humidity and abrasion protection. The regulator shall include 1/4% regulation, true volts per hertz operation with adjustable cut in, loss of sensing continuity shutdown, over-excitation shutdown, three-phase RMS sensing, over-voltage protection, and provisions for parallel operation.

1.20.6.14.4 Control Panel

Blue Star model DGC-2020: Open Architecture / Non Proprietary Software

Provide microprocessor-based control system for automatic control, monitoring, and

protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.

Generator engine crank control implements a starting sequence. Three separate start signal inputs available: Manual run button. Closing a contact across the automatic transfer switch input on the back of controller Remote start command through the software Password protected Customized start up sequence RS485 Communications Port for Modbus Protocol.

Available with continuous crank (can be set from 5 to 60 seconds) or cycle crank (can be set from 5 to 15 seconds); cycles are adjustable from 1 to 7

Crank cycle delay can be enabled to control pre-heaters or operate a pre-lube system

Pre-crank delay is adjustable from 0 to 30 seconds

7 shutdown conditions: high coolant temperature over speed, low oil pressure, sender failure, over crank, low fuel level, low coolant level 10 Pre-Alarm conditions can be enabled:

Low fuel

Low coolant temperature High coolant temperature Low oil pressure

Weak battery voltage Battery over-voltage Low battery voltage Battery charger failure

kW overload

Maintenance

A complete metering package displays 28 system parameters to help ensure trouble free operation and can be displayed on the front of the Blue Star DGC- 2020 or remotely on a personal computer

Protection levels for both prime mover and generator Battery failure

Other safety features displayed on panel are display panel on and EPS supplying load

1.20.6.14.5 Base Design

The base shall be constructed of steel. The base shall be designed to rigidly support the engine-generator set, ensure permanent alignment of rotating parts, be arranged to provide easy access to allow changing of lube-oil, and ensure that alignment is maintained during shipping and normal operation. The base shall permit skidding in any direction during installation and shall withstand and mitigate the effects of synchronous vibration of the engine and generator. The base shall be provided with suitable holes for anchor bolts. Coolant and oil drains must be plumbed to base with stainless steel lines and isolation valves with bulk head fittings.

1.20.6.14.6 Vibration Isolation

Vibration Mounts to Isolate Unit from Base Rail. Heavy duty vibration isolators shall be provided between the engine-generator and welded steel base. Between the base of the tank and the concrete slab, (2) runs of 1/2" thick commercial grade neoprene meeting ASTM D2000-BC-609 cut into 4" wide strips shall be placed at the anchoring points on the base tank.

1.20.6.14.7 Sub base Tank

A sub-base fuel tank with a minimum capacity for 48 hours of operation at full load shall be provided. This tank will be a UL 142 listed generator subbase tank. The tank shall be constructed to UL-142, sub base generator specifications and of double wall construction. Tank shall be complete with required vents, openings, low level and leak alarm contacts, mechanical level gauge and required emergency vents. Shall have a convenient stub up area for electrical conduit entry.

All diesel fuel tanks must be coated on the exterior with “Liner Xtreme” (Product Code BLK20), an epoxy/urethane blend painting system, for a minimum total dry mils of 40, but not exceeding 125 dry mils. Any request for approval of an alternate manufacturer’s tank must comply with the prior approval procedure previously stated. The capacity of the fuel tanks shall NOT exceed 540 gallons unless approved by the City of Davenport.

1.20.6.14.8 Housing

Sound attenuated aluminum weather-protective enclosure with hinged side panels to allow inspection and maintenance. Sound level shall not exceed 71 db at a distance of 23 feet. Wind load rating on the enclosure shall be 150 mph. The enclosure shall be coated with primer and two coats of high-gloss, weather-proof, sag resistant vinylac in the manufacture’s standard color through an electrical bonding process. The specified exhaust silencer shall be integrated inside the enclosure. The enclosure is to have large piano style hinged doors to allow access to engine, alternator, and control panels. Each door is to be fitted with stainless steel lockable hardware with identical keys. Padlocks do not meet this specification.

Crankcase fumes disposal shall terminate in front of the radiator to prevent oil from collecting on the radiator core and reducing cooling capacity.

1.20.6.14.9 Startup and Warranty Validation

The start-up of engine generator set and automatic transfer switch (if applicable) will be performed by an authorized service dealer of the Manufacturer. The test will include instruction to personnel of normal maintenance and operation under existing load available. All systems shall be operated for proper starting and stopping and transfer of the emergency power.

1.20.6.14.10 Manufacturer’s Product Period of Warranty

The standby electric generating system components, complete engine-generator and instrumentation panel shall be warranted by the manufacturer against defective materials and factory workmanship for a period of **two years or 2,000 hours**.

Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge. The warranty period shall commence when the standby system is invoiced by the factory. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided.

Sec 1.20.6.15 AUTOMATIC TRANSFER SWITCH

Furnish and install automatic transfer switches (ATS) with number of poles, amperage, voltage, and withstand current ratings as shown on the plans. Each automatic transfer shall consist of an inherently double throw power transfer switch unit and a

microprocessor controller, interconnected to provide complete automatic operation. All transfer switches and control panels shall be the product of the same manufacturer.

1.20.6.15.1 Acceptable Manufacturers

Automatic transfer switches shall be ASCO Series 300 or Equal.

Any alternate shall be submitted to the consulting engineer in writing at least 10 days prior to bid. Each alternate bid must list any deviations from this specification.

1.20.6.15.2 Codes and Standards

The automatic transfer switches and accessories shall conform to the requirements of:

- A.** UL 1008 - Standard for Automatic Transfer Switches
- B.** NFPA 70 - National Electrical Code
- C.** NFPA 110 - Emergency and Standby Power Systems
- D.** IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
- E.** NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches
- F.** NEC Articles 700, 701, 702
- G.** International Standards Organization ISO 9001

1.20.6.15.3 Mechanically Held Transfer Switch

A. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main operators which include overcurrent disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.

B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.

C. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand current capability and be protected by separate arcing contacts.

D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.

E. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

F. Where neutral conductors must be switched, the ATS shall be provided with fully rated neutral transfer contacts.

G. Where neutral conductors are to be solidly connected, a neutral terminal plate with fully-rated AL-CU pressure connectors shall be provided.

1.20.6.15.4 Microprocessor Controller with Membrane Interface Panel

A. The controller shall direct the operation of the transfer switch. The controller's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and inherent serial communications capability. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.

B. The controller shall be enclosed with a protective cover and be mounted separate from the transfer switch unit for safety and ease of maintenance. Sensing and control logic shall be provided on printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers.

C. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:

1. ANSI C37.90A/IEEE 472 Voltage Surge Test
2. NEMA ICS – 109.21 Impulse Withstand Test
3. IEC801-2 Electrostatic discharge (ESD) immunity
4. ENV50140 and IEC 801 – 3 Radiated electromagnetic field immunity
5. IEC 801 – 4 Electrical fast transient (EFT) immunity
6. ENV50142 Surge transient immunity
7. ENV50141: Conducted radio-frequency field immunity
8. EN55011: Group 1, Class A conducted and radiated emissions
9. EN61000 –4 – 11 Voltage dips and interruptions immunity

1.20.6.15.5 Enclosure

A. The ATS shall be furnished in a NEMA 4X Stainless Steel enclosure

B. Controller shall be flush-mounted display with LED indicators for switch position and source availability. It shall also include test and time delay bypass switches.

1.20.6.16 PART 3 OPERATION

1.20.6.16.1 Voltage and Frequency Sensing

A. The voltage of each phase of the normal source shall be monitored, with pickup adjustable to 95% of nominal and dropout adjustable from 70% to 90% of pickup setting.

B. Single-phase voltage and frequency sensing of the emergency source shall be provided.

1.20.6.16.2 Time Delays

A. An adjustable time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals.

B. An adjustable time delay shall be provided on transfer to emergency, adjustable from 0 to 5 minutes for controlled timing of transfer of loads to emergency.

C. An adjustable time delay shall be provided on retransfer to normal, adjustable to 30 minutes. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.

D. A 5-minute cool down time delay shall be provided on shutdown of engine generator.

E. All adjustable time delays shall be field adjustable without the use of tools.

1.20.6.16.3 Additional Features

- A.** A set of gold-flashed contacts rated 10 amps, 32 VDC shall be provided for a low voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.
- B.** A push-button type test switch shall be provided to simulate a normal source failure.
- C.** A push-button type switch to bypass the time delay on transfer to emergency, the engine exerciser period on the retransfer to normal time delay whichever delay is active at the time the push-button is activated.
- D.** Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal.
- E.** Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact, closed, when the ATS is connected to the emergency source.
- F.** Indicating lights shall be provided, one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red). Also provide indicating lights for both normal and emergency source availability.
- G.** Terminals shall be provided to indicate actual availability of the normal and emergency sources, as determined by the voltage sensing pickup and dropout settings for each source.

1.20.6.16.3 Engine Exerciser

An engine generator exercising timer shall be provided, including a selector switch to select exercise with or without load transfer. It will be a seven day electronic time switch for automatic weekly testing of the engine - generator set. The exerciser shall be fully programmable and backed up by a permanent battery.

A fully programmable engine exerciser with seven independent routines to exercise the engine generator, with or without loads, on a daily, weekly, bi-weekly or monthly basis. Engine exerciser setting can be displayed and changed from the user interface keypad.

Program Control to periodically exercise the emergency engine-generator plant. The engine-generator should be exercised under load once a week for minimum time period of 60 minutes.

1.20.6.16.4 Inphase Monitor

An Inphase monitor shall be inherently built into the controls. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer.

1.20.6.16.5 Selective Load Disconnect

A double throw contact shall be provided to operate after a time delay, adjustable to 20 seconds prior to transfer and reset 0 to 20 seconds after transfer. This contact can be used to selectively disconnect specific load(s) when the transfer switch is transferred. Output contacts shall be rated 6 amps at 28 VDC or 120 VAC.

1.20.6.16.6 Withstand and Closing Ratings+

A. The ATS shall be rated to close on and withstand the available rms symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans. WCR ATS ratings as be as follows when used with specific circuit breakers:

<u>ATS Size</u>	<u>Withstand & Closing Rating MCCB</u>	<u>W/CLF</u>
30 – 200	22,000A	200,000
225 – 400	42,000A	200,000
600 – 1200	65,000A	200,000
1600 – 2000	85,000A	200,000
2600 – 3000	100,000A	200,000

1.20.6.15.7 Tests and Certification

A. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

9.20.6.16.8 Startup and Warranty Validation

The start-up of engine generator set and automatic transfer switch (if applicable) will be performed by an authorized service dealer of the manufacturer. The test will include instruction to personnel of normal maintenance and operation under existing load available. All systems shall be operated for proper starting and stopping and transfer of the emergency power.

9.20.6.16.9 Manufacturer's Product Period of Warranty

The standby electric generating system components, complete Automatic Transfer Switch (ATS) shall be warranted by the manufacturer against defective materials and factory workmanship for a period of **two years from the date installed**. Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge. Satisfactory warranty documents must be provided.

1.20.6.17 TESTING

The intent of this specification is to provide equipment of proven reliability and compatibility. In addition to providing factory prototype test data, two separate production tests shall be performed; factory production tests and field tests. The equipment shall be installed by the Vendor/Contractor in accordance with the manufacturer's recommendations and all applicable codes.

Factory prototype tests

To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer shall be responsible for design prototype tests as described herein: Components of the emergency system, such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes which will not be sold, shall be used for these tests. Prototype test programs shall include the requirements of NFPA-110 and the following:

Minimum 1 hour load test Full load at unity, 1.0 PF

Recordings of the maximum load carrying capabilities of the engine generator set

Maximum single block load pickup capability

Kilowatts Amperes Voltage

Kilovolt amperes

Resistance of exciter field and stator

Insulation test, generator field, exciter armature, exciter field, generator armature

Dielectric test, generator armature, generator field, exciter armature, exciter field

Lube oil pressure (if applicable) Time

Water temperature (if applicable) Battery charge rate (if applicable) Heaters, jacket water and/or lube oil Safety shutdowns and automatic controls

Accessories (annunciator panel, charger, pumps as supplied) Phase sequence on three phase

Full load and .4PF to verify the motor starting capability of the engine generator set (optional)

Frequency;

Full rated load at rated PF and maximum load, to verify engine power, overload and maximum capability.

kVA, kilowatts, amperes, voltage, frequency and voltage transients at ½ and rated load frequency at: no load, full load rated and maximum output.

Regulator range (adjust), phase sequence, phase voltage balance.

Stator and exciter field resistance.

Insulation test, generator field, exciter armature, exciter field, generator armature or stator.

Dielectric test, generator field, exciter armature, exciter field, generator armature or stator.

All safety shutdown and automatic controls. Standard testing includes portions of MIL-

STD 705: MIL-STD-705 Methods:

301.1b: Insulation Resistance Test

302.1a: High Potential Test

401.1a: Winding Resistance Test

410.1a: Open Circuit Saturation Curve Test

503.1b: Start and Stop Test

505.2a: Overspeed Protective Device Test

507.1c: Phase Sequence Test (Rotation)

508.1c: Phase Balance Test (Voltage)

- 510.1c: Rheostat Range Test
- 511.1c: Regulator Range Test
- 511.2b: Frequency Adjustment Range Test
- 515.1a: Low Oil Pressure Protective Device Test
- 515.2a: Overtemperature Protective Device Test
- 516.1: Controls, Direction of Rotation
- 640.1c: Maximum Power Test

1.20.6.17.1 Factory Production Tests

Before shipment of the equipment, all components shall be tested under rated load and power factor for performance and proper functioning of control and interface. These tests shall be performed to the name plate power factor rating with a reactive load bank. Certified copies on the test results shall be supplied to the engineer for approval before final acceptance by the owner.

1.20.6.17.2 Field Test After Installation

The complete installation shall be initially checked, started and tested for operational compliance by a factory representative. The time and date of the site tests shall be coordinated with the Owner.

- A.** Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations under the environmental conditions present and expected. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. This shall include: engine heaters, battery charger, generator strip heaters, remote annunciator, etc.
- B.** Initial start-up testing shall include check for exhaust leaks, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and phase rotation while running a known test load. Upon completion of initial start-up and system check out, the supplier of the Emergency Generator set shall perform a field test to demonstrate load carrying capability, stability, voltage, and frequency. It shall be tested under varying loads with guards and exhaust system in place.
- C.** The equipment shall be tested to show it is free of defects and will start automatically by means of simulated power outage. Prior to this test, all transfer switch timers shall be adjusted for proper systems coordination. It shall be subjected to testing by using portable load banks provided by generator set supplier. Engine temperature, oil pressure and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test. Load bank shall be capable of definite and precise incremental loading and shall not be dependent on generator control instrumentation to read amperage and voltage of each phase.
- D.** Test instrumentation shall serve as a check of generator set meters. Salt water brine tanks are not acceptable. Under no circumstances shall job site load be utilized for this test. Load bank testing shall be done in the presence of the Owner's Representative after unit is permanently installed in accordance with the drawings and specifications. Load Bank Testing shall be for a minimum of four hours under full load. Tests shall include:

- 1. Single-step load pickup.
- 2. Transient and steady-state governing.

3. Safety shutdown device testing
4. Voltage regulation.
5. Rated Power.
6. Maximum Power.

Prior to acceptance, any defects which became evident during this test shall be corrected at no additional expense to the Owner.

E. The CONTRACTOR shall refill the main fuel tank at the completion of the test

1.20.6.17.3 Submittal, Operator's Manual, Certification and Warranty

Submittal shall include specification sheets showing all standard and optional accessories to be supplied; foundation plan; schematic wiring diagrams; dimension drawings; and interconnection diagrams identifying by terminal number of each required interconnection between the generator set, the transfer switch, and the remote annunciator panel and the load. The complete installation manual shall be delivered with the submittal. Equipment shall not be released for manufacture until submittal materials are approved. Each standby electrical power system shall be provided with an operator's manual providing installation and operating instructions. On request, the manufacturer shall provide a letter certifying compliance with all requirements of the transfer switch specification. The certification shall identify equipment by serial number.

1.20.6.17.4 Codes and Regulations

All materials and equipment shall be in accordance with any and all applicable Federal, State, and Local codes, laws, and ordinances in effect at the jobsite. All of the above referenced codes, laws, and ordinances shall take precedence over these specifications in case of any conflict. All such conflicts shall be referred to the OWNER for adjudication. The following industry, association, and government codes and standards shall be followed as applicable to the design, fabrication, assembly, installation, and testing of all materials and equipment furnished under this specification:

AISC-American Institute of Steel Construction
AISI-American Iron and Steel Institute
ANSI-American National Standards Institute
ASME-American Society of Mechanical Engineers
ASTM-American Society of Testing and Materials
AWS-American Welding Society
FM-Factory Mutual
IEEE-Institute of Electrical and Electronics Engineers
NACE-National Association of Corrosion Engineers
NEMA -National Electrical Manufacturers Association
OSHA-Occupational Safety and Health Administration
SBCC-Southern Building Code Congress
SSP-Structural Steel Painting Council
UL-Underwriters Laboratories

1.20.6.18 DELIVERY & ACCEPTANCE OF EQUIPMENT

1.20.6.18.1 Acceptance of Material

The material will be accepted after all work included in the contract is completed to the satisfaction of the OWNER, after the material has been installed, connected, and placed in operation by the Vendor/Contractor, and when performance guarantees have been met.

The VENDOR shall include sufficient training to assure proper operation and maintenance of the equipment, and to certify the OWNER'S personnel in safely operating and maintaining the equipment.

1.20.6.18.2 Identification

Each complete field assembly shall be given an IDENTIFICATION number or letter, and each part of each field assembly which is not permanently connected in shop assembly shall be legibly marked. Shop assembly and subassemblies as used herein are defined as minor assembly or parts for ease of shipment. Descriptions and diagrams of all such markings shall be supplied. Each piece or subassembly separately packaged for shipment shall be labeled or tagged with the project name. Material shipped without a complete packing list shall be subject to rejection. All material shall be furnished with a permanently attached stainless steel nameplate. If the equipment is to be insulated the nameplate shall be raised at least one inch above the surface. As a minimum, the following information is to be on the plate:

- a) Manufacturer's Name
- b) Model and Serial Number
- c) Size and/or Type
- d) Item Number
- e) Design Data
- f) Date of Manufacture

A shipping tag must be securely attached to each package shipped. This tag must be durable and must be plainly marked with the project name and equipment item number. Separate packages for a single item must be so marked as to identify the component(s) in each package.

1.20.6.18.3 Spare Parts

The VENDOR'S instruction manual shall include an itemized list of recommended spare parts that should be stocked by OWNER, after warranty expires, to assure proper and expedient maintenance. The VENDOR shall stock spare parts for the material or guarantee delivery of parts within 48 hours.

1.20.6.18.4 Training

The VENDOR shall include sufficient training to assure proper operation and maintenance of the equipment, and to certify the OWNER'S personnel in safely operating and maintaining the equipment.

1.20.6.18.5 Drawings

The VENDOR shall furnish drawings of sufficient detail to document, identify, and define the system(s) and equipment supplied under this Contract.

The drawings shall provide both general and detailed information as follows:

- A. System drawings shall show the physical and/or operational relationships of the composite system and major sub-systems. These drawings may include general layout, outline, plan, elevation, and schematic drawings. All drawings shall reference other related system and detail drawings.
- B. Detail and section drawings shall show all component parts, and shall include dimensions, manufacturer, and part numbers. These drawings shall reference the related system drawing.
- C. Detail drawing showing internal measurements of the fuel tank.

The transmittal of drawings shall include one AutoCAD drawing file stored on CD, and one (1) reproducible print.

1.20.6.18.6 Instruction Manuals

The VENDOR shall furnish operation manuals that provide detailed instructions relative to proper unloading, storage, installation, calibration, and maintenance of equipment supplied and an itemized list of recommended spare parts.

The transmittal of instruction manuals shall include one (1) printed copy and one (1) electronic copy.

1.20.6.18.7 Document Distribution

The mailing address for all correspondence, drawings, and manuals will be as follows:

City of Davenport
Utilities Department
1318 By Goss
Davenport, FL 33837
Tag: Project Manager & Project Name

Sec. 1.20.7 FLOW MONITORING SYSTEM

1.20.7.1. GENERAL

When indicated on the DRAWINGS or as required by Section 1.6.4., a flow monitoring system capable of indicating, recording, and totalizing wastewater flows shall be provided. The system shall include magnetic flowmeter/transmitter, electronic recording receiver, and miscellaneous related accessories as specified herein. It shall be the CONTRACTOR's responsibility to provide and install such equipment resulting in a completely operational flow monitoring system.

1.20.7.2. MAGNETIC FLOWMETER/TRANSMITTERS

The magnetic flowmeter shall be of the low frequency electromagnetic induction type and shall produce a DC pulsed signal directly proportional and linear to the liquid flow rate. The meter shall be designed for operation on 120 VAC+ 10%, 60 Hz + 5% with a power consumption of less than 20 watts for sizes through 12-inches.

The metering tubes shall be constructed of stainless steel. All magnetic flowmeters shall be designed to mount directly in the pipe between ANSI Class 150 flanges and shall consist of a flanged pipe spool piece with laying length of at least 1-1/2 times the meter diameter. Meters shall be mounted according to manufacturer's specifications, but, as a general rule, precautions must be taken to assure that the metering tube is filled at all times during measurement (i.e. do not mount meter at system high point). Meters shall have polyurethane liners with stainless steel electrodes.

The electronics portion of the magnetic flowmeter shall include both a magnet environment. A separate terminal strip for power connection shall be supplied. Driver to power the magnet coils and a signal converter. The signal converter shall be integrally mounted. The converter shall include a separate customer connection section to isolate the electronics compartment and protect the electronics from the electronics shall be of the solid state, feedback type and utilize integrated circuitry.

The input span of the signal converter shall be continuously adjustable between 0-1 and 0-31 fps for both analog and frequency outputs. The converter shall not be affected by quadrature noise nor shall it require zero adjustment or special tools for start-up.

Input and output signals shall be fully isolated. The converter output shall be 4 to 20 mA DC into 0 to 900 ohms. Meter shall be suitable for outdoors installation

and shall be furnished complete with grounding rings and installation hardware including studs, nuts, gaskets, and flange adapter hardware.

The converter shall include an integral zero return to provide a constant zero output signal in response to an external dry contact closure.

Converter shall also include digital type switches for direct adjustment of scaling factor in engineering units along with integral calibration self-test feature to verify proper operation of the electronics.

The meter shall be hydraulically calibrated at a facility located in the United States and the calibration shall be traceable to the National Bureau of Standards. A computer printout of the actual calibration data giving indicated versus actual flows at a minimum of three (3) flow rates shall be provided with the meter. A certification letter shall accompany the computer printout of the calibration data for each meter referencing the meter's serial number. The accuracy of the metering system shall be 1% of rate from 10 to 100% of flow for maximum flow velocities of 3 to 31 feet per second.

Complete zero stability shall be an inherent characteristic of the meter system to eliminate the need to zero adjust the system with a full pipe at zero flow.

The meter housing shall be splash-proof and weather resistant design. The meter shall be capable of accidental submergence in up to 30 feet of water for up to 48 hours without damage to the electronics or interruption of the flow measurement.

1.20.7.3. ELECTRONIC RECORDING RECEIVER

The electronic recording receiver shall be of the solid state, null-balance, servo operated potentiometer type.

The instrument shall contain a differential amplifier, a TORQ-ER driver motor to position the pen, and a Flux Bridge contact less solid state position feedback device for balancing. The instrument shall be capable of receiving one process variable input. Inputs shall be provided with electrical isolation. The instrument shall accept an input signal of 4 to 20 mADC.

Electrical zero and span adjustments shall be provided. Power requirements shall be 120 VAC+ 10%, 60 Hz. A power supply shall be provided for two-wire transmitters. Accuracy shall be + 0.5% of span, with repeatability of + 0.2% of span.

The receiver shall be provided with an indicating 5-inch segmental scale.

The electronic recording receiver shall be housed in a cast aluminum case suitable for panel mounting. The case shall have a gasketed door with glass window. A 12-inch circular chart shall be provided, with 7 day/rev. and chart rotation. An eight (8) digit electronic totalizing counter shall also be provided.

1.20.7.4. WARRANTY AND SERVICE

WARRANTY

Products shall be guaranteed to be free from defects in material and workmanship under normal use and service for a period of one (1) year after start-up.

SERVICE

Service shall be available for insitu repair of the products. Manufacturer's Repair personnel shall be based in Florida to insure a reasonable response time of not more than two (2) working days.

Sec. 1.20.8. CHAIN LINK FENCE

1.20.8.1. GENERAL

The CONTRACTOR shall furnish and erect the chain link fence and gate in accordance with these specifications and in conformity with the lines, grades, notes and typical sections shown on the DRAWINGS and the STANDARD DETAILS.

1.20.8.2. MATERIALS

The fabric, posts, fastenings, fittings and other accessories for chain link fence shall meet the requirement of AASHTO M 181 with the following changes:

1. The weight of coating of wire fabric shall be 1.2 ounces of zinc per square foot (Class B).
2. The galvanizing of steel materials shall be hot-dipped galvanized.
3. The weight of coating on posts and braces shall be 1.8 ounces of zinc per square foot, both inside and outside to meet the requirements of AASHTOM 111.

The base metal of the fabric shall be a good commercial quality 11.5 Gage Steel Wire. The fabric shall be of uniform quality, and shall be 6 foot high with a 2 inch mesh size.

All posts and rails shall be in accordance with the following schedule:

End, corner and pull posts - 2 3/8" O.D., Schedule .055.

Line posts and gate frames - 2" O.D., Schedule .065.

Gate Posts - 3" O.D., Schedule .065.

Post braces and top rail - 1 5/6" O.D., Schedule .055.

Tension wire shall be 0.177 inch coiled spring wire tensioned along the bottom of the fabric and shall be coated similarly to the wire fabric.

Miscellaneous fittings and hardware shall be zinc coated commercial quality or better steel or zinc coated cast or malleable iron as appropriate for the article. Post caps, designed to provide a drive fit over the top of the tubular post to exclude moisture, shall be provided.

1.20.8.3. INSTALLATION

POST SETTING

All post shall be set three (3) feet deep in concrete footings, 12" diameter for line posts, gate and corner posts.

After the post has been set, aligned and plumbed, the hole shall be filled with 2500 p.s.i. concrete. The concrete shall be thoroughly worked into the hole so as to leave no voids. The exposed surface of the concrete shall be crowned to shed water.

End, corner, pull and gate posts shall be braced to the nearest post with horizontal brace used as a compression member and a galvanized 3/8 inch steel truss rod and truss tightener used as a tension member. Corner posts and corner bracing shall be constructed at all changes of fence alignment of 30 degrees or more. All chain link fence shall be constructed with a top rail and bottom tension wire.

GATES

Swing gates shall generally be two 6-foot wide double hung gates as indicated on the STANDARD DETAILS and hinged to swing through 180 degrees from closed to open and shall be complete with latches, locking device, stops keeper, hinges, fabric and braces. Gates shall be the same height as the fence and the gate fabric shall be the same as the fence fabric.

Gate leaves less than 8 feet wide shall have truss rods or intermediate braces and gate leaves 8 feet or more in width shall have intermediate braces and diagonal truss rods or shall have tubular members as necessary to provide rigid construction, free from sag or twist.

PLACING FABRIC

The fabric shall not be placed until the posts have been permanently positioned and concrete foundations have attained adequate strength. The fabric shall be placed by securing one end and applying sufficient tension to remove all slack before making permanent attachments at intermediate points.

The fabric shall be fastened to all corner, end and pull posts by substantial and approved means. Tension for stretching the fabric shall be applied by mechanical fence stretchers.

Submittals shall be provided to the CITY in triplicate (minimum) and include the following:

1. Shop and erection drawings showing all important details of construction, dimensions and anchor bolt locations.
2. Descriptive literature, bulletins, and/or catalogs of the equipment.
3. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves, based on actual shop tests of similar units, which show that they meet the specified requirements for head, capacity, efficiency, NPSHR, submergence and horsepower. Curves shall be submitted on eight and one-half (8 ½) inch by eleven (11) inch sheets, at as large a scale as is practical. Curves shall be plotted from no flow at shut off head to maximum manufacturer recommended pump capacity. Catalog sheets showing a family of curves will not be acceptable.
4. Complete layouts, wiring diagrams, elementary or control schematics, including coordination with other electrical control devices operating in conjunction with the pump control system. Suitable outline drawings shall be furnished for approval before proceeding with manufacture of any equipment. Standard preprinted sheets or drawings simply marked to indicate applicability will not be acceptable.
5. A drawing showing the layout of the pump control panel shall be furnished. The layout shall indicate all devices mounted on the door and in the panel shall be completely identified.
6. The weight of each pump.
7. Complete motor data shall be submitted including:
 - Nameplate identification
 - No-load current
 - Full load current
 - Full load efficiency
 - Locked rotor current
 - High potential test data
 - Bearing Inspection report

Sec. 1.20.10. ELECTRICAL GROUNDING SYSTEM

1.20.10.1.GENERAL

A grounding system shall be installed as per National Electrical Code, Local Codes and Ordinances. The DRAWINGS shall clearly show the Electrical Grounding System. An underground perimeter cable grounding system shall be installed with connections to at least eh following equipment:

1. Wet Well Cover
2. Valve Vault Cover

3. Control Panel
4. Generator
5. Utility Company Transformer
6. Main Disconnect Switch
7. Fence

1.20.10.2. MATERIAL AND INSTALLATION

The DRAWINGS shall show details of material and installation to construct a completely functional and operational Electrical Grounding System.

Sec. 1.20.11 INSPECTION AND TESTING

A factory representative knowledgeable in pump operation and maintenance shall inspect and supervise a test run at the pumping station covered by this MANUAL. A minimum of one (1) working day shall be provided for the inspections. Additional time made necessary by faulty or incomplete WORK or equipment malfunctions shall be provided as necessary to meet the requirements in the MANUAL at no additional cost to the CITY. Upon satisfactory completion of the test run, the factory representative shall issue the required manufacturer's certificate.

The test run shall demonstrate that all items of the MANUAL 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.
2. That the units operate without overheating or overloading any parts and without objectionable vibration.
3. That there are no mechanical defects in any of the parts.
4. That the pumps can deliver the specified pressure and quantity at all design points.
5. That the pumps are capable of pumping the specified material.
6. That the pump controls perform satisfactorily.

Sec. 1.20.12. ACCESS ROADS AND QUALITY ASSURANCE

A minimum 10' wide, paved access road shall be provided from the nearest public roadway. Curb, if present, shall have a 15 foot cut for the access road.

Roadway shall include deeded easement or dedicated right-of-way.

- * stabilized (if necessary) subgrade: 12" min.
- * base course (limerock): 6" min.

* asphaltic concrete surface, type S-1: 1 ½"

SECTION 1.21. SUBMERSIBLE WASTEWATER PUMPS

Sec. 1.21.1. GENERAL

The equipment covered by these specifications is intended to be standard pumping equipment of proven ability as manufactured by a reputable firm having at least five (5) years' experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods, and shall operate satisfactorily when installed as shown on the DRAWINGS and STANDARD DETAILS.

All part shall be so designed and proportioned as to have liberal strength, and stiffness and to be especially adapted for the work to be done. Ample space shall be provided for inspection, repairs, and adjustment. All necessary foundation bolts, plates, nuts, and washers shall be furnished by the equipment manufacturer, and shall be of Type 304 stainless steel. Brass or stainless steel nameplates giving the name of the manufacturer, voltage, phase, rated horsepower, speed, and any other pertinent data shall be attached to each pump. The nameplate rating of the motors shall not be exceeded.

The pumps shall be capable of handling raw unscreened domestic wastewater and minimum

3" diameter solid sphere. Pump operation shall be controlled automatically by means of float-type liquid level sensors in the wet well. Pumps shall be mounted in the wet well as shown on the DRAWINGS and STANDARD DETAILS. (See approved manufacturer's list in appendix).

Pumps shall be field tested and certified by manufacturer's representative. Certifications and guarantees shall be supplied to the City before acceptance.

Sec. 1.21.2. PUMP CONSTRUCTION DETAILS

1.21.2.1. SHAFT

The pump shaft shall be of Series 300 or 400 stainless steel or carbon steel. When a carbon steel shaft is provided, the manufacturer shall demonstrate that any part of the shaft which will normally come in contact with the wastewater has proven to be corrosion resistant in this application. The shaft and bearings shall be adequately designed to meet the maximum torque required for any startup or operating condition and to minimize vibration and shaft deflection. As a minimum, the pump shaft shall rotate on two (2) permanently lubricated bearings. The upper bearing shall be a single row ball bearing. The lower bearing shall be a two row angular contact ball bearing, if required to minimize vibration and provide maximum bearing life.

1.21.2.2. IMPELLER

The impeller shall be constructed of gray cast iron, ASTM A-48, class 30. All external bolts and nuts shall be of series 300 stainless steel. Each pump shall be provided with a replaceable metallic wear ring system to maintain pump efficiency. As a minimum one stationary wear ring provided in the pump volute or one rotating wear ring provide on the pump impeller shall be required. A two part system is acceptable.

1.21.2.3. MECHANICAL SEAL

Each pump shall be provided with a tandem double mechanical seal running in an oil reservoir, composed of two separate lapped face seals, each consisting of one stationary and one rotating tungsten carbide 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 lower seal. The pumped liquid shall be sealed from the oil reservoir by one face seal and the oil reservoir from the

airfilled motor chamber by the other. The seals shall require neither maintenance nor adjustment, and shall be easily replaced. Conventional double mechanical seals with a single spring between the rotating faces, requiring constant differential pressure to effect sealing and subject to opening and penetration by pumping forces, shall not be considered equal to tandem seal specified and required.

.21.2.4. BEARINGS

Motor shaft bearings shall have a minimum life of 40,000 hours, ANSI B-10.

1.21.2.5. GUIDES

A sliding guide bracket shall be an integral part of the pump casing and shall have a machined connecting flange to connect with the cast iron discharge connection, which shall be bolted to the floor of the wet well with stainless steel anchor bolts and so designed as to receive the pump discharge flange without the need of any bolts or nuts. Sealing of the pumps to the discharge connection shall be accomplished by a simple linear downward motion of the pump with the entire weight of the pumping unit guided by no less than two (2) 300 series seamless tubular stainless steel guides which will press it tightly against the discharge connection. No portion of the pump shall bear directly on the floor of the wet well and no rotary motion of the pump shall be required for sealing. Sealing at the discharge connection by means of a diaphragm or similar method of sealing will not be accepted as an equal to a metal to metal contact of the pump discharge and mating discharge connection specified and required. Approved pump manufacturers, if necessary to meet the above specification, shall provide a sliding guide bracket adapter. The design shall be such that the pumps shall be automatically connected to the discharge piping when lowered into place on the discharge connection. The pumps shall be easily removable for inspection or service, requiring no bolts, nuts or fastenings to be removed for this purpose, and no need for personnel to enter the wet well. Each pump shall be fitted with a Type 304 stainless steel, lifting chain of adequate strength. A stainless steel cable, aircraft rating, shall be provided between the cable holder and the lifting chain.

Sec. 1.21.3. MOTORS

1.21.3.1. GENERAL REQUIREMENTS

All motor shall be built in accordance with latest NEMA, IEEE, ANSI and AFBMA Standards where applicable. Pump motors shall be housed in an airfilled, water-tight casing and shall have Class F insulated windings which shall be moisture resistant. Motors shall be NEMA Design 8, rated I 55 degrees 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 non-submerged condition under full load without damage, for extended periods. The motor shall be capable of a minimum of 10 starts per hour. If required by the CITY, 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. Motors 25 horsepower and below shall be rated 230/460 volts, 3 phase. Motors greater than 25 horsepower shall be 460 volt, 3 phase.

1.21.3.2. HEAT AND MOISTURE SENSORS

Each motor shall incorporate a minimum of one ambient temperature compensated overheat sensing device and one moisture sensing device. These protective devices shall be wired into the pump controls in such a way that if excessive temperature or moisture is detected the pump will shut down. These devices shall be manual reset.

In lieu of moisture and temperature sensors, each pump motor shall have its motor winding insulation resistance monitored automatically by an automatic megger solid state electronics module. Each automatic megger must have an individual disconnect terminal plug, manual shut off switch, three lights

to indicate 10 Mohm, 5 Mohm, and 1 Mohm, resistance values, two output circuits for external alarms, and two switches for manual testing. The power source shall be 110 VAC fused at 0.24 AMP. The test voltage shall be 500-700 volts d.c. The automatic megger shall monitor the motor resistance only when the motor is off and shall activate an alarm system when the motor resistance drops to 1 Mohm.

9.21.3.3. CABLES

Cables shall be designed specifically for submersible pump applications and shall be properly sealed. A type CGB water-tight connector with a neoprene gland shall be furnished with each pump to seal the cable entry at the control panel.

Sec. 1.21.4. PUMPS AND CONTROL SYSTEM

Refer to Section 9.22. For control system specifications.

Sec. 1.21.5. SHOP PAINTING

Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry and free from all mill-scale, rust, grease, dirt and other foreign matter. All pumps and motors shall be shop coated with a corrosion resistant paint proven to withstand an environment of raw wastewater. All nameplates shall be properly protected during painting.

Gears, bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to the CITY up to the time of the final acceptance test.

Sec. 1.21.6. HANDLING

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 wooden planks, strongly built and securely bolted thereto. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

Sec. 1.21.7. WARRANTY

The pump manufacturer shall warrant the units being supplied to the CITY against defects in workmanship and material for a period of five (5) years or 10,000 hours, whichever comes first. Warranty shall begin at time of start-up.

Sec. 1.21.8. TOOLS AND SPARE PARTS

One (1) set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.

The manufacturer shall furnish the following spare parts for each size pump supplied:

1. 1 – Set impeller wear rings
2. 1 – Impeller
3. 4 – Roto – float normally open

*See Control Panel Specifications Standard Detail 950310 & 950315 for Manufacturer and Part Numbers on the following items.

4. 1 – Surge suppression device 650vac, 3phase/4-wire
5. 1 – Phase Monitor, Base Mont, DPDT, 430-480Vac or 190-270Vac
6. 2 – Motor Starter , Open Type, Nema Size _, 120Vac Coil
7. 2 – Pump Monitor Relay, 11 Pin, 120Vac Coil
8. 1 – Control Transformer, 120Vac/24Vac, 100VA

Spare parts shall be properly packaged and labeled for easy identification without opening the packaging and suitably protected for long-term storage under humid conditions. Spare parts and tools shall be delivered to the CITY at or prior to the time of pump station start-up.

SECTION 1.22 PUMP STATION ELECTRICAL POWER AND CONTROL SYSTEM

Sec. 1.22.1. GENERAL

This section specifies the electrical power and control system requirements for wastewater pump stations. These requirements apply to duplex pump panels. Similar requirements shall apply when more than two pumps are involved except for the quantity of control equipment and panel size shall be increased accordingly. The manufacturer of the control panel shall provide data to indicate that the manufacturer has a minimum of 3 years experience in the building of pump control panels.

A pump station control panel shall be provided for each wastewater pump station. (See approved manufacturers' list in appendix.) The control panel shall respond to liquid level float switches to automatically start and stop pumps as well as sound an alarm upon high wet well levels. The control panel shall operate submersible pumps at the power characteristics stipulated. The control function shall provide for the operation of the lead pump under normal conditions. If the incoming flow exceeds the pumping capacity of the lead pump, the lag pump (s) shall automatically start to handle the increased flows. As the flow decreases, pumps shall be cut off at elevation as shown on the PLANS. Pumps shall alternate positions as lead pump at the end of each cycle. A failure of the alternator shall not disable the pumping system. The alternator shall include a safe, convenient method of manual alternation and also have provisions to prevent automatic alternation without disturbing any wiring. Should the "pump off" regulator fail, the system shall keep the station in operation and provide a visual indication of the regulator failure.

The control panel shall consist of main circuit breakers and generator breaker with mechanical interlock, an emergency power receptacle, a circuit breaker and magnetic starter for each pump motor, and 5 ampere, 120 volt circuit breakers as required. All pump control operations shall be accomplished by a float type liquid level control system with all control components mounted in one common enclosure. Control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall provide means to manually select or automatically alternate the position of the "lead" and "lag" pumps after each pumping cycle.

A float type liquid level control system shall continuously monitor wet well liquid level and control operation of the low-level cutoff for the pumps and shall operate off a 24 volt circuit.

Sec. 1.22.2. PANEL CONSTRUCTION

The duplex pump panel shall be housed in a NEMA 3R, Type 304, 14 Gauge stainless steel enclosure with 30% extra mounting space for additional equipment. Enclosure shall have provisions for padlocking the door and a dead front inner door unit for mounting controls. All exterior hardware and hinges shall be stainless steel there shall be permanently affixed to the interior side of the exterior enclosure door both a nameplate and a 10" X 12" pocket for log sheet storage.

The nameplate shall contain the following information, voltage, phase, rated horsepower, speed, date manufactured and pump and control panel manufacturer's name, address and telephone number, pump data, including impeller data, operating point and head. KW input, and amps at the operating point and at least two other points on the pump curve.

The control panel enclosure shall be Underwriters Laboratories (UL) 50 type 3 R listed.

Sec. 1.22.3. POWER SUPPLY AND MAIN DISCONNECT

Power supply to the control panel shall be 480 volt, 3 phase, 4 wire. Minimum service shall be 480 volt, 3 phase, 4 wire. Minimum service shall be 100 AMP. Single phase power shall not be accepted.

Nonfusible safety service main disconnects shall be installed at all stations. Disconnect should be installed ahead of the meter. LED power available indicators shall be supplied on all legs.

Sec. 1.22.4. CIRCUIT BREAKERS

1.22.4.1. MAIN BREAKERS

The panel shall have an inter-lock system between the normal power main breaker and the emergency breaker to ensure only one breaker is in the "on" position at a time. Both breakers shall be equal in size. (See approved manufacturers' list in appendix.)

1.22.4.2. CIRCUIT BREAKERS

All circuit breakers shall be heavy duty molded case breaker. The handle on the circuit breakers shall be operational through the inner door. (See approved manufacturers' list in appendix.)

Sec. 1.22.5. MOTOR CIRCUIT PROTECTORS

Each pump motor shall be protected by a 3-pole motor circuit protector. (See approved manufacturers' list in appendix.) The Motor Circuit Protector shall be operated by a toggle-type handle and shall have a quick-make, quick-break over center switching mechanism that is mechanically trip-free from the handle so that the contacts cannot be held closed against a short circuit and abnormal currents which cause the Motor Circuit Protection to trip. Tripping shall be clearly indicated by the handle automatically assuming a position midway between the normal ON and OFF positions. All latch surfaces shall be ground and polished. All poles shall be so constructed that they open, close, and trip simultaneously. Motor Circuit Protector must be completely enclosed in a high-strength glass polyester molded case. Ampere ratings shall be clearly visible. Contacts shall be of non-welding silver alloy. Arc extinction must be accomplished by means of arc chutes. A manual pushtotrip button shall be provided for manual exercising of the trip mechanism. Each pole of these Motor Circuit Protector's shall provide instantaneous short circuit protection by means of an adjustable magnetic-only element.

Sec. 1.22.6. MOTOR STARTER AND SELECTOR SWITCHES

The panel shall contain the motor starters. The motor starter shall be across the line magnetic starter with individual overload protection on each power leg with reset installed through the inner door unit. (See approved manufacturers' list in appendix.) Local Power Company Regulations shall govern.

Selector switches shall be installed on the face of the inner door unit. Selector switch shall be a heavy duty oil tight "Hand-Off-Auto" three position switch to control the operation mode of each pump motor starter.

Sec. 1.22.7. PUMP ALTERNATOR

An eight pin plug-in solid state alternator (see approved manufacturers' list in appendix) shall be provided to change the pump starting sequence on each pumping cycle. A three position alternator test switch shall be provided to control the alternation operation. Switch positions to include the "Auto" to provide normal automatic sequence, "Off" position to disable alternator, and "test" position with a spring return to allow the alternating of the pump sequence to check alternator operation.

Sec. 1.22.8. LIGHTS AND ALARMS

1.22.8.1. INDICATOR LIGHTS

There shall be installed on the face of the inner door unit, heavy duty oil tight indicator lights.

1.22.8.2. HIGH LEVEL ALARM

A vapor proof red light and horn shall be mounted on top of the panel for high level alarm. Also, there shall be an alarm silence pushbutton on the inner door and a silence relay which will silence the horn and automatically reset when these signals are restored to normal. The pushbutton shall be heavy duty oil tight. The red glove shall be the screw-on type.

1.22.8.3. MOTOR HIGH TEMPERATURE AND LEAK INDICATION

Motor high temperature and leak detection shall be provided. Upon high temperature or leak detection, contacts will close, energizing panel mounted lights on the inner door and sending 120 VAC signal to the RTU to signal pump failure. Manual resets will be provided on the inner door.

Sec. 1.22.9. EMERGENCY POWER RECEPTACLE

This item shall only be required on stations that do not have a permanent standby generator system. The panel shall have external mounted generator receptacle of the required size (See approved manufacturer's list).

Sec. 1.22.10. ADDITIONAL REQUIREMENTS

1.22.10. 1. WIRING

All power wires shall be THW or THWN 75 Degree C insulated stranded copper conductors and shall be approximately sized for the given load application. All control circuit wire shall be type THW; Size 14, stranded type. All wiring within the enclosure shall be neatly routed by the use of slotted type wiring duct with snap on type covers.

Wiring on the rear of the inner door shall be neatly bundled with nylon ties and include sufficient loop across the hinges to prevent wire damage, with each end of conductor marked (I.D.), Color: Red, 24 volt; white, neutral; black, 120 volts.

1.22.10. 2. TERMINAL POINTS

Terminal points of all strips shall be permanently identified. All terminal numbers and identifying nomenclature shall correspond to and be shown on electrical diagrams. All wiring shall be permanently shown on electrical schematic diagrams.

1.22.10. 3. ENGRAVED NAMEPLATES

All circuit breakers, control switches, indicator pilot lights and other control devices shall be identified with permanently affixed legend plates and lamicoïd-type engraved nameplates where applicable.

1.22.10. 4. SURGE PROTECTORS

Surge protectors shall be included and wired to protect motors and control equipment from lightning induced line surges. Surge protectors shall have a response time of picoseconds and be capable of dissipating high levels of line side surge energy, without damage to pump station equipment and controls. All surge protectors shall be U.L. approved and installed per respective power company requirements and manufacturer's specifications, primary surge protectors shall be attached to the main disconnects.

1.22.10. 5. ELAPSED TIME METERS

Elapsed time meters shall be 115 volt not-reset type and shall totalize pump running time in hours and tenths of hours to 99999.9 hours.

1.22.10. 6. CONVENIENCE RECEPTACLE

On the face of the inner door unit, there shall be installed a 15 AMP 120 volt, duplex convenience receptacle. It shall be provided with it's own single pole, 15 AMP circuit breaker for protection. Ground fault interrupt type shall be required.

1.22.10. 7. CONTROL TERMINAL BLOCKS

Control terminal blocks shall be of the clamp screw type, rated for 600 volts. Amperage rating shall accommodate the control circuit amperage. The minimum number of terminals provided shall be 30 single stacked or 20 double stacked.

1.22.10. 8. CONTROL POWER TRANSFORMERS

There shall be a control power transformer with a minimum size of 3 KVA to provide 120 VAC power for: coils for starters, 15A duplex receptacle, indicator pilot lights, alarm horn, alarm light, pump alternator, elapsed time meters etc. The secondary side shall have one leg fused and the other grounded. This control power transformer is required only on 480 volt control panels.

The signal required by the float switches and relays shall be 24 VAC. This shall be provided by a 24 VAC control power transformer properly sized with a fused secondary.

1.22.10. 9. CONTROL RELAY

The level control relays shall operate from 24 VAC. They shall be enclosed, plug-in 8 pin type with octal-style screw terminal sockets.

1.22.10.10. ELECTRICAL SCHEMATIC

There shall be permanently affixed to the interior side of the exterior enclosure door an electrical schematic diagram and a copy supplied to CITY personnel at start-up. The schematic diagram shall include the rated amperage and voltage for all components.

1.22.10.11. PHASE MONITOR

For all 240 volt stations an eight pin plug-in type phase monitor shall be provided for protection of electrical components due to phase loss. Adequate dummy pin protection shall be provided to prevent accidental interchanging of the eight pin phase monitor with the eight pin alternator. All 480 volt stations shall have surface mount type phase monitors. Both types of phase monitors shall have 2 sets of normally open contacts and 2 sets of normally closed contacts.

1.22.10.12 AREA LIGHT

Provide a LED area lighting fixture with on/off switch, 175 watt minimum. Mount lighting fixture to control panel support post as shown on the STANDARD DETAIL entitled "Lift Station".

1.22.10.13 TELEMETRY

Provide a remote monitoring device "Appendix B"

Sec. 1.22.11. TESTING, SERVICE AND WARRANTY

1.22.11. 1. TESTING

After fabrication in the control panel manufacturer's plant, an operational test shall be performed to check out the entire panel before delivery. Three phase source voltage to which the panel is intended for shall be used for the testing.

1.22.11. 2. SERVICE

The control panel manufacturer shall maintain a service organization in the area that is available for service.

1.22.11. 3. WARRANTY

The manufacturer shall furnish a five (5) year warranty against defects in materials and workmanship covering parts and labor on all items supplied under this section from time of start -up of the lift station.

SECTION 1.23 PIPE MATERIAL FOR WATER MAINS AND SERVICE CONNECTIONS

Sec. 1.23.1. GENERAL

These specifications cover the pipe, fittings, and accessory items used for water distribution systems.

Pipe used in water distribution systems shall be either polyvinyl chloride pipe (PVCP), or ductile iron pipe (DIP). Above ground pipe and buried pipe with less than 30" of cover, or 6" of clearance shall be ductile iron pipe.

The CONTRACTOR shall be responsible for all materials furnished and storage of same, until the date of substantial completion. He shall replace at his expense all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by the CITY, furnish certificates, affidavits of compliance, test reports, or samples for 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.

Sec. 1.23.2. PIPE INSPECTION AND TESTING

Requirements specified in section 1.14.5. shall apply.

Sec. 1.23.3. PVC PIPE

1.23.3.1. PVC PIPE

All PVC pipe of nominal diameter four (4) through twelve (12) inches shall be manufactured in accordance with AWWA standard C900, latest edition. The PVC pipe shall have a minimum working pressure rating of 150 psi and shall have a dimension ratio (DR) of 18. Pipe shall be the same O.D. as ductile iron pipe.

1.23.3.2. JOINTS

PVC pipe shall be integral bell, push-on type joints. **NO pipe Deflection, must use fittings**

1.23.3.3. FITTINGS

Fittings used with PVC pipe shall conform to section 9.23.4.

Sec. 1.23.4. DUCTILE IRON PIPE AND FITTINGS

1.23.4.1. DUCTILE IRON PIPE

All ductile iron pipe of nominal diameter four (4) through fifty four (54) inches shall conform to ANSI/AWWA A21.51/C151. A minimum of Class 50 pipe shall be supplied for all sizes of pipe unless specifically called out in the DRAWINGS, or required by the CITY.

1.23.4.2. FITTINGS

Any fittings required shall be mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A21.10/C110, 250 psi minimum pressure rating, or ductile iron compact fittings four (4) through twelve (12) inches in accordance with ANSI/AWWA A21.53/C153.

1.23.4.3. JOINTS

Joints for ductile iron pipe shall be push-on or mechanical joints conforming to ANSI/AWWA A21.11/C111. Where called for in the plans, restrained or flanged joints shall be provided. Above ground joints shall be flanged with galvanized bolts, nuts and washers. Flanged joints shall conform to ANSI Standard B 16.1-125 LB. Restrained joints shall conform to Section 34.2 of these standards.

1.23.4.4. COATINGS AND LININGS

Where ductile iron pipe and fittings are to be below ground or installed in a casing pipe the exterior coating shall be a minimum 1.0 mil thick in accordance with ANSI/AWWA A21.51/C151. Where ductile iron pipe and fittings are to be installed above ground, pipe, fittings and valves shall be thoroughly cleaned and given one field coat (minimum 1.5 mils dry thickness) of rust inhibitor primer. Intermediate and finished field coats of Alkyd shall also be applied by the CONTRACTOR (minimum 1.5 mils dry thickness each coat).

Primer and field coats shall be compatible and shall be applied in accordance with the manufacturers recommendations. (See approved manufacturers' list in appendix.) Final field coat color shall be as directed by CITY.

All ductile iron pipe and fittings shall have an interior protective lining of cement-mortar with a seal coat of asphaltic material in accordance with ANSI/AWWA A21.4/C104.

1.23.4.5. POLYETHYLENE ENCASEMENT

The pipe shall be polyethylene encased (8 mil) where shown on the DRAWINGS or required by the CITY in accordance with ANSI/AWWA A21.51/C105.

Sec. 1.23.5. SERVICE PIPE, STOPS, FITTINGS, AND SERVICE SADDLES

1.23.5.1. SERVICE PIPE

All service lines shall be 1", 1-1/2" or 2" blue, PC200, DR9, polyethylene tubing conforming to specifications in AWWA C901. Larger service pipe shall be PVC or DIP as specified in sections 50.3 and 50.4 respectively.

1.23.5.2. STOPS

Corporation stops shall be 1", 1-1/2" or 2" brass, equipped with connections compatible with the polyethylene tubing and threaded in accordance with specifications in AWWA C800. Curb stops shall be lockable and sized to match the meter size and conform to the specifications in AWWA C800 and AWWA C901. Larger services shall have resilient wedge gate valves as specified in section 9.25.2.

1.23.5.3. FITTINGS

Fittings shall be brass, cast and machined in accordance with specifications in AWWA C800 with compatible polyethylene tubing connections.

Direct taps into ductile iron pipe, to accommodate corporation stops up to 1" are allowable if the DIP wall thickness is adequate to allow a minimum of three threads. Refer to AWWA C151, Appendix A, Table A.2.

SECTION 1.24. PIPE INSTALLATION FOR WATER MAINS

Sec. 1.24.1. GENERAL

Pipe shall be installed in accordance with the manufacturer's specifications and instructions for the type of pipe used and applicable AWWA standards, such as C600, unless otherwise stated in these specifications.

Sec. 1.24.2. PIPE HANDLING

All types of pipe shall be handled in such manner as will prevent damage to the pipe or coating. Accidental damage to pipe or coating shall be repaired to the satisfaction of the CITY or be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on properly prepared ground, graded to eliminate all rock points and to provide uniform support along the full 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 CITY, is damaged beyond repair by the CONTRACTOR shall be removed from the site of the work and replaced with another unit.

Joint gaskets shall be stored in clean, dark dry location until immediately before use.

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. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a water-tight plug.

Sec. 1.24.3. SEPARATION OF WATER MAINS AND SEWERS

1.24.3.1. GENERAL

Water mains that are laid in the vicinity of pipe line designated to carry storm water, raw wastewater or reclaimed water (wastewater effluent) shall meet the horizontal and vertical separations specified in section 1.24.3.3.

1.24.3.2. HORIZONTAL SEPARATION

NORMAL CONDITIONS: Water mains shall be located at least 10 feet horizontally from pipes carrying raw wastewater, and 3 feet horizontally from pipes carrying reclaimed water and storm water, whenever possible; the distance shall be measured from edge of pipe to edge of pipe.

UNUSUAL CONDITIONS: When local conditions prevent the minimum required horizontal separation, a water main may be laid closer to a pipe carrying storm or wastewater provided that the sewer pipe is ductile iron.

1.24.3.3. CROSSING OF WATER MAINS AND SEWER PIPES

Normal Conditions: Water mains shall be above the sewers whenever they cross any sanitary sewer, storm sewer, sewage force main or reuse force main.

A vertical separation of at least 18 inches shall be maintained between the top of the sewer and the bottom of the water main.

Unusual Conditions: Sewers shall have one full length of ductile iron pipe centered at the point of crossing so that the joints will be equidistant and as far as possible from the water main.

Sec. 1.24.4. TRENCH PREPARATION AND PIPE BEDDING

1.24.4.1. TRENCH PREPARATION AND PIPE BEDDING

Applicable provisions of Section 1.10. shall apply. Also refer to STANDARD DETAILS.

1.24.4.2. PIPE PREPARATION AND HANDLING

All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken, or otherwise defective materials are being used. CONTRACTOR shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after laying.

CONTRACTOR shall use proper implements, tools, and facilities for the safe and proper protection of the WORK. CONTRACTOR shall lower pipe into the trench in such a manner as to avoid any physical damage to the pipe and shall remove all damaged pipe from the jobsite. Care shall be taken to not drop or dump pipe into trenches under any circumstances.

1.24.4.3. TRENCH DEWATERING AND DRAINAGE CONTROL

Specifications from Section 1.10. shall apply. CONTRACTOR shall prevent water from entering the 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.

1.24.4.4. SURVEY LINE AND GRADE

Pipe shall be laid to the lines and grades shown on the PLANS. The CONTRACTOR shall provide line and grade stakes at a 100 foot maximum. Spacing and at all line and/or grade change locations. CONTRACTOR shall provide Temporary Bench Marks at maximum 1000 foot intervals. The minimum pipe depth shall be three (3) feet below the elevation of the edge of pavement of the road surface whichever is greater.

1.24.4.5. PIPE LAYING IN TRENCH

CONTRACTOR shall prevent foreign material from entering the pipe while it is being placed in the trench. CONTRACTOR shall remove all foreign material from the pipe or joint ring before the next pipe is placed. Pipe shall be lowered into trench and installed, one piece at a time. During laying operations, CONTRACTOR shall keep debris, tools, clothing, or other materials out of the pipe.

1.24.4.6. LAYING PVC PIPE

All PVC pipe shall be installed in accordance with standards set forth in the UNI-BELL "Handbook of PVC pipe design and construction" unless such standards conflict with this MANUAL in which case this MANUAL shall apply.

1.24.4.7. LAYING DUCTILE IRON PIPE

All ductile iron pipe shall be installed in accordance with AWWA C600 unless such standards conflicts with this MANUAL in which case this MANUAL shall apply. CONTRACTOR shall cut pipe only as necessary to comply with alignment shown on the PLANS. Flame cutting of pipe shall not be allowed.

CONTRACTOR shall provide special tools and devices, such as special jacks, chokers, and similar items required for proper installation. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, for potable water piping.

The pipe shall be polyethylene encased (8 mil) where shown on the DRAWINGS in accordance with ANSI/AWWA A21.51/C105.

1.24.4.8. LAYING OF PIPES ON CURVES

Long radius curves, either horizontal or vertical, are prohibited.

1.24.4.9. PIPE RESTRAINT

Requirements specified in Section 1.12. shall apply.

1.24.4.10. BEDDING AND BACKFILL FOR PIPES

Requirements specified in Section 1.12. shall apply.

Sec. 1.24.5. HYDROSTATIC TESTS

1.24.5.1. GENERAL

Before Hydrostatic testing can be done road base MUST be in place.

Hydrostatic tests shall consist of pressure test and leakage test. Hydrostatic tests shall be conducted on all newly laid pressure pipes, joints and valves including all service lines to the curb stops. Air testing of pressure pipes will not be permitted under any circumstance. Tests may be made on sections not exceeding 2,000 feet, or between valves, whichever is less. CONTRACTOR shall furnish all necessary equipment and material, make all taps, and furnish all closure pieces in the pipe as required. Equipment to be furnished by the CONTRACTOR shall include graduated containers, pressure gauges, hydraulic force pumps, and suitable hoses and piping. The CITY will monitor and approve a satisfactory test.

The CONTRACTOR may conduct hydrostatic tests after the trench has been partially backfilled with the joints left exposed for inspection for his informational purposes only. The hydrostatic tests for acceptance shall only be conducted after the trenches have been completely backfilled and compacted as specified.

1.24.5.2. TESTING CRITERIA

All pipe sections to be pressure tested shall be subjected to a hydrostatic pressure of 150 psi minimum. The duration of each pressure test shall be for a period of 2 hours for final acceptance the pressure shall not fall below 150 psi during the test period. If during the test, the integrity of the tested line is in question, the CITY may require a 6 hour pressure test. The basic provisions of AWWA C-600 shall be applicable.

1.24.5.3. PROCEDURE FOR PRESSURE TEST

Each section of pipe to be tested, as determined by the CITY, shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, and appropriate valves installed to ensure bleeding of all air from the main. If defective pipes, fittings, valves, or hydrant are discovered in consequence of this pressure test, all such items shall be removed and replaced by the CONTRACTOR with sound material and the test shall be repeated until satisfactory results are obtained. Provisions of AWWA C600, where applicable, shall apply.

1.24.5.4. PROCEDURE FOR LEAKAGE TEST

After completion of the pressure test, a leakage test shall be conducted to determine the quantity of water lost by leakage under the specified test pressure. Applicable provisions of AWWA C600 shall apply.

Allowable leakage in gallons per hour for pipeline shall not be greater than that determined by the formula: $L = \frac{SD(P)^{1/2}}{133,200}$

Note: L = Allowable leakage in gallons per hour.
S = Length of pipe tested, in feet.
D = Nominal diameter of the pipe in inches.
P = Average test pressure during leakage test in pounds per square inch gauge.

Leakage is defined as the quantity of water to be supplied in the newly laid pipe or any valved section under test, which is necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. Should any test of pipe laid disclose leakage greater than that allowed, CONTRACTOR shall locate and replace or repair the defective joints, pipe or valve until the leakage from subsequent testing is within the specified allowance.

Sec. 1.24.6 DISINFECTION OF WATER MAINS

1.24.6.1. GENERAL

Before being placed in service, all new water mains shall be chlorinated in accordance with the specifications below and the procedures outline in AWWA C-651 “Standard Procedure for Disinfecting Water Mains”.

1.24.6.2. FLUSHING

Sections of pipe to be disinfected shall first be flushed (full diameter) to remove any solids or contaminated material that may have become lodged in the pipe. If no hydrant is installed at the end of the main, then a blow-off valve shall be provided large enough to develop a velocity of at least 2.5 feet per second in the main.

All taps required for chlorination or flushing purpose or for temporary or permanent release of air shall be provided for by the CONTRACTOR as a part of the construction of water mains. After the disinfection, all such taps shall be sealed to the satisfaction of the CITY.

1.24.6.2.1. DISINFECTION CRITERIA

Before being placed into service, all new mains and repaired portions of, or extensions to existing mains shall be chlorinated so that the initial chlorine residual is no less than 50 mg/1 and that a chlorine residual of not less than 25mg/1 remains in the water after standing 24 hours in the pipe.

1.24.6.4. FORM OF APPLIED CHLORINE

Chlorine may be applied as a liquid chlorine (gas-water mixture), or a mixture of water and high-test calcium hypochlorite. CONTRACTOR shall assume responsibility for safe handling of chlorine and shall meet requirements of OSHA and other regulatory agencies for safe handling of chlorine.

1.24.6.5. POINT OF APPLICATION

The preferred point of application of the chlorinating agent is at the beginning of the pipe line extension or any valved section of it, and through a corporation stop inserted in the pipe.

The water injector for delivering the chlorine-bearing water into the pipe should be supplied from a tap made on the pressure side of the gate valve controlling the flow into the pipe line extension. Alternate points of applications may be used when approved or directed by the CITY.

1.24.6.6. OPERATION OF CITY VALVES

Valves shall be manipulated by the CITY personnel so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water.

1.24.6.7. RETENTION PERIOD

Treated water shall be retained in the pipe at least 24 hours. After this period, the chlorine residual at pipe extremities and at other representative points shall be at least 25 mg/l.

1.24.6.8. CHLORINATING VALVES AND HYDRANTS

In the process of chlorinating newly laid pipe, all valves or other appurtenances shall be operated while the pipe line is filled with the chlorinating agent and under normal operating pressure.

1.24.6.9. FINAL FLUSHING AND TESTING

Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity until the replacement water throughout its lengths shows upon test, a free chlorine residual not in excess of that normally carried in the system. Chlorinated water shall not be discharged to surface water.

After flushing, water samples collected on 2 successive days from the treated piping system, as directed by the CITY, shall show acceptable bacteriological results.

All bacteriological testing shall be witnessed by the CITY, after 48 hour notice at the expense of the contractor and proper chain of custody procedures must be followed.

Copies of testing results and all related correspondence with the Florida Department of Environmental Protection (FDEP) shall be copied to the CITY.

1.24.6.10. REPETITION OF FLUSHING AND TESTING

Should the initial treatment result in an unsatisfactory bacterial test, the original chlorination procedure shall be repeated by the CONTRACTOR until satisfactory results are obtained.

Sec. 1.24.7. NOTIFICATION AND CONNECTION TO EXISTING MAINS

Requirements specified in Section 1.13. shall apply.

Sec. 1.24.8. WATER SERVICE PIPING AND CONNECTION

Water service piping and connection shall be installed as indicated in the STANDARD DETAILS. The location of all service lines shall be as shown on the DRAWINGS and shall be either single, dual or multiple service. On curbed streets the exact location for each installed service shall be marked by indenting the letter "W" into the wet concrete curb. **No Saw Cuts** will be allowed to indicate location of service. Where no curb exists, locations shall be adequately marked by a 4" x 4" x 18" concrete marker with "W" indented into the top of the wet concrete pad **No Saw Cuts** will be allowed to indicate service.

Sec. 1.24.9. LOCATION AND IDENTIFICATION

All water mains shall be installed with a continuous, insulated 10 gauge solid copper wire (tracer wire) taped directly on top of the pipe for location purposes. Terminate insulated locator wires, capable of extending 12 inches above top of box, at each valve box pad.

All water mains shall be blue in color or marked with a continuous stripe located within the top 90 degrees of the pipe. Said stripe shall be a minimum 2 inches in width and shall be blue in color. Paint should be touch-dry before backfilling. Provide warning tape 12" to 18" above all water mains.

SECTION 1.25. VALVES, HYDRANTS AND ACCESSORIES FOR WATER MAINS

Sec. 1.25.1. GENERAL

All valves and appurtenances shall be products of firms who are fully experienced 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 as applicable.

Sec. 1.25.2. RESILIENT WEDGE GATE VALVES

1.25.2.1. GENERAL

All valves shall be Resilient Wedge Gate Valves

1.25.2.2. VALVE CONSTRUCTION

Resilient Wedge Gate Valves shall be in accordance with AWWA C509.

- * Shall have fusion bond epoxy coating.
- * Shall have a synthetic rubber encapsulated gate.
- * Shall have oil impregnated bronze mechanical components, for permanent lubrication.
- * If actuating nut deeper than four (4) feet it must have actuating nut extension..

Above ground service - flanged, OS & Y, handwheel. Buried Service - mechanical joint, NRS, nut w/extension.

Submerged or otherwise inaccessible, above ground service - flanged, NRS, floor stand or suitable operator.

Sec. 1.25.3. (Section has been removed)

Sec. 1.25.4. VALVE INSTALLATION

All valves shall be inspected upon delivery in the field to insure proper working order before installation. They shall be set and jointed to the pipe in the manner as set forth in the AWWA Standards for the type of connection ends furnished. All valves and appurtenances shall be installed true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the CITY before they are installed.

Flanged joints shall be made with hot dipped galvanized bolts, nuts and washers. Mechanical joints shall be made with mild corrosion resistant alloy steel bolts and nuts. All exposed bolts shall be painted the same color as the pipe.

Sec. 1.25.5. VALVE BOXES

All buried valves shall have cast-iron three piece valve boxes. Valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as shown on the STANDARD DETAILS. The barrel shall be two-piece, sliding type, 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 cast iron covers. Barrel extensions for deep valves shall be ductile iron or cast iron pipe. Covers shall have "WATER" cast into the top for all water mains. The actuating nuts for deeper valves shall be extended to come up to within 6" of finished grade as shown on the STANDARD DETAILS.

Care shall be taken while constructing valve boxes to ensure that valve stems are vertical and the cast iron box has been placed over the stem with base bearing on compacted fill and top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. CONTRACTOR shall remove any sand or undesirable fill from valve box prior to final inspection.

1.25.5.1. VALVE IDENTIFICATION

A 3" diameter cast bronze disc engraved with identification data as shown on the STANDARD DETAILS shall be provided for each buried valve.

Bronze disc shall be cast into the concrete valve box pad as shown on the STANDARD DETAILS.

Sec. 1.25.6. AIR RELEASE VALVES

The air release valves for use in water mains shall be installed where shown on the DRAWINGS and as shown on the STANDARD DETAILS. The valves shall have a cast iron body and cover, and a stainless steel float. Valves shall be provided with a vacuum check to prevent air from reentering the line.

Sec. 1.25.7. FIRE HYDRANTS

1.25.7.1. MATERIAL

Fire hydrants shall have 5-1/4 inch valve opening and shall comply with AWWA Standard C502 for fire hydrants for water works service, unless in conflict with MANUAL in which case this manual shall apply. Each hydrant shall have 6 inch mechanical joint ends with harnessing lugs (“dog-ears”) and shall open by turning to the left (counter-clockwise). Fire hydrant shall be of ample length for 3-1/2 foot depth of bury. It shall be provided with two 2-1/2 inch hose nozzles and one 4-1/2 inch pumper nozzle, all having National Standard hose threads. Nozzles shall have caps attached by chains. Operating nuts shall be AWWA Standard (pentagonal, measuring 1-1/2 inch point to flat). Fire hydrants shall be equipped with “O-Ring” packing. Fire hydrant shall be provided with weep hole. Fire hydrant shall be equipped with break - away flanges. Shear bolts shall not be acceptable. (See approved manufacturers’ list in appendix.)

1.25.7.2. PAINTING

All iron parts of the hydrant both inside and outside shall be painted, in accordance with AWWA C-501. All inside surfaces and the outside surfaces below the ground line shall be coated with asphalt varnish. They shall be covered with two coats, the first having dried thoroughly before the second is applied.

The outside of the hydrant above the furnished ground line shall be thoroughly cleaned and thereafter painted with one coat of paint of a durable composition, and one additional coat of compatible paint, the color of which is to be determined by the Fire Department under whose jurisdiction the fire hydrant becomes the responsibility.

All hydrants are to be painted by AWWA color scheme for relative capacity. The capacity is to be determined by flow measurements of the individual hydrants taken at a period of ordinary demand. When initial pressure are over 40psig at the hydrant under test, the rating is to be on 20psig residual pressure, observed at the nearest hydrant connected to the same main and when no water is being drawn. When initial pressures are less than 40 psig, residual pressures shall be at least half of the initial.

1.25.7.3. CONSTRUCTION DETAILS

Hydrants shall be plumb and shall be set so that the lowest hose connection is, at least, eighteen (18) inches above the surrounding finished grade. All hydrants shall be inspected in the field upon delivery to the job to insure proper operation before installation. The resetting of existing hydrants and moving and reconnecting of existing hydrants shall be handled in a manner similar to a new installation. Hydrant shall be constructed in accordance with the STANDARD DETAILS.

1.25.7.4. LOCATION

Fire hydrants shall be located in the general location as shown on the DRAWINGS. Final field location of all hydrants shall be as approved by the CITY. All hydrants shall be located no less than five (5) and no more than ten (10) feet from the edge of pavement of the adjacent roadway and no less than five (5) feet from any physical feature which may obstruct access or view of any hydrant unless otherwise approved by the CITY.

1.25.7.5. TESTING

Fire hydrants shall be flow tested and witness by the CITY and flow test reports must be turnover at the end of the testing to the CITY.

APPENDIX “B”

LIST OF MATERIALS

AND

APPROVED MANUFACTURES

Last updated: October 22, 2018

WASTEWATER MAIN MATERIALS

<u>ITEM</u>	<u>MANUFACTURERS</u>	<u>PART NO. OR DISCRPTION</u>
AIR RELEASE / VACUUM RELIEF VALVES AND FORCE MAIN	<ol style="list-style-type: none"> 1. Apco 2. Val-matic 	443 with attachments minimum VM-801-ABW
CASING SPACERS (POLY)	<ol style="list-style-type: none"> 1. BWM 2. CASCADE 3. PSI 	BWM-SS-8 (4" to 20") BWM-SS-12 (24" to 36") CCS-12" Width Min. C12G-2
CHECK VALVES (4" & LARGER)	<ol style="list-style-type: none"> 1. Kennedy 2. M & H 3. Mueller 4. Clow 5. American Flow Control 	D.I. body, rubber seat, weighted lever, fusion bond, epoxy coated
EPANSION JOINTS	<ol style="list-style-type: none"> 1. Mercer 2. Metraflex 	
FITTING M.J.	<ol style="list-style-type: none"> 1. Union 2. U.S. Pipe 3. NAPPCO 4. American Ductile Iron Pipe 5. Tyler 	
FREEZE PROTECTION VALVE	<ol style="list-style-type: none"> 1. Conbraco 	1. 40-000-FPV1
STANDARD MANHOLE FRAME AND COVER	<ol style="list-style-type: none"> 1. U.S. Foundry 	1. USF #663 RING & AB/MG COVER
<u>LOCKABLE</u> MANHOLE FRAME AND COVER	<ol style="list-style-type: none"> 1. U.S. Foundry 	1. USF #663 RING & AB/M COVERS BWT
MANHOLE JOINTING MATERIAL	<ol style="list-style-type: none"> 1. K.T. Snyder Co. Inc. 2. Conseal 	
MANHOLE SURFACE COATING PAINTING: AERIAL PIPING AND FITTINGS		Water Based Epoxy
<ol style="list-style-type: none"> A. FIELD PROMER B. FINISH (EXTERIOR) 		Alkyd Metal Primer Alkyd Gloss Enamel

<u>ITEM</u>	<u>MANUFACTURERS</u>	<u>PART NO. OR DISCRIPTION</u>
PIPE (DI)		Pressure Class 150 Minimum Interior coating "Protecto" 401' or equal.
PIPE FORCEMAIN		1. C900, DR minimum 2. HDPE Driscipline 4000 series, DR II
PIPE (PVC) GRAVITY		SDR 35 minimum
PLUG VALVE	1. Clow/Kennedy	1. 6413-FF Fusion Bond Epoxy Coated Stainless Stem
RESTRAINED JOINTS	1. Romac Industries, 2. EBAA Iron 3. Uniflange	Grip Ring
TAPPING SLEEVES, STAINLESS STEEL		Fusion Bond Epoxy Coated
TAPPING SLEEVES, MJ	1. Mueller 2. Smith Blair 3. Ford 4. JCM	
TAPPING VALVES, RESILIENT WEDGE	1. AFC 2. Clow 3. Kennedy	Fusion Bond Epoxy Coated
VALVE BOXES	1. Union 2. Star 3. Sigma 4. Proflo	
VALVE MAKERS	Flint	Green - Thermoplastic (90 Mils)
VAULT FRAME AND COVER FOR AIR RELEASE / VACUUM RELIEF VALVES	1. U.S. Foundry	1. USF #663-AB-M
WIRE CONNECTORS	1. Pro-Trace	TW Connector – Part# 739010250

II. WASTEWATER PUMP STATION METERIALS

<u>ITEM</u>	<u>MANUFACTURERS</u>	<u>PART NO. OR DISCRIPTION</u>
GENERATOR CIRCUIT BREAKER	1. Square D 2. Westinghouse	
GENERATOR SYSTEMS (DIESEL)	1. Blue Star Power Systems 2. Gillette Generators	
LED AREA LIGHT FXITRE	1. Dialight	1. HZD5C2G
LIGHT FXITRE - Mounting Bracket	1. Safe Site	1. Pipe Mount Clamp Kit HZXW8
MOTOE AUTOMATIC MEGGER	1. Automeg	
PRESSURE GAUGES	1. Ashcroft 2. H.O. Trerice Co.	
SUBMERSIBLE PUMPS	1. Hydro Matic	Barney's Pumps
WETWELL ACCESS	1. U.S. Foundry	
FRAMES AND COVERS	1. Bilco Co.	
CONTROL PANELS	1. Sta-Con, Inc. 2. Quality Control, Inc.	
ALARM HORN (AH)	1. Edwards 2. Wheelock	1. 870-N5 2. 31T-115-R
ALARM LIGHT (AL)	1. American Electric 2. Red Dot	1. F32552 2. 866 B
CONTROL CIRCUIT BREAKER	1. Square D	1. QOU120
CONTROL CIRCUIT TRANSFORMER	1. Square D	1. EO-18
DUPLEX RECEPTACLE GFI (DR)	1. Square D 2. Hubbel	1. GFSR-115-IC 2. GF-5262I

<u>ITEM</u>	<u>MANUFACTURERS</u>	<u>PART NO. OR DISCRPTION</u>
ELAPSE TIME METER (ETM)	1. Engler 2. Hecon	1. AC-200-10NG7 2. TO621134
EMERGENCY	1. Square D	
ENCLOSURE	1. Hoffman 2. Tanco	
FUSE (F)	1. Bussmann 2. Gould-Shawmut	
FLASHER (FL)	1. Sta-Con, Inc. 2. SSAC	1. 008-24-13SP 2. FS-126
FLOAT REGULATOR (FR)	1. Roto-Float	1. GSI8ONO
GENERATOR RECEPTACLE (GR) 1. 230V, 100A, 3P, 4W 2. 230/460V, 200A, 3P, 4W	1. Russell-Stroll 2. Russell-Stroll	1. JRSB1044FR 2. JRSBZ044FR
INSIDE DROP BOWL	1. Reiner / Duran Inc.	
MAIN SILENCE BUTTON (HSS)	1. Westinghouse 2. Square D	1. PB1AAH 2. 9001-SKR-1U
MAIN CIRCUIT BREAKER (MCB)	1. Square D	
MAIN CIRCUIT TRANSFORMER (MCT)	1. Square D	1. 500 SV43F
MOISTURE AND TEMPERATURE FAILURE LIGHT (MT)	1. Dialco 2. Littlefuse	1. 803-1710 2. 930407X
MOTOR CIRCUIT BRAKER (MB)	1. Square D	
MOTOR STARTER (MS)	1. Westinghouse 2. Square D	1. A-200 2. D-8536
OVERLOAD HEATER (OL)	1. Westinghouse 2. Square D	
PHASE MONITOR	1. Diversified	1. SLA-230-ASA (230 Volt) 2. SLA-440-ASA (460 Volt)

<u>ITEM</u>	<u>MANUFACTURERS</u>	<u>PART NO. OR DISCRIPTION</u>
PILOT LIGHT (PL)	1. Dialco 2. Littlefuse	1. 803-1710 2. 93047X
PUMP AUTOMATIC ALTERNATOR (PAA)	1. Diversified	1. ARA-120-ACA
RELAY (R)	1. Potter Burmfield	1. KRPA-11AN 2. 22 Series
RESISTOR 5 watt, 2500 ohm	1. Rockwood	
RUN INDICATOR	1. Dialco 2. Littlefuse	1. 803-1710 2. 930407X
SURGE PROTECTOR (LA)	1. Volt-Guard	1. VGX
TERMINAL STRIP (TS)	1. Marathon 2. Square D 3. Phoenix	1. Series 200 2. 9070-GR6 3. UKK B3
TELEMETRY	1. Omni site	1. XR-50 Alarm Monitor

III. WATER AND REUSE MAIN MATERIALS

<u>ITEM</u>	<u>MANUFACTURERS</u>	<u>PART NO. OR DISCRPTION</u>
AIR RELEASE VALVES	1. Apco 2. Val-matic	S-200A (2" NPT) Series 38 (Model #38.2)
AUTOMATIC FLAUSH DEVICE	1. Hydro-Guard	HG-1
WATER SAMPLING STATION	1. GIL Industries	EH101-30
CASING SPACERS (POLY)	1. BWM 2. CASCADE 3. PSI	BWM-SS-8 (4" to 20") BWM-SS-12 (24" to 36") CCS-12" Width Min. C12G-2
CORPORATION STOPS	1. Ford	FB1100-4-NL (1") FB1100-6-NL (1-1/2")
CURB STOP	1. Ford	1. Single Service: B43-342W-NL Double Service / Branch: UVBS43-42W-NL Water Sampling Station: B41-343W-NL
EXPANSION JOINTS	1. Mercer 2. Metraflex	

<u>ITEM</u>	<u>MANUFACTURERS</u>	<u>PART NO. OR DISCRIPTION</u>
FIRE HYDRANTS	1. Kennedy 2. M & H	2. Guardian K-81A 4. Model # 129
FITTINGS D.I.	1. Tiger Union 2. Sigma	
GATE VALVES,	1. AFC 2. Clow 3. Kennedy	Fusion Bond Epoxy Coated
RESILIENT WEDGE	1. American Flow Control 2. M & H 3. Kennedy 4. Mueller 5. AVK	Series 25
HYDRANT PAINT (Body Only)	Dupli-Color	CS101 Chrome Spray paint
HYDRANT PAINT (Bonnet Only)	Dupli-Color Krylon Dupli-Color Dupli-Color	DE1601- Ford Blue 1817 - John Deere Green DE1653 - Red DE1620 – Chevrolet Orange
LOCKSEAL STUD (EXTRA LONG)	Highfield	Part# 93210143
LOCKSEAL STUD (WITH SEAL)	Highfield	Part# 93280156

<u>ITEM</u>	<u>MANUFACTURERS</u>	<u>PART NO. OR DISCRIPTION</u>
METER BOX (DUAL)	Hubbell	A131730506425X 17 x 30 x 18 Assembly
METER BOX SINGLE RESIDENTIAL	Hubbell	A131118520425X
METER BOX RECLAIME SINGLE RESIDENTIAL (PURPULE)	Hubbell	A131118521425X
PIPE (DI)		Pressure Class 150
PIPE (PVC)		C900, DR18 Minimum HDPE Driscopipe
POLYETHYLENE TUBING	1. Endot Pure Blue 2. Charter Plastics	
RESTRAINED JOINTS	1. Romac Gripring 2. EBBA Iron Inc. 3. Uniflange / Ford	
SERVICE SADDLES	1. Smith Blair 2. Romac Gripring 3. Ford	Double Strap / Stainless Steel
STRAIGHT DUAL CARTRIDGE CHECK VALVE	1. Ford	HHC31-323-NL
TAPPING SLEEVES, STAINLESS STEEL	1. Mueller 2. Smith Blair 4. M & H 5. Ford 6. JCM	Fusion Bond Epoxy Coated
TAPPING VALVES, RESILIENT WEDGE	1. AFC 2. Clow 3. Kennedy	Fusion Bond Epoxy Coated
TRACER WIRE	1. Copperhead	10 Gauge UF Solid
SHAFT CATHODIC TEST BOX	1. Bingham & Taylor	P200 NFG Test

<u>ITEM</u>	<u>MANUFACTURERS</u>	<u>PART NO. OR DISCRIPTION</u>
VALVE BOXES	<ol style="list-style-type: none"> 1. Tyler Union 2. Star 3. Sigma 4. Proflo 	
VALAVE MAKERS	<ol style="list-style-type: none"> 1. Flint 	Blue - Thermoplastic (90 Mils) Red - Thermoplastic (90 Mils)
VAULT FRAME AND COVER	<ol style="list-style-type: none"> 1. U.S. Foundry 	1. USF #663-AB-M
WIRE CONNECTORS	<ol style="list-style-type: none"> 1. Pro-Trace 	TW Connector – Part# 739010250

END OF APPENDIX “B”