

**MANUAL OF
STANDARDS AND SPECIFICATIONS
FOR
UTILITIES CONSTRUCTION**

**CITY OF
WINTER GARDEN, FLORIDA**

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**MANUAL OF
STANDARDS AND SPECIFICATIONS
FOR
UTILITIES CONSTRUCTION**

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INTRODUCTION

INTRODUCTION

DOCUMENT TITLE

The title of this document is "Manual of Standards and Specifications for Utilities Construction, City of Winter Garden, Florida." Other City of Winter Garden documents that supplement this document include the City of Winter Garden Road Construction Specifications, the City of Winter Garden Subdivision Regulations, and the City of Winter Garden Right-of-Way Utilization Regulations, and Winter Garden Code of Ordinances.

JURISDICTION

This MANUAL shall apply to all proposed water, wastewater and reclaimed water systems to be owned, operated or maintained by the City of Winter Garden.

PURPOSE

These standards and specifications are adopted to establish minimum acceptable standards for the design and construction of water distribution and transmission facilities, wastewater collection and transmission facilities and reclaimed water distribution in the City of Winter Garden. Such facilities include water mains, gravity sewers, wastewater force mains, wastewater pump stations, reclaimed water mains, 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 water, wastewater and reclaimed water systems.

Part 2 of this document, Specifications, includes Division III, IV and V. These three Divisions contain detailed technical specifications governing construction of water, wastewater and reclaimed water systems.

Part 3 of this document is Standard Drawings. This part contains Drawings showing standard details associated with the installation of water, wastewater and reclaimed water systems.

PART 1 - STANDARDS

DIVISION I

GENERAL REQUIREMENTS

SECTION 10

DEFINITIONS

10.1 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 "shall" is mandatory, and the word "may" 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.

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

CITY - means the City of Winter Garden Board of City Commissioners, Winter Garden, Florida, and/or its designated representative(s).

CITY ENGINEER - City of Winter Garden's designated City Engineer.

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

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

DIPRA - means Ductile Iron Pipe Research Association.

DIRECTOR - means the Director of Public Services of City of Winter Garden, 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 the City of Winter Garden Manual of Standards and Specifications for Utilities 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 WINTER GARDEN - means the City of Winter Garden, 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.

PUBLIC SERVICES - means the Public Services Division of the City of Winter Garden, Florida.

RIGHT-OF-WAY UTILIZATION REGULATIONS - means the City of Winter Garden Right-of-Way Utilization Regulations, latest edition.

ROAD CONSTRUCTION SPECIFICATIONS - means the City of Winter Garden Road Construction Specifications, latest edition.

SANITARY SEWER - means pipes, manholes and structures that collect and convey wastewater by means of gravity, including laterals, clean-outs, etc.

SITE DEVELOPMENT ORDINANCE - means the City of Winter Garden Site Development Ordinance #86-20, including latest amendments.

SPECIFICATIONS - means the specifications contained in Part 2 of this MANUAL.

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

STANDARD DRAWINGS - means the detailed drawings in Part 3 of this MANUAL related to water, wastewater and reclaimed water 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 Winter Garden Subdivision Regulations, 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.

SECTION 11

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

11.1 PLANS AND SPECIFICATIONS

11.1.1 GENERAL

All submitted plans shall be standard size sheet (24" x 36" or 11" x 17") 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 will only be required when special facilities outside the scope of this MANUAL are proposed. All PLANS sheets and the title page of submitted specifications must be signed, sealed and dated by the DEVELOPER's ENGINEER.

11.1.2 MASTER PLAN

Whenever possible, the entire water, wastewater and reclaimed water 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, wastewater and reclaimed systems. Main sizes shall be indicated on the Master Plan.

11.1.3 PLAN AND PROFILE

All gravity sewers, wastewater force mains, reclaimed water mains and off-site water mains shall be drawn in plan and profile. On-site water mains may be shown in plan view only.

Whenever possible, on-site water, wastewater and reclaimed water 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. Profile 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 outside of paved areas.
- f. Pipe data including size, lengths, material, and slopes.
- g. Size, type, and locations of fittings, valves, hydrants, air release/vacuum release, and other related appurtenances.

- 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. Location(s) and general layout of wastewater pumping stations.
- n. Construction notes regarding cover, horizontal and vertical control, special construction requirements, and references to standard and special details.

11.1.4 DETAILS

The PLANS shall include all applicable STANDARD DRAWINGS as shown in Part 3 of this MANUAL. Special details shall be prepared by the DESIGN ENGINEER for aerial and underwater crossings of rivers, streams, canals and ditches. Other special details shall be prepared by the DESIGN ENGINEER as required.

11.1.5 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.

11.2 SUBDIVISION RELATED WATER, WASTEWATER AND RECLAIMED WATER IMPROVEMENTS

11.2.1 GENERAL

This section covers all water, wastewater and reclaimed water system improvements that are dedicated to the City of Winter Garden and constructed in compliance with the City of Winter Garden Subdivision Regulations.

11.2.2 DESIGN AND PLAN REVIEW

Design of water, wastewater and reclaimed water system improvements associated with the City of Winter Garden approved subdivisions shall be in compliance with the design standards in Division II, and the specification outlined in Divisions III, IV, and V of this MANUAL. PLANS will be reviewed and approved by the City of Winter Garden Utilities Division as part of the subdivision review and approval process. Refer to the City of Winter Garden's Subdivision Regulations for other requirements governing plan review and approval.

11.2.3 CONSTRUCTION INSPECTION

Inspection of improvements shall be in accordance with criteria established in City of Winter Garden Subdivision Regulations. The DIRECTOR or his designated representative shall inspect the water, wastewater and reclaimed water improvements to ensure their compliance with requirements in Divisions II, III, IV and V of this MANUAL.

11.2.4 APPROVAL AND ACCEPTANCE

Approval and acceptance of water, wastewater and reclaimed improvements shall be in accordance with the criteria established in the City of Winter Garden Subdivision Regulations.

11.3 WATER, WASTEWATER AND RECLAIMED WATER SYSTEM IMPROVEMENTS ASSOCIATED WITH THE CITY OF WINTER GARDEN SITE DEVELOPMENT ORDINANCE

11.3.1 GENERAL

This section covers all water, wastewater and reclaimed water system improvements that are constructed in compliance with the City of Winter Garden Site Development Ordinance as amended and are to be dedicated to the City of Winter Garden. Such improvements shall be designed, reviewed, constructed and accepted in accordance with the criteria established in Section 11.3 herein.

11.3.2 DESIGN AND PLAN REVIEW

Design of water, wastewater and reclaimed water system 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 Utilities Division as part of the Commercial Site Plan review process.

11.3.3 CONSTRUCTION INSPECTION

The DIRECTOR or his designated representatives) shall periodically inspect all construction subject to these standards and specifications.

After all required improvements have been installed, the DESIGN 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 CONTRACTOR or DEVELOPER's DESIGN ENGINEER and if not corrected in an expeditious manner, all work on the project will be suspended and/or certificate of occupancy withheld. Laboratory tests may be required when appropriate.

**11.3.4 MAINTENANCE, MATERIALS AND WORKMANSHIP
WARRANTY BOND**

A bond shall be posted by the DEVELOPER or CONTRACTOR and executed by a company authorized to do business in the State of Florida that is satisfactory to the CITY, payable to the City of Winter Garden in the amount of twenty (20) percent of the estimated construction cost of all required water, wastewater and reclaimed water system 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 two (2) year period, and the materials, workmanship and structural integrity of utility systems, and miscellaneous related facilities, excluding mechanical equipment for a two (2) year period, commencing after a Certificate of Completion has been issued by the CITY. See Appendix C 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/CONTRACTOR may provide for the deposit of cash in an escrow account or a letter of credit acceptable to the CITY.

11.3.5 CERTIFICATE OF COMPLETION/APPROVAL FOR MAINTENANCE

After successful completion of all water, wastewater and reclaimed water system improvements, and after receipt of the required documents. 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 two (2) year Warranty Period and verification by the CITY of satisfactory performance of all water, wastewater, and reclaimed water system improvements, the CITY will issue the "Approval for Maintenance", thereby releasing the DEVELOPER or CONTRACTOR from further responsibilities.

11.4 MISCELLANEOUS WATER, WASTEWATER AND RECLAIMED WATER SYSTEM IMPROVEMENTS

All water, wastewater and reclaimed water system improvements constructed which are intended to be owned, operated or maintained by the CITY, excluding the improvements discussed in Sections 11.2 and 11.3 hereinabove, shall be designed, reviewed, inspected and accepted in strict compliance with the criteria established in Section 11.3 hereinbefore.

11.5 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 permits.

11.6 LIST OF MATERIALS AND APPROVED MANUFACTURERS

A list of Materials and Approved Manufacturers for the various products specified in this MANUAL is included in Appendix A. It is the intent of the CITY to review and update Appendix A 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.

SECTION 12

DIGITAL, CAD, and AS BUILT REQUIREMENTS

12.1 INTRODUCTION

Electronic files are shared and referenced by many departments and must satisfy various needs. The electronic files must be shareable in formats that all parties can utilize. Therefore, digital requirements must be established. The City of Winter Garden Digital Requirements outlines the required standards, conventions and formats necessary to be followed with submittals.

12.1.1 INITIAL SUBMITTAL

Electronic data must be submitted on a CD or DVD. The entire submittal package and engineering drawings must be provided as TIFF or PDF with 300 DPI (dots per inch) or higher. The electronic data submitted must be identical to the hard copy provided. You may include other digitally formatted documents relevant to the projects (i.e., Word.doc, Excel.xls, PowerPoint.ppt). On the disk, include the name of the project, location, date of submission. You may include other digitally formatted documents relevant to the projects (i.e., Word.doc, Excel.xls, PowerPoint.ppt).

12.1.2 FINAL SUBMITTAL

Electronic data must be submitted on a CD or DVD. The final submittal package must include all documents and engineering drawings as TIFF or PDF with 300 DPI (dots per inch) or higher. In addition, all engineering drawings must also be provided with all CAD drawings (.dgn, dwg, dxf, etc.) or GIS files (.shp, gdb, etc.) and meet the CAD requirements. Label the disk "Final Submittal". On the disk, include the name of the project, location, date of submission.

The project will not be issued a final development order until all of the AutoCAD or GIS information is correct and complete.

12.2 CAD REQUIREMENTS

12.2.1 Any drawing submitted should be AutoCAD or Microstation.

12.2.2 All drawings must be submitted in NAD 1983 State Plane Florida East. Vertical datum shall be referenced to the National Geodetic Vertical Datum of 1929 or to the North American Vertical Datum of 1988. **THIS SHALL BE CLEARLY NOTED ON THE PLANS.**

- Projection: Transverse Mercator
- Coordinate System: State Plane Florida East (Feet)
- Datum NAD 1983
- Spheroid: GRS 80
- Units: US Feet
- Drawing Naming Convention: It is recommended that each drawing must be named to match its content (i.e., base.dwg,

stormwater.dwg, sanitary.dwg, water.dwg, soils.dwg, topography.dwg).

- Required colors for stormwater, reclaim, water distribution, and collection:

Description	Color	Microstation Color #	AutoCAD Color #
Force main and sanitary sewer pipe	Green	2	3
Reclaimed/water pipe	Violet	5	6
Drinking water and raw water pipe	Blue	1	5
Stormwater pipe	Tan	10	10
Fire Hydrant	Blue	1	5
Manhole (sanitary)	Green	2	3
Manhole (stormwater)	Tan	10	10
Meter (water)	Blue	1	5
Meter (reclaim)	Violet	5	6
Pump/Lift Station	Cyan	7	4
Valve (sewer)	Green	2	3
Valve (water)	Blue	1	5
Valve (reclaim)	Violet	5	6

- Always include cover sheet, a drawing index, and all standard details.
- Feature information such as pipe size, material, depth, etc. will be clearly labeled.
- Only one (1) layout per layout tab.
- No layouts in Model Space - Please use Model Space for Data not Title Blocks.
- Scale in Model space 1:1.
- Use X-Reference Manager to check that all external references in the drawing are included.
- Include all special fonts, custom shape files, or custom graphics either in the drawing or on the CD as a separate X-reference.

12.3 GIS REQUIREMENTS

12.3.1 Departments will accept the Engineering Drawing in ESRI shape file (.shp) or geodatabase (.gdb).

12.3.2 All feature classes must be submitted in NAD 1983 State Plane Florida East.

- Projection: Transverse Mercator
- Coordinate System: State Plane Florida East (Feet)
- Datum NAD 1983
- Spheroid: GRS 80
- Units: US Feet

12.3.3 Topology will be free of errors.

- Points, lines, and polygons will have a single unique user-id number.
- Data will be free of undershoots, overshoots, and sliver polygons unless necessary to describe the specific spatial data.

12.3.4 All GIS features will include metadata.

12.3.5 For a plan to be deemed complete, the layering scheme must be readily understood by City Staff. These digital submittal requirements are enacted to enable the City of Winter Garden to increase the efficient use of project time and management and to serve our customers, the public, better.

12.4 AS BUILT REQUIREMENTS/RECORD DRAWINGS

12.4.1 RECEIVABLES

The DESIGN ENGINEER shall submit FOUR (4) certified sets (24"X36") of Record Drawings to the CITY prior to issuance of Certificate of Completion for the improvements. The DESIGN 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 - CD or DVD** in a jewel case to include Two (2) electronic files of record drawings shall be provided to the City. One Drawing file shall be PDF format (Signed and Sealed) and the second shall be in AutoCAD format. **The disk label shall include the following:
 1. Engineering and/or Survey Company Name with prepared by statement
 2. Project Name, City of Winter Garden Project Number
 3. Date the data is burned onto disk
 4. Designate "Record Drawing", "Preliminary Record Drawing" or "Other".
- Auto-CAD Files must be submitted in DWG format minimally.
- Each file should be for one section of development and one layer included below. Multiple sections will not be accepted in one file.
- Provide outline of layers on the Auto-CAD file.
- Auto-CAD files shall be saved by using the E-TRANSMIT command.
- Drawings shall clearly show all field changes of dimension and detail including changes made by field order or by change order. Everything in the ground shall be "as-built" and turned in to Engineering Dept. in a Signed & Sealed scanned PDF format.
- Drawings shall clearly show all details not on original contract drawings but constructed in the field. All equipment and piping relocation shall be clearly shown.
- Tie into section corners in the Florida State Plane Coordinate System East to insure proper orientation at each end of baseline. Section corner tie sheets can be obtained from the Orange County Surveyor's web page.
- Each sheet of the PLANS shall be signed, sealed and dated by the DESIGN ENGINEER as being "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 DESIGN ENGINEER. The "Certificate of Completion" will not be issued until correct "Record Drawings" have been submitted.

12.4.2 DATUM

- As used in the design and shown on the Record Drawing; Horizontal datum shall be referenced to North American Datum of 1983, on the 1990 adjustment for Florida Transverse Mercator - East Zone. **The same datum used in the design and shall be shown as the datum used in the Record Drawing;** Vertical datum shall be referenced to the National Geodetic Vertical Datum of 1929 or to the North American Vertical Datum of 1988. **THIS SHALL BE CLEARLY NOTED ON THE PLANS.**
- Where there is no baseline, the baseline for water main should be the sanitary sewer, if there is no sanitary sewer then the storm sewer, if no storm sewer the property/ROW line, baseline for sanitary sewer should be the sanitary sewer, baseline for storm sewer should be the storm sewer.
- All record data shall be digitally positioned on the design drawings prepared by the engineer of record. Said design drawings shall be complete and include both plan and profile views of the infrastructure.
- In all cases, State Plane Coordinates shall be used in the electronic datum, station, off-set and elevations shall be shown on the plan.

12.4.3 GENERAL (FOR ALL LAYERS)

- All references to "proposed" and "plan" are to be removed from the Record Drawing.
- All lines, structures, and other items that are relocated will be removed and shown in the proper location (hand written notes and "x"ing out will not be allowed).
- All record drawings will be signed and sealed by Certified Land Surveyor or Professional Engineer licensed to practice in the State of Florida. If certified by a Surveyor, P.E. will sign off Stating that the record drawings were checked by the engineer, verifying that they inspected the work.
- Lot numbers on the as-builts shall match the lot numbers on the recorded plat.
- Clearly mark existing infrastructure which is to remain.
- Clearly mark existing infrastructure which has been abandoned, and how it was abandoned.
- Station, length, width and depth of flowable fill used.
- Record Drawings shall not be greater than 1" equals 30'.
- All Detail sheets shall be included with each record drawing.
- Location by station and elevation, width, depth and length of flowable fill used for all uses
- Supply all surveys of the project and or property

12.4.4 WATER, REUSE AND FORCE MAINS (EACH TO BE LOCATED ON A SEPERATE LAYER)

- Location of all meter boxes, valves, tees, bends, reducers, caps, plugs, fire hydrants, backflow preventers, water services, taps, air release valves, including top of pipe at ARV, and centerline of water main on station and offset not to exceed 100'. All horizontal deflections shall be called out.
- Top of pipe elevations should be shown on all tees, valves, bends, reducers, caps, plugs, centerline of water main not to exceed 100 lineal

feet, and bottom flange of barrel section of the fire hydrant. All vertical deflections shall be called out.

- Restrained joint pipe length (station to station).
- Manufacturer, model, usage, type and size of valves shall be shown on the plan.
- Numbered sample points locations needed for DEP submittal (to be removed from "final" as-built).
- Length of run between fittings, type of and size of pipe material.
- Call out variation (if it exists) in stationing of corporation compared to meter box.

12.4.5 SANITARY SEWERS: (TO BE LOCATED ON A SEPARATE LAYER)

- Manhole rim elevation, invert elevations and directions.
- Length of run between sanitary structures, type of and size of pipe material with calculated percentage of slope for the run of pipe.
- Location of sanitary service wyes with station and offset, together with the invert elevation, station and offset, pipe diameter and material (only at clean-out).
- Applicable lift station information should be filled out on the detail sheet for lift stations.

12.4.6 WATER/SANITARY/STORM/REUSE PIPE CROSSINGS AND SEPARATIONS (PART OF WATER, SANITARY, REUSE AND/OR STORM LAYER)

- Pipe types, sizes and material.
- Crossings; Top and bottom elevations of pipes crossing each other and the distance between the outside of the two lines.
- Separation; Distance between the outside of the two lines.

12.4.7 CONFLICT STORM/WATER/SANITARY/REUSE STRUCTURES (PART OF EACH APPLICABLE LAYER)

- Top and bottom of casing.
- All info asked for in storm or sanitary manhole descriptions with the addition of top of all pipes.

12.4.8 CASINGS (PART OF EACH APPLICABLE LAYER)

- Material and thickness.
- Top of and invert of casing.
- Length and station and offset of ends.
- If used, station and offset for vent, including tap location, and fittings.

12.4.9 STORM SEWERS AND UNDERDRAIN (TO BE LOCATED ON A SEPARATE LAYER)

- Manhole and catch basin rim elevation, outfalls and top of headwall invert elevations and direction, weir elevations, bottom of manholes and catch basins (sumps).
- Length of run between storm structures, type of and size of pipe material with calculated percentage of slope for the run of pipe.

- Location of service connections (without manholes) together with the invert elevation, pipe diameter and material.
- Dry retention, wet retention, dry detention, wet detention areas.
- Exfiltration trenches, Station at beginning and end of system, width, depth.
- Top of and toe of slope on berm elevation designed to stop flooding.
- Underdrain, Station at beginning and end of the system, type of and size of pipe with clean-out locations.

12.4.10 STREET LIGHTS (TO BE LOCATED ON A SEPARATE LAYER)

- Manufacturer, model, and height of poles shall be shown on the record drawings.
- Manufacturer, model, and wattage and voltage of lights shall be shown on the record drawings.
- Pull boxes, station and offset.
- Length of conduit runs between boxes and poles, type of, and size of pipe material. Shown as, laid in the ground not as a wiring schematic, with amount, by color, type of, and size of wiring material.
- Service connection, type (Duke Energy owned, City metered) station and offset.

12.4.11 IRRIGATION (TO BE LOCATED ON A SEPARATE LAYER)

- Backflow preventer, control stand location, Control valve, zone, station and offset.
- Main line piping size, material, lengths, depth.
- Heads, Type (1/4, half, 3/4, full circle) zone, station and offset.
- Control Stand, station and offset.

12.4.12 LANDSCAPING (TO BE LOCATED ON A SEPARATE LAYER)

- Tree type, caliper, and height.
- Tree grate, size, and model.
- Station, elevation, length, width, and depth of Structural Soil used.
- Top of and toe of slope on berm elevation for landscaping.

12.4.13 PRIVATE CONSTRUCTION IMPACTS TO RIGHT-OF-WAY (TO BE LOCATED ON A SEPARATE LAYER)

- Private utility or revocable easements in the City ROW's or on City property must be shown on the plan. Any improvements within the easement need to be shown and called out as private. The recording information should be on the as-built.
- Privately owned lighting, irrigation and landscaping in the City right-of-way needs to be called out as private and identified.
- All aerial and underground footer easements (in ROW).

12.4.14 FLOWABLE FILL (PART OF EACH APPLICABLE LAYER)

- Limits of flowable fill shall be noted on the as-built. (Location, Length, Width, & Depth)

DIVISION II

DESIGN STANDARDS

SECTION 20

GRAVITY SEWERS

20.1 GENERAL CONSIDERATIONS

20.1.1 TYPE OF SEWERS

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

20.1 2 DESIGN PERIOD

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

20.1.3 LOCATION

Gravity sewers shall be located in dedicated rights-of-way or utility easements. Whenever possible, sewers shall be located under pavement in dedicated rights-of-way. All sewers located outside of dedicated rights-of-way shall require a minimum 30 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 so dictate. 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.

Trees shall not be planted within any rights-of-way, utility easements, or drainage easements that are dedicated to the City of Winter Garden.

20.2 DESIGN BASIS

20.2.1 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 Equivalent Residential Unit (ERU) method as outlined in the City of Winter Garden Ordinance #78-60.

20.2.2 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 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.

20.2.3 DESIGN CALCULATIONS

DESIGN 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.

20.3 DETAILS OF DESIGN AND CONSTRUCTION

20.3.1 MINIMUM SIZE

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

20.3.2 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.

20.3.3 SLOPE

All sewers shall be designed and constructed to give minimum velocities, when flowing full, of not less than 2.0 feet per second, based on Manning's formula using an "n" value of 0.012 for PVC and 0.013 for other pipe materials. The following minimum slopes shall be provided; however, slopes greater than these are desirable:

<u>Sewer Size</u>	<u>Minimum Slope in Feet Per 100 Feet</u>
8 inch	0.40
10 inch	0.28
12 inch	0.22
15 inch	0.15
18 inch	0.12
21 inch	0.10
24 inch	0.08

Under special conditions, if detailed justifiable reasons are given, slopes slightly less than those required for the 2.0 feet per second velocity when flowing full may be permitted. Such decreased slopes will only be considered where the depth of flow will be 0.3 of the diameter or greater for design average flow. Whenever such decreased slopes are selected, the DESIGN ENGINEER must furnish his computations of the depths of flow in such pipes at minimum, average, and peak rates of flow.

Where design velocities greater than 15 feet per second are attained, due to topography or other reasons, special provisions shall be provided for sewer protection.

Sewers shall be laid with uniform slope between manholes.

20.3.4 SIZE AND ALIGNMENTS

Size conversion between manholes shall not be allowed. All sewers shall be laid with straight alignments between manholes. Line and grade shall be maintained by using a laser pipe level.

20.3.5 ADDITIONAL REQUIREMENTS

Main drain and back wash 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 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.

20.4 MANHOLES

20.4.1 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 on the private side. The maximum depth for a gravity sewer manhole shall be 18 feet.

20.4.2 **TYPE**

An outside drop pipe shall be provided for a sewer entering a manhole where its invert elevation is 24 inches or more above the manhole 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.

20.4.3 **DIAMETER**

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

A minimum access cover diameter of 24 inches shall be provided.

20.4.4 **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.

20.4.5 **MATERIALS**

Manholes shall be constructed of precast units as specified in Section 42. Brick manholes shall not be permitted. Cast-in-place manholes may be accepted on a case by case basis for conflict resolution.

20.4.6 **CASTINGS**

Cast iron frames and covers shall be as specified in Section 42.3. Bolt down and/or gasketed covers shall be provided where manholes are located in areas subject to ponding or flooding.

20.4.7 **ACCESS**

A 10 foot wide access road shall be provided for all manholes which are located outside of CITY roadways. The top 8 inches of the access road shall be stabilized to a Florida Bearing value of 50 psi, and compacted to 98 percent of AASHTO T-180 for the top 8 inches.

20.5 SERVICE CONNECTIONS

20.5.1 GENERAL

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

20.5.2 SIZE AND LENGTH

Service laterals and fittings shall be a minimum of 6 inches in diameter. All service laterals shall be less than 100 feet in length. Skewed service laterals running under the pavement should be avoided.

20.5.3 SLOPE

Service laterals shall have a minimum slope of 1 percent.

20.5.4 CONNECTION

In general, service laterals shall not be allowed to discharge into sanitary manholes. A case by case exception to this requirement may be allowed if the lateral discharges at the same elevation as the manhole invert.

20.6 GREASE TRAPS

20.6.1 GENERAL

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

20.6.2 FAST FOOD RESTAURANTS

Single grease trap capacity shall be sized at the rate of 10 gallons per seat. If two grease traps are used in series, total capacity of the grease traps shall be based on 5 gallons per seat.

20.6.3 GENERAL RESTAURANTS

Single grease trap capacity shall be sized at the rate of 20 gallons per seat. If two grease traps are used in series, total capacity of the grease traps shall be based on 10 gallons per seat.

20.6.4 24-HOUR RESTAURANTS

Single grease trap capacity shall be sized at the rate of 30 gallons per seat. If two grease traps are used in series, total capacity of the grease traps shall be based on 15 gallons per seat.

20.6.5 CONVENTION CENTER/MANUFACTURING CAFETERIAS

Single grease trap capacity shall be sized at the rate of 3 gallons per meal. If two grease traps are used in series, total capacity of the grease traps shall be based on 1.5 gallons per meal.

20.6.6 MISCELLANEOUS FOOD PREPARATION/SERVICE ESTABLISHMENTS

DESIGN ENGINEER shall consult with the CITY Utilities Division personnel before finalizing the design.

20.7 MATERIALS, INSTALLATION AND TESTING

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

SECTION 21

WASTEWATER FORCE MAINS

21.1 GENERAL CONSIDERATIONS

21.1.1 DESIGN PERIOD

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

21.1.2 LOCATION

Force mains shall be located in dedicated rights-of-way 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 30 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 depth 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. This criteria shall also apply to force mains in retention pond berms.

Trees shall not be planted within any rights-of-way, utility easements, or drainage easements that are dedicated to the City of Winter Garden.

21.2 DESIGN BASIS

21.2.1 AVERAGE DAILY FLOW

Provisions of Section 20.2.1 shall apply.

21.2.2 PEAK DESIGN FLOW

Provisions of Section 22.2.1 shall apply.

21.2.3 DESIGN CALCULATIONS

DESIGN 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.

21.3 DETAILS OF DESIGN AND CONSTRUCTION

21.3.1 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 not exceed 8 feet per second for ductile iron pipe or 5 feet per second for PVC pipe. The minimum force main diameter shall be 4 inches. Only 4", 6", 8", 10", 12", 16", 20", 24", 30", 36", 42", and 48" diameter force mains shall be permitted.

21.3.2 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 120 for ductile iron pipe and 130 for PVC pipe. "C" values greater than 130 shall not be allowed.

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.

21.3.3 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.

21.3.4 TERMINATION

Force mains shall not terminate directly into a gravity sewer line. Force mains should enter the gravity sewer system at a point not more than 1 foot above the flow line of the receiving manhole.

21.3.5 AIR RELEASE AND VACUUM RELEASE VALVES

Air release valves shall be provided, as necessary, to prevent air. All such valves shall be clearly delineated on the force main profile in the DRAWINGS. The DESIGN ENGINEER shall submit calculations to the CITY justifying the valve sizing. See additional requirements in Section 45.6.

21.3.6 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 between the aerial and buried sections of the pipe.

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 45.4.4 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 release 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 or DESIGN ENGINEER 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.

21.3.7

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 provided 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.

21.3.8 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 where force mains intersect to facilitate isolation of pipe segments.

21.4 MATERIALS, INSTALLATION AND TESTING

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

21.5 LOCATION AND IDENTIFICATION

A means for locating and identifying all force mains and valves shall be provided in accordance with the provisions in Section 45 and the STANDARD DRAWINGS.

21.6 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 22

WASTEWATER PUMP STATIONS

22.1 GENERAL CONSIDERATIONS

The design standards outlined in this section apply to wastewater pump stations discharging 3000 gallons per minute or less. All such pump stations shall be submersible type stations. 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.

22.2 DESIGN BASIS

22.2.1 DESIGN FLOWS

Design flows 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 20.2.1. 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.

22.2.2 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 22.2.3 for standby requirements.

22.2.3 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. Head capacity curves shall be prepared and submitted to the CITY along with the pump station plans. Such curves shall be based upon the friction losses outlined in Section 21.3.2 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 head capacity curves shall reflect hydraulic conditions in cases where receiving force main systems are interconnected to additional pumping stations.

22.2.4 DESIGN CALCULATIONS

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

22.3 DETAILS OF DESIGN AND CONSTRUCTION

22.3.1 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.

22.3.2 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.

22.3.3 BUOYANCY

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

22.3.4 PUMP REQUIREMENTS

Submersible wastewater pump stations shall comply with the requirements spelled out in Section 47. 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.

All wastewater pump stations shall be constructed with emergency pump-out located at the station.

22.3.5 **WET WELL REQUIREMENTS**

Wet well shall be minimum 6-foot diameter and shall have a minimum 6 foot depth below the lowest invert to the floor surface. Additional depth shall be provided based on station design and cycle time.

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 pumps.

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 hopper 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.

22.3.6 **PUMP STATION WATER SERVICE**

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

22.3.7 **ELECTRICAL EQUIPMENT, POWER SUPPLY AND POWER CORDS**

Requirements in Sections 47 and 48 shall apply.

22.3.8 **CONTROLS**

Requirements in Section 48 shall apply.

22.3.9 **SITE SIZING AND EASEMENT REQUIREMENTS**

Pump station sites shall be sized as delineated on the "Pump Station Site Plan" in the STANDARD 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 "Pump Station Site Plan" in the STANDARD 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/engress easement for the access road.

22.3.10 SITE FENCING

Fencing at the pump station site perimeter shall comply with the technical criteria established in Section 46.8. 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.

22.4 FLOW METERS

Indicating, totalizing and recording flow measurement shall be provided at pumping stations designed to handle peak flows of 1000 GPM or more. Applicable provisions of Section 46.7 shall apply.

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

22.5 EMERGENCY OPERATION

All pump stations shall be provided with an emergency power generator and shall comply with the requirements included in Section 46.6. All such generators shall be rated and designed to operate the pump station under peak design conditions.

SECTION 23

WATER MAINS

23.1 GENERAL CONSIDERATIONS

23.1.1 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.

23.1.2 DESIGN PERIOD

Water mains should be designed for the estimated ultimate tributary population, as delineated in the approved City of Winter Garden 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.

23.1.3 LOCATION

Water mains shall be located in dedicated rights-of-way or utility easements under concrete sidewalks when possible. 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 30 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. 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.

Trees shall not be planted within any rights-of-way, utility easements, or drainage easements that are dedicated to the City of Winter Garden.

23.2 DESIGN BASIS

23.2.1 AVERAGE DAILY DEMAND AND PEAK DEMAND

Average daily water demand shall be calculated by referencing the Equivalent Residential Connection (ERU) flow rates as outlined in the City of Winter Garden Ordinance, Chapter 78 (Municode). Maximum daily and peak hourly water demand rates shall be two times (2x) and four times (4x) the average daily demand, respectively.

23.2.2

FIRE FLOW FOR SUBDIVISIONS AND COMMERCIAL PROPERTY

The following requirements apply to utility system (water and fire mains) design that often occurs before building plans are submitted. The approval of fire flow design is for the utility system only and does not address building plan review. Developers are advised to consider proposed building requirements when designing utility systems, specifically proposed buildings requiring Needed Fire Flow that exceed minimum fire flows provided by the utility system.

Residential Buildings:

The minimum fire flow requirements for one and two family dwellings or residences having a fire area that does not exceed 3,600 square feet shall be 1000 gpm.

Needed Fire Flow for dwellings having a fire area in excess of 3,600 square feet shall be as specified in Table H.5.1., Annex H, Uniform Fire Code, 2003 edition.

Fire Flow reduction up to 35 percent may be allowed, as approved by the Fire Marshall, when the building is provided with an approved automatic sprinkler system that fully conforms to the requirements of NFPA 13R/13D. The resultant fire flow shall not be less than 1,000 gpm.

Commercial, Public, Multi-Family, Institutional or Industrial Buildings:

The minimum fire flow requirements for commercial, public, multi-family, institutional or industrial areas shall be 2,000 gpm.

Needed Fire Flow for commercial, public, multi-family, institutional or industrial buildings shall be as specified in Table H.5.1., Annex H, Uniform Fire Code, 2003 Edition.

A fire flow reduction up to 50 percent may be allowed, as approved by the Fire Marshall, when the commercial, public, multi-family, institutional or industrial building is provided with an approved automatic sprinkler system that fully conforms to the requirements of NFPA 13. The resultant fire flow shall not be less than 2,000 gpm.

23.2.3

DESIGN CALCULATIONS

DESIGN ENGINEER shall submit signed, sealed and dated design calculations with the PLANS for all water distribution projects. Calculation shall show the water mains will have sufficient hydraulic capacity to transport peak hourly flows and the combination of maximum daily flows and fire flows while meeting the requirements of Section 23.3.1. Head losses through meters and backflow devices shall also be included in calculations. Flow in pipelines shall not exceed a velocity of 8 feet per second.

23.3 DETAILS OF DESIGN AND CONSTRUCTION

23.3.1 PRESSURE

All water mains shall be designed in accordance with Section 23.2.3 above. The system shall be designed to maintain a minimum pressure of 20 psi at all points in the distribution system under all conditions of flow. Higher pressures may be required at commercial, industrial and high density residential areas. The normal working pressure in the distribution system should be approximately 55 psi, but in no case less than 35 psi on the downstream side of a meter. For pressures greater than 90 psi special provisions may be required. Design Friction Losses for water mains shall be as specified in Section 21.3.2.

23.3.2 DIAMETER

Pipe diameters shall be standard sizes. Four (4) inch water mains shall be permitted only in cul-de-sac areas with a maximum length of 500 feet of pipe. In cul-de-sac areas only, a 4 inch looped connection may 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 23.3.1.

23.3.3 FIRE HYDRANT LOCATION, SPACING AND TESTING

As a minimum, specifications outlined in the latest version of the City of Winter Garden's Subdivision Regulations and applicable City of Winter Garden Fire Department Codes shall apply.

Fire hydrants shall be spaced in distance according to zoning classification:

R-1	-	800 ft.
R-2, R-3, R-NC, PUDs	-	500 ft.
C-1, C-2, C-3, C-4, I-1	-	500 ft.
I-2	-	300 ft.

Flow tests shall be performed by the Developer/Contractor to determine pressure and flow-producing capabilities within the distribution system. The flow tests shall be performed according to the American Water Works Association Manual of Water Supply Practices M17, *"INSTALLATION, FIELD TESTING, AND MAINTENANCE OF HYDRANTS" Third Edition*. A test report shall be submitted to the City and shall include the following information:

1. Manufacturer
2. Number of Location
3. Date
4. Time
5. Nozzle Size
6. Static Pressure
7. Residual Pressure
8. Pitot Pressure
9. Flow in Gallons Per Minute
10. Flow at 20 psi
11. Time of Flow in Minutes
12. Gallons of Water Used

23.3.4 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 self-flushing hydrant or blow-off for flushing purposes. Flushing devices shall be sized to provide flows which will give a velocity of at least 2.5 feet per second in the water main being flushed. No flushing device shall be directly connected to any sewer.

23.3.5 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 all areas where water mains intersect to ensure effective isolation of water lines for repair, maintenance or future extension.

23.3.6 SEPARATION OF WATER MAINS AND SEWERS

Refer to Section 51.3 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 sewage treatment plants or industrial complexes. Individual septic tanks must be located and avoided.

23.3.7 SURFACE WATER CROSSINGS

The CITY shall be consulted before final PLANS are prepared. Requirements outlined in Sections 21.3.6 and 21.3.7 shall apply. All above ground pipe shall be painted as specified in Section 50.4.4 for water mains.

23.3.8 AIR RELEASE VALVES

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

23.3.9 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 release valves be connected directly to any sewer.

23.3.10 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 51.6 of these specifications.

23.4 WATER SERVICES AND CONNECTIONS

Water services and connections shall conform to the applicable provisions of Section 50 and 51 and the STANDARD DRAWINGS. Only 1", 2", 4", 6", 8" and 12" services will be permitted. Where water services greater than 12" are required, dual services shall be provided. Water services and connections to existing CITY systems shall be made by the CONTRACTOR. Fire service connections and potable water service connections shall be connected to the distribution system by a separate tap. At no time shall these services share a single service connection.

23.5 WATER METERING

23.5.1 GENERAL

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

**23.5.2 SINGLE FAMILY, DUPLEX, AND MULTI-FAMILY
SUBDIVISIONS WITH PUBLIC RIGHTS-OF-WAYS**

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

**23.5.3 SINGLE FAMILY AND DUPLEX SUBDIVISIONS WITH
PRIVATE STREETS**

Individual meters may be permitted in accordance with Section 23.5.2 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 23.5.5.

23.5.4 COMMERCIAL, INDUSTRIAL, AND INSTITUTIONAL PROJECTS WITHOUT PRIVATE FIRE LINES

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

23.5.5 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 to the DEVELOPER executing a Meter Installation and Easement Agreement.

23.5.6 SHOPPING CENTERS

In general, shopping centers shall require installation of a fire line master meter. Individual meters to each unit may be considered on a case-by-case basis subject to the DEVELOPER executing a Meter Installation and Easement Agreement.

23.5.7 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. In general, meters larger than two inch shall be located in a meter easement located adjacent to the public right-of-way.

23.5.8 METER SIZING

Size of all meters shall be determined by the City of Winter Garden Utilities Division. The DESIGN ENGINEER shall provide sufficient information on estimated peak flows and low flows so that meter size can be determined. The DESIGN ENGINEER shall include headlosses through metering device when designing the water system.

23.6 MATERIALS, INSTALLATION AND TESTING

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

23.7 LOCATION AND IDENTIFICATION

A means for locating and identifying all water mains and valves shall be provided in accordance with Sections 50, 51 and the STANDARD DRAWINGS.

23.8 CROSS-CONNECTION CONTROL

23.8.1 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. Some of the common instances requiring installation of cross connection control devices are listed below. However, the DESIGN ENGINEER must obtain CITY approval before finalizing the design of a Cross Connection Control Device.

23.8.2 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 device or other device.

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 valve assembly.

23.8.3 IRRIGATION SYSTEMS

Pressure-type vacuum breakers or double check valve assembly shall be utilized on all irrigation systems.

23.8.4 LOCATION AND INSTALLATION

In general, all backflow prevention devices are to be located directly following the water meter on DEVELOPER'S/OWNER'S property. Backflow prevention devices shall be installed above ground to facilitate maintenance and testing. It shall be the OWNER'S responsibility to pay for, install and maintain all backflow prevention devices.

SECTION 24

RECLAIMED WATER SYSTEM

24.1 GENERAL CONSIDERATIONS

24.1.1 TYPE OF WATER MAINS

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

24.1.2 DESIGN PERIOD

Reclaimed water mains should be designed for the estimated reclaimed irrigation requirements of served areas. Estimates shall include irrigatable area, irrigation rate based on soil conditions and peak conditions.

24.1.3 LOCATION

Refer to Section 23.1.3 of these specifications.

24.2 DESIGN BASIS

24.2.1 AVERAGE DAILY DEMAND AND PEAK DEMAND

Reclaimed water peak demand rate shall be estimated as six (6) times the estimated average daily demand rate.

24.2.2 DESIGN CALCULATIONS

DESIGN ENGINEER shall submit signed, sealed and dated design calculations with the PLANS for all water distribution projects. Calculation shall show the reclaimed water mains will have sufficient hydraulic capacity to transport peak hourly flows and the combination of peak daily flows. Head losses through meters and backflow devices shall also be included in calculations. Flow in pipelines shall not exceed a velocity of 8 feet per second. Working pressure at the connection point to the system shall be provided by the City.

24.3 DETAILS OF DESIGN AND CONSTRUCTION

24.3.1 PRESSURE

All reclaimed water mains shall be designed in accordance with Section 24.2. The system shall be designed to maintain a minimum pressure of 30 psi at all points in the distribution system under all conditions of flow. The normal working pressure in the distribution system should be approximately 55 psi, but in no case less than 35 psi on the downstream side of a meter.

24.3.2 **DIAMETER**

Reclaimed water mains shall be standard size pipe. Reclaimed water systems shall be looped as much as possible to avoid dead end lines. Lines shall be sized as needed. Reclaimed water mains in distribution systems shall not exceed the size of diameter of the corresponding distribution water main.

24.3.3 **FIRE HYDRANT LOCATION AND SPACING**

Fire hydrants shall not be provided on reclaimed water system.

24.3.4 **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 blow-off for flushing purposes.

24.3.5 **VALVES**

Sufficient valves shall be provided on reclaimed water mains so that inconvenience 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 all areas where reclaimed water mains intersect to ensure effective isolation of reclaimed water lines for repair, maintenance or future extension.

24.3.6 **SEPARATION OF RECLAIMED WATER MAINS AND OTHER UTILITY LINES**

Refer to Standard Detail Notes, Separation Table for applicable requirements.

24.3.7 **SURFACE RECLAIMED WATER CROSSINGS**

Requirements outlined in Sections 21.3.6 and 21.3.7 shall apply. All above ground pipe shall be painted as specified in Section 50.4.4 for reclaimed water mains. Paint color shall be Pantone 522C - Purple.

24.3.8 **AIR RELEASE VALVES**

At high points in reclaimed water mains where air can accumulate, provisions shall be made to remove the air by means of automatic air release valves. See details in STANDARD DRAWINGS.

24.4 RECLAIMED WATER SERVICES AND CONNECTIONS

Reclaimed water services and connections shall conform to the applicable provisions of Section 50 and 51 and the STANDARD DRAWINGS. Only 1", 2", 4", 6" and 8" services will be permitted. Where reclaimed water services greater than 8" are required, dual services shall be provided. Reclaimed water services and connections to existing CITY systems shall be made by the CONTRACTOR.

24.5 RECLAIMED WATER METERING

24.5.1 GENERAL

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

24.5.2 SINGLE FAMILY, DUPLEX, AND MULTI-FAMILY SUBDIVISIONS WITH PUBLIC RIGHTS-OF-WAYS

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

24.5.3 SINGLE FAMILY AND DUPLEX SUBDIVISIONS WITH PRIVATE STREETS

Individual meters may be permitted in accordance with Section 24.5.2 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 reclaimed water mains, services, and meters. If the above criteria cannot be met, the subdivision shall be metered pursuant to Section 24.5.5.

24.5.4 COMMERCIAL, INDUSTRIAL, INSTITUTIONAL, MULTI-FAMILY WITH PRIVATE STREETS, APARTMENTS, AND CONDOMINIUM PROJECTS

In general, all such projects shall require installation of a reclaimed water meter.

24.5.5 SHOPPING CENTERS

In general, shopping centers shall require installation of a reclaimed master meter.

24.5.6 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. In general, meters larger than two inch shall be located in a meter easement located adjacent to the public right-of-way.

24.5.7 METER SIZING

Size of all meters shall be determined by the City of Winter Garden Utilities Division. The DESIGN ENGINEER shall provide sufficient information on estimated peak flows and low flows so that meter size can be determined. The DESIGN ENGINEER shall include headlosses through metering device when designing the reclaimed water system.

24.6 MATERIALS, INSTALLATION AND TESTING

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

24.7 LOCATION AND IDENTIFICATION

A means for locating and identifying all reclaimed water mains and valves shall be provided in accordance with Sections 60, 61 and the STANDARD DRAWINGS.

24.8 CROSS-CONNECTION CONTROL

24.8.1 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 on all private reclaimed water distribution systems.

24.8.2 COMMERCIAL, INDUSTRIAL ANDMULTI-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 device or other device.

24.8.3 LOCATION AND INSTALLATION

In general, all backflow prevention devices are to be located directly following the water meter on private property. Backflow prevention devices shall be installed above ground to facilitate maintenance and testing. It shall be the DEVELOPER's responsibility to pay for, install and maintain all backflow prevention devices.

SECTION 25

FIBER OPTICS ENGINEERING

Scope of Standard

- A. These guidelines identify and define the City of Winter Garden requirements and policies for designing and installing broadband infrastructure and substructure at all City of Winter Garden facilities. Use of, and compliance with these guidelines is mandatory for architects, engineers, and installation contractors working on City of Winter Garden projects.

25.1 Design Guidelines

- A. The City of Winter Garden Infrastructure Standards are based upon the code requirements and telecommunications industry standards contained in the following guidelines. These guidelines will not duplicate the information contained in those references, except where necessary to provide guidance, clarification or direction.
- B. In instances where several technical alternatives may be available to provide a design solution, these guidelines will identify the preferred solution to meet City of Winter Garden needs. However, each facility and project is unique. Design for new construction will differ from design for retrofit of existing facilities. These guidelines will differentiate certain design approaches and solutions to be applied to new construction versus existing facilities, and different types of City of Winter Garden facilities. However, designers and installers shall always use sound engineering judgment in order to comply with the requirements of the codes and standards identified in this section.
- C. Designs will include, but not be limited to, all man-hole, hand-holds, conduits, roads, bridges, railway crossings, railways, buildings, utility poles, traffic light structures, traffic control boxes, other utilities structures, both existing and planned (new) that are pertinent to the construction of the fiber path.
- D. As-builts will be provided in paper 8.5" x 14" format with all construction notes and geo-spatially correct measurements (verified by GPS), as well as digitally in AutoCAD 2008 or earlier and projected in the coordinate system NAD1983 State Plane Florida East FIPS 0901 US Feet. Scale should be 1ft. x 1 ft. As-builts will include cadastral boundaries to include right of ways and planimetric boundaries that includes edge of pavement. City of Winter Garden basemap can be provided upon request. As-builts shall be provided to designated City representative, incorporating any changes made during or after construction. Final As-builts shall be completed only once all Fiber-Optic cables in said project have been fully installed and tested and tests have been accepted by designated City representative prior to project closeout.

25.2 Reference Standards

- A. Adherence to, and compliance with, the codes and standards referenced, and the City of Winter Garden unique requirements and design solutions identified in the manual, is mandatory. Requests to deviate from the industry standards and design solutions prescribed in these guidelines may be submitted, on a case-by-case basis, in accordance with the instructions in the Policy and Procedures section of these guidelines. No deviation from the requirements of the National Electrical Code will be allowed.

- B. Architects, Consultants and Contractors shall always reference the most recent standards available. Most references listed below can be purchased directly from the individual standards organization, or from:

Global Engineering Documents
Inverness Way East Englewood, CO 80112-5776
Telephone: (800) 854-7179 (303) 397-7956
Fax: (303) 397-2740
<http://www.global.ihs.com>

25.3 Codes, Standards, References, and Applicability

- A. NATIONAL ELECTRICAL CODE, NFPA 70
 - 1. The National Fire Protection Association has acted as the sponsor of the National Electrical Code (NEC) since 1911. The original Code was developed in 1897 as a result of the united efforts of various insurance, electrical, architectural, and allied interests. The purpose of the NEC is the practical safeguarding of persons and property from hazards arising from the use of electricity. The NEC provides the minimum code requirements for electrical safety. In telecommunications distribution design, the NEC must be used in concert with the ANSI/EIA/TIA standards identified below, which are intended to insure the performance of the telecommunications infrastructure.

- B. ANSI/TIA/EIA STANDARDS
 - 1. The Telecommunications Industry Association/Electronics Industry Association (TIA/EIA) engineering standards and publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers. The standards facilitate interchangeability and improvement of products, and assist the purchaser in selecting and obtaining the proper product for his or her particular need.

The TIA/EIA Standards are updated every five years. Due to the rapid

changes in the telecommunications and electronics industries, TIA/EIA publishes periodic Telecommunications Systems Bulletins (TSB), which provide additional guidance on certain technical issues that must be addressed prior to the next scheduled revision of the standards. The information contained in TSBs is usually incorporated into the applicable standard during the next standards revision. Standards and publications are adopted by TIA/EIA in accordance with American National Standards Institute (ANSI) patent policy. The TIA web site is: <http://www.tiaonline.org/>

C. FIBER OPTIC TEST STANDARDS, TIA/EIA-526 (SERIES)

1. The TIA/EIA-455 series, together with its addenda, provides uniform test procedures for testing the fiber optic components intended for, or forming a part of, optical communications and data transmission systems. This series contains standard test procedures for optical fibers, cables, transducers, and connecting and terminating devices.

D. CABLING STANDARD, ANSI/TIA/EIA-568 (SERIES)

1. The ANSI/TIA/EIA-568-A (series) is the Commercial Building Telecommunications Cabling Standard. This standard defines a generic telecommunications wiring system for commercial buildings that will support a multiproduct, multivendor environment. It also provides direction for the design of telecommunications products for commercial enterprise.
 - a. The purpose of the standard is to enable planning and installation of building wiring with little knowledge of the telecommunications products that subsequently will be installed. Installation of wiring systems during building construction or renovation is significantly less expensive and less disruptive than after the building is occupied. TIA/EIA-568-A establishes performance and technical criteria for various wiring system configurations for interfacing and connecting their respective elements.

E. GROUNDING AND BONDING, ANSI/TIA/EIA-607 (SERIES)

1. The ANSI/TIA/EIA-606 (series) is the Commercial Building Grounding and Bonding Requirements for Telecommunications. The National Electrical Code (NEC) provides grounding, bonding, and electrical protection requirements to ensure life safety. Modern telecommunications systems require an effective grounding infrastructure to insure optimum performance of the wide variety of electronic information transport systems that may be used throughout the life of a building. The grounding and bonding requirements of this standard are additional technical requirements for telecommunications that are beyond the scope of the NEC. These standards are intended to work in concert with the cabling topology

specified in ANSI/TIA/EIA-568-A, and installed in the pathways and spaces designed in accordance with ANSI/TIA/EIA-569-A.

F. CUSTOMER OWNED OUTSIDE PLANT (OSP), ANSI/TIA/EIA-758

1. The ANSI/TIA/EIA-758 provides industry standards for the design and construction of customer owned OSP infrastructure. Unless specified otherwise in the City of Winter Garden standard OSP designed and constructed at all City of Winter Garden facilities will be in compliance with ANSI/TIA/EIA-758.

G. TRANSMISSION PERFORMANCE SPECIFICATIONS, TIA/EIA BULLETIN TSB67

1. TSB67 is the Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair (UTP) Cabling Systems. This bulletin specifies the electrical characteristics and performance requirements of field test instruments, test methods, and the minimum transmission requirements for UTP cabling. All testing of horizontal distribution cabling at City of Winter Garden facilities will be performed with a TSB67 Level II test instrument.

H. ADDITIONAL HORIZONTAL CABLING PRACTICES FOR OPEN OFFICES, TIA/EIA BULLETIN TSB75

1. This document specifies optional practices for open office environments, for any horizontal telecommunications cabling recognized in TIA/EIA-568. It specifies optional cabling schemes and topologies for horizontal cabling routed through modular office furniture or movable partitions, which are frequently reconfigured

I. LOCAL AREA NETWORK ETHERNET STANDARD, IEEE 802.3 (SERIES)

1. City of Winter Garden utilizes the Ethernet LAN protocol at all facilities. All The City of Winter Garden infrastructure must be designed to support the Institute of Electrical and Electronic Engineers (IEEE) Ethernet 802.3 standards, which define protocols and signaling technologies. All newly installed cabling must support 1000BaseX Gigabit Ethernet protocol based on the IEEE 802.3z standard.

J. THE BICSI TELECOMMUNICATIONS DISTRIBUTION METHODS MANUAL

1. The Building Industry Consulting Service International, Inc. (BICSI) is a Telecommunications Association whose mission is to provide state-of-the-art telecommunications knowledge to the industry, resulting in good service to the end user. BICSI develops and publishes the Telecommunications Distribution Methods Manual (TDMM). The TDMM is not a code or standard. The TDMM is an extensive volume of information on the various aspects of telecommunications systems and telecommunications distribution. The TDMM provides discussions and examples of various engineering methods and design solutions that can be

selected and employed in order to meet the requirements of the NEC and ANSI/TIA/EIA standards. Designers and installers are encouraged to use the TDMM as an engineering tool, within the constraints of the unique requirements of the City of Winter Garden Infrastructure Standards.

25.4 DEFINITIONS

FDOT:

Florida Department of Transportation.

Fiber Optic Cable:

A cable that contains individual glass fibers, designed for the transmission of digital information, using light pulses.

All Dielectric Self Support (ADSS) Cable:

A cable designed and constructed with non-metallic components, that is designed for aerial applications and does not require a separate cable messenger.

Loose Tube Cable:

A cable designed and constructed with non-metallic components, that is designed for underground applications. These are "dry" cables using water swellable powders to protect against water penetration.

OTDR:

Optical Time Domain Reflectometer. A device used for characterizing a fiber, wherein an optical pulse is transmitted through the fiber and the resulting backscatter and reflections are measured as a function of time.

Single-mode Fiber:

An optical fiber with a small core diameter, in which only a single mode of light is capable of propagation.

Multi-mode Fiber:

An optical fiber whose core diameter is large compared with the optical wavelength and which, consequently, a large number of light modes are capable of propagation.

Splicing:

A permanent junction between optical fiber splices. May be thermally fused or mechanically applied.

Minimum Bend Radius:

The minimum radius a fiber may be bent before optical losses are induced.

25.5 Guidelines for Designing Underground Fiber Optic Cable Routes

Governing FDOT Indexes and regulations should be used as well as all applicable codes in force.

Conduit Placement

The conduit shall be placed at an offset from the roadway that meets the governing FDOT regulations and Indexes while still staying within the ROW. If this cannot be accomplished please raise issue to The City of Winter Garden project engineer or liaison.

Depth (Minimum / Maximum):

The conduit used as the primary carrier of the fiber optic cable should be buried no greater than 42" and no less than 36" beneath grade except where code requires otherwise or directed in writing by the Project Engineer on behalf of The City of Winter Garden.

Grade away from Buildings/Structures:

The conduit shall be placed in such a way to as to maintain a gradual grade down away from buildings and other major structures.

Conduit type/ Inner Duct type

Conduit shall be of the HDPE type, of suitable strength per the governing FDOT indexes for the location of work. Conduit shall be 2" in size in all cases unless the specific project requires another size. Inner duct, where required, shall be of the HDPE smooth wall type as well, colored three separate colors (Green, Brown, Gray). Inner duct requirements (size and amount) shall be discussed with the project engineer.

Conduit Turns & Transitions

All conduit turns shall be made with 45-degree bends or sweeps. At no time shall 90-degree bends be utilized in the outside plant arena, unless it is already existing conduit, and approved by The City of Winter Garden.

Exceptions may be made to this rule for work inside of buildings.

Trace Wire

A minimum #12 AWG trace wire should be placed along with all conduit put in place. This trace wire should maintain continuity from end station to end station. Where possible it is acceptable to use vaults/hand holds for joining the trace wire, while keeping these joints visible and out of the way of the fiber cable. Where not possible please use the small hand hole for joining the trace wire. Conduit with built in tracer wire is acceptable for use in the City of Winter Garden.

Marker Posts

Easily visible, marked, 6' fiber optic marker posts should be placed above the conduit at all major transitions to said conduit (turns greater than 25 degrees etc). Fink plated marker posts are required where necessary. Marker posts will display the seal of the City of Winter Garden and will be marked "Underground Fiber Cable."

Conduit Entering Hand Holes/Man Holes

All conduits should be stubbed up underneath the bottom of each manhole/hand hole leaving at least 8" but no more than 12" of visible conduit exposed. Conduit and inner ducts should be capped until use, after use they should be plugged appropriately to

maintain the integrity of the conduit/inner duct from dirt and water.

Locate Information

All splice points, vaults/hand hole/manhole/conduit turns of 45 degrees or greater should receive a GPS coordinate that is marked and labeled back onto the as-built drawings.

Building Entrances

All building entrances should be checked and approved with The City of Winter Garden Project Engineer or liaison. Preference is given in the following order (but dictated by the facility itself) core drilling and bringing conduit up through the floor, utilizing existing conduit to enter the building, bringing conduit up the outside of a facility, attaching a pullbox to the exterior of said building and entering through the wall of the building.

Pull Box Sizing

All boxes utilized MUST meet the FDOT applicable Indexes and be on the FDOT approved equipment list. The following sizes are to be used wherever possible:

17x30x24 (20K Load)

24x24x24 (20K Load)

24x36x24 (20K Load)

Please have all boxes approved during the design phase and prior to purchasing/installation of said boxes. All box lids shall have a marker embedded on them. This logo will be provided by The City of Winter Garden.

Pull Box Spacing

Pull boxes shall be placed no more than 1,000 feet apart and at all intersections. The Contractor shall provide a plan with the pull box shop drawing submittal showing the location of all proposed pull boxes, to be approved by the City's project manager prior to installation.

25.6 Guidelines for Installing/Pulling Underground Fiber Optic Cable

Bend Radius:

The main risk of damage to the fiber optic cable is by overlooking the minimum-bend radius. It is important to know that the damage occurs more easily when the cable is bent under tension, so when the installation is in process be sure to allow for at least the minimum-bend radius. The number of 90-degree turns on a pull shall not exceed four (4).

Reel Placement:

Have the reel set adjacent to the manhole and use a fiber optic manhole pulling block assembly from Sherman & Reilly (or similar).

Cable Slack:

Coil 150 feet of cable at the Transition, Termination points, and every 1500 feet.

Splices:

The City of Winter Garden communications department will designate all splice locations.

Strength:

The fibers in the cable will shatter under considerable impact, pressure or if pulling tensions exceed 600 LB, although from the outside of the cable this will not be apparent. With fiber optic cable the jacket of the cable and the Kevlar layer directly beneath give the cable its strength so please be sure to note and repair all nicks and cuts.

Installation:

When installing use a swivel eye for pulling the fiber optic cable and conduit system.

Precautions:

Please review the manufacturer's installation instructions prior to commencing with the installation. If any questions arise during installation please refer to the manufacturer's installation instructions, or notify the project engineer.

Testing:

Perform OTDR test on each fiber in the installed cable, to verify the parameters of each fiber meet the system design criteria. Power meter tests should also be performed. Test results are to be provided to the project engineer and City of Winter Garden representatives.

25.7 Guidelines for Installing Conduit

Depth (Minimum / Maximum):

The conduit used as the primary carrier of the fiber optic cable should be buried no greater than 42" and no less than 36" beneath grade except where code requires otherwise or directed in writing by the Project Engineer on behalf of The City of Winter Garden.

Reel Placement:

Have the reel set adjacent to the manhole and use a fiber optic manhole pulling block assembly.

Conduit type/ Inner Duct type

Conduit shall be of the HDPE type, of suitable strength per the governing FDOT indexes for the location of work. Conduit shall be 2" in size in all cases unless the specific project requires another size. Inner duct, where required, shall be of the HDPE smooth wall type as well, colored three separate colors (Green, Brown, Gray). Inner duct requirements (size and amount) shall be discussed with the project engineer.

All conduits and inner ducts should be cleared and cleaned prior to capping. All ducts should be proofed and sealed using physical duct plugs

SAFETY

Contractor will provide proper work zone safety through an approved M.O.T plan utilizing FDOT Standard Indexes.

Contractor will ensure that all personnel working in the field adhere to all PPE (Personnel Protection Equipment) requirements needed for the particular job location at all times.

LOCATING FIBER OPTIC CABLES

Florida Statute 556.101-111 requires all excavators to call for locates 48 hours before they dig. The Sunshine State One-Call of Florida phone # is 1-800-432-4770. The One-Call office will contact The City of Winter Garden locating contractor requiring locates of our facilities. Aiding the locators, please install a #12 gauge wire. Pull #12 gauge wire in with the Fiber cable for the Directional Bored conduit systems. Terminate the ends of the #12 gauge wire in a handhold box. This box can be used by the locating contractor.

25.8 Technical Specifications for the Installation of Fiber Optic Cable

25.8.1 Introduction

The City of Winter Garden currently specifies the installation of 62.5/125 micron multimode and 8.3/125 micron single mode fiber optic cable to support data communication services to and within their facilities.

The following WINTER GARDEN specifications for the selection and installation of fiber-optic cable and associated hardware are intended to ensure a reliable and consistent fiber optic media infrastructure for the City of Winter Garden.

25.8.2 Fiber Cable Specification

Fiber installed on behalf of The City of Winter Garden must meet or exceed the following specifications.

25.8.3 Multimode Fiber

Installed cable shall be 62.5/125micron core/cladding, enhanced grade, multimode, and graded index glass fiber. All materials in the cable shall be dielectric.

25.8.3.1 Performance

Installed fiber must meet or exceed the following performance specifications.

Wavelength (nm)	Max. Attn.(dB/Km)
850	3.0
1,300	0.9

25.8.3.2 Cable Construction

Installed cable must be manufactured to meet or exceed the following specifications:

25.8.3.3 Plenum Cable (Inside Cable)

Plenum rated cable shall be used for all interior installations. Installed cable shall meet or exceed the following specifications:

- a. Tight buffered 900 um, mechanical strippable Teflon (for plenum applications).
- b. EIA/TIA -598 color coding for fiber optic cable.

- c. Aramid yarn strength member, capable of supporting a short-term tensile load of 400 lb. without stretching.
- d. Capable of bend radii as small as 20 x outside cable diameter (under installation load) and 10 x outside cable diameter (long term load).
- e. Capable of a minimum crush resistance of 850 lb./in.

25.8.3.4 Outside Plant Cable

Outside plant cable shall be used for all applications where cable is to be run in underground conduits. Outside plant cable may not be used for interior applications and shall meet the following specifications:

Part Number	Fiber Count	Cable O.D. (in)	Min Bend Radius with Load (in)	Min Bend Radius No Load (in)
A-ES-LTS-1JKT-144	144	0.63	13	6
A-ES-LTS-1JKT-072	72	0.48	10	5
A-ES-LTS-1JKT-048	48	0.44	9	4
A-ES-LTS-1JKT-024	24	0.44	9	4

Cable/Fiber specified is from Draka Comteq (Formerly Alcatel Cable). Fiber type is Enhanced Single Mode. This cable is a non-armored dielectric single jacket cable.

25.8.4 Singlemode Fiber

Installed cable shall be 8.3/125micron core/cladding, single mode, and graded index glass fiber. All materials in the cable are to be dielectric.

25.8.4.1 Performance

Installed fiber must meet or exceed the following performance specifications.

Fiber cable types	Wavelength (nm)	Max. Attn. (dB/Km)
Single mode, Inside plant	1,310	1.0
	1,550	1.0
Single mode, Outside plant	1,310	0.35
	1,550	0.25

25.8.5 Cable Construction

Riser or plenum rated cable shall be used for all interior installations. Installed cable shall meet or exceed the following specifications:

25.8.5.1 Riser or Plenum (Inside Cable)

Riser cable shall be used for all interior installations and shall meet the following specifications:

- a. Tight buffered 900 um, mechanical strippable Teflon.
- b. EIA/TIA -598 color coding for fiber optic cable.

- c. Aramid yarn strength member, capable of supporting a short-term tensile load of 400 lb. without stretching.
- d. Capable of bend radii as small as 20 x outside cable diameter (under installation load) and 10 x outside cable diameter (long term load).
- e. Capable of a minimum crush resistance of 850 lb./in.

25.8.6 Installation Standards

25.8.6.1 Underground Inter-Building Cable

All fiber cable is to be protected with inner duct. After installation, inner ducts are to be permanently labeled as containing fiber optic cable, per city of Winter Garden's instructions.

At no time shall more than 400 pounds of tension be placed on any fiber cable while it is being pulled through tray or conduit. It is preferred that all fiber cable be pulled with hand power only. If power winches or mechanical advantage devices are used to pull cable, a tensionometer must be used to insure that maximum tension is not exceeded. Alternatively, a "mechanical fuse" rated at 350 pounds may be included in the linkage. Torsion shall be avoided by the use of a swivel at the cable end. While under tension, a minimum bend radius of 20 times the outside cable diameter will be maintained through the use of pulleys and sheaves where required. After pulling, no bend may have a radius, at rest, of less than 10 times the outside cable diameter.

25.8.6.2 Labeling

Each cable and inner duct is to be permanently labeled at each end with a unique cable number. In addition, labels shall be affixed to the cable/inner duct at every transition of a vault, hand hole, riser closet, or major pull box. Labels will be in the form of "WINTER GARDEN-Location one-Location two- sequence number". The City of Winter Garden will provide further info.

Each fiber optic strand shall be labeled with a unique identifier at the SC coupler in the fiber panel. Connectors shall be labeled on the identifying sheets on the front of the fiber panel.

25.8.6.3 Conduit Assignments

The City of Winter Garden has a conduit management system in force. Scopes of Work for cable installation, supplied by Winter Garden for each project, will specify which conduits are to be used for cable installation.

25.8.7 Termination Standards

Where space provides, the use of a FP (Fiber Panel) of appropriate size is highly recommended. This FP should be of the type manufactured by Multilink or ADC. Small facilities a 24 or 48 count FP is sufficient. Main facilities should look at utilizing a larger FP, up to 144-positions. Please consult the Project Engineer/Coordinator prior to final choice of sizing. The FP then becomes the main point of termination for all outside fiber optic plant to that facility. Any inside plant cable should be run to the FP and all splicing to be undertaken inside the FP itself. This mandates the use of preterminated (on one end) IFC type cable.

25.8.7.1 Fiber Organizers

Fiber cables are to be terminated in one of two types of enclosures. Winter Garden may specify either wall-mounted or rack-mountable stand-alone units for installation. Rack

mounted units made by Multilink or ADC are acceptable. The final choice of fiber organizer shall be cleared with Winter Garden prior to installation.

Each enclosure shall be labeled with a machine made label with permanent black ink on a white background. Labels shall be in the format "SITE-FPxx", with the numbers, "xx", supplied by Winter Garden; In addition, each FP shall be labeled on the face plate.

Each fiber optic strand shall be labeled with a unique identifier at the SC coupler in the FP. Connectors shall be labeled on the identifying sheets on the front of the FP. Each fiber shall be labeled where it enters the back of the coupler panels. Consult City of Winter Garden on specific labeling scheme.

25.8.7.2 Connectors and Splices

Fiber ends are to be terminated in SC-type connectors with composite ferrules. They must be of the "epoxy and polish". All spliced must be fusion spliced. Mechanical splicing is not allowed inside The City of Winter Garden facilities or Plant.

25.8.7.3 Miscellaneous

At each end of the cable, sufficient slack (50 feet) shall be left to facilitate reasonable future relocation of the FP. Slack shall be mounted on walls or upper ladder racks according to City of Winter Garden direction.

25.8.8 Testing

25.8.8.1 Before Installation

Fiber-Optic cable shall be fully pre-tested by the contractor as specified by the City's "OSP Standards" prior to any burial. Full "reel testing" shall be performed on any cable, prior to installation. Results shall be provided digitally in Adobe Acrobat PDF format to designated City representative prior to release of materials for installation.

25.8.8.2 After Installation and termination

- a. All single mode and multi mode fiber strands shall be tested end-to-end for bi-directional attenuation, 850 nm/1300 nm for multimode and 1310 nm/1550 nm for single mode fibers. Tests should be conducted in compliance with EIA/TIA-526-14 or OFSTP 14, Method B, according to the manufacturer's instructions for the test set being utilized.
- b. Tests must ensure that the measured link loss for each strand does not exceed the "worst case" allowable loss defined as the sum of the connector loss (based on the number of mated connector pairs at the EIA/TIA-568 B maximum allowable loss of 0.75 dB per mated pair) and the optical loss (based on the performance standard above).
- c. After the cable is in place it shall be tested in the following manner:
 1. After termination, each fiber shall be tested with an ODTR for length, transmission anomalies, and end-to-end attenuation. Results are to be recorded and supplied to Winter Garden in the form of hard-copy printouts. In addition electronic copies of all test results shall be provided to Winter Garden along with any required viewing programs.

2. After termination and bulkhead mounting, each terminated fiber is to be tested for end-to-end loss with a power meter/light source; bi-directionally. As above, results are to be recorded and supplied to Winter Garden.
3. The maximum allowable attenuation for any splice or termination is 0.3 dB.

25.8.8.3 The contractor shall review all end faces of field-terminated connectors with a fiber inspection scope. Connector end faces with hackles; scratches, cracks, chips and or surface pitting shall be rejected and re-polished or replaced if re-polishing will not remove the end face surface defects. The recommended minimum viewing magnifications for connector ends are 100X for multimode fiber and 200X for single mode fiber.

25.8.8.4. The contractor shall verify continuity of conduit from fiber backbone to all traffic control cabinets in route.

PART 2 - SPECIFICATIONS

DIVISION III

GENERAL CONSTRUCTION REQUIREMENTS

SECTION 30

GRADES, SURVEY LINES AND PROTECTION OF MONUMENTS

30.1 GENERAL

30.1.1 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.

Bench marks and base line controlling points shall be established prior to beginning work. Reference marks for lines and grades as the work progresses will be located to cause as little inconvenience to the prosecution of the work as possible. The CONTRACTOR shall so place excavation and other materials as to cause no inconvenience in the use of the reference marks provided. CONTRACTOR shall remove any obstructions placed contrary to this provision.

30.1.2 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 this, 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.

30.1.3 MONUMENT PRESERVATION

Property corners and survey 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, whether by accident, careless work, or required to be disturbed or destroyed by the construction work, 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.

30.2 UTILITY COORDINATION

30.2.1 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 CONTRACTOR's 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 main, 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 cost, charges, or claims connected with the interruption and repair of such services.

30.2.2 DEVIATIONS OCCASIONED BY STRUCTURES OR UTILITIES

Design Engineer shall coordinate relocation of existing private utility line during the design phase.

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, hot water, steam 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 removal. 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.

30.2.3 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 CITY. The costs for such test pits shall be borne by the CONTRACTOR.

30.3 MAINTENANCE OF TRAFFIC AND CLOSING OF STREETS

Projects that may impact traffic flow or require street closings temporarily shall comply with the following minimum requirements.

1. The Maintenance of Traffic design, devices, implementation, construction, maintenance, etc. shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), latest edition, and the Florida Department of Transportation Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (Florida Green Book), latest edition.
2. The contractor shall submit a Maintenance of Traffic Plan to the City for review and approval at least 30 days in advance of any anticipated traffic interruptions.

3. The Maintenance of Traffic Plan shall be prepared, and signed and sealed by a professional engineer registered in the State of Florida or by a certified MOT designer.
4. The contractor shall provide Variable Message Signs or Boards (VMS) for a minimum of one (1) week in advance of any road closures in order to provide notice to the public. The city may increase this time, at it's discretion, given the complexity of the closure and the volume of traffic.
5. The contractor shall be responsible for notifying the Police Department, the Fire Department, Lynx, Orange County Public Schools, and any others seventy two (72) hours prior to construction requiring lane closures or road closures.
6. The contractor's personnel, including flagmen and work zone supervisors, in charge of the Maintenance of Traffic implementation, operations, and other items, shall be certified through the Florida Department of Transportation in the applicable category.
7. 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, the CONTRACTOR shall notify and obtain the approval of responsible authorities and the CITY.
8. Unless permission to close a street is received in writing from the proper authority (CITY, FDOT, etc.), all excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the CONTRACTOR's operations cause traffic hazards, he shall repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the CITY.
9. 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.
10. 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.

30.4 PROTECTION OF PUBLIC AND PROPERTY

30.4.1 BARRICADES, GUARDS AND SAFETY PROVISIONS

The CONTRACTOR shall be solely responsible for adhering to the rules and regulations of OSHA and 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.

30.4.2 **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.

30.4.3 **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 handrailings 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 approved 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.

30.4.4 **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.

30.4.5 **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.

30.4.6 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.

30.4.7 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.

30.5 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 made 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.

30.6 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.

30.7 CONSTRUCTION HOURS

No WORK shall be done between the hours of 5:00 p.m. and 7:00 a.m., or on Sundays unless the proper and efficient prosecution of the WORK requires operations during the night or weekend. Written notification for doing the WORK shall be provided to the CITY a minimum 72 hours before starting such items of the WORK.

30.8 CONSTRUCTION IN EASEMENTS AND RIGHTS-OF-WAY

30.8.1 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.

30.8.2 **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.

30.8.2 **CONSTRUCTION IN ORANGE COUNTY RIGHT-OF-WAY**

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

30.8.3 **CONSTRUCTION IN CITY OF WINTER GARDEN RIGHT-OF-WAY**

WORK shall be governed by the City of Winter Garden Right-of-Way Utilization Regulations as amended. The CONTRACTOR shall show proof of valid State of Florida, Contractor's License applicable to the work to be performed.

30.9 **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.

30.10 **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.

30.11 **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.

30.12 SUBSURFACE EXPLORATION

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

30.13 CLEANING

30.13.1 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.

30.13.2 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 and properly dispose of all water, dirt, rubbish or any other foreign substances.

30.14 SALVAGE

Any existing CITY owned equipment or material including but not limited to bricks, 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.

30.15 SHOP DRAWINGS AND SAMPLES

Prior to construction, the CONTRACTOR shall submit one original copy of the shop drawings, signed by the DESIGN 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 31

SITE PREPARATION, SURFACE REMOVAL AND RESTORATION

31.1 GENERAL

This Section covers clearing, grubbing, and stripping of the construction sites. The CONTRACTOR shall clear and grub all of the area within the limits of construction as shown on the PLANS and approved by the CITY prior to the beginning any WORK. All site work shall conform to the applicable site clearing ordinance, landscaping and tree ordinances of the CITY.

31.2 CLEARING AND GRUBBING

31.2.1 CLEARING

The surface of the ground for the area to be cleared and grubbed shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish and all other objectionable obstructions resting on or protruding through the surface of the ground. However, trees and shrubs shall be preserved as specified in Section 30.4.4. Clearing operations shall be conducted so as to prevent damage to existing structures and installations and to those under construction, and so as to provide for the safety of employees and others.

31.2.2 GRUBBING

Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs and any other organic or metallic debris not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of 18 inches below the subgrade. All depressions excavated below the original ground surface for or by the removal of such objects shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

31.2.3 STRIPPING

In areas so designated, top soil shall be stripped and stockpiled. Topsoil so stockpiled shall be protected until it is placed as specified. Any topsoil remaining after all WORK is in place shall be disposed of by the CONTRACTOR.

31.2.4 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

The CONTRACTOR shall at his expense dispose of all material and debris from the clearing and grubbing operation in accordance with all applicable ordinances.

31.3 DUST CONTROL

CONTRACTOR shall control dust resulting from clearing and grubbing operations to prevent nuisance to adjacent property owners and the general public. CONTRACTOR shall use dust control methods and materials approved by the CITY.

31.4 SURFACE REMOVAL

Along the proposed pipe lines as indicated on the PLANS, the CONTRACTOR shall remove the surface materials only to such widths as will permit a trench to be excavated which will afford sufficient room for proper efficiency and proper construction. All applicable CITY and FDOT regulations shall be followed. Where sidewalks, driveways, pavements and curb and gutter are encountered, care shall be taken to protect against fracture or disturbance beyond reasonable working limits. All fractured, broken or disturbed surfaces shall be restored to their original condition prior to completion of the WORK.

31.5 RESTORATION

Restoration of all surfaces including road subbase, soil cement, asphaltic concrete surface, portland cement concrete pavement and driveways, sidewalks and concrete curbs shall be in strict accordance with ROAD CONSTRUCTION SPECIFICATIONS. All grassing and mulching shall be done as specified in the ROAD CONSTRUCTION SPECIFICATIONS. Solid sodding shall be placed on all slopes greater than 4:1, within 10 feet of all proposed structures and where existing sod is removed or disturbed by the WORK. In addition, CONTRACTOR shall restore all storm drains, culverts, inlets and storm manholes to equal or better condition in accordance with the ROAD CONSTRUCTION SPECIFICATIONS.

SECTION 32

EXCAVATION, BACKFILL, COMPACTION AND GRADING

32.1 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 and water handling.

32.2 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.

32.3 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 CONTRACTOR's responsibility. Refer to Section 30.2 for utility coordination requirements.

The CITY shall not be responsible for uncharted or incorrectly charted water and wastewater mains or other utilities. It is the CONTRACTOR'S responsibility to ensure that such facilities exist at the presumed point prior to commencing construction.

32.4 MATERIALS

32.4.1 GENERAL

Materials for use as bedding and backfill, whether insitu 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.

32.4.2 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.

32.4.3 **COMMON FILL**

Common fill shall consist of mineral soil, substantially free of clay, organic material, loam, wood, trash and other objectionable material which may be compressible or which cannot be compacted properly. Common fill shall not contain stones larger than 6 inch in any dimension, asphalt, broken concrete, masonry, rubble, or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling. Additionally, common fill shall be no more than 12 percent by weight finer than the No. 200 mesh sieve unless finer material is approved for use in a specific location by the CITY. No fill shall be placed without prior approval from the city.

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

32.4.4 **SELECT COMMON FILL**

Select common fill shall be as specified above from common fill, except that the material shall contain no stones larger than 1-1/2 inches in largest dimension, and shall be no more than 5 percent by weight finer than the No. 200 mesh sieve. No fill shall be placed without prior approval from the city.

32.4.5 **BEDDING ROCK**

Bedding Rock shall be 57 -3/4 rock.

32.5 SHEETING AND BRACING IN EXCAVATIONS

32.5.1 **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, brace and maintain cofferdams consisting of 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.

32.5.2 **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 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 necessary clearances and dimensions.

32.6 DEWATERING, DRAINAGE AND FLOTATION

32.6.1 GENERAL

The CONTRACTOR shall excavate, construct and place all pipelines, concrete work, fill, and bedding rock, in-the-dry. In addition, the CONTRACTOR shall not make the final 24 inches of excavation until the water level is a minimum of one foot below proposed bottom of excavation. For purposes of these specifications, "in-the-dry" is defined to be within 2 percent of the optimum moisture content of the soil. The CITY reserves the right to ask the CONTRACTOR to demonstrate that the water level is a minimum of one foot below proposed bottom of excavation before allowing the construction to proceed.

Discharge water shall be clear, with no visible soil particles. 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. 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.

32.6.2

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 wellpoints 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. Wellpoints 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 backfilling and construction, water levels shall be measured in observation wells located as directed by the CITY.

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

32.7 EXCAVATION

32.7.1

GENERAL

Excavation consists of removal, storage and disposal of material encountered when establishing 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 CONTRACTOR's 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 rocks, 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.

Slope 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 stability of the material excavated. Sides and slopes shall be maintained in a safe condition until completion of backfilling.

CONTRACTOR shall stockpile satisfactory excavated materials at a location approved by the CITY until required for backfill or 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.

32.7.2 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 formwork, 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.

32.7.3 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 dry and in all respects acceptable to the CITY.

Excavation shall not exceed normal trench width as specified in the STANDARD DRAWINGS. Any excavation which exceeds the normal trench width, shall require special backfill requirements as determined by the CITY.

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

Where the pipes are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated to grade by machinery. The last of the material being excavated shall be done manually in such a manner that will give a shaped bottom, true to grade, so that pipe can be evenly supported on undisturbed material, as specified in the STANDARD DRAWINGS. Bell holes shall be made as required.

32.8 BEDDING AND BACKFILL

32.8.1 GENERAL

Material placed in fill areas under and around structures and pipelines shall be select common fill as defined in Section 32.4.4. Fill material 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 layers by a backhoe or other approved method, unless otherwise specified. Prior to the process of placing and spreading, all materials not meeting those specified under Section 32.4 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 "in-the-dry". The CONTRACTOR shall dewater excavated areas as required to perform the work and in such 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, obstructions and deleterious 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 32.9 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.

Before compaction, material shall be moistened or aerated as necessary to provide the optimum moisture content. 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 32.9. Backfill or fill material shall not be placed on surfaces that are muddy, frozen or contain frost or ice.

32.8 2 BEDDING AND BACKFILL FOR STRUCTURES

Bedding rock shall be used for bedding under all structures as indicated on the STANDARD DRAWINGS. 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. Structural fill shall be used as backfill against the exterior walls of the structures. Fill shall be compacted sufficiently in accordance with Section 32.9.2 of these specifications. If compaction is by rolling or ramming, material shall be wet down as required.

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

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.

32.8.3 BEDDING AND BACKFILL FOR PIPES

Bedding for pipe shall be as shown on the PLANS and detailed on the STANDARD DRAWINGS. 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 DRAWINGS.

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 DRAWINGS and Section 32.9.

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 DRAWINGS and Section 32.9.

32.9 COMPACTION

32.9.1 GENERAL

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

When existing trench bottom has a density less than that specified under Section 32.9.2, the CONTRACTOR shall break up the trench bottom surface, pulverize, moisture-condition to the optimum moisture content and compact to required depth and percentage of maximum density.

32.9.2

PERCENTAGE OF MAXIMUM DENSITY REQUIREMENTS

Fill or undisturbed soil from the bottom of the pipe trench to 1 foot above the pipe shall be densified to a minimum density of 98 percent of the maximum dry density as determined by AASHTO T-180.

Backfill from 1 foot above utility pipes to grade shall be densified to a minimum density of 98 percent of the maximum dry density as determined by AASHTO T-180.

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

32.9.3

COMPACTION TESTS

One compaction test location shall be required for each 100 linear feet of pipe and for every 100 square feet of backfill around structures as a minimum. The CITY may determine that more compaction tests are required to certify the installation depending on field conditions. The locations of compaction tests within the trench shall be in conformance with the following schedule:

- a. For 24 inch diameter pipe and smaller, one test at the spring line of the pipe.
- b. For 30 inch diameter pipe and larger, at least one test for each 12" layer of backfill within the pipe bedding zone.
- c. One test at an elevation of one foot above the top of the pipe.
- d. One test for each two feet of backfill placed from one foot above the top of the pipe to finished grade elevation.

If based on GEOTECHNICAL/SOILS ENGINEER testing reports and inspection, fill which has been placed is below specified density, CONTRACTOR shall provide additional compaction and testing prior to commencing further construction.

32.10 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. After grading, 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 pipelines that may be uncovered or damaged until such lines have been relocated.

32.11 MAINTENANCE

CONTRACTOR shall protect newly 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.

Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, CONTRACTOR shall scarify surface, and reshape and compact to required density prior to further construction.

32.12 INSPECTION AND QUALITY ASSURANCE

32.12.1 INSPECTION

CONTRACTOR shall examine the areas and conditions under which excavating, filling and grading are to be performed, and not proceed with the WORK until unsatisfactory conditions have been corrected.

CONTRACTOR shall examine existing grade prior to commencement of WORK and report to the CITY if elevations of existing grade vary from elevations shown on DRAWINGS.

32.12.2 QUALITY ASSURANCE

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

The CONTRACTOR, at his expense, shall engage soil testing and inspection services for quality control testing during earthwork operations. The testing and inspection service shall be subject to the approval of the CITY.

Quality control testing shall be performed during construction to ensure compliance with these Specifications. CONTRACTOR shall allow the testing service to inspect and approve fill materials and fill layers before further construction is performed. The CONTRACTOR shall give copies of all test results in a report form to the DIRECTOR to demonstrate compliance with compaction requirements stipulated in this MANUAL.

SECTION 33

BORING AND JACKING

33.1 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 be 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 DRAWINGS, and restoration. Applicable provisions of Division 111, 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.

33.2 PIPE MATERIAL

33.2.1 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. The casing pipes shall have the minimum nominal diameter and wall thickness as shown on the following table:

<u>Carrier Pipe</u> Nominal Diameter	Casing Outside Diameter	Casing Wall Thickness
4"	16"	.250"
6"	18"	.250"
8"	20"	.250"
10"	24"	.250"
12"	30"	.312"
16"	30"	.312"
20"	36"	.375"
24"	42"	.500"
30"	48"	.500"
36"	54"	.500"
42"	60"	.500"

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. Welds 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.

33.2.2 CARRIER PIPE

The carrier pipe shall be minimum Pressure Class 250 ductile iron pipe with restrained joints. Ductile iron pipe shall comply with the specification outlined in Division IV and V.

33.2.3 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.

33.3 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.

33.4 CONSTRUCTION REQUIREMENTS

33.4.1 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 at no additional cost to the CITY.

33.4.2 DEWATERING

Dewatering through the casing during construction shall not be permitted. All dewatering methods shall be approved by the CITY before construction work begins.

33.4.3 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. Casing spacers shall be bolt on style split shells made of either T-304 stainless steel or fusion coated steel (a minimum 0.010" thick coating of PVC shall be provided over the entire band). The shell shall be lined with a PVC liner 0.090" thick with 85-90 Durometer. All nuts and bolts shall be high strength, low alloy meeting AWWA C111. Runners shall be made of a high molecular weight polymer with inherent high abrasion resistance and a low coefficient of friction.

33.4.4 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.

33.4.5 MISCELLANEOUS REQUIREMENTS

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.

The annular space between the carrier pipe and casing shall be filled with clean sand, if required in the Bore and Jack permit. Masonry plugs are to be installed at each open end of the casing. Plugs shall be suitable for restraining the earth load while allowing drainage of the casing.

SECTION 34

PRESSURE PIPE RESTRAINT

34.1 GENERAL

Pressure pipe fittings and other items requiring restraint shall be restrained with mechanical restraining devices as specified herein.

All pressure pipe shall be restrained as specified herein. Use of thrust blocks for pressure pipe and fittings shall not be allowed.

Ductile iron pressure pipe and fittings may be restrained with products specifically designed for use on ductile iron pipe. PVC pressure pipe and fittings shall be restrained with products specifically designed for use on PVC pipe systems.

34.2 RESTRAINED PIPING SYSTEMS

Sections of piping requiring restrained joints shall be constructed using pipe and fittings with restrained joints manufactured by the pipe and fitting manufacturer or a specialty restraining device manufacturer. Joints shall be capable of holding against withdrawal for line pressures 50 percent above the normal working pressure and the test pressures indicated on the Construction Documents. Any restrained joints that allow for elongation upon pressurization will not be allowed in those locations where the pipe comes out of the ground.

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 lengths of restrained joint shall be as depicted on the "Restrained Pipe Table" in the STANDARD DRAWINGS. All calculations are based on the method outlined in the publication entitled "Thrust Restraint Design for Ductile Iron Pipe", latest edition, published by Ductile Iron Pipe Research Association, Birmingham, AL, or "PVC Pipe Thrust Restraint Design Handbook", Latest Edition, Published by EBAA Iron, Eastland, Texas. When conditions require exceptional restraint due to higher than typical pressure, the DESIGN ENGINEER shall specify additional requirements per the noted design standards.

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

34.3 RESTRAINING DEVICES

34.3.1 GENERAL

Restraining devices shall be as specified or equal to those listed in Appendix A, restraining devices. The number of joints to be restrained shall be based on the "Restrained Pipe Table" in the STANDARD DRAWINGS.

34.3.2 **JOINT RESTRAINT DEVICE**

Mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Flexibility of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A 536. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI A21.11 and ANSI/AWWA C153/A21.53. Twist-off nuts shall be used to insure proper actuating of the restraining devices.

The mechanical joint restraint device shall have a working pressure of at least 250 psi with a minimum safety factor of 2:1.

34.3.3 **GASKET TYPE RESTRAINERS**

Restraining gaskets, manufactured for location within the pipe or fitting bell are acceptable for use at pipe joints or MJ joints between straight pipe sections and as recommended by the product manufacturer.

Gasket type restrainers manufactured for AWWA C900 PVC pipe systems shall meet the requirements of ASTM F-1674.

34.3.4 **HARNESS TYPE RESTRAINERS**

Harness type restraining assemblies are acceptable for use in restraining ductile iron or PVC pipe joints in straight pipe sections as recommended by the product manufacturer.

SECTION 35

PRESSURE CONNECTION

35.1 GENERAL

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

35.2 TAPPING SLEEVES

35.2.1 GENERAL

Tapping sleeves shall be mechanical joint sleeves or fabricated steel sleeves as specified below. All pressure connections to asbestos cement pipe and all "size on size" taps shall utilize mechanical joint sleeves.

35.2.2 MECHANICAL JOINT SLEEVES

Sleeves shall be cast of gray-iron or ductile-iron and have an outlet flange with the dimensions of the Class 125 flanges shown in ANSI B16.1 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/AWWA C111/A21.11. Sleeves shall be capable of withstanding a 200 psi working pressure.

35.2.3 STEEL TAPPING SLEEVES

Sleeves shall be fabricated of stainless steel, 18-8 grade. Outlet flange shall meet AWWA C-207, Class "D" ANSI 150 lb. drilling and be properly recessed for the tapping valve. Flange shall be coated with fusion bonded epoxy by manufacturer. Bolts and nuts shall be high strength low alloy steel to AWWA C111 (ANSI A21.11). Gasket shall be vulcanized natural or synthetic rubber.

35.2.4 TAPPING VALVES

Tapping valves shall meet the requirements of Section 52.2 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.

35.3 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 it in a manner acceptable to the CITY.

All connections shall only be made on the agreed upon date and time. 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.

35.4 INSTALLATION

35.4.1 EXCAVATION, BACKFILL, COMPACTION AND GRADING

The applicable provisions of Section 32 shall apply.

35.4.2 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 percent 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 pressure tested a minimum of fifteen minutes at 150 psi to ensure that no leakage will occur.

For pressure connections through 12" diameter or less, the minimum diameter cut shall be 1/2" 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.

For pressure connections to wastewater force mains, the tapping valve shall be placed horizontally. After the tapping procedure is complete, a plug valve shall be attached to the tapping valve. The tapping valve shall be left in the open position prior to backfilling.

Adequate restraining devices at pipe joints or restrained joint fittings shall

be provided to prevent movement of the installation when test pressure is applied. Provisions of Section 34 shall apply.

SECTION 36

DIRECTIONAL DRILLING OF HIGH DENSITY POLYETHYLENE (HDPE) PIPE

36.1 - GENERAL

36.1.1 DESCRIPTION

- A. Scope of Work: The work included under this Section consists of the installation of HDPE pipe utilizing the directional drilling method. The work in this section includes all labor, machinery, construction equipment and appliances required to perform in a good workmanlike manner all directional drilling operations.
- B. Related Work Described Elsewhere:
 - 1. Utility Piping, fittings, Valves and Accessories:
 - 2. Pressure Testing of Pipe: Section 51

36.1.2 QUALITY ASSURANCE REQUIREMENTS

- A. Directional drilling and pipe installation shall be performed by an experienced contractor specializing in directional drilling.
 - 1. The key personnel must have at least four (4) years of experience with directional drilling projects of equal size and scope.
 - 2. The operator shall have performed at least three (3) directional bores of 20" pipe diameter, 1,000-foot bore length, and in similar soil conditions.
- B. The directional drilling equipment shall be operated by individuals trained by the manufacturer as experienced operators. Documentation to be submitted to the Owner.
- C. Work shall be in conformance with the Directional Crossing Contractor's Association (DCCA) guidelines, latest edition.
- D. Installation, storage and handling of pipe and appurtenances shall be in accordance with pipe manufacturer's guidelines and recommendations.
- E. Technical support, tool suppliers and required support systems shall be provided by the contractor.
- F. All directional drilling shall be in accordance with all applicable local, state, and federal regulations.

36.1.3 SUBMITTALS

- A. Contractor shall submit qualifications of personnel who will be performing

the directional drill including years of experience and past projects.

B. Contractor shall submit certificates of inspection from the drill pipe manufacturer that the drill pipe has been inspected and certified and meets the requirements of these specifications.

C. Contractor shall submit a drilling work plan outlining the procedures, drill path, depth, reaming diameter, and materials to be used in the drilling operation, as well as proposed laydown areas, pipe staging area during pullback, and drill pit size and locations.

D. Contractor must submit a Maintenance of Traffic (MOT) Plan.

E. Contractor shall prepare an environmental protection plan and schedule of work activities for submittal to the Engineer and Owner.

F. Contractor shall hire a geotechnical consultant and shall submit results of a soil investigation at the directional bore entry and exit locations at a minimum. One (1) soil boring to a depth of three (3) feet below the bottom of pipe at the deepest vertical point of the bore shall be conducted at each entry and exit location. It is the Contractor's responsibility to conduct construction activities in an appropriate manner as required by geotechnical constraints, if any.

G. Contractor shall submit technical criteria for the Bentonite drilling mud used and the conformance of the product with the existing soil and ground water conditions.

H. As-built survey documentation showing location of installed piping system, vertical and horizontal, and location of any abandoned-in-place bores, etc.

I. The Contractor shall log all necessary data from the locator/tracking system:

1. Position
2. Roll Angle
3. Tilt Angle
4. Depth
5. Temperature of Data Transmitter
6. Remaining Battery Life
7. Pull Back Force (Maximum pull back force shall be recorded)

Location and depth measurements shall be recorded by the Contractor every ten (10) feet over the course of the bore and that data shall be provided with the data above to the Owner and Engineer.

36.1.4

PRODUCT, DELIVERY, STORAGE AND HANDLING

A. Particular care shall be taken not to injure the pipe strength, coating or lining during delivery, storage or installation. Contractor shall check roundness of pipe prior to accepting delivery.

B. The pulling force used shall not exceed the pipe material safety pull strength as per the manufacturers recommendation.

C. The Owner reserves the right to reject the work performed on any portion of the project in which there is evidence that the materials have not been handled in accordance with the manufacturers recommendations.

36.1.5 WARRANTY AND GUARANTEES

A. The Contractor is responsible for replacing any portion of the work found to be installed in a way that stresses the material beyond the manufacturers' recommendations.

B. The Contractor shall provide all warranties and guarantees relative to workmanship and materials as required by the Contract Documents, General Conditions and Supplementary Conditions.

36.2 - PRODUCTS

36.2.1 GENERAL

A. The equipment used in the directional drilling shall be of adequate commercial size and satisfactory working condition for safe operation, and will be subject to approval by the Design Engineer. Such approval, however, will not relieve the Contractor of the responsibility for making a satisfactory installation satisfying all criteria of the project.

B. The directional drilling equipment shall be controlled by means of an electronic tool directional system with wireline guidance, and shall provide a Bentonite clay slurry to completely seal around the installed carrier pipe.

C. The Contractor shall provide all materials for completing the installation and for adequate protection of the work. Contractor must provide back-up generator and portable lights in case drill extends into the evening. Contractor must provide vacuum truck(s) of sufficient capacity to hold drilling fluid volume in the event of a frac-out or spill.

D. Mechanical joints to HDPE pipe shall be fully constrained by compressing the pipe OD against a rigid tube or stiffener made of Type 304 stainless steel in the pipe bore.

E. Transition fittings between HDPE pipe and ductile iron pipe shall consist of a flanged end being butt fused onto a plain HDPE pipe as shown on the drawings.

36.2.2 MATERIALS AND EQUIPMENT

A. Directional Drilling Equipment:

1. The directional drilling equipment shall employ a fluid cutting technique.

2. The following directional drill rig manufacturers are approved for use in the City of Winter Garden.

- a. Vermeer, Inc.
- b. American Augers, Inc.
- c. or Equal

3. The directional drilling equipment shall be a "Maxi-HDD" and sized based on the drill distances, and shall minimally be capable of the following:

<u>Pipe Diameter being Installed</u>	<u>Drill Length</u>
8"	1,000 ft
10"	1,000 ft
16"	1,000 ft
20"	1,000 ft

The rig shall have means to monitor and record maximum pullback force. The pulling strength of the boring equipment shall not exceed the HDPE pipe safety pull strength as per the manufacturer's recommendation. Contractor shall be aware that the "safe" pull-load is time dependent.

B. Drill Pipe:

1. The drill pipe shall be API steel drill pipe, range 2, premium class or higher, Grade S-135 in a diameter sufficient for the torque and longitudinal loads and fluid capacities required for the work.

C. HDPE Pipe:

1. Pipe: HDPE pipe for nominal diameters 4-inch through 42-inch in size shall conform to ASTM F714 and AWWA C906, Latest Edition, NSF 61 Standard. Pipe shall be ductile iron pipe sizes (DIPS), DR 11 with a minimum pressure rating of 200 psi.

2. Pipe Material: Materials used for the manufacturing of polyethylene pipe shall be PE 4710 High Density Polyethylene (HDPE) with a minimum ASTM D3350-08 cell classification of 345464E or higher (for color stripes). The material shall have a minimum Hydrostatic Design Basis (HDB) of 1600 psi at 73°F when tested in accordance with Plastics Pipe Institute (PPI) TR-3 and shall be listed in the name of the pipe and fitting manufacturer in PPI TR-4. Pipe shall have a manufacturing standard of ASTM D3035 and F-714, and be manufactured by an ISO 9001 certified manufacturer. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects. All HDPE pipe shall be National Pipe and Plastics or JM Industries, or pre-approved equal.

3. Joints: HDPE pipe shall have fusion-bonded joints.

4. Pipe Installation: Installation shall be in accordance with ASTM D2774 and manufacturer's recommendation. Installation and thermal fusing shall be performed by personnel trained and experienced in the use of fusion equipment recommended by the pipe supplier. Installer shall have the necessary information relative to fusion such as, but not limited to, fusion temperature, interface pressure, and cooling time before fusing begins. Fusing shall be performed in accordance with ASTM D2657.

5. Pipe Markings: Permanent identification of piping service shall be provided by co-extruding longitudinal stripes (color coded per service type) into the outer surface of the pipe. The stripping material shall be the same material as the pipe material except for color. Stripes printed or painted on the outside surface shall not be acceptable. Markings on the pipe shall include the following:

- a) Nominal size and OD base.
- b) Standard material code designation.
- c) Dimension Ratio.
- d) Pressure Class.
- e) AWWA designation (AWWA C906)
- f) Material test category of the pipe.
- g) Continuous stripes, 90 degrees apart, color coded per service (blue – potable water; green – sewer; purple – reclaimed water. Etc..).

6. Fittings:

a) Ductile iron mechanical fittings used with polyethylene pipe shall be specifically designed for, or tested and found to be acceptable for use with polyethylene pipe. Mechanical fittings designed for other materials shall not be used unless authorized by the mechanical fitting manufacturer. Special precautions may exist with certain mechanical fittings or additional components may be required. Consult the manufacturer of the fitting prior to its use. Cast ductile iron fittings 3-inch through 24-inch shall be pressure rated at 350 psi minimum (except flange-joint and groove-joint type fittings shall be rated at 250 psi minimum). All fittings shall conform to either ANSI/AWWA C110/A21.10 and/or C153/A21.53, latest revision, and shall be ductile iron only. All fittings shall be cast and machine allowing the bolt holes to straddle the vertical centerline.

b) Mechanical joint (MJ) adapters shall be used for connections between HDPE pipe and ductile iron pipe. HDPE mechanical joint adapter shall be jointed to the HDPE pipe by butt fusion. HDPE mechanical joint adapter shall be molded or fabricated conforming to AWWA C906. Molded fittings shall conform to ASTM D2683 for socket-type fittings, ASTM D3261 for butt-type fittings or ASTM F1055 for electro fusion-type fittings.

MJ adapter shall match pressure rating and dimension ratio of HDPE pipe.

Iron Pipe Size	DR	Class	Pipe O.D.
8"	11	200 psi	8.625"
10"	11	200 psi	10.75"
16"	11	200 psi	16.00"
20"	11	200 psi	20.00"

c) Mechanical restraint for HDPE may be provided by mechanical means separate from the mechanical joint gasket sealing gland. The restrainer shall provide wide, supportive contact around the full circumference of the pipe and be equal to the listed widths. Means of restraint shall be machined serrations on the inside surface of the restrainer equal to or greater than the listed serrations per inch and width. Loading of the restrainer shall be by a ductile iron follower that provides even circumferential loading over the entire restrainer. Design shall be such that restraint shall be increased with increases in line pressure. All sizes shall have a minimum factor of safety of 2:1 on the rated pressure.

All parts shall be cast of ductile iron conforming to the requirements of ASTM A536 grade 65-45-12, or grade 60-40-18. Ductile Iron gripping wedges shall be hardened by heat treatment to a range of 370 – 470 BHN. Physical, Chemical, and Nodularity tests shall be performed in accordance with Underwriter's Laboratories Specifications and ASTM A536. Tensile, yield and elongation shall be determined in accordance with ASTM E8.

The system shall be designed for cam action wedges with no more than 60 ft-lbs. of torque for full engagement and restraint. Systems utilizing the sliding wedges will not be acceptable. Torque limiting twist off nuts shall be used to actuate the gripping wedges and to prevent deflection away from the MJ gasket, wedge activation screws shall require no more than 60 ft-lbs. of torque. To accommodate out-of-round pipe, all restraint devices shall incorporate a collar bolt and threaded wedge. The design of the restraint system shall be made to reduce the stress in the pipe wall by making the resistance to axial thrust of the tooth bearing against the pipe wall, not the shaving on the pipe.

Installation shall incorporate the procedures and T-bolt torque ranges found in AWWA C-600, and the assembled joint shall be capable of deflection after assembly. Mechanical joint restraints shall be listed by Underwriters Laboratories in sizes 4-inch through 12-inch and shall have Factory Mutual Approval in sizes 4-inch through 12-inch. All mechanical joint restraint systems shall have a date code or identification number consisting of the year, date, shift, and plant, and shall be cast into each gland body.

Serrated restrainer shall be ductile iron ASTM A536-80 with a

ductile iron follower; bolts and nuts shall be corrosive resistant, high strength alloy steel.

The restrainer shall have a pressure rating of, or equal to that of the pipe on which it is used or 200 PSI which ever is lesser. Restrainers shall be Tyler TUF-Grip, Smith Blair Cam-Lock or pre-approved equal.

Nominal Size	Restraint Width	Serrations per inch
4", 6"	1-1/2"	8
8" 10 & 12"	1-3/4"	8

Pipe stiffeners shall be used in conjunction with restrainers. The pipe stiffeners shall be designed to support the interior wall of the HDPE. The stiffeners shall support the pipe's end and control the "necking down" reaction to the pressure applied during normal installation. The pipe stiffeners shall be formed of 304 or 316 stainless steel to the HDPE manufacturers published average inside diameter of the specific size and DR of the HDPE. Stiffeners shall be by JCM Industries or pre-approved equal.

D. Bentonite Drilling Mud

1. The drilling mud used shall be adequate for the soil and ground water conditions in this project as determined by the contractor.
2. The drilling mud used shall be totally inert and pose no environmental risk. Disposal to be off-site and in accordance with all Local, State, and Federal regulations.

E. Ground Survey Equipment

1. Contractor shall provide and use ground survey grid systems, such as "Tru-Tracker" during pilot-hole operations.

36.2.3 ACCESSORIES & MISCELLANEOUS ITEMS

- A. Contractor shall attach a minimum of three (3) locating wires at different locations on the pipe circumference prior to directional drill installation. The wires shall be continuous blue coated 10-gauge UF solid (for water) insulated copper wire pipe.
- B. Contractor shall furnish all items that are necessary for a complete installation whether or not specified herein or shown on the Drawings. Other items necessary for a complete installation, if any, shall conform to all applicable standards as identified in the Manual of Standards and Specifications for Utilities Construction.

36.2.4 SPARE PARTS - NOT USED

36.2.5 QUALITY CONTROL

A. The directional drilling rig shall be calibrated to verify correct depth of drill prior to proceeding with installation.

36.2.6 COORDINATION

A. Contractor shall notify Owner and Engineer a minimum of three (3) days in advance of starting work. Drilling operations shall not begin until Owner's representative is on-site and their inspection of work plan and set-up is satisfactory. Contractor is ultimately responsible for successful performance and completion of the drill.

36.3 - EXECUTION

36.3.1 PREPARATION

A. Site Conditions:

1. The directional drilling operation shall be a closed system to minimize the discharge of water, drilling mud and cuttings to the water body or land areas involved in or contiguous to the construction process.

2. Contractor shall provide equipment and procedures to maximize the cleaning and recirculation of drilling mud to minimize waste.

3. The general work areas on the entry and exit sides shall be enclosed by a 12 inch berm to contain unplanned spills or discharges. Mud pits must be lined with water proof liners.

4. Equipment (pumps, tanks, vacuum trucks, etc.) and materials (such as ground sheets, silt fence, hay bales, booms, absorbent pads and sediment curtains) for clean-up of seeps, mud fractures and other contingencies shall be provided and maintained at all sites. These items are incidental and shall be included in the Contractor's price.

5. Construction related activities involving fuels and lubricants such as vehicle refueling and equipment maintenance, including the draining and pumping of lubricants, shall be conducted a minimum of 100 feet from the surface water bodies to eliminate contamination in case of a spill.

6. Any fuels or lubricants spilled shall be cleaned up immediately to the satisfaction of the Design Engineer's representative and as required by Federal, State, or local regulations.

7. All directional drilling activities shall be conducted in a manner to minimize disturbances to traffic and business activity.

8. The contractor shall be responsible for maintaining the

appropriate traffic control measures required by the Florida Department of Transportation or the Owner.

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

10. Contractor shall obtain a location for all materials and equipment to be stored and to facilitate all construction operations. If easement locations are not adequate, Contractor shall provide provisions for such activity in lump sum for mobilization.

B. Existing Utilities

1. The Drawings show existing utilities that are believed to be near the directional drill alignment.

2. There is no guarantee that these utilities are located as shown or that other utilities may not be present.

3. The Contractor is to field locate existing utilities within 25 feet of work in advance of the work so as not to delay work and avoid conflict and disruption of utility services.

4. Contractor to notify Sunshine State One-Call Services two (2) business days prior to excavation.

36.3.2 INSTALLATION

A. Pilot Hole

1. A pilot hole will be drilled by an appropriately sized drill pipe.

2. A smoothly curved pilot hole shall follow the designated center line of the pipe profile described on the Drawings. The entry angle shall not exceed 15°. Exit angle should be 6° to 12° to facilitate the pullback operation.

3. The position of the drill string shall be monitored by the contractor.

4. Contractor shall compute the position in the x, y and z axis relative to ground surface from down-hole survey data a minimum of one per pipe length (approximately 30 foot intervals).

5. Deviations between the recorded position of the drill string and the required position shall be documented and immediately brought to the attention of the Engineer. If pilot hole deviates more than two (2) percent of depth over a length of 100 feet, the Contractor may be directed to pull back and re-drill.

6. The radius of curvature shall not exceed 90% of the

manufacturer's recommended radius of curvature for the HDPE pipe.

7. At no time in the drilled profile shall the radius of curvature be less than 150 times the outside diameter of the HDPE pipe.

8. Contractor shall provide to the Design Engineer, on demand, the data generated by the down-hole survey tools in a form suitable for independent calculation of the pilot hole profile.

9. The actual exit point shall fall within the planned exit pit which shall be a rectangle which is approximately 20 feet wide by 100 feet long.

B. Reaming

1. Upon approval of the pilot hole location by the Design Engineer's representative, the hole opening or enlarging phase of the installation shall begin.

2. The borehole diameter shall be increased to a minimum of 25% greater than the outside diameter of the HDPE pipe being installed to accommodate the pullback operation of the HDPE pipe.

3. The type of hole opener or back reamer to be utilized in this phase shall be determined by the types of subsurface soil conditions that have been encountered during the pilot hole drilling operation.

4. The reamer type shall be at the Contractor's discretion.

C. Pipe Pullback Operation

1. The pipes shall be assembled in a manner that does not obstruct adjacent roads or City, County, or Public activities as well as vehicle and pedestrian traffic adjacent to the layout areas.

2. In front of the pipe shall be a swivel and barrel reamer to compact the borehole walls.

3. Contractor shall use buoyancy control by filling pipe with water prior to pipe pull back for all drills larger than 24 inches in diameter or as necessary for soil conditions.

4. Pullback shall never be stopped, except for drilling rod removal, until the pipe is completely pulled into its permanent position.

5. During the pullback operation, the Contractor shall monitor roller operation and use side-booms or cranes if required, to assist movement of the pipe.

6. Situations which cause coating or pipe damage shall be corrected immediately.

7. Coating or pipe damage shall be repaired by Contractor before pulling operations resume.
8. The Contractor shall provide adequate support/rollers along the stringing area to support the required length of the HDPE pipe for each bore.
9. Support/rollers shall be comprised of a non-abrasive material arranged in a manner to provide support to the bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback.
10. Spacing for the supports/rollers shall be at 20 feet on center. Contractor may increase spacing of supports/rollers as long as pipe material is not adversely affected or drag along the ground.
11. Pulling Loads: The maximum pull (axial tension force) exerted on the HDPE pipelines shall be measured continuously and limited to the maximum allowed by the pipe manufacturer so that the pipe or joints are not overstressed. A breakaway head rated at the maximum safe pull force shall be utilized in advance of the pipe.
12. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50 percent (50%) of the yield stress for flexural bending of the HDPE pipe.
13. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense.
14. The contractor shall take appropriate steps during pullback to ensure that the HDPE pipe will be installed without damage. Pipe deformation of 10% or more may be grounds to abandon bore.
15. The lead end of the pipe shall be closed during the pull back operation.
16. The pull-nose should be pulled out 3-4 percent longer than the total length of the pull.
17. If unexpected subsurface conditions are encountered during the bore, the procedure shall be stopped and not continued until Owner and Engineer have been consulted.
18. Any mud fractures or frac-outs resulting from drilling activities and any damage caused by the frac-out must be contained and repaired immediately. Public safety must be maintained at all times.
19. After the carrier pipe is completely pulled through the tunnel, a sufficient relaxation period, as recommended by the specified pipe manufacturer, shall be provided prior to the final pipe tie-in.

20. The Contractor shall install, maintain, and leave in place any sheeting, underpinning, cribbing, and other related items (other than that required for the boring and receiving pits) to support any structure or facility affected by the boring operation. The Engineer, depending upon existing conditions, may require that additional sheeting for excavation be left in place.

D. Pipe Handling

1. The Contractor shall off load, stack, handle and string the pipe.

2. Pipe may be assembled and aligned for fusing using the line string or stovepipe method.

3. Torsion and Stresses: A swivel with a minimum load rating that is appropriate for the selected drill shall be used to connect the HDPE pipe to the back-reamer.

4. Pipeline Support: The pipelines shall be adequately supported during installation so as to prevent over-stressing or buckling. Contractor shall provide the necessary skids and padding to protect pipe coatings and prevent contact with the ground.

5. The contractor shall at all times handle the HDPE pipe in a manner that does not over-stress the pipe.

E. Handling Drilling Fluids and Cuttings

1. During the drilling, reaming or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids, or cuttings at the entry and exit pits.

2. These fluids must not be discharged into any waterways or stormwater system.

3. When the Contractor's provisions for storage of the fluids or cuttings on site are exceeded, these materials shall be hauled away to a suitable legal disposal site. Contractor shall be responsible for safely disposing of drilling fluids or cuttings and obtaining any necessary permits for disposal.

4. After completion of the directional drilling work, the entry and exit pit locations shall be restored to original conditions. The Contractor shall comply with all permit provisions.

F. Water

1. The Contractor must make provisions for obtaining water at the site.

G. Responsibility

1. The Contractor shall be fully responsible for the steerable, clay lined directional drilling operation.
2. Any noticeable surface defects resulting from improper operation of this boring equipment shall be repaired by the Contractor at his expense.
3. Contractor shall notify the Owner, Engineer, and Engineer's Resident Project Representative, as well as any requested regulatory authority three (3) working days prior to starting the directional drill.
4. As-built variance from the designed bore path shall not exceed plus or minus one (1) foot in the vertical plane and plus or minus two (2) feet in the horizontal plane.
5. Contractor is responsible for containing and cleaning up any mud fractures or frac-outs such as to minimize damage and protect the public.

36.3.3 INSPECTION AND TESTING

- A. All HDPE and fittings are subject to inspection by the Owner or Engineer at the point of delivery. Material found to be defective due to manufacture or damage in shipping shall be marked as rejected and immediately removed from the job site.
- B. All piping systems shall be field hydrostatically tested per Section 51.

36.3.4 START-UP AND INSTRUCTION - NOT USED

END OF SECTION

DIVISION IV

GRAVITY SEWERS, FORCE MAINS AND PUMP STATIONS

SECTION 40

PIPE MATERIAL FOR GRAVITY SEWERS

40.1 GENERAL

Pipe used in gravity sewer construction shall be polyvinyl chloride (PVC). Other pipe materials shall not be allowed.

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,

40.2 PIPE MATERIALS

40.2.1 PVC GRAVITY SEWER PIPE

PVC Gravity Sewer Pipe (4" - 15"), ASTM D3034, SDR 26. The pipe shall be formed from green PVC to identify as sewer pipe. Uniform minimum "pipe stiffness" at five (5) percent deflection shall be 115 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" - 48"), ASTM F679, SDR 26. Uniform minimum "pipe stiffness" at five (5) percent deflection shall be 115 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-7.

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

40.2.2 PIPE MARKINGS

All pipe shall have a homing or assembly mark on the spigot provided by the manufacturer. On field cut pipe, CONTRACTOR shall provide homing /assembly mark on the spigot in accordance with manufacturers' recommendations. Pipe specification class shall be clearly printed on outside of pipe.

40.3 JOINT MATERIALS

40.3.1 PVC PIPE

PVC sewer pipe joints shall be flexible elastomeric seals per ASTM D 3212.

40.4 FITTINGS

PVC pipe fittings shall be SDR 26. Unless otherwise specified, wye branches shall be provided in the gravity sewer main for service lateral connections. Wyes shall be six (6) inches nominal diameter, unless otherwise approved by the CITY. All fittings shall be of the same material as the pipe.

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 44 of these specifications.

40.5 INSPECTION AND TESTING

40.5.1 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.

40.5.2 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 subjected 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 41

GRAVITY SEWER PIPE LAYING, JOINTING AND MISCELLANEOUS CONSTRUCTION DETAILS

41.1 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.

41.2 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.

41.3 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. All pipe shall be installed using a pipe laser. All pipe shall be pushed to the "home line". Refer to Section 41.4 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 (1/2) 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.

Service lateral should be taken off at an angle no greater than 45 degrees from the horizontal. Good compaction is imperative beneath the entire length of the lateral and should be fully compacted before any top backfill is installed. Once the lateral is buried,

there shall be no movement made on the top portion of the lateral in attempt to adjust the laying angle. If the angle is off, the entire lateral must be excavated and reinstalled with proper angle and compaction.

All PVC pipe shall be installed in accordance with the pipe manufacturer's written recommendations as approved by the CITY.

41.4 TRENCH PREPARATION AND PIPE BEDDING

41.4.1 TRENCH EXCAVATION, DEWATERING, BEDDING MATERIAL, BACKFILL, COMPACTION, FILL AND GRADING

Applicable provisions of Section 32 shall apply. Also refer to STANDARD DRAWINGS.

41.4.2 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.

41.4.3 DEPTH OF BEDDING MATERIAL

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

41.5 GRAVITY PIPE AND WATER MAIN SEPARATION

Gravity sewers that are laid in the vicinity of pipe lines designated to carry potable water shall meet the conditions set forth in Section 51.3.

41.6 PLUGS AND CONNECTIONS

Plugs for pipe branches, stubs or other open ends 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.

41.7 PIPE JOINTING

The markings on reinforced concrete pipe indicating the minor axis of the elliptical reinforcement shall be placed in a vertical plane (top or bottom) when the pipe is laid.

All pipe 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 40.3. All pipe and jointing for gravity sewers shall be subject to the tests specified in Section 44.

SECTION 42

MANHOLES

42.1 GENERAL

Manholes shall be leak-tight and constructed of pre-cast concrete units or fiberglass monolithic structure units. Any manhole that fails the vacuum test or forms a leak during the two year warranty shall be removed and replaced with new manhole at the expense of the installing Contractor. The maximum depth for manholes shall be 18 feet.

42.2 PRE-CAST CONCRETE SECTIONS

42.2.1 GENERAL

Pre-cast manholes shall conform to specifications for Pre-cast Reinforced Concrete Manhole Sections, ASTM Designation C478, except as otherwise specified below. Structural design shall be the responsibility of the pre-caster. Precast products shall be designed by Engineer registered in the State of Florida.

Fiberglass manholes may be required for specific projects. All fiberglass manholes shall be constructed of glass fiber-reinforced polyester resin containing chemically enhanced silica. Manholes shall conform to the following design criteria: ASTM D-3753, ASTM C-581, ASTM D-2412, ASTM D-695, ASTM D-2584 and AASHTO H-20 Axle Loading. All fiberglass manholes shall be water tight and be certified by the manufacturer of all compliances.

42.2 2 MISCELLANEOUS REQUIREMENTS

The minimum wall thickness shall be 5 inches. Pre-cast manholes shall be constructed with a pre-cast monolithic base structure as shown on the STANDARD DRAWINGS. The minimum base thickness shall be 8 inches.

Concrete for manholes shall be Type II, 4000 psi at 28 days. Barrel, top and base sections shall have tongue and groove joints. All jointing material shall be cold adhesive preformed plastic gaskets, conforming with FDOT Article 942-2. (See approved manufacturers' list in appendix.)

The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on each pre-cast section.

Sections shall be cured by an approved method for at least 28 days prior to painting and shall not be shipped until at least 2 days after having been painted. All sections of the pre-cast manholes shall have the joints sealed over with non-shrink grout in the MH interior.

Pre-cast concrete top slabs shall be used where cover over the top of the pipe is less than 5 ft. Lift rings or non-penetrating lift holes shall be provided for handling pre-cast manhole sections. Non-penetrating lift

holes shall be filled with non-shrink grout after installation of the manhole sections.

Concrete surfaces shall have form oil, curing compounds, dust, dirt and other interfering materials removed by brush sand blasting and shall be fully cured prior to the application of any coatings.

Interior surfaces of manholes shall have a protective coal tar epoxy coating with a minimum dry mil thickness of 16 mils. Exterior surfaces shall have a protective epoxy coal tar coating with a minimum dry mil thickness of 9 mils. Coatings shall be applied in two (2) applications by the manhole manufacturer in strict accordance with the paint manufacturer's recommendations. (See approved manufacturer's list in appendix.)

Manholes receiving flow from wastewater force main shall be lined as per Section 46.3.

All manholes and wet wells shall be water tight and have no leaks. All new manholes shall be completely sealed at all the joints and risers by the use of a wraparound sleeve. See Appendix A for approved manufacturers.

42.2.3 INSPECTION

The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the CITY. Such inspection may be made at the place of manufacture or at the site after delivery, or at both places, and the sections shall be subject to rejection at any time on account of failure to meet any of the specification requirements; even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. All sections which have been damaged after delivery will be rejected and, if already installed, removed and replaced, entirely at the CONTRACTOR's expense. Any manhole that fails the vacuum test of forms a leak during the one year warranty shall be removed and replaced with new manhole at the expense of the installing Contractor.

At the time of inspection, the sections will be carefully examined for compliance with the specified ASTM designation, and with the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch-strength" blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.

42.3 CASTINGS

Gray iron castings for manhole frames, covers, adjustment rings and other items shall conform to the ASTM Designation A48, Class 35B. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects which would impair their strength, or otherwise make them unfit for the service intended. The seating surfaces between frames and covers shall be machined to fit true. No plugging or filling

will be allowed. Lifting or "pick" holes shall be provided, but shall not penetrate the cover. Lifting rings shall be cut off and patched after assembly of manhole is completed. Casting patterns shall conform to those shown or indicated on the STANDARD DRAWINGS. All manhole frames and covers shall be traffic bearing to meet AASHTO H-20 loadings. Frames shall be suitable for the future addition of a cast iron ring for upward adjustment of top elevation. In certain locations, bolt down covers and gasketed covers shall be located as shown on the DRAWINGS (i.e., flood prone areas).

42.3.1 RISER RINGS

All riser rings utilized in the city shall be manufactured from pre-cast concrete or High Density Polyethylene. Bricks shall not be used to adjust manholes to grade. All riser rings shall be manufactured in accordance with industry standards in regards with dimension, sizing, and ratio to insure tight fit in the installation of the rings and uniformity in multiply units. Riser rings shall be made from recycled High Density Polyethylene materials in accordance with ASTM D 4976-04a and ASTM D-1248 under controlled manufacturing conditions. All rings must carry a minimum of a H-20 load factor and be suitable for use in heavy traffic locations. All riser rings shall be listed in the QPL listings as published by the Florida Department of Transportation approval for use in DOT right-of-ways. The supplier must certify proof of load factor and manufacturing quality control prior to installation of riser rings. All rings must comply with the following standards and property values, and be certified by the manufacturer:

<u>Property</u>	<u>Test Method</u>	<u>Acceptable Value</u>
Melt Flow Index	ASTM D-1238	0.30 to 30 g/10 min.
Density	ASTM D-792	0.84 to 0.98 g/cm ²
Tensile Strength, yield	ASTM D-638	2.0 to 5.0 10 lb./in.

All dimensions of rings must be constant and uniform to insure watertight fit during installation. The HDPE riser rings shall be installed in accordance with manufacturers' recommendation. Only butyl rubber adhesive rope will be allowed as the sealant between rings as recommended ASTM C-990. Any defected rings shall not be used and sent back to the manufacturer or recycling. All rings shall adhere to the following requirements of these standards.

High Density Polyethylene Grade Adjustment Rings

Adjustment rings shall be manufactured from polyethylene as identified in ASTM D-1248, and shall be tested and qualified for usage under this standard. Recycled material meeting this requirement may be used. All HDPE rings shall be manufactured utilizing the injection molding process as defined by the Society of Plastic Engineers, and shall be tested to assure compliance with impact and loading requirements of AASHTO's standards for highway and bridges.

Structural Test Design - HDPE Adjustment Rings

All tests to be conducted free board - with no support to rings.

Static Compressive Von Mises Stress (25,250 lb. load fully centered) - Stress value of 640 lb./in² and safety factor of 6.
 Static Shear Stress (22% Grade with 25,250 lb. load fully centered) - Stress value of -370 lb./in² and safety factor of 5.

Static Elastic Stability (Buckling) Stress (25,250 lb. load centered) - Buckling onset with stack of 8 units - safety factor of 20.

Shock Impact Effects Free Fall of .75 inch @ 25,250 lb. load centered - Stress of 3,200 lb./ in² and safety factor of 4.

1,000,000-cycle load test - simulated AASHTO HS-25 wheel load - Ring combinations to support HS-25 load factor from height of 3/4-inch with no fatigue, cracking or significant permanent deformation at 6-inch, 10-inch, and 16-inch.

Cycle to heat and cold elements: Hot-mix asphaltic (287°F) exposure and 5°F exposure using standard 2-inch rings: Adjusting rings not to show any cracking to heat and no brittle fracture to cold.

Sealing of HDPE Adjustment Rings

If necessary, use the following: ASTM Test Method C 1244-93: 10-inch vacuum for 30 minutes. Rings and sealant must with stand test valves with less than 1-inch vacuum lost.

Expansion - Contraction Test: -40°F and 140°F:

	<u>72°F</u>	<u>-40°F</u>	<u>140°F</u>
Cast Iron Frame	Normal	-0.0060-in.	0.0050-in.
HDPE Ring	Normal	-0.170-in.	0.135-in.
Concrete Cone	Normal	-0.0065-in.	0.0054-in.

The concrete cone or top slab shall be clean and free of any debris, rises, or objects in seating area. To assure proper installation of rings, surface area shall be cleaned with brush, broom, chisel, or blower and shall form a flat seating surface, free of any and all obstructions.

42.4 CONSTRUCTION DETAILS

42.4.1 BEDDING

Base sections shall be placed on bedding rock conforming to the requirements in Section 32.8.2. The bedding rock shall be firmly tamped and made smooth and level to assure uniform contact and support of the pre-cast element. Refer to Section 32.9.2 for density requirements. Refer to the STANDARD DRAWINGS for additional bedding details.

42.4.2 CAST-IN-PLACE BASES

Cast-in-place bases shall be utilized only when specifically approved by the CITY. Unless otherwise specified, cast-in-place bases shall be at least eight (8) inches in thickness and shall extend at least six (6) inches radially outside of the outside dimension of the manholes section. Anti-floatation, reinforcement, and connection to the riser sections shall be designed by the DESIGN ENGINEER and submitted to the CITY for approval.

42.4.3 PRE-CAST MANHOLES

A pre-cast base section shall be carefully placed on the prepared bedding so as to be fully and uniformly supported in true alignment and making sure that all entering pipes can be inserted on proper grade. Pre-cast manhole sections shall be handled by lift rings or non-penetrating lift holes. Such holes shall be filled with non-shrink grout after installation of the manhole.

The first pre-cast section shall be placed and carefully adjusted to true grade and alignment. All inlet pipes shall be properly installed so as to form an integral watertight unit. The sections shall be uniformly supported by the base structure, and shall not bear directly on any of the pipes. All joints shall be wrapped.

Pre-cast sections shall be placed and aligned to provide vertical alignment with a 1/4-inch maximum tolerance per 5 feet of depth. The completed manhole shall be rigid, true to dimensions, and watertight.

42.4.4 EXCAVATION AND BACKFILLING

Requirements of Section 32 shall apply.

42.4.5 PLACING CASTINGS

Casting shall be fully bedded in mortar with adjustments being made by placing precast concrete riser rings or HDPE riser rings, as described in Section 42.3.1, as needed between the frame and manhole. Riser rings shall not exceed 12 inches in height. Mortar shall conform to ASTM C-270, type M.

Top of manhole castings located in pavement, shouldered areas, and sidewalks shall be set flush with grade. Top of manhole castings located outside these areas shall be placed 2" above grade.

42.4.6 CHANNELS

Manhole flow channels shall be as shown in the STANDARD DRAWINGS, with smooth and carefully shaped bottoms, built up sides and benching constructed using cement and brick with no voids. Bricks shall be clay and conform to ASTM C-216, grade SW, size 3 1/2" (w) x 8" (L) x 2 1/4" (h). Channels shall conform to the dimension of the adjacent

pipe and provide changes in size, grade and alignment evenly. Cement shall be Portland Cement Type II only.

42.4.7 PIPE CONNECTIONS

Special care shall be taken to see that the openings through which pipes enter the structure are provided with watertight connections. Connections shall conform with ASTM C923, "Standard Specifications for Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes."

42.4.8 DROP MANHOLE CONNECTIONS

Drop manhole connections shall conform in all respects to details shown on the STANDARD DRAWINGS or DRAWINGS.

42.5 CLEANING

All newly constructed manholes shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind, and shall be free from such accumulations at the time of final inspection.

42.6 INSPECTION FOR ACCEPTANCE

No visible leakage in the manhole or at pipe connections will be permitted. All manholes shall be inspected by the CITY prior to acceptance. All manholes failing to meet the specification set forth in Section 42 above shall be reconstructed or replaced by the CONTRACTOR to comply with these specifications. Pressure grouting of manholes for repair shall not be accepted.

SECTION 43

SERVICE LATERALS

43.1 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 40 and 41 of these Specifications shall apply for service laterals unless they are inconsistent with the provisions of this section.

Service laterals and fittings shall be six (6) inches in diameter.

43.2 MATERIALS

43.2.1 PIPE, FITTINGS AND JOINTS

Pipe, fittings and joints shall be PVC SDR 26 pipe and shall conform to the requirement for gravity sewer construction in Section 40 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 available, connection shall be made by cutting in a wye, a machine-made tap and suitable saddle, or a cast-in-place manhole as referenced in Section 20.4.5. The method of connection will be determined by the City.

43.3 CONSTRUCTION DETAILS

43.3.1 GENERAL

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

43.3.2 EXCAVATION AND BACKFILL

Excavation and backfilling for service sewers shall conform to the requirements of Section 32 and 41, excepting that no backfill in excess of that required to hold the pipe in true alignment shall be placed prior to inspection. Service lateral should be taken off at an angle no greater than 45 degrees from the horizontal. Good compaction is imperative beneath the entire length of the lateral and should be fully compacted before any top backfill is installed. Once the lateral is buried, there shall be no movement made on the top portion of the lateral in attempt to adjust the laying angle. If the angle is off, the entire lateral must be excavated and reinstalled with proper angle and compaction.

43.3.3 PIPE LAYING AND JOINTING

Pipe laying and jointing, except as hereinafter provided, shall in general conform to the requirements of Section 41. During the pipe laying and jointing, the service lateral shall be kept free of any water, dirt or objectionable matter.

43.3.4 LINE AND GRADE

Pipe shall be laid with a minimum grade 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.

43.4 TERMINATION OF SERVICE LATERALS

Standing clean-out with a water-tight factory made glued cap is required at lateral termination. Service laterals shall terminate at the right-of-way line in accordance with the STANDARD DRAWINGS. Water-tight factory made plug(s) shall be installed at the end of each service lateral. All service laterals shall be a minimum of three (3) feet deep and a maximum of four (4) feet deep at the right-of-way line.

43.5 INSPECTION

Service sewers shall meet the inspection requirements specified in Section 40.5.

43.6 RESTORATION, FINISHING AND CLEANUP

The CONTRACTOR shall restore all paved surfaces, 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.

43.7 LOCATION

The exact location of the termination point of each installed service lateral shall be marked by etching or cutting an "S" in the concrete curb. Where no curb exists, locations shall be adequately marked by a method approved by the CITY.

SECTION 44

TESTING AND INSPECTION FOR ACCEPTANCE OF GRAVITY SEWER SYSTEMS

44.1 GENERAL

All gravity sewers, including service laterals, shall be inspected by closed circuit television (CCTV) 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. CCTV inspection shall be performed by the CONTRACTOR prior to leakage testing. In addition, sewer manholes shall be vacuum tested for tightness prior to CCTV inspection.

44.2 SEWER LEAKAGE TESTING

44.2.1 GENERAL

Gravity sewers and service laterals shall be required to pass a leakage test after the CCTV inspections and repairs of all deficiencies found during CCTV are performed before acceptance by the City. Leakage tests shall be the low-pressure air test as described below. The CONTRACTOR shall prepare a test report, to be certified by the DESIGN ENGINEER and submitted to the City for approval.

44.2.2 SELECTION OF TEST SECTIONS

Each test section shall not exceed 400 feet in length and shall be tested between adjacent manholes.

44.2.3 PREPARATION AND COORDINATION FOR TESTING

The CONTRACTOR shall flush all sewer mains and laterals with water sufficient in volume to obtain free flow through each line. Flushing water and debris shall not enter any pump station wet well. 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 Engineering Inspector 48 hours prior to performing any leakage testing.

The CONTRACTOR shall install sufficient monitoring wells in the representative areas of the gravity system, acceptable to the DESIGN ENGINEER, to determine the groundwater elevations. Monitoring wells shall be installed a minimum 24 hours prior to testing.

44.2.4 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. Passing this test shall be presumed to establish leakage test limits

of 50 gallons per day per inch diameter per mile of sewer. The DESIGN ENGINEER shall determine the test procedure that is applicable to field conditions and certify test results for City approval.

44.3 MANHOLE TESTING

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.

44.3.1 GENERAL

Each manhole shall be vacuum tested after backfilling.

All lift holes and any pipes entering the manhole are to be plugged and sealed. A vacuum will be drawn and the vacuum drop over a specified time period is used to determine the acceptability of the manhole (ref: Section 10.02 - Paragraph 4, 5, 6).

The values recorded are applicable only to the manhole being tested and at the time of testing, and the recorded information, reported on the Vacuum Testing Result form, at the end of this section.

Any manhole that fails the vacuum test or forms a leak during the one (1) year warranty shall be removed and replaced with new manhole at the expense of the installing Contractor.

44.3.2 PREPARATION OF THE MANHOLE

Care shall be taken to affect a seal between the vacuum base and the manhole rim. Pipe plugs shall be secured to prevent movement while the vacuum is drawn.

All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.

44.3.3 TYPICAL FIELD TEST PROCEDURE

The test head gauge shall be placed at the top of the manhole or in accordance with the manufacturer's recommendations.

A vacuum of 10 inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 inches of mercury.

The manhole shall pass if the time for the vacuum reading to drop from 10 inches of mercury to 9 inches of mercury meets or exceeds the values indicated in the table below.

Minimum test times for various diameter manholes for depths 8 feet and greater:

<u>Depth of Manhole (feet)</u>	<u>Diameter of Manhole (Feet)</u>		
	4	5	6
	<u>Time (Sec.)</u>		
Up to 8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30+	74	98	121

If the manhole fails the initial test, necessary repairs shall be made by the Contractor. Repairs shall be inspected by the City prior to testing. The manhole shall then be retested until a satisfactory test is obtained.

44.4 CCTV INSPECTION FOR ALIGNMENT, DEFLECTION AND INTEGRITY

44.4.1 GENERAL

Internal video inspection for the gravity sewer shall be performed by the CONTRACTOR to check for alignment and deflection. The television inspection shall also be used to check for leaking, cracked, broken or otherwise defective pipe, and overall pipe integrity. All joints shall be inspected (panned) 360 degrees.

44.4.2 PREPARATION AND COORDINATION FOR TESTING

Prior to video inspection, the CONTRACTOR shall flush all sewer mains and laterals with water sufficient in volume to obtain free flow through each line. Flushing water and debris shall not enter any pump station wet well. Water will be pumped from the sewer system during flushing to an acceptable discharge location in compliance with applicable regulations of FDEP and jurisdictional water management district. A visual inspection shall be made and all obstructions removed.

44.4.3 CCTV INSPECTION

The CCTV internal inspection will be performed in two stages. The

DEVELOPER shall provide a construction and warranty CCTV inspection. The construction inspection will be within 30 days after Substantial Completion of 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 CCTV inspection shall be performed once the trench has been compacted up to the road base. The warranty inspection of the gravity sewer pipe will be before the end of the two year warranty period.

The CCTV inspection shall comply with the standard specification attached to this standard as "Appendix B", Standard Specification of Closed Circuit Television Inspection of Sewer Mains and Laterals.

If the construction or warranty CCTV inspection reveals infiltration from cracked, broken, or defective pipe, or pipe misalignment resulting in vertical sags in excess of 1/2" and a ring deflection in excess of 5 percent, the CONTRACTOR shall be required to repair or replace the pipeline. The CITY reserves the right to pass a mandrel through the sewer pipe to confirm ring deflection.

Successful passage of both the leakage test and CCTV inspection is required before acceptance by the CITY.

SECTION 45

WASTEWATER FORCE MAINS

45.1 GENERAL

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

Pipe used in wastewater (transmission) force main systems shall be Polyvinyl Chloride (PVC), exclusively. Pipe used at pumping stations and lift stations shall include ductile iron pipe (DIP).

The CONTRACTOR shall be responsible for all materials furnished and storage of same, 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.

45.2 PIPE INSPECTION AND TEST

Requirements specified in Section 40.5 shall apply.

45.3 PVC PIPE

45.3.1 PVC PIPE

The PVC pipe shall have a minimum working pressure of 150 psi. All PVC pipe shall be manufactured to have outside diameters equal to Ductile Iron pipe.

PVC pipe of a nominal diameter four (4) through twelve (12) inches shall have a dimension ratio (DR) of 18 and be manufactured in accordance with AWWA standard C900.

PVC pipe of a nominal diameter sixteen (16) through forty-eight (48) inches shall have a dimension ratio (DR) of 25 and be manufactured in accordance with AWWA standard C905.

45.3.2 JOINTS

PVC pipe shall have integral bell push on type joints conforming to ASTM D3139.

45.3.3 FITTINGS

Fittings used with PVC pipe shall conform to Section 45.4.

45.4 DUCTILE IRON PIPE AND FITTINGS

45.4.1 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 Pressure Class 250 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.

45.4.2 FITTINGS

All fittings shall conform to either ANSI/AWWA C110/A21.10 and/or C153/A21.53, latest revision, and shall be ductile iron only. All fittings shall be cast and machine allowing the bolt holes to straddle the vertical centerline.

The material supplier and/or Contractor shall furnish data certified by the pipe and/or the fitting manufacturer that the fittings are of the material specified, and shall furnish physical and chemical certifications. Manufacturer shall furnish to the Engineer certifications that all fittings comply with the following requirements: All fittings shall be capable to withstand, without bursting, hydrostatic tests of three (3) times the rated water working pressure. The results of these tests, along with all other foundry test, shall be retained for at least two (2) years, preferably three (3), for review. All fittings shall have a date code cast, not printed or labeled, with identification of date and place it was cast and machined. Fittings shall have distinctly cast on them the pressure rating, nominal diameter of openings, manufacturer's name, the country where cast, and number of degrees or fraction of the circle. Ductile iron fittings shall have the letters "DI" or "Ductile" cast on them. The tabulated nominal weight, and wall thickness, of each size and type of fitting shall be supplied by the manufacturer, on the manufacturer's letterhead stationary, for all items proposed. Any fitting submitted with a nominal weight less than that of the same fitting listed in C153/A.21.53-94, will not be acceptable. Any fittings submitted with a wall thickness that is less than that of the same fitting listed in C153/A21.53-94, will not be acceptable. Note the term "manufacturer" shall be construed to mean the actual casting of the component and the "manufacturer" is the foundry performing said casting operations. Brokers or suppliers are not considered manufacturers and shall not be approved. The same manufacturer shall supply accessories as the fittings, except for those that require special types of restraint. All fittings shall have NSF 61 certification, and ISO 9001 certification for both the foundry and manufacturer. The NSF 61 certification shall be issued on all coatings and linings, from the said manufacturers that are used for potable water applications. All fittings shall be Ductile Iron Fittings as manufactured by Union/Tyler Pipe, Clow, or approved equal.

No others will be accepted without prior written approval by Engineer and Owner. Submittals from the manufacturer ONLY will be accepted, third party companies will not be recognized as the manufacturer.

Epoxy-lined pipe and fittings shall have legible markings on the interior

with the date of application, application approval number (if applicable) and have legible exterior markings identifying the lining and calling out “sewer use only”. A certification shall be provided by the applicator and the manufacturer of the product being lined, that the pipe and fittings were bare, and never lined with any type of material, before the epoxy was applied in accordance with manufacturer’s specifications. The only epoxy approved for sewer applications is the Protecto 401.

45.4.3 **JOINTS**

Joints for ductile iron pipe and fittings shall be push-on or 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. Flanged joints shall conform to ANSI Standard B16.1-125 LB. Restrained joints shall conform to Sections 34.2 or 34.3.

45.4.4 **EXTERIOR COATINGS**

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 within vaults or pumping stations, 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 grey for raw wastewater and brown for treated wastewater.

45.4.5 **INTERIOR LINING**

All ductile iron pipe and fittings shall have an interior protective lining of ceramic epoxy with a minimum dry thickness of 40 mils applied by the pipe manufacturer. Ceramic epoxy shall be Protecto 401 as manufactured by Induron Coatings, Inc. and shall be applied per applicable standards and manufacturer’s requirements.

Epoxy-lined pipe and fittings shall have legible markings on the interior with the date of application, application approval number (if applicable) and have legible exterior markings identifying the lining and calling out “sewer use only”. A certification shall be provided by the applicator and the manufacturer of the product being lined, that the pipe and/or fittings were bare, and never lined with any type of material, before the epoxy was applied in accordance with manufacturer’s specifications. The only epoxy approved for sewer applications is Protecto 401 or City of Winter Garden approved equal.

45.4.6 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.

45.5 PIPE HANDLING

Requirements specified in Section 51.2 shall apply.

45.6 AIR AND VACUUM RELEASE VALVES

45.6.1 GENERAL

Wastewater force mains shall be equipped with air release valves as required. The DESIGN ENGINEER shall determine the need and location of air release valves as shown on the DRAWINGS. Valves shall be located in an enclosure as detailed on the STANDARD DRAWINGS.

The valves shall be as described below. (See approved manufacturers' list in appendix.)

45.6.2 WASTEWATER AIR RELEASE VALVE

All force mains and other pressure non-treated mains shall have air and vacuum release valves installed as they are indicated on the plans. The body of these valves shall be conical shaped to maintain maximum air gap with the spring loaded float and seal plug connection combining to ensure no contact between the sewage and the seal. The valve shall have a double float design with the upper float being enclosed in the upper section of the valve and shall be made of polypropylene. The lower float shall be in the main body of the valve and shall be constructed of 316 stainless steel or foam polypropylene. The body, cover flange, and lower flange shall be constructed of 316 stainless steel, and shall have a funnel shaped lower body to automatically drain sewage back into the system. All internal metal parts are to be made from corrosion resistant 316 stainless steel, with all operating parts in the upper and lower sections to be non-metallic plastic materials. The hinge for operation for the opening and closing of the seal on the orifice shall be made of EPDM rubber. The rolling resilient seal shall provide smooth positive opening, closing, and leak-free sealing over the fluctuation of pressure differentials. The working pressure shall be 150 psi and tested to 230 psi. All hardware shall be of stainless steel bolts and nuts, and the entire valve, except to upper outlet, shall be constructed of 316 stainless steel. All valves shall be equipped for backflushing maintenance with easy connection or disassembly. Valves with a total weight of more than 45 pounds shall be anchored to relieve the excessive weight to the saddle and PVC pipe. Those valves weighing less than 45 pounds will not be required to be anchored. The connection on all pipelines shall be the following sizing with an isolation valve of the same size:

8-inch and smaller

2-inch threaded

10-inch through 16-inch	3-inch flange
18-inch through 24-inch	4-inch flange
30-inch through 48-inch	6-inch flange
54-inch and larger	8-inch flange

Please refer to the Approved Material List in Appendix A for all air and vacuum combination release valves. All valves shall be installed in accordance with manufacturer recommendations and shall have an isolation valve connection for control. All ARV shall have ISO 9002 certification.

45.7 NOTIFICATION AND CONNECTION TO EXISTING MAINS

Pressure connection to existing wastewater force mains shall comply with the requirements of Section 35.3.

45.8 PLUG VALVES

45.8.1 GENERAL

Only plug valves as specified below shall be used on wastewater force main systems. All plug valves shall be installed so that the direction of flow through the valve is in accordance with the manufacturer's recommendations. Valves shall be eccentric plug valve type. (See approved manufacturers' list in appendix.)

45.8.2 VALVE CONSTRUCTION

Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans. Flanged valves shall be faced and drilled to the ANSI 125/150 lb. standard. Mechanical joint ends shall meet AWWA C111, Class B.

Valve bodies shall be of ASTM A126, Class B semi-steel, 31,000 psi tensile strength minimum in compliance with AWWA C507 and C504. All exposed nuts, bolts, springs, washers, etc. shall be zinc or cadmium plated. Resilient plug facings shall be of Hycar or Neoprene.

Port areas for valves 4 inches through 20 inches shall be 80 percent nominal pipe diameter. Valves 24 inches and larger shall have a minimum port area of 70 percent of nominal pipe diameter. All exposed nuts, bolts, springs, washers, etc., stainless steel. Resilient plug facings shall be of Hycar or Neoprene.

Valves shall be furnished with permanently lubricated stainless steel or oil-impregnated bronze upper and lower plug stem bushings. These bearings shall comply with AWWA C507 and C504.

Seats in 4-inch and larger valves shall have a welded-in overlay of a high nickel content on all surfaces contacting the plug face which comply with AWWA C507 and C504.

Valve shaft seals shall be adjustable and comply with AWWA C507.

45.8.3 **VALVE TESTING**

Plug valves shall be tested in accordance with AWWA C504. Each valve shall meet the performance, leakage, and hydrostatic tests described in AWWA C504. The leakage test shall be applied to the face of the plug tending to unseat the valve. The manufacturer shall furnish certified copies of reports covering proof of design testing as described in AWWA C504.

45.8.4 **ACTUATORS**

Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floorstands, etc. as indicated on the plans. All valves 6-inch and larger shall be equipped with gear actuators. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. All actuator shafts shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. All exposed nuts, bolts, and washers shall be zinc or cadmium plated. Valve packing adjustment shall be accessible without disassembly of the actuator.

45.9 **VALVE BOXES**

Requirements specified in Section 52.5 shall apply, except that covers shall have "sewer" cast into the top.

45.10 **SEPARATION OF FORCE MAINS AND WATER MAINS**

Requirements specified in Section 51.3 shall apply.

45.11 **FORCE MAIN CONSTRUCTION**

Requirements specified in Section 51.4 shall apply.

45.12 **PRESSURE PIPE PIGGING**

Each section of pipeline shall be thoroughly cleaned with one Polyurethane Foam Pig. Lines shall be pigged a minimum of two times.

City of Winter Garden representatives shall be present at the time of insertion and exit of the pigs. Lines shall be pigged and/or flushed until the water runs clear and is approved by the City representative. The City requires a 48 hour minimum notice prior to pigging or flushing.

On short lengths of pipeline (100' max), cleaning may be accomplished by flushing with water at a minimum velocity of 2.5 feet per second. Water required for testing and cleaning shall be provided by the city at the contractor's expense. Water shall be from a potable source satisfactory to the city.

45.13 HYDROSTATIC TESTS

Requirements specified in Section 51.5 shall apply except that all pipe sections to be tested shall be subjected to a hydrostatic pressure of 100 psi.

45.14 FINAL CLEANING

Prior to final inspection and acceptance of the force main by the CITY, CONTRACTOR shall flush and clean all parts of the system. Flushing and cleaning shall remove all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the sewer system at or near the downstream end.

Upon the CITY's final inspection of the pressure pipe systems, if any foreign matter is still present in the system, CONTRACTOR shall clean the sections and portions of the lines as required.

45.15 LOCATION AND IDENTIFICATION

pipe and shall run the entire length of the pipe. Lettering shall read as is acceptable for the intended use.

SECTION 46

WASTEWATER PUMP STATIONS

46.1 GENERAL

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

46.2 WET WELL AND VALVE VAULT

Wet well and valve vault shall be constructed as shown on the STANDARD DRAWINGS and in conformance with the specifications outlined in Section 42. Any pump station that fails the vacuum test or forms a leak during the two (2) year warranty shall be removed and replaced with new manhole at the expense of the installing Contractor. All sections of the pre-cast wet well shall have the joints sealed over with non-shrink grout in the interior. All manholes shall be watertight and have no leaks. All new manholes shall be completely sealed at all the joints and risers by the use of a wraparound sleeve or approved equal as specified in Section 42.2.

46.3 WET WELL LINER

All wastewater pump stations shall be provided with wet well interior lining, as per one (1) of the following:

46.3.1 FIBERGLASS LINER

Fiberglass reinforced polyester wetwell liner shall be manufactured from commercial grade polyester resin or vinyl ester resin with fiberglass reinforcements. The resin system shall be suitable for atmospheres containing hydrogen sulphide and dilute sulfuric acid, as well as other gases associated with the wastewater collection systems. The wetwell liner shall be a one-piece unit, 1/8-inch minimum thickness, manufactured in accordance with the requirements of ASTM D3753. Fiberglass liner system shall be as manufactured by GLI-Florida or approved equal. All inserts and sleeves for piping shall be in accordance with the liner manufacturer's recommendations and shall result in complete coverage of all pre-cast sections and be capable of passing a spark test.

46.3.2 HDPE LINER

The HDPE embedment sheeting shall be mechanically bonded to the concrete by integral studs. The liner shall be cast in place by the precast manufacturer and the Contractor shall field weld the joints. Minimum thickness of liner is 80 mils. HDPE liner system shall be as manufactured by Agru Sure Grip or approved equal. All inserts and sleeves for piping shall be in accordance with the liner manufacturer's recommendations and shall result in complete coverage of all pre-cast sections and be capable of passing a spark test.

46.3.3 EPOXY LINER

Epoxy coating shall be solvent-free 100 percent solids, ultra high build epoxy coating specifically formulated for service in wastewater pump stations and manholes. The epoxy coating shall have broad range of chemical resistance, high physical strength and superior bond to concrete, steel, masonry and fiberglass surfaces. The epoxy coating shall be designed for operating temperatures up to 200°F. The epoxy coating shall may be spray applied at the construction site prior to lift station start up but after all work is completed in the wet well. Epoxy coating for wastewater pump stations shall be Raven 405 as manufactured by Raven Lining Systems or approved equal. Epoxy coating shall be 80-mil thickness, and applied per the manufacturer's recommendations by experienced applicators and shall be capable of passing a spark test.

46.4 PRE-CAST CONCRETE SECTIONS

- 46.4.1** Pre-cast wet wells shall conform to specifications for ASTM C 478 "Pre-cast Reinforced Concrete Manhole Sections", except as otherwise specified below.
- 46.4.2** The minimum wall thickness shall be eight (8) inches. Pre-cast wet-wells shall be constructed with a pre-cast monolithic base structure as shown on the Standard Drawings. The minimum base thickness shall be eight (8) inches.
- 46.4.3** Concrete shall be Type II, 4,000 psi at 28 days. All sections shall have tongue and groove joints except for top slab. All jointing material shall be a cold adhesive preformed plastic gasket, conforming to ASTM C443 "Manhole Section Connections".
- 46.4.4** The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on each pre-cast section.
- 46.4.5** Sections shall be cured by an approved method as per ASTM C478 for at least 28 days prior to coating and shall not be shipped until at least two (2) days after having been coated.

46.5 ACCESS FRAMES AND COVERS

Both the wet well and the valve vault shall be furnished with an access frame and cover. Equipment furnished shall include the necessary aluminum access frames, complete with hinged and slide bar equipped covers, stainless steel upper guide holder and level sensor cable holder. The frames shall be securely mounted above the pumps. Doors shall be of aluminum checkered plate. The access cover and frame with stainless steel hardware shall be sized as shown on the DRAWINGS. (See approved manufacturers' list in appendix.)

46.6 PUMPS AND CONTROLS

Wastewater pumps shall be submersible type only. Submersible wastewater pumps and miscellaneous accessories shall be as specified in Section 47. Controls and miscellaneous accessories shall be as specified in Section 48.

46.7 PIPING, VALVES AND ACCESSORIES

46.7.1 PIPING

Influent piping to the wet well shall meet the requirements of Sections 40. All pipe inside the wet well and the valve vault shall be ductile iron pipe per Section 45 and as shown on the STANDARD DRAWINGS. All ductile iron pipe, fittings, and valves shall have corrosion protection. Recommended method being completely encapsulated for corrosion protection with the heat-shrink membrane - CCI LPB pipe sleeves, CCI LFL flange sleeves, Wrapid Seal, and Wrapid Tape or approved equal. The complete surface area shall be covered with the membrane for total protection. The membrane shall be applied in sections with at least 3 to 4 inch over lap on the LPB and LFL Sleeves and Wrapid Seal, and 1 to 2 inch over lap with the Wrapid Tape. The LPB and LFL Sleeves and Wrapid Seal shall be used on all major areas while the Wrapid Tape may be used in only those areas of short radius on the fittings and valves such as the body around the bell section. The material shall be applied as specified above and in accordance with the manufacturer's recommendation. The area of the joints shall be protected with a plastic barrier supplied by the Wrapid Seal representative. This barrier shall be applied and secured with tape over the complete joint area to protect the gasket, bolts and nuts, and glands from coming in contact with the mastic material on the Wrapid Seal. The membrane shall be applied over the barrier after the barrier is secured in place with tape. The entire area shall be heat applied and 100 percent adhesion of the CCI Wrapid Seal products shall be accomplished. All plastic fittings shall be encapsulated on the joint area to protect the bolts, nuts, and gasket materials as specified above. All materials shall comply with the above minimum requirements as stated in 444.8.3, or approved equal.

For those applications for joint and gasket protection of hydrocarbon contamination, the use of the Wrapid Seal and Wrapid Tape shall be used. The wrap shall be applied along the centerline of the wrap over the bell of the pipe. The size and dimensions of the pipe and pipe bell being protected shall determine the size of the wrap. At least three (3) inches of wrap shall be heat shrunk and fused on both sides of the bell to the pipes. Any less, a larger size wrap shall be used. Only 9-inch, 12-inch and 18-inch Wrapid Seal materials shall be used, alone with Wrapid Tape, if needed. All applications shall be in accordance with manufacturer's recommendation. Depending on soil conditions, the City may select to waive this requirement.

Epoxy-lined pipe and fittings shall have legible markings on the interior with the date of application, application approval number (if applicable) and have legible exterior markings identifying the lining and calling out

“sewer use only”. A certification shall be provided by the applicator and the manufacturer of the product being lined, that the pipe and fittings were bare, and never lined with any type of material, before the epoxy was applied in accordance with manufacturer’s specifications. The only epoxy approved for sewer applications is the Protecto 401. Thickness of lining shall be 40 mil nominal thickness with no holidays and shall meet all requirements as specified in the Protecto 401 Ceramic Epoxy - Standard For Lining Ductile Iron Pipe and Fittings For Sewer Service.

46.7.2 PLUG VALVES

Plug valves shall meet the requirements of Section 45.8.

46.7.3 CHECK VALVES

Check valves for ductile iron pumping stations 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.

46.7.4 PRESSURE GAUGES

Pressure gauges shall be installed on each discharge pipe as indicated on the STANDARD DRAWINGS. 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, 1/4-inch shut-off (isolation) 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. (See approved manufacturers' list in Appendix).

46.7.5 THIS SECTION HAS BEEN RESERVED

46.8 STANDBY POWER SYSTEM

46.8.1 GENERAL

A standby power generator system shall be installed at pump stations as required by Section 22.5 for electrical power during the loss of normal power.

46.8.2 GENERATOR SET

46.8.2.1 GENERAL

The generator set shall consist of a diesel engine directly coupled to an electric generator, together with the necessary controls and accessories to provide continuous electric power to the lift station for the minimum duration of a 48 hour failure of the normal power supply.

A complete engine generator system shall be furnished and installed with belly tank, battery, battery charger, muffler, radiator, control panel, remotely mounted automatic transfer switch (part of the control panel), and all other accessories required for an operational system. The automatic transfer switch may come as part of the complete generator system. All materials and parts of the generator set shall be new and unused. Each component shall be of current manufacture from a firm regularly engaged in the production of such equipment. The set shall be of a standard model in regular production at the manufacturer's place of business. Units and components offered under the Specifications shall be covered by the manufacturer's standard warranty on new machines.

46.8.2.2 REQUIREMENTS

The emergency generator set and accessories shall be of a type that complies with the latest edition of the National Electrical Code and all applicable state and local building codes.

The material and workmanship used in the manufacture of this equipment shall be of the highest quality consistent with the current standards for like equipment, and the equipments shall be manufactured in such a manner so as to conform to the latest applicable IEEE, ANSI, ISA, NEMA, and EEIA Standards.

The equipment supplier shall be liable for any latent defects due to faulty materials or workmanship in the equipment which may appear within one (1) year from the date of equipment start-up.

46.8.2.3 TESTS

Equipment shall be completely assembled and tested at the factory prior to shipment. Certified copies of the data obtained during these tests shall be submitted to the CITY.

Final tests shall be conducted at the site, after installation has been completed, in the presence of the CITY'S representative. The emergency generator manufacturer shall furnish a service representative to operate the engine during the tests, to check all details of the installation and to instruct the CITY'S representatives in proper equipment operation.

Field tests shall include operating the diesel generating set for two (2) hours, carrying normal lift station loads. The CONTRACTOR shall refill the main fuel tank at the completion of the tests.

46.8.2.4 RATINGS

The rating of the generator shall be as shown on the DRAWINGS. These ratings must be substantiated by the manufacturer's standard published curves. Special ratings shall not be acceptable. The set shall be capable of supplying the specified usable KW for the specified duration, including the power required for the pump start-up, without exceeding its safe operating temperature.

46.8.2.5 ENGINE

The engine shall be water-cooled, four-stroke cycle, compression ignition diesel. It shall meet specifications when operating on No. 2 domestic burner oil. The engine shall be equipped with fuel, tube oil and intake air filters; lube oil coolers, fuel priming pump, and gear-driven water pump.

The engine and generator shall be torsionally compatible to prevent damage to either engine or generator.

An engine instrument panel shall be installed on the generator set in an approved location. The panel shall include oil and fuel pressure and water temperature gauges.

The engine governor shall be of the isochronous electronic type. Frequency regulation shall not exceed plus/minus 0.25 percent under steady state conditions. The engine shall start and assume its rated load within 10 seconds, including transfer time.

46.8.2.6 **GENERATOR**

The generator shall be a three-phase, 60 hertz, single bearing, synchronous type, built to NEMA Standards. Epoxy impregnated Class F insulation shall be used on the stator and the rotor.

The excitation system shall employ a generator-mounted volts per hertz type regulator. Voltage regulation shall be plus/minus 2 percent from no load to full load. Readily accessible voltage drop, voltage level and voltage gain controls shall be provided. Voltage level adjustment shall be a minimum of plus/minus 5 percent.

46.8.2.7 **ENGINE GENERATOR CONTROL PANEL**

A generator mounted NEMA 3R type 304, vibration isolated, 14 gauge stainless steel control panel shall be provided. Panel shall contain, but not be limited to, the following equipment:

An automatic safety shut down shall be provided for low oil pressure and/or high temperature conditions in the engine. An emergency shut down lever switch shall be provided on the air intake.

Metering Equipment: Metering equipment shall include 3-1/2-inch meters (dial or digital type frequency meter, 2 percent accuracy voltmeter, and ammeter and ammeter-voltmeter phase selector switch). The control panel shall also include the engine water temperature, lube oil pressure and hour meter.

Fault Indicators: Individual press-to-test fault indicator lights for low oil pressure, high water temperature, low water level, overspeed, overcrank, and for day tank high and low fuel level shall be provided.

Function Switch: A four position function switch marked "Auto", "Manual", "Off/Reset", and "Stop" shall be provided.

46.8.2.8 **BATTERY CHARGER**

The battery charger shall be so designed that it shall not be damaged and shall not trip its circuit protective device during engine cranking or it shall be automatically disconnected from battery during cranking period. The charger shall be mounted in the emergency generator control panel. The charger shall have a 7 day/24 hour timer control.

46.8.2.9 **BATTERY**

The battery shall be lead-acid type with sufficient capacity to provide 90 seconds total cranking time without recharging. The battery shall be adequately rated for the specific generator set. The battery shall be encased in hard rubber or plastic and shall be furnished with proper cables and connectors, together with rack and standard maintenance accessories. The battery shall be provided with a 48 month warranty for the replacement of the battery if found to be defective.

46.8.2.10 **BASE AND MOUNTING**

A suitable number of spring-type vibration isolators with a noise isolation pad shall be provided to support the set and its liquids.

46.8.2.11 **UTILITY CONNECTIONS**

All connections to the generator set shall be flexible.

46.8.2.12 **COOLING SYSTEM**

The generator set shall be equipped with an engine mounted radiator sized to maintain safe operation at 110 degree F maximum ambient at the pump station altitude. A blower type fan shall be used directing the air flow from the engine through the radiator. The entire cooling system shall be filled with 50 percent glycol-water solution.

46.8.2.13 **FUEL SYSTEM**

The generator shall come fitted with a self-contained, double walled belly tank. The volume of the belly tank shall not exceed 1,000 gallons.

46.8.2.14 **EXHAUST SYSTEM**

The generator set supplier shall provide a critical-type silencer, with flexible exhaust fittings, properly sized and installed, according to the manufacturer's recommendation. The silencer shall be mounted so that its weight is not supported by the engine.

Exhaust pipe size shall be sufficient to ensure that measured exhaust back pressure does not exceed the maximum limitations specified by the generator set manufacturer. The exhaust system shall include a flexible, seamless, stainless steel connection between the engine exhaust outlet and the rest of the exhaust system. The

exhaust system shall be a part of generator enclosure.

46.8.2.15 **WEATHERPROOF ENCLOSURE**

Enclosure and all other items shall be designed and built by engine manufacturer as an integral part of the entire generator set and shall be designed to perform without overheating in the ambient temperature specified.

Enclosure shall be constructed of 14 or 16 gauge sheet metal suitably reinforced to be vibration free in the operating mode.

Four hinged doors shall be provided to allow complete access without their removal.

Each door shall have at least two catch-bearing points.

Side and rear panels shall be completely and simply removable for major service access.

Roof shall be peaked to allow drainage of rain water. Baked enamel finish with primer and finish coat shall be painted before assembly. All fasteners shall be rust resistant.

Unit shall have sufficient guards to prevent entrance by small animals. Padlocks shall be provided.

Batteries shall be designed to fit inside enclosure and alongside the engine. Batteries under the generator are not acceptable.

Unit shall have coolant and oil drains outside the unit to facilitate maintenance. Each drain line shall have a high quality valve located near the fluid source.

Fuel filter shall be inside the base perimeter and located so spilled fuel cannot fall on hot parts of engine or generator. A cleanable primary fuel strainer shall be used to collect water and sediment between tank and main engine fuel filter.

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

46.8.2.16 **AUTOMATIC TRANSFER SWITCH**

The automatic transfer switch shall be part of the control panel described in Section 48.

The transfer switch shall be provided with the following features:

Complete protection, close differential voltage sensing relays monitoring all three phases (pick-up set for 95 percent of nominal voltage, drop-out set for 85 percent nominal voltage).

Voltage sensing relay on emergency source (pick-up set for 95 percent of nominal frequency).

Time delay on engine starting - adjustable from 1 second to 300 seconds (factory set at 3 second).

Time delay normal to emergency transfer - adjustable from zero second to 300 seconds (factory set at 1 second). The CONTRACTOR shall request time delay settings in accordance with the priority rating or their respective loads. Time delay emergency to normal transfer - adjustable 30 seconds to 30 minutes (factory set at 5 minutes) and time delay bypass switch shall be provided on door of the switch cabinet.

Unload running time delay for emergency engine generator cooling down-adjustable from 0 to 5 minutes (factory set at 5 minutes) unless the engine generator control panel includes the cool down timer.

46.8.2.17 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.

46.9 FLOW MONITORING SYSTEM

46.9.1 GENERAL

When indicated on the DRAWINGS or as required by Section 22.4, a flow monitoring system capable of indicating, recording, and totalizing wastewater flows shall be provided.

46.9.2 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 two (2) years 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.

46.10 CHAIN LINK FENCE

46.10.1 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 DRAWINGS.

46.10.2 MATERIALS

The fabric, posts, fastenings, fittings and other accessories for chain link fence shall meet the requirements 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 AASHTO M 111.

The base metal of the fabric shall be a good commercial quality 9 gauge steel wire. The fabric shall be of uniform quality, and shall be 6 foot high with a 2 inch mesh size. Fabric shall be coated with vinyl, green color.

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

- End, corner and pull posts - 2 3/8" O.D., Schedule 40.
- Line posts and gate frames - 2" O.D., Schedule 40.
- Gate Posts - 3" O.D., Schedule 40.
- Post braces and top rail - 1 5/8" O.D., Schedule 20.

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.

46.10.3 INSTALLATION

POST SETTING

All posts 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 be two 6-foot wide double hung gates as indicated on the STANDARD DRAWINGS 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.

46.11 REQUIRED SUBMITTALS

Submittals shall be provided to the CITY in Triplicate 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 1/2) 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
 - Pull load efficiency
 - Locked rotor current
 - High potential test data
 - Bearing Inspection report

46.12 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 this 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 this 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 objectional vibration.
3. That there are no mechanical defects in any of the parts.
4. That the pumps can deliver the specified pressure and quantity.
5. That the pumps are capable of pumping the specified material.

6. That the pump controls perform satisfactorily.

46.13 LIFT STATION SPARE PARTS

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.

The manufacturer shall furnish the following spare parts for each lift station:

- | | | |
|----|----------------------|---------------------------|
| 1. | 1 - LC-150 Base Unit | Part Number W2T278195 |
| 2. | 1 - Level Transduce | Part Number 01004AA-CZ-50 |
| 3. | 1 - Radio | Part Number 242-4018-600 |

SECTION 47

SUBMERSIBLE WASTEWATER PUMPS

47.1 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.

All parts 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 spheres. 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. (See approved manufacturer's list in appendix).

47.2 PUMP CONSTRUCTION DETAILS

47.2.1 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 start-up 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.

47.2.2 IMPELLER

The impeller shall be constructed of gray cast iron, ASTM A-48, class 30, All external bolts and nuts shall be of Type 304 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.

47.2.3 **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. Silicon 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 air-filled 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 openings and penetration by pumping forces shall not be considered equal to tandem seal specified and required.

47.2.4 **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) Type 316 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, 3/4" lifting chain of adequate strength. A 1/4" stainless steel cable, air craft rating, shall be provided between the cable holder and the lifting chain.

47.3 **MOTORS**

47.3.1 **GENERAL REQUIREMENTS**

All motors shall be built in accordance with latest NEMA, IEEE, ANSI and AFBMA Standards where applicable. Pump motors shall be housed in an air-filled, water-tight casing and shall have Class F insulated windings

which shall be moisture resistant. Motors shall be NEMA Design B, rated 155°C maximum. Pump motors shall have cooling characteristics suitable to permit continuous operation, in a totally, partially or non-submerged condition. The pump shall be capable of running continuously in a 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 20 horsepower and below shall be rated 230 volt, 3 phase. Motors greater than 20 horsepower shall be 460 volt, 3 phase.

47.3.2 HEAT SENSORS

Each motor shall incorporate a minimum of one ambient temperature compensated overheat sensing device. This protective device shall be wired into the pump controls in such a way that if excessive temperature is detected then pump will shut down. This device shall be self-resetting.

47.3.3 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. The pump cable entry seal design shall preclude specific torque requirements to insure a water-tight and submersible seal. The cable entry shall be comprised of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the entry body containing a strain relief function, separate from the function of sealing the cable. The assembly shall bear against a shoulder in the pump top. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the motor interior from foreign material gaining access through the pump top. Secondary sealing systems utilizing epoxy potting compounds may be used. When this type of sealing system is used, the manufacturers shall supply a cable cap as part of the spare parts for each pump. All cables shall be continuous, without splices from the motor to the control panel, unless otherwise approved by the CITY. The junction chamber, containing the terminal board, shall be perfectly leak proof.

47.4 PUMP CONTROL SYSTEM

Refer to Section 48 for control system specifications.

47.5 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.

47.6 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 wooded planks, strongly built and securely bolted thereto. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

47.7 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.

SECTION 48

PUMP STATION ELECTRICAL POWER AND CONTROL SYSTEM

48.1 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 automatically start and stop pumps upon high or low wet well levels. The control panel shall operate a minimum of two (2) electrical 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 shall automatically start to handle this increased flow. 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

The control panel shall consist of components outlined in the city detail sheets and in appendix A. An emergency power receptacle, a circuit breaker, a magnetic starter for each pump motor, and 15 ampere – 120 volt circuit breakers as required. Control switches shall provide means to operate each pump manually or automatically. When operated 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.

48.2 PANEL CONSTRUCTION

The duplex pump panel shall be housed in a NEMA 3R, Type 304, 14 gauge stainless steel enclosure with 30 percent 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 end 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 3R listed.

48.3 POWER SUPPLY AND MAIN DISCONNECT

Power supply to the control panel shall be either 240 volt, 3 phase, 4 wire or 480 volt, 3 phase, 4 wire. Minimum service shall be 100 AMP. Single phase power shall not be accepted.

Non-fusible safety service main disconnects shall be installed at all stations. In all 240

volt systems, disconnects should be installed between the meter and the panel and on all 480 volt systems disconnect should be installed ahead of the meter. LED power available indicators shall be supplied on all legs.

48.4 MOTOR STARTER AND SELECTOR SWITCHES

The panel shall contain two 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.

48.5 EMERGENCY POWER RECEPTACLE

This item shall only be required on stations that do not have a permanent standby generator system. The panel shall have an external mounted generator receptacle of the required size. (See approved manufacturer's list.)

48.6 ADDITIONAL REQUIREMENTS

48.6.1 WIRING

All power wires shall be THHN 90°C insulated stranded copper conductors and shall be appropriately 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.

48.6.2 TERMINAL POINTS

Terminal points of all terminal 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.

48.6.3 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.

48.6.4 SURGE PROTECTOR

A surge protector shall be included and wired to protect motors and control equipment from lightning induced line surges. All surge protectors shall be U.L. approved and installed per respective power company requirements and manufacturers' specifications, surge protectors shall be attached to the main disconnects.

48.6.5 **CONTROL POWER TRANSFORMERS**

There shall be a control power transformer with a minimum size of 500VA to provide 120VAC 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.

48.6.6 **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.

48.6.7 **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. All 480 volt stations shall have surface mount type phase monitors.

48.6.8 **LIFT STATION CONTROLLER/REMOTE TERMINAL UNIT**

Controller/Remote Terminal Unit

There shall be installed a lift station pump controller and remote terminal unit as specified in Appendix C.

48.8 **TESTING, SERVICE AND WARRANTY**

48.11.1 **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.

48.11.2 **SERVICE**

The control panel manufacturer shall maintain a service organization in the City of Winter Garden that is available for service.

48.11.3 **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.

DIVISION V

WATER DISTRIBUTION

SECTION 50

MATERIALS FOR WATER DISTRIBUTION SYSTEMS

50.1 GENERAL

These specifications include the pipe, fittings, and accessory items used for water distribution systems.

Pipe used in water distribution systems shall be either polyvinyl chloride (PVC), high density polyethylene (HDPE), or ductile iron pipe (DIP).

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.

50.2 PIPE INSPECTION AND TESTING

Requirements specified in section 40.5 shall apply.

50.3 PVC PIPE

50.3.1 PVC PIPE

All PVC pipe of nominal diameter six (6) 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 200 psi and shall have a dimension ratio (DR) of 18. Pipe shall be the same O.D. as ductile iron pipe. PVC pipe of nominal diameter four (4) inches may be AWWA Standard C900, DR 18 or PVC pipe with a Standard Dimension Ratio (SDR) of 18.

50.3.2 JOINTS

PVC pipe shall have integral bell push on type joints conforming to ASTM D3139.

50.3.3 FITTINGS

Fittings used with PVC pipe shall conform to section 50.4.

50.4 DUCTILE IRON PIPE AND FITTINGS

50.4.1 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 250 pipe shall be supplied for all sizes of pipe unless

specifically called out in the DRAWINGS, or required by the CITY.

50.4.2

FITTINGS

All fittings shall conform to either ANSI/AWWA C110/A21.10 and/or C153/A21.53, latest revision, and shall be ductile iron only. All fittings shall be cast and machine allowing the bolt holes to straddle the vertical centerline.

The material supplier and/or Contractor shall furnish data certified by the pipe and/or the fitting manufacturer that the fittings are of the material specified, and shall furnish physical and chemical certifications. Manufacturer shall furnish to the Engineer certifications that all fittings comply with the following requirements: All fittings shall be capable to withstand, without bursting, hydrostatic tests of three (3) times the rated water working pressure. The results of these tests, along with all other foundry test, shall be retained for at least two (2) years, preferably three (3), for review. All fittings shall have a date code cast, not printed or labeled, with identification of date and place it was cast and machined. Fittings shall have distinctly cast on them the pressure rating, nominal diameter of openings, manufacturer's name, the country where cast, and number of degrees or fraction of the circle. Ductile iron fittings shall have the letter "DI" or "Ductile" cast on them. The tabulated nominal weight, and wall thickness, of each size and type of fittings shall be supplied by the manufacturer, on the manufacturers' letter head stationary, for all items proposed. Any fitting submitted with a nominal weight less than that of the same fitting listed in C153/A.21.53-94, will not be acceptable. Any fitting submitted with a wall thickness that is less than that of the same fitting listed in C153/A21.53-94, will not be acceptable. Note the term "manufacturer" shall be construed to mean the actual casting of the component and the "manufacturer" is the foundry performing said casting operations. Brokers or suppliers are not considered manufacturers and shall not be approved. The same manufacturer shall supply accessories as the fittings, except for those that require special types of restraint. All fittings shall have NSF 61 certification, and ISO 9001 certification for both the foundry and manufacturer. The NSF 61 certification shall be issued on all coatings and linings, from the said manufacturers that are used for potable water applications. All fittings shall be ductile iron fittings as manufactured by Union/Tyler Pipe, Clow or approved equal. No others will be accepted without prior written approval by the City.

50.4.3

JOINTS

Joints for ductile iron pipe and fitting joints 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. Flanged joints shall conform to ANSI Standard B 16.1-125 LB. Restrained joints shall conform to Sections 34.3 and 34.4.

50.4.4

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 shall be green for raw water and blue for finished water.

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.

50.4.5 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.

50.5 SERVICE PIPE, STOPS, FITTINGS AND SERVICE SADDLES

50.5.1 SERVICE PIPE

Two (2) inch pipe and smaller shall be either CTS or IPS OD controlled high density tubing/pipe. The tubing/pipe shall be produced only with approved bimodal PE 3408/PE 80/PE 4710 listed resins. All service tubing/pipe shall comply or exceed the applicable standards of ASTM D1248, D3035, D2239, D2737NSF-14, and AWWA C901. The resin shall be DOW Continuum DGDC 2480BK, High Density Polyethylene, PE 80, and shall have a minimum Cell Classification of 445574 as defined in ASTM D3350. All tubing/pipe shall have the following minimum physical properties: Density Hardness of .959, Flexural Strength of 150,000 psi, HDB of no less than 1,600 psi at 68°F and 1,000 psi at 176°F, and an Impact Strength of 9.1 ft-lb./in. All tubing/pipe shall come, factory installed, with 10 gauge tracer wire securely attached to the tubing.

All potable waterline tubing/piping shall be blue in color with a clear virgin high density polyethylene center, in which the manufacturer shall furnish a certificate of purity. All reclaimed tubing/piping shall be Pantone 522C in color, and wastewater shall be green in color, with a clear virgin high density polyethylene center, and shall have a certificate of purity supplied by manufacturer. The tubing/pipe shall have UV protection and shall not be affected by direct Florida sun light for up to a minimum of five (5) years. Tubing/pipe shall have a minimum pressure rating of 200 psi with a SODR of 9 for CTS and SDR 9 for IPS outside diameter controlled. Size range for tubing/pipe shall be 3/4-inch to 2-inch and shall come with a factory certified lifetime warranty. The tubing/pipe for potable water, reclaimed water, and wastewater shall be in accordance with the City's Approved Material List (see Appendix A). The cell classification for tubing/pipe shall be 445574E (exterior) and 445574D (interior); no other classification will be accepted. Approvals and certifications must be

supplied by manufacturer on all the above requirements prior to any material being supplied. All materials not complying with the above will not be accepted and will be removed from system at installing Contractor's expense. All tubing shall be supplied with No. 10 gauge tracer with pre-attached to the tubing. The wire must be completely secured to the tubing to prevent separation during and after installation. The wire shall be a steel - copper clad wire with polyethylene coating on the outside for protection.

50.5.2 STOPS

Corporation stops shall be 1" or 2" brass, equipped with connections compatible with the polyethylene tubing and threaded in accordance with specifications in AWWA C800 and AWWA C901. Curb stops shall be sized to match the meter size and conform to the specifications in AWWA C800 and AWWA C901.

50.5.3 FITTINGS

Fittings shall be brass, cast and machined in accordance with specifications in AWWA C800 and AWWA C901, with compatible polyethylene tubing connections.

50.5.4 SERVICE SADDLES

A service saddle shall be used for all service line taps. Service saddles shall be double strap, anchored by a minimum four (4) bolt pattern on a ductile iron saddle body. Service saddles for PVC pipe shall have the double strap sized exactly to the pipe outside diameter. Sealing gaskets shall be BUNA-N rubber and straps shall be corrosion resistant alloy steel.

Iron Body shall be nylon, or fusion bonded epoxy coated. Double straps shall be stainless steel.

50.5.5 AIR RELEASE VALVES

All potable water lines shall have air and vacuum release valves installed as they are indicated on the plans. The body/base of these valves shall be made from high strength lightweight non-corroding fiberglass reinforced nylon, with total weight of no more than three (3) pounds, and all operating parts are to be made of engineered corrosion resistance plastic materials. The rolling resilient seal shall provide smooth positive opening, closing, and leak free sealing over the fluctuation of pressure differentials. The valve shall be designed to allow larger than normal automatic orifice providing efficient air release and minimize potential debris build up and clogging. The working pressure shall be 200 psi and shall have a 3/4-inch, 1-inch, 2-inch threaded connection, or 3-inch and 4-inch flange connection. All air and vacuum release valves shall be in accordance with the City's Approved Materials List (see Appendix A). The connection to the system shall be a direct threaded connection, or flange, on the top of the pipe with a saddle, with an isolation valve. The

height of valve shall not be more than 9-inches. If room does not allow for a direct connection, the use of a 90 degree bend can be used to offset the connection to the side. This connection must have a grade that increases as it leaves the connection at the pipe. All ARV valves must be ISO-9000 and NSF 61 certified.

All potable water lines that require automatic air release only, shall have as shown on the plans a 1/2-inch, 3/4-inch, or 1-inch threaded air release valve. This valve shall be made from lightweight non-corroding fiberglass reinforced nylon plastic, with a total weight of no more than one (1) pound, with all non-metallic operating parts. The rolling resilient seal shall provide smooth positive opening, closing, and leak free sealing over the fluctuation of pressure differentials. The valve shall be designed to allow larger than normal automatic orifice providing efficient air release and minimize potential debris build up and clogging. The working pressure shall be 200 psi and tested to 350 psi. All air release valves shall be in accordance with the City's Approved Materials List (see Appendix A). The connection to the system shall be a direct connection to the pipeline with the use of a saddle and an isolation valve. All ARV valves must be ISO-9000 certified, and those valves for potable water applications must have NSF 61 certification.

SECTION 51

INSTALLATION OF WATER MAINS

51.1 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 and C603, unless otherwise stated in these specifications.

51.2 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 relaid. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a water-tight plug or by other means approved by the CITY to ensure absolute cleanliness inside the pipe.

51.3 SEPARATION OF WATER MAINS AND SEWERS (Refer to F.A.C. Rule 62-555.314.)

51.3.1 GENERAL

Water mains that are laid in the vicinity of pipe lines designated to carry raw wastewater or reclaimed water (wastewater effluent) shall meet the horizontal and vertical separations specified in State of Florida, Florida Administrative Code (FAC), Rule 62-555-314.

51.4 TRENCH PREPARATION AND PIPE BEDDING

51.4.1 TRENCH PREPARATION AND PIPE BEDDING

Applicable provisions of Section 32 shall apply. Also refer to STANDARD DRAWINGS.

51.4.2 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.

51.4.3 TRENCH DEWATERING AND DRAINAGE CONTROL

Specifications from Section 32 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.

51.4.4 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 finished grade surface or three (3) feet below the elevation of the edge of pavement of the road surface whichever is greater. The Contractor shall stake all property corners along right-of-way line prior to placement of pipe.

51.4.5 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. If the pipe laying crew cannot put the pipe into the trench and in place without getting earth into the pipe, the CITY may require that snugly-fitted, tightly-woven canvas bags be placed over each end before lowering the pipe. The bags shall be left in place until the connection is to be made to the adjacent pipe. During laying operations, CONTRACTOR shall keep debris, tools, clothing, or other materials out of the pipe.

51.4.6 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.

51.4.7 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, and no substitutes shall be permitted under any circumstances.

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

51.4.8 LAYING OF PIPES ON CURVES

Long radius curves, either horizontal or vertical. May be laid with standard pipe by deflections at the joints. Maximum deflections at pipe joints and laying radius for the various pipe lengths shall be as recommended by the pipe manufacturer.

51.4.9 PIPE RESTRAINING DEVICES

Requirements specified in Section 34 shall apply.

51.4.10 BEDDING AND BACKFILL FOR PIPES

Requirements specified in Section 32 shall apply.

51.5 HYDROSTATIC TESTS

51.5 1 GENERAL

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, when this procedure is acceptable to the CITY. 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. Where any section of pipe is provided with concrete thrust blocking, pressure test will not be made until at least five

days have elapsed after the thrust blocking is installed. If high-early cement is used for the concrete thrust blocking, the time may be reduced to 24 hours if the CITY concurs that the concrete has cured and reached adequate strength.

51.5.2 TESTING CRITERIA

All pipe sections to be pressure tested shall be subjected to a hydrostatic pressure of 150 psi. The duration of each pressure test shall be for a period of 2 hours. 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.

51.5.3 PROCEDURE FOR PRESSURE TEST

Each section of pipe to be tested, as determined by the DESIGN ENGINEER, 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 hydrants 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. Completed test reports, certified by the DESIGN ENGINEER shall be submitted to the City for approval.

51.5.4 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:

$$L = \frac{SD(P)^{1/2}}{148,000}$$

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.

51.6 DISINFECTION OF WATER MAINS

51.6.1 GOAL

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".

51.6.2 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.

51.6.3 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 not less than 50 mg/l and that a chlorine residual of not less than 25 mg/l remains in the water after standing 24 hours in the pipe.

51.6.4 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.

51.6.5 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 requested by the DESIGN ENGINEER and approved by the CITY.

51.6.6 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.

51.6.7 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.

51.6.8 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.

51.6.9 PRESSURE PIPE PIGGING

Each section of pipeline shall be thoroughly cleaned with one Polyurethane Foam Pig. Lines shall be pigged a minimum of two times.

City of Winter Garden representatives shall be present at the time of insertion and exit of the pigs. Lines shall be pigged and/or flushed until the water runs clear and is approved by the City representative. The City requires a 48 hour minimum notice prior to pigging or flushing.

On short lengths of pipeline (100' max), cleaning may be accomplished by flushing with water at a minimum velocity of 2.5 feet per second. Water required for testing and cleaning shall be provided by the city at the contractor's expense. Water shall be from a potable source satisfactory to the city.

51.6.10 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.

After flushing, water samples collected on 2 successive days from the treated piping system, as directed by the DESIGN ENGINEER, shall show acceptable bacteriological results. All bacteriological testing shall be performed by the DEVELOPER. All bacteriological analysis must be performed by a laboratory certified by the State of Florida.

Proper chain of custody procedures must be followed and samples shall only be collected by certified laboratory personnel in the presence of CITY personnel.

Copies of testing results and all related correspondence with the Florida Department of Environmental Protection (FDEP) shall be submitted to the CITY.

51.6.11 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.

51.7 NOTIFICATION AND CONNECTION TO EXISTING MAINS

Requirements specified in Section 35.3 shall apply.

51.8 WATER SERVICE PIPING AND CONNECTION

Water service piping and connection shall be installed as indicated in the STANDARD DRAWINGS. The location of all service lines shall be as shown on the DRAWINGS and shall be either single or dual service. On curbed streets, the exact location for each installed service shall be marked by etching or cutting a "W" in the concrete curb. Where no curb exists, locations shall be adequately marked by a method approved by the CITY.

51.9 LOCATION AND IDENTIFICATION

All non-metallic water mains shall be installed with a continuous, insulated 10 gauge copper wire installed directly on top of the pipe for location purposes. See STANDARD DRAWINGS. In addition, all PVC water mains shall be either a solid blue color or white with blue lettering. All lettering shall appear legibly on pipe and shall run the entire length of the pipe. Lettering shall read as is acceptable for the intended use.

All ductile iron water mains shall be 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. Backfill shall not be placed for 30 minutes following paint application.

SECTION 52

VALVES, HYDRANTS AND ACCESSORIES FOR WATER MAINS

52.1 GENERAL

All valves and appurtenances shall be products of well established 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.

52.2 RESILIENT SEAT GATE VALVES

52.2.1 GENERAL

All gate valves twenty-four (24) inches and smaller shall be resilient seat gate valves. Such valves shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C509, latest revision, and in accordance with the following SPECIFICATIONS. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve. See approved manufacturers' list in appendix.

52.2.2 MATERIAL

The valve body, bonnet, and bonnet cover shall be cast iron ASTM A126, Class B. All ferrous surface inside and outside shall have a fusion-bonded epoxy coating. A 2" wrench nut shall be provided for operating the valve. All valves are to be tested in strict accordance with AWWA C509.

52.2.3 MISCELLANEOUS REQUIREMENTS

The valves shall be non-rising stem with the stem made of cast, forged, or rolled bronze as specified in AWWA C509. Two stem seals shall be provided and shall be of the O-ring type. The stem nut must be independent of the gate.

The resilient sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

52.3 BUTTERFLY VALVES

52.3.1 GENERAL

All shut-off valves larger than twenty-four (24) inches shall be butterfly valves. Butterfly valves and operators shall conform to the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, except as hereinafter specified. Valves, except as specified hereinafter, shall be Class 150A or B. See approved manufacturers' list in appendix.

52.3.2 MATERIAL

The valve body shall be constructed of close grain cast iron per ASTM A126, Class B or equivalent material. All retaining segments and adjusting devices shall be of corrosion resistant material. Valve seats shall be a natural rubber or synthetic rubber compound. Valve seats 30 inches and larger shall be field adjustable and replaceable without dismantling operator disc or shaft and without removing the valve from the line. All retaining segments and adjusting devices shall be of corrosion resistant material. Valves 24 inches and smaller shall have bonded or mechanically restrained seats as outlined in AWWA C504.

52.3.3 FACE-TO-FACE DIMENSION

The face-to-face dimensions of valves shall be in accordance with above mentioned AWWA Specification for short-body valve.

52.3.4 VALVE SHAFT

The valve shaft shall be turned, ground, and polished constructed of 18-8 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. Shaft shall be of either a one piece unit extending full size through the valve disc and valve bearing or it may be of a stub shaft design.

52.3.5 VALVE OPERATOR

In general, the butterfly valve operators shall conform to the requirements of AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, insofar as applicable.

52.4 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.

Valves shall be installed in a vertical position and be provided with a standard valve box so arranged that no shock will be transmitted to the valve. The box shall be vertically centered over the operating nut, and the cast iron box cover shall be set flush with the road bed or finished surface.

After installation, all valves shall be subjected to the field test for piping as outlined in Section 51 of these specifications. Should any defects in materials or workmanship appear during these tests, the CONTRACTOR shall correct such defects to the satisfaction of the CITY.

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. All buried bolts and nuts shall be heavily coated with two (2) coats of bituminous paint.

52.5 VALVE BOXES

All valves boxes shall be domestic manufacture, 3-piece cast iron. Valve boxes shall have installed a non-pop lid with "WATER" molded in the top for identification. The lid main body shall be constructed of high-impact, fiberglass-reinforced nylon, with H-20 truck loading and with UV resistance. The lids shall be designed of premium quality materials, for use on valve boxes in all locations and capable of operating at temperatures in excess of 250°F and highly resistant to UV sunlight, ozone, hydrocarbon fluids, and other chemicals associated with the roadway environment. The rubber retention seal shall be a ozone and chemical resistant thermoplastic elastomer composite (Dead-Bang Rubber). This rubber seal shall absorb the direct shock and vibration from traffic impact insuring the lid to stay in place. The non-pop lid shall fit snug in the box, but easy to install. The non-pop lid shall be the MIZI Non-Pop Lid, Model NP600 with ID disk, from SW Services or an approved equal. A "debris skirt", for prevention of debris from getting into the valve box and to insure a snug fit, shall be factory attached around the top. Additional features shall include an identification disk and/or a 3-M locator coil fixed in the under-side of the cap for pertinent information and location.

52.6 AIR RELEASE VALVES

All potable water lines shall have air and vacuum release valves installed as they are indicated on the plans. The body/base of these valves shall be made from high strength lightweight non-corroding fiberglass reinforced nylon, with total weight of no more than three (3) pounds, and all operating parts are to be made of engineered corrosion resistance plastic materials. The rolling resilient seal shall provide smooth positive opening, closing, and leak free sealing over the fluctuation of pressure differentials. The valve shall be designed to allow larger than normal automatic orifice providing efficient air release and minimize potential debris build up and clogging. The working pressure shall be 200 psi and shall have a 3/4-inch, 1-inch, 2-inch threaded connection, or 3-inch and 4-inch flange connection. All air and vacuum release valves shall be in accordance with the City's Approved Materials List (see Appendix A). The connection to the system shall be a direct threaded connection, or flange, on the top of the pipe with a saddle, with an isolation valve. The height of valve shall not be more that 9-inches. If room does not allow for a direct connection, the use of a 90 degree bend can be used of offset the connection to the side. This connection must have a grade that increases as it leaves the connection at the pipe. All ARV valves must be ISO-9000 and NSF 61 certified.

All potable water lines that require automatic air release only, shall have as shown on the plans a 1/2-inch, 3/4-inch, or 1-inch threaded air release valve. This valve shall be made from lightweight non-corroding fiberglass reinforced nylon plastic, with a total weight of no more than one (1) pound, with all non-metallic operating parts. The rolling resilient seal shall provide smooth positive opening, closing, and leak free sealing over the fluctuation of pressure differentials. The valve shall be designed to allow larger than normal automatic orifice providing efficient air release and minimize potential debris build up and clogging. The working pressure shall be 200 psi and tested to 350 psi. All air release valves shall be Model ARI S-050 or approved equal. The connection to the

system shall be a direct connection to the pipeline with the use of a saddle and an isolation valve. All ARV valves must be ISO-9000 certified, and those valves for potable water applications must have NSF 61 certification.

52.7 FIRE HYDRANTS

52.7.1 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. (See approved manufacturers' list in appendix.)

52.7.2 PAINTING

All iron parts of the hydrant both inside and outside shall be painted, in accordance with AWWA C-502. 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 painted at the factory with yellow paint.

52.7.3 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 DRAWINGS.

52.7.4 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.

DIVISION VI

RECLAIMED WATER DISTRIBUTION

SECTION 60

MATERIALS FOR RECLAIMED WATER SYSTEMS

60.1 GENERAL

These specifications include the pipe, fittings, and accessory items used for reclaimed water distribution systems.

Pipe used in reclaimed water distribution systems shall be either polyvinyl chloride (PVC), high density polyethylene (HDPE), or ductile iron pipe (DIP).

The CONTRACTOR shall be responsible for all materials furnished and storage of same, until the date of substantial completion. Materials found to be defective or damaged in handling or storage shall be replaced. The CONTRACTOR shall, if requested by the CITY, provide proof of compliance for any of the materials specified herein. All materials delivered to project site for installation is subject to random testing for compliance with the designated specifications.

60.2 PIPE INSPECTION AND TESTING

Requirements specified in section 40.5 shall apply.

60.3 PVC PIPE

60.3.1 PVC PIPE

All PVC pipe of nominal diameter six (6) 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 200 psi and shall have a dimension ratio (DR) of 18. Pipe shall be the same O.D. as ductile iron pipe. PVC pipe of nominal diameter four (4) inches may be AWWA Standard C900, DR 18 or PVC pipe with a Standard Dimension Ratio (SDR) of 18.

60.3.2 JOINTS

PVC pipe shall have integral bell push on type joints conforming to ASTM D3139.

60.3.3 FITTINGS

Fittings used with PVC pipe shall conform to section 60.4.

60.4 DUCTILE IRON PIPE AND FITTINGS

60.4.1 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 250 pipe shall be supplied for all sizes of pipe unless specifically called out in the DRAWINGS, or required by the CITY.

60.4.2

FITTINGS

All fittings shall conform to either ANSI/AWWA C110/A21.10 and/or C153/A21.53, latest revision, and shall be ductile iron only. All fittings shall be cast and machine allowing the bolt holes to straddle the vertical centerline.

The material supplier and/or Contractor shall furnish data certified by the pipe and/or the fitting manufacturer that the fittings are of the material specified, and shall furnish physical and chemical certifications. Manufacturer shall furnish to the Engineer certifications that all fittings comply with the following requirements: All fittings shall be capable to withstand, without bursting, hydrostatic tests of three (3) times the rated water working pressure. The results of these tests, along with all other foundry test, shall be retained for at least two (2) years, preferably three (3), for review. All fittings shall have a date code cast, not printed or labeled, with identification of date and place it was cast and machined. Fittings shall have distinctly cast on them the pressure rating, nominal diameter of openings, manufacturer's name, the country where cast, and number of degrees or fraction of the circle. Ductile iron fittings shall have the letter "DI" or "Ductile" cast on them. The tabulated nominal weight, and wall thickness, of each size and type of fitting shall be supplied by the manufacturer, on the manufacturers' letterhead stationary, for all items proposed. Any fitting submitted with a nominal weight less than that of the same fitting listed in C153/A.21.53-94, will not be acceptable. Any fitting submitted with a wall thickness that is less than that of the same fitting listed in C153/A21.53-94, will not be acceptable. Note the term "manufacturer" shall be construed to mean the actual casting of the component and the "manufacturer" is the foundry performing said casting operations. Brokers or suppliers are not considered manufacturers and shall not be approved. The same manufacturer shall supply accessories as the fittings, except for those that require special types of restraint. All fittings shall have NSF 61 certification, and ISO 9001 certification for both the foundry and manufacturer. The NSF 61 certification shall be issued on all coatings and linings, from the said manufacturers that are used for potable water applications. All fittings shall be ductile iron fittings as manufactured by Union/Tyler Pipe, Clow or approved equal.

No others will be accepted without prior written approval by the City. Submittals from the manufacturer ONLY will be accepted, third party companies will not be recognized as the manufacturer.

60.4.3

JOINTS

Joints for ductile iron pipe and fitting joints 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. Flanged joints shall conform to ANSI Standard B 16.1-125 LB. Restrained joints shall conform to Sections 34.3 and 34.4.

60.4.4 **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 shall be green for raw water and blue for finished water.

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.

60.4.5 **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.

60.5 **SERVICE PIPE, STOPS, FITTINGS AND SERVICE SADDLES**

60.5.1 **SERVICE PIPE**

Two-inch pipe and smaller shall be either CTS or IPS OD Controlled High Density Tubing/Pipe. The tubing/pipe shall be produced only with approved bimodal PE 3408/PE 80/PE 4710 listed resins. All service tubing/pipe shall comply or exceed the applicable standards of ASTM D1248, D3035, D2239, D2737NSF-14, and AWWA C901. The resin shall be DOW Continuum DGDC 2480BK, High Density Polyethylene, PE 80, and shall have a minimum Cell Classification of 445574 as defined in ASTM D3350. All tubing/pipe shall have the following minimum physical properties: Density Hardness of .959, Flexural Strength of 150,000 psi, HDB of no less than 1,600 psi at 68°F and 1,000 psi at 176°F, and an Impact Strength of 9.1 ft.-lb./in. All tubing/pipe shall come, factory installed, with 10 gauge tracer wire securely attached to the tubing.

All potable waterline tubing/pipe shall be blue in color with a clear virgin high density polyethylene center, in which the manufacturer shall furnish a certificate of purity. All reclaimed tubing/pipe shall be Pantone 522C in color, and wastewater shall be green in color, with a clear virgin high density polyethylene center, and shall have a certificate of purity supplied by manufacturer. The tubing/pipe shall have UV protection and shall not be affected by direct Florida sun light for up to a minimum of five years. Tubing/pipe shall have a minimum pressure rating of 200 psi with a SODR of 9 for CTS and SDR 9 for IPS outside diameter controlled. Size range for tubing/pipe for potable water, reclaimed water, and wastewater shall be EndoPure, EndoCore, and EndoSewer, respectively, or pre-

approved equal. The cell classification for tubing/pipe shall be 445574E (exterior) and 445574D (interior); no other classification will be accepted. Approvals and certifications must be supplied by manufacturer on all the above requirements prior to any materials being supplied. All materials not complying with the above will not be accepted and will be removed from system at installing Contractor's expense. All tubing shall be supplied with No. 10 gauge tracer and pre-attached to the tubing. The wire must be completely secured to the tubing to prevent separation during and after installation. The wire shall be a steel-copper clad wire with polyethylene coating on the outside for protection.

60.5.2 **STOPS**

Corporation stops shall be 1" or 2" brass, equipped with connections compatible with the polyethylene tubing and threaded in accordance with specifications in AWWA C800 and AWWA C901. Curb stops shall be sized to match the meter size and conform to the specifications in AWWA C800 and AWWA C901.

60.5.3 **FITTINGS**

Fittings shall be brass, cast and machined in accordance with specifications in AWWA C800 and AWWA C901, with compatible polyethylene tubing connections.

60.5.4 **SERVICE SADDLES**

A service saddle shall be used for all service line taps. Service saddles shall be double strap, anchored by a minimum four (4) bolt pattern on a ductile iron saddle body. Service saddles for PVC pipe shall have the double strap sized exactly to the pipe outside diameter. Sealing gaskets shall be BUNA-N rubber and straps shall be corrosion resistant alloy steel.

Iron Body shall be nylon, or fusion bonded epoxy coated. Double straps shall be stainless steel.

60.5.5 **AIR RELEASE VALVES**

All reclaimed water lines shall have air and vacuum release valves installed as they are indicated on the plans. The body/base of these valves shall be made from high strength lightweight non-corroding fiberglass reinforced nylon, with total weight of no more than three (3) pounds, and all operating parts are to be made of engineered corrosion resistance plastic materials. The rolling resilient seal shall provide smooth positive opening, closing, and leak free sealing over the fluctuation of pressure differentials. The valve shall be designed to allow larger than normal automatic orifice providing efficient air release and minimize potential debris build up and clogging. The working pressure shall be 150 psi and shall have a 1-inch or 2-inch threaded connection, or 3-inch and 4-inch flange connection. All air and vacuum release valves shall be in accordance with the City's Approved Materials List (see

Appendix A). The connection to the system shall be a direct threaded connection, or flange, on the top of the pipe with a saddle, with an isolation valve. The height of valve shall not be more than 9-inches. If room does not allow for a direct connection, the use of a 90 degree bend can be used to offset the connection to the side. This connection must have a grade that increases as it leaves the connection at the pipe.

All reclaimed water lines that require automatic air release only, shall have as shown on the plans a 1/2-inch, 3/4-inch, 1-inch or 2-inch threaded air release valve. This valve shall be made from lightweight non-corroding fiberglass reinforced nylon plastic, with a total weight of no more than 1 pound, with all non-metallic operating parts. The rolling resilient seal shall provide smooth positive opening, closing, and leak free sealing over the fluctuation of pressure differentials. The valve shall be designed to allow larger than normal automatic orifice providing efficient air release and minimize potential debris build up and clogging. The working pressure shall be 200 psi and tested to 350 psi. All air release valves shall be in accordance with the City's Approved Materials List (see Appendix A). The connection to the system shall be a direct connection to the pipeline with the use of a saddle and an isolation valve. All ARV valves must be ISO-9000 certified.

SECTION 61

INSTALLATION OF RECLAIMED WATER MAINS

61.1 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 and C603, unless otherwise stated in these specifications.

61.2 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 relaid. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a water-tight plug or by other means approved by the CITY to ensure absolute cleanliness inside the pipe.

61.3 SEPARATION OF WATER MAINS AND SEWERS (Refer to F.A.C. Rule 62-555.314.)

61.3.1 GENERAL

Water mains that are laid in the vicinity of pipe lines designated to carry raw wastewater or reclaimed water (wastewater effluent) shall meet the horizontal and vertical separations specified in State of Florida, Florida Administrative Code (FAC), Rule 62-555-314.

61.4 TRENCH PREPARATION AND PIPE BEDDING

61.4.1 TRENCH PREPARATION AND PIPE BEDDING

Applicable provisions of Section 32 shall apply. Also refer to STANDARD DRAWINGS.

61.4.2 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.

61.4.3 TRENCH DEWATERING AND DRAINAGE CONTROL

Specifications from Section 32 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.

61.4.4 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 finished grade surface or three (3) feet below the elevation of the edge of pavement of the road surface whichever is greater. The Contractor shall stake all property corners along right-of-way line prior to placement of pipe.

61.4.5 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. If the pipe laying crew cannot put the pipe into the trench and in place without getting earth into the pipe, the CITY may require that snugly-fitted, tightly-woven canvas bags be placed over each end before lowering the pipe. The bags shall be left in place until the connection is to be made to the adjacent pipe. During laying operations, CONTRACTOR shall keep debris, tools, clothing, or other materials out of the pipe.

61.4.6 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.

61.4.7 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, and no substitutes shall be permitted under any circumstances.

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

61.4.8 LAYING OF PIPES ON CURVES

Long radius curves, either horizontal or vertical. May be laid with standard pipe by deflections at the joints. Maximum deflections at pipe joints and laying radius for the various pipe lengths shall be as recommended by the pipe manufacturer.

61.4.9 PIPE RESTRAINING DEVICES

Requirements specified in Section 34 shall apply.

61.4.10 BEDDING AND BACKFILL FOR PIPES

Requirements specified in Section 32 shall apply.

61.4.11 PRESSURE PIPE PIGGING

Each section of pipeline shall be thoroughly cleaned with one Polyurethane Foam Pig. Lines shall be pigged a minimum of two times.

City of Winter Garden representatives shall be present at the time of insertion and exit of the pigs. Lines shall be pigged and/or flushed until the water runs clear and is approved by the City representative. The City requires a 48 hour minimum notice prior to pigging or flushing.

On short lengths of pipeline (100' max), cleaning may be accomplished by flushing with water at a minimum velocity of 2.5 feet per second. Water required for testing and cleaning shall be provided by the city at the contractor's expense. Water shall be from a potable source satisfactory to the city.

61.5 HYDROSTATIC TESTS

61.5 1 GENERAL

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, when this procedure is acceptable to the CITY. 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. Where any section of pipe is provided with concrete thrust blocking, pressure test will not be made until at least five days have elapsed after the thrust blocking is installed. If high-early cement is used for the concrete thrust blocking, the time may be reduced to 24 hours if the CITY concurs that the concrete has cured and reached adequate strength.

61.5.2 TESTING CRITERIA

All pipe sections to be pressure tested shall be subjected to a hydrostatic pressure of 150 psi. The duration of each pressure test shall be for a period of 2 hours. 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.

61.5.3 PROCEDURE FOR PRESSURE TEST

Each section of pipe to be tested, as determined by the DESIGN ENGINEER, 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 hydrants 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. Completed test reports, certified by the DESIGN ENGINEER shall be submitted to the City for approval.

61.5.4 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:

$$L = \frac{SD(P)^{1/2}}{148,000}$$

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.

61.6 NOTIFICATION AND CONNECTION TO EXISTING MAINS

Requirements specified in Section 35.3 shall apply.

61.7 WATER SERVICE PIPING AND CONNECTION

Water service piping and connection shall be installed as indicated in the STANDARD DRAWINGS. The location of all service lines shall be as shown on the DRAWINGS and shall be either single or dual service. On curbed streets, the exact location for each installed service shall be marked by etching or cutting a "R" in the concrete curb. Where no curb exists, locations shall be adequately marked by a method approved by the CITY.

61.8 LOCATION AND IDENTIFICATION

All non-metallic water mains shall be installed with a continuous, insulated 10 gauge copper wire installed directly on top of the pipe for location purposes. See STANDARD DRAWINGS. In addition, all PVC water mains shall be either a solid purple color or white with purple lettering. All lettering shall appear legibly on pipe and shall run the entire length of the pipe. Lettering shall read as is acceptable for the intended use.

All ductile iron water mains shall be 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 purple in color. Backfill shall not be placed for 30 minutes following paint application.

APPENDIX A

List of Materials and Approved Manufacturers

Revised June 2020

Water Distribution

Please indicate your selection by writing an “x”
in the box alongside the item of your choice.

A cut sheet is required for any item not listed.

GATE VALVES	✘	Manufacturer	Part Number
<i>2 inch (threaded)</i>		Mueller – AVR Resilient	A-2360-8 and 2361
		Clow	F6103
		American Flow Control	2500
		Kennedy	4507
<i>4 to 12 inches (mechanical joint)</i>		Mueller	A-2360-20 and 2361
		Flomatic	115 Series
		American Flow Control	2500
		Clow	F6100
<i>16 to 24 inches (gear actuated, mechanical joint)</i>		Mueller	A-2361-20
		American Flow Control	2500
		Clow	2639
BUTTERFLY VALVES	✘	Manufacturer	Part Number
<i>Larger than 24 inches (mechanical joint)</i>		Mueller/Pratt	Lineseal III
		Kennedy/M&H/Clow	BFV, fig. 30
		Flomatic	Model 45
AIR RELEASE VALVES	✘	Manufacturer	Part Number
<i>Stainless steel 316 for underground assemblies ONLY. Above ground can use reinforced nylon assemblies or City-approved equal.</i>		Vent-o-Mat	RBX Series
		International Valve	Vent-tech Series WTR/
		ARI	D-040P, D-040SS
FITTINGS	✘	Manufacturer	Part Number
<i>Ductile iron, C153 SSB/C110 FLG, cement lined</i>		Tyler/Union	All
		Clow/McWane	All
		American	24 inch and larger
		Sigma	All
		SIP Industries	All
		Star	All
PIPE	✘	Manufacturer	Part Number
<i>1 and 2 inch HDPE service pipe, SODR 9 CTS blue, with 10-gauge wire, PE 4710</i>		ADS	Polyflex (with tracer wire added)
		Endot	EndoTrace 4710
<i>4 to 12 inches (PVC) blue</i>		Diamond Plastics	C-900, DR-18
		JM Eagle	C-900, DR-18
		National Pipe & Plastics	C-900, DR-18
		North American Pipe	C-900, DR-18
<i>4 to 54 inches (ductile iron) Cement lined</i>		American	Pressure Class 250
		US Pipe	Pressure Class 250
		Clow	Pressure Class 250
		McWane	Pressure Class 250
TAPPING VALVES	✘	Manufacturer	Part Number
		Mueller	T-2360-16 & 2361
		American Flow	AFC 2500
		Kennedy/Clow	F6114
TAPPING SLEEVES	✘	Manufacturer	Part Number
<i>Stainless steel, full wrap-around seal</i>		Ford	FTSS
		Smith-Blair	663, 665
		JCM	432
		Total Piping Solutions	TPS Triple Tap

LINE STOP SLEEVES	X	Manufacturer	Part Number
<i>Stainless steel, full wrap-around seal</i>		Ford	FTSS
		Smith-Blair	663, 665
		JCM	432
		Total Piping Solutions	TPS Triple Tap

RESTRAINING DEVICES FOR MJ	X	Manufacturer	Part Number
<i>PVC pipe Or City-approved equal</i>		Tyler/Union	TufGrip 2000 Series
		EBAA	2000 PV Series
		Sigma	Model SLCE
		SIP Industries	E-Z Grips for PVC
		Star	Stargrip 4000G2

<i>Ductile iron pipe Or City-approved equal</i>		Tyler/Union	TufGrip 1000 Series
		EBAA	1100 Series
		Sigma	Model SLDE
		SIP Industries	E-Z Grips for DIP
		Star	Stargrip 3000

RESTRAINING DEVICES FOR BELLS	X	Manufacturer	Part Number
<i>PVC pipe</i>		EBAA	2800 Series (C-905) 1500 Series (C-900)
		Tyler/Union	3000 PP Series
		Sigma	PV-Lok Model PWP
		SIP Industries	E-Z Grips PTP for PVC
		Star	Stargrip 4100P

<i>Ductile iron pipe</i>		EBAA	1700 Series and 1100 HD Series
		Tyler/Union	
		Sigma	PV-Lok Model SLDEH & SSLDH
		SIP Industries	E-Z Grips PTP for DIP
		Star	Stargrip 3100P

CORPORATION STOPS	X	Manufacturer	Part Number
<i>1 inch, CC thread, non-lead</i>		Ford	FB-1000-NL
		Mueller	B-25008-N
		McDonald	4846A

<i>2 inch, IP thread, non-lead</i>		Ford	FB-1100-NL
		Mueller	B-25008-N
		McDonald	4846A

CURB STOPS	X	Manufacturer	Part Number
<i>3/4 inch, FIP X FIP, non-lead</i>		Ford	B-11-333-W-NL
		Mueller	B-20200-N
		McDonald	

CURB STOPS CONT.	X	Manufacturer	Part Number
<i>3/4 inch angle, FIP X FIP, non-lead</i>		Ford	AV11-333W-NL
		Mueller	H-14285-N
		McDonald	4604BF

<i>1 inch, CTS X FIP, non-lead</i>		Ford	B41-444-W-NL
		Mueller	B-24275-N
		McDonald	6102W22

<i>1 inch angle, CTS X FIP, non-lead</i>		Ford	BA41-444-W-NL
		Mueller	B-24274-B
		McDonald	4606B22

CURB STOPS	✘	Manufacturer	Part Number
<i>2 inch, non-lead</i>		Ford	BF43-777W-NL
		Mueller	P-24335-N
		McDonald	76100M-22
<i>2 inch angle, non-lead</i>		Ford	FV43-777W-NL
		Mueller	P-24276-N
		McDonald	74602B-22
U-BRANCHES	✘	Manufacturer	Part Number
<i>1 inch x 3/4 inch x 7 inch – 1/2 inch, non-lead</i>		Ford	U-48-43-NL
		Mueller	H-15363
		McDonald	708U2M
STRAIGHT METER COUPLINGS	✘	Manufacturer	Part Number
<i>3/4 inch, MIP X meter, non-lead</i>		Ford	C38-23-2.5-NL
		Mueller	H-14223-N
		McDonald	74620
<i>1 inch, MIP X meter, non-lead</i>		Ford	C38-44-2.625-NL
		Mueller	H-14223-N
		McDonald	74620
SERVICE SADDLES	✘	Manufacturer	Part Number
<i>1 inch, CC thread outlet – epoxy coated, double strap SS</i>		Mueller	DR-2S
		Ford	FC-202
		Smith-Blair	317 Series
		Romac	202-N-H
<i>2 inch, IP thread outlet – epoxy coated, double strap SS</i>		Mueller	DR-2S
		Ford	FC-202
		Smith-Blair	317 Series
		Romac	202-N-H

VALVE BOXES	X	Manufacturer	Part Number
With heavy duty lid, 6850 series Or City-approved equal		Tyler/Union	461-S (18 to 24 inches)
			562-S (24 to 36 inches)
		SIP Industries	6000 HD Series Pt. No. 6004
VALVE BOX LIDS, NO POP BLUE	X	Manufacturer	Part Number
No pop red used for fire hydrant valve boxes		SW Services	NP 600 Blue
		SW Services	NP 600 Red
FIRE HYDRANTS	X	Manufacturer	Part Number
5 1/4 inch barrel with factory-applied yellow paint		Mueller	A-423
		American Flow	B-84-B
		Clow	Medallion
FIRE HYDRANT PAINT	X	Manufacturer	Part Number
Factory-applied yellow. If touch-up paint is required, see manufacturer for paint code!		Sherwin-Williams	
CASING SPACERS	X	Manufacturer	Part Number
Or City-approved equal		CCI	CSS-8, CSS-12
		PSI	Stainless Steel CSS
WATER METER BOXES	X	Manufacturer	Part Number
Single meter box, 11" x 18", straight wall		CDR	B031118502
		Highline	CHB111812HW1
		Glasmasters	S111812S2N08-1
Single meter box lids, 11" x 18" All meter box lids must be blue and have one (1) AMR hole for radio-read meters		CDR	C00111802P
		Highline	175053
		Glasmasters	S1118SN08-1-WA
Double meter boxes, 15" x 17", straight wall		CDR	B031517502
		Highline	
		Glasmasters	S151712S2N08-1
Double meter box lids, 15" x 17" All meter box lids must be blue and have one (1) AMR hole for radio-read meters		CDR	C00151702P
		Highline	175047
		Glasmasters	S1517SN08-1-WA
2 inch meter box, 17" x 30", straight wall		CDR	B03173012M
		Highline	CHB173012HW1
		Glasmasters	S173012S2N08-1
2 inch meter box lids, 17" x 30" All meter box lids must be blue and have one (1) AMR hole for radio-read meters		CDR	C00173002P
		Highline	175073
		Glasmasters	S1730SN08-1-WA

BACKFLOW ASSEMBLY RPZ	✘	Manufacturer	Part Number
<i>All Manufacturers that meet the requirements of AWWA M14 Backflow Prevention and Cross Connection Control: Recommended Practices, Latest Edition.</i>			

DOUBLE CHECK ASSEMBLIES	✘	Manufacturer	Part Number
<i>All Manufacturers that meet the requirements of AWWA M14 Backflow Prevention and Cross Connection Control: Recommended Practices, Latest Edition.</i>			

BALL CHECK VALVES	✘	Manufacturer	Part Number
<i>Or City-approved equal</i>		Flomatic	208, 408, 508 Series

Tracer Wire	✘	Manufacturer	Part Number
<i>Open Cut Installation</i>		Cooperhead	1030 HS
		PRO-TRACE	HS-CCS PE30
<i>Horizontal Directional Drill</i>		Cooperhead	1045 EHS
		PRO-TRACE	HDD-CCS PE45
<i>Service Connection for Tracer Wires</i>		Tracer-Lock	DB Connector

Wastewater Collection / Transmission

Please indicate your selection by writing an “x”
in the box alongside the item of your choice.

A cut sheet is required for any item not listed.

PLUG VALVES	✘	Manufacturer	Part Number
		Mueller/Pratt	Ballcentric
		Clow/Kennedy	5400 Series
		Dezurik	Series 118
CHECK VALVES	✘	Manufacturer	Part Number
		American Flow Control	Series 600
		Flowmatic	Model 92, 745
		Mueller	A-2604-6-01-Air Cushion
AIR RELEASE VALVES	✘	Manufacturer	Part Number
<i>Stainless steel 316 ONLY! Or City-approved equal</i>		Vent-o-Mat	Series RGX II
		International Valve	Vent-tech Series SWG/
		ARI	D-025-SS
FITTINGS	✘	Manufacturer	Part Number
<i>Ductile iron, C153 SSB/C110, FLG and MJ Protecto 401 lining Or City-approved equal</i>		Tyler/Union	All
		Clow/McWane	All
		American	24 in. and larger
		Sigma	All
		SIP Industries	All
		Star	All
RESTRAINING DEVICES	✘	Manufacturer	Part Number
<i>PVC Or City-approved equal</i>		EBAA	2000PV Series
		Tyler/Union	TufGrip 2000 Series
		Sigma	PV-Lok Model PWP
		SIP Industries	E-Z Grip for PVC
		Star	Stargrip 4100P
<i>Ductile iron pipe Or City-approved equal</i>		EBAA	1100 Series
		Tyler/Union	TufGrip 1000 Series
		Sigma	One-Lok Models SLDEH & SSLDH
		SIP Industries	E-Z Grip for DIP
		Star	Stargrip 3100P
GRAVITY SEWER PIPE	✘	Manufacturer	Part Number
<i>PVC green Or City-approved equal</i>		Diamond Plastics	SDR 26
		JM Eagle	SDR 26
		National Pipe & Plastics	SDR 26
		North American Pipe	SDR 26
GRAVITY SEWER FITTINGS	✘	Manufacturer	Part Number
<i>PVC Or City-approved equal</i>		Multi Fittings	Trench Tough SDR 26
		GPK PVC Fittings	SDR 26 Gasketed PVC
CASING SPACERS	✘	Manufacturer	Part Number
<i>Or City-approved equal</i>		CCI	CSS-8, CSS-12
		PSI	Stainless Steel CSS
MANHOLE FRAMES AND COVERS	✘	Manufacturer	Part Number
<i>Or City-approved equal</i>		US Foundry	USF #225 AS
MANHOLE RISER RINGS	✘	Manufacturer	Part Number
<i>Or City-approved equal</i>		Ladtech, Inc.	2400 Series
MANHOLE JOINT SEALANT	✘	Manufacturer	Part Number
<i>Or City-approved equal</i>		Canusa – Wrapid Seal	WS-12, CL-12
		Riser Wrap	

MANHOLE PIPE CONNECTORS	X	Manufacturer	Part Number
<i>Or City-approved equal</i>		Trelleburg	Kor-N-Seal
MANHOLE JOINT MATERIAL	X	Manufacturer	Part Number
<i>Or City-approved equal</i>		KT Snyder Co.	Ram-Nek
		Conseal	CS102
MANHOLE SURFACE COATINGS	X	Manufacturer	Part Number
<i>Exterior and interior Or City-approved equal</i>		Koppers/Carboline	Bitumastic 300M
		Refratta	HAC 100
		SewperCoat	
CLEAN OUT COVERS	X	Manufacturer	Part Number
<i>Cast iron Or City-approved equal</i>		US Foundry	7621
FORCE MAIN PIPE	X	Manufacturer	Part Number
<i>Green PVC pipe 4 inches and above Or City-approved equal</i>		Diamond Plastics	C900, DR18
		JM Eagle	C900, DR18
		National Pipe & Plastics	C900, DR18
		North American Pipe	C900, DR18
HDPE FORCE MAIN PIPE	X	Manufacturer	Part Number
<i>2 inch SODR 9 green, with 10-gauge wire Or City-approved equal</i>		ENDOT	EndoSewerTrace – 4710
VALVE BOXES	X	Manufacturer	Part Number
<i>With heavy-duty lid Or City-approved equal</i>		Tyler/Union	461-S (18 to 24 inches)
			562-S (24 to 36 inches)
		SIP Industries	6000 HD Series, Pt. No. 6004
VALVE BOX LIDS, NO POP GREEN	X	Manufacturer	Part Number
<i>Valve box lids, no pop green</i>		SW Services	NP 600 Green
TAPPING SLEEVES	X	Manufacturer	Part Number
<i>Stainless steel, full wrap-around seal</i>		Ford	FTSS
		Smith-Blair	663, 665
		JCM	432
		Total Piping Solutions	TPS Triple Tap
LINE STOP SLEEVES	X	Manufacturer	Part Number
<i>Stainless steel, full wrap-around seal</i>		Ford	FTSS
		Smith-Blair	663, 665
		JCM	432
		Total Piping Solutions	TPS Triple Tap
CORPORATION STOPS	X	Manufacturer	Part Number
<i>2 inch, IP thread, non-lead</i>		Ford	FB-1100-NL
		Mueller	B-25008-N
		McDonald	4846A

Wastewater Pumping Station

Please indicate your selection by writing an “x”
in the box alongside the item of your choice.

A cut sheet is required for any item not listed.

DUCTILE IRON PIPE	✘	Manufacturer	Part Number
<i>4 to 54 inches (ductile iron) Protecto 401 lined</i>		American	Pressure Class 250
		US Pipe	Pressure Class 250
		Clow	Pressure Class 250
		McWane	Pressure Class 250
FITTINGS	✘	Manufacturer	Part Number
<i>Ductile iron, C153 SSB/C110, FLG and MJ Protecto 401 lining Or City-approved equal</i>		Tyler/Union	All
		Clow/McWane	All
		American	24 inch and larger
		Sigma	All
		SIP Industries	All
EXTERIOR PIPE PROTECTION	✘	Manufacturer	Part Number
		CCI Wrapid Seal	LPB Pipe Sleeves
			LFL Flange Sleeves
			LFT Tape
LIFT STATIONS (WET WELLS) COATINGS	✘	Manufacturer	Part Number
<i>Interior coating Or City-approved equal</i>		Raven 405	
		Aquadex	
<i>Exterior coating</i>		Koppers/Carboline	Bitumatic 300M
SUBMERSIBLE PUMPS	✘	Manufacturer	Part Number
		Flygt	"N" Pumps
ARVs	✘	Manufacturer	Part Number
<i>Stainless steel 316 ONLY! Or City-approved equal</i>		ARI	D-025SS
		Vent-o-Mat	RGX Series
		International Valve	Vent-tech Series SWG/
CHECK VALVES	✘	Manufacturer	Part Number
		American Flow	52SC
		Mueller	MA-2600-6-01-LW
		Flomatic	90/92 and 745
TRACER WIRE	✘	Manufacturer	Part Number
<i>Open Cut Installation</i>		Cooperhead	1030 HS
		PRO-TRACE	HS-CCS PE30
<i>Horizontal Directional Drill</i>		Cooperhead	1045 EHS
		PRO-TRACE	HDD-CCS PE45
<i>Service Connection for Tracer Wires</i>		Tracer-Lock	DB Connector

Reclaimed Water Distribution

Please indicate your selection by placing an “x”
in the box alongside the item of your choice.

A cut sheet is required for any item not listed.

AIR RELEASE VALVES	✘	Manufacturer	Part Number
<i>Stainless steel 316 for underground assemblies ONLY Above ground can use reinforced nylon assemblies Or City-approved equal</i>		Vent-o-Mat	Series RBX II
		International Valve	Vent-tech Series WTR/
		ARI	D-040P, D-040SS
GATE VALVES	✘	Manufacturer	Part Number
<i>2 inch (threaded)</i>		Mueller – AVR Resilient	A2360 and 2361
		Clow	2639
		American Flow Control	2500
		McWane/Clow/Kennedy	F6103
<i>4 to 12 inches (mechanical joint)</i>		Mueller	A-2360-20 and 2361
		American Flow Control	2500
		Clow	F6100
		Flowmatic	115 Series
<i>16 to 24 inches (gear actuated, mechanical joint)</i>		Mueller	A2361-20
		American Flow Control	2500
		Clow	2639
BUTTERFLY VALVES	✘	Manufacturer	Part Number
<i>Larger than 24 inches (mechanical joint)</i>		Mueller	Lineseal III MJ
		Kennedy	Style 1450, 4500
		Flomatic	Model 45
FITTINGS	✘	Manufacturer	Part Number
<i>Ductile iron (C153 SSB/C110 FLG & MJ), cement lined</i>		Tyler/Union	All
		Clow/McWane	All
		American	24 inch and larger
		Sigma	All
		SIP Industries	All
		Star	All
PIPE	✘	Manufacturer	Part Number
<i>1 and 2 inch HDPE pipe, CTS – SODR9 purple, with 10-gauge wire, PE4710</i>		ADS	Polyflex (with tracer wire added)
		ENDOT	EndoCoreTrace 4710
<i>4 to 24 inches – PVC purple Or City-approved equal</i>		Diamond Plastics	C-900, DR-18
		JM Eagle	C-900, DR-18
		National Pipe & Plastics	C-900, DR-18
		North American Pipe	C-900, DR-18
<i>4 to 54 inches – ductile iron pipe, cement lined</i>		US Pipe	Pressure Class 250
		American	Pressure Class 250
		Clow	Pressure Class 250
		McWane	Pressure Class 250
TAPPING VALVES	✘	Manufacturer	Part Number
		Mueller	T-2360-16 & 2361
		American Flow	AFC 2500
		Kennedy/Clow	F6114
TAPPING SLEEVES	✘	Manufacturer	Part Number
<i>Stainless steel, full wrap-around seal</i>		Ford	FTSS
		Smith-Blair	663, 665
		JCM	432
		Total Piping Solutions	TPS Triple Tap

LINE STOP SLEEVES	✘	Manufacturer	Part Number
<i>Stainless steel, full wrap-around seal</i>		Ford	FTSS
		Smith-Blair	663, 665
		JCM	432
		Total Piping Solutions	TPS Triple Tap
RESTRAINING DEVICES FOR MJ	✘	Manufacturer	Part Number
<i>PVC pipe Or City-approved equal</i>		EBAA	2000 PV Series
		Tyler/Union	TufGrip 2000 Series
		Sigma	Model SLCE
		SIP Industries	E-Z Grip for PVC
		Star	Stargrip 4000G2
<i>Ductile iron pipe Or City-approved equal</i>		EBAA	1100 Series
		Tyler/Union	TufGrip 1000 Series
		Sigma	Model SLDE
		SIP Industries	E-Z Grip for DIP
		Star	Stargrip 3000
RESTRAINING DEVICES FOR BELLS	✘	Manufacturer	Part Number
<i>PVC pipe</i>		EBAA	2800 Series (C-905) 1500 Series (C-900)
		Tyler/Union	3000 PP Series
		Sigma	PV-Lok Model PWP
		SIP Industries	E-Z Grip for PTP for PVC
		Star	Stargrip 4100P
<i>Ductile iron pipe</i>		EBAA	1700 Series and 1100 HD Series
		Tyler/Union	
		Sigma	One-Lok SLDEH & SSLDH
		SIP Industries	E-Z Grip for PTP for DIP
		Star	Stargrip 3100P
CORPORATION STOPS	✘	Manufacturer	Part Number
<i>1 inch, CC thread, non-lead</i>		Ford	FB-1000-NL
		Mueller	B-25008-N
		McDonald	4845A
<i>2 inch, IP thread, non-lead</i>		Ford	FB-1100-NL
		Mueller	B-25008-N
		McDonald	4846A
CURB STOPS	✘	Manufacturer	Part Number
<i>3/4 inch, FIP X FIP, non-lead</i>		Ford	B-11-333-W-NL
		Mueller	B-20200-N
		McDonald	

CURB STOPS CONT.	✘	Manufacturer	Part Number
<i>3/4 inch angle, FIP X FIP, non-lead</i>		Ford	AV11-333W-NL
		Mueller	H-14285-N
		McDonald	4604BF
<i>1 inch, CTS X FIP, non-lead</i>		Ford	B41-444-W-NL
		Mueller	B-25170
		McDonald	6102W22
<i>1 inch angle, CTS X FIP, non-lead</i>		Ford	BA41-444-W-NL
		Mueller	B-24274
		McDonald	4606B22
<i>2 inch, non-lead</i>		Ford	BF43-777W-NL
		Mueller	P-24335-N
		McDonald	76100M-22
<i>2 inch angle, non-lead</i>		Ford	V43-777W-NL
		Mueller	P-24276-N
		McDonald	74602B-22
U-BRANCHES	✘	Manufacturer	Part Number
<i>1 inch x 3/4 inch x 7 inch – 1/2 inch, non-lead</i>		Ford	U-48-43-NL
		Mueller	H-15363
		McDonald	708U2M
STRAIGHT METER COUPLINGS	✘	Manufacturer	Part Number
<i>3/4 inch, MIP X Meter, non-lead</i>		Ford	C38-23-2.5-NL
		Mueller	H-14223-N
		McDonald	74620
<i>1 inch, MIP X Meter, non-lead</i>		Ford	C38-44-2.625-NL
		Mueller	H-14223-N
		McDonald	74620
SERVICE SADDLES	✘	Manufacturer	Part Number
<i>1 inch, CC thread outlet, epoxy coated-double strap SS</i>		Ford	FC-202
		Mueller	DR-2S
		Romac	202-N-H
		Smith-Blair	317 Series
<i>2 inch, IP thread, epoxy coated-double strap SS</i>		Ford	FC-202
		Mueller	DR-2S
		Romac	202-N-H
		Smith-Blair	317 Series

VALVE BOXES	X	Manufacturer	Part Number
Valve box lid must be stamped "reclaimed water" or "reuse water" Round or square (heavy duty) lids are acceptable Or City-approved equal		Tyler/Union	HD 461-S (18 to 24 inches)
			HD 562-S (24 to 36 inches)
		SIP Industries	6000 HD Series Part No. 6004/6007 Reuse

GATE VALVES	X	Manufacturer	Part Number
4 to 12 inches (mechanical joint)		Mueller	A-2360-20 and 2361
		Kennedy/Clow/M&H	1571-A
		American Flow	2500
		Flowmatic	115 Series
12 inches and larger (geared actuated, mechanical joint)		Mueller	A-2361-20
		Kennedy/Clow/M&H	2639
		American Flow	2500

RECLAIMED WATER METER BOX	X	Manufacturer	Part Number
Single meters, 11" x 18", straight wall		CDR	B001118502
		Highline	CHB111812HW1
		Glasmasters	S111812S2N08-2
Single meter box lids, 11" x 18" All meter box lids must be purple and have one (1) AMR hole for radio-read meters		CDR	C00111802PP
		Highline	CHC1118HR
		Glasmasters	S1118SN08-2-RW
Double meter boxes, 15" x 17", straight wall		CDR	B001517502
		Highline	
		Glasmasters	S151712S2N08-2
Double meter box lids, 15" x 17" All meter box lids must be purple and have one (1) AMR hole for radio-read meters		CDR	C00151702PP
		Highline	
		Glasmasters	S1517SN08-2-RW
2 inch meter boxes, 17" x 30", straight wall		CDR	B00173012M
		Highline	CHB173012HW1
		Glasmasters	S173012S2N08-2
2 inch meter box lids, 17" x 30" All meter box lids must be purple and have one (1) AMR hole for radio-read meters		CDR	C00173002PP
		Highline	CHC1730HR
		Glasmasters	S1730SN08-2-RW

Tracer Wire	X	Manufacturer	Part Number
Open Cut Installation		Cooperhead	1030 HS
		PRO-TRACE	HS-CCS PE30
Horizontal Directional Drill		Cooperhead	1045 EHS
		PRO-TRACE	HDD-CCS PE45
Service Connection for Tracer Wires		Tracer-Lock	DB Connector

APPENDIX B

CLOSED CIRCUIT TELEVISION INSPECTION OF SEWER MAINS AND LATERALS

CITY OF WINTER GARDEN
STANDARD SPECIFICATIONS FOR UTILITIES CONSTRUCTION

APPENDIX B

**CLOSED CIRCUIT TELEVISION INSPECTION
OF SEWER MAINS AND LATERALS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section Includes: Requirements to execute internal closed circuit television (CCTV) survey to inspect sewer mains and laterals.

1.2 SUBMITTALS

- A. Submit following:
 - 1. Sample of television survey log, DVD/CD-ROMs, and equipment list for approval before commencement of work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General

- 1. Provide equipment to perform inspections of sewer mains and laterals located in streets, street rights-of-way, and off-road easements.
 - a. Including but not limited to portable CCTV equipment, vehicles capable of transporting TV equipment and accessing remote easements, and adequate cleaning equipment.
 - b. Pipe plugs, pumps, equipment, and operators as needed to prepare and maintain sewer system conditions for test period.
- 2. Certify that backup equipment is available and can be delivered to site within 48 hours.

B. Software Requirements: PACP certification and video recording.

C. CCTV

- 1. Color Video Camera
 - a. Specifically designed and constructed for this application.

- b. Camera, 17-inch minimum, Closed Circuit, Color Television Monitor, and Other Components: Capable of producing a color video picture with a standard resolution of 720 x 480.
- c. Produce 720 x 480 line resolution minimum.
- d. Pan and tilt type, capable of turning at right angles to pipe's axis over an entire vertical circle (minimum pan of 270 degrees and rotation of 360 degrees).
- e. Lighting: Suitable to allow clear picture of entire inner pipe wall extending at least 10 feet in front, including black High Density Polyethylene (HDPE) pipe.
- f. Operative in 100 percent humidity conditions.
- g. Image: Capable of self righting itself.
- h. Include data view display feature capable of showing on tape following information.
 - 1) Lateral addresses.
 - 2) City and state.
 - 3) Date and time.
 - 4) Project name.
 - 5) Contractor's name.
 - 6) Inside pipe diameter and type.
 - 7) Manhole identification (upstream manhole to downstream manhole).
 - 8) On-going footage counter accurate within 0.2 foot, per 100 feet.
 - 9) Include operator narration, in format approved by City Inspector, using Commission approved terminology.
 - 10) Recording of single section of sewer onto 2 DVD/CD-ROMs will not be acceptable.
 - 11) Clearly label each DVD/CD-ROM as approved by the City Inspector.
- i. Mounting
 - 1) Launched From Within Mainline Sewer: Mounted on tread tractor that moves through sewers and positions inspection camera launcher opposite lateral line connection.
 - 2) Launched From Within A Cleanout: Able to travel to mainline sewer.
- j. Attachment: Push cable with a fiberglass rod core.

D. Recording Media

- 1. Provide a high quality DVD in a MPEG2 format video with a standard resolution of 720 x 480.

2. Camera, Television Monitor, and Other Components: Capable of producing a minimum 720 x 480 line resolution color video picture.

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION SURVEY

A. Procedure

1. CCTV

a. Mainline

- 1) Before repair work, light clean and inspect sewer line from manhole to manhole, preferably upstream to downstream, one section at a time.
 - a) Light cleaning includes up to 3 passes with a hydraulic jet cleaner.
 - b) Heavy cleaning by method approved by City Inspector.
- 2) Maintain sewer main isolation by plugging or bypass pumping while camera is moving and recording.
 - a) Plugs: Secured so as to remain in place during inspection.
 - b) Conduct operations to prevent building backups and sewer overflows.
 - c) Be responsible for cleanup, repair, fines, property damage costs and claims for any sewage backup, bypass spillage or sanitary sewer overflow.

b. Lateral: Follow mainline above, except as modified below.

- 1) Inspect entire lateral. Simultaneous with CCTV inspection clean and flush lateral with clean water.
- 2) Isolate section inspected
 - a) Method may include turning off property water, or bypassing flow.
- 3) Prevent backflow into laterals.
- 4) Identify inspection by building address and mainline.

- a) If lateral services 2 addresses, identify both addresses.
2. Placement of camera
 - a. Manhole
 - 1) Place at center of manhole and commence video recording before entering pipe.
 - 2) Start footage counter at center of manhole.
 - b. Mainline: Mount on a transport platform that will keep it centered along longitudinal axis of sewer mainline and above water.
 - c. Laterals from mainline
 - 1) Place camera into connection and commence video recording before entering connection.
 - 2) Start footage counter at connection.
 - d. Laterals from cleanout
 - 1) Place camera into sweep and commence video recording before entering lateral or before lowering through cleanout stack.
 - 2) Start footage counter at sweep.
 3. Operation of Camera
 - a. Provide full 360 degree pan of all pipe joints. Camera shall be located precisely at each joint. Film the entire circumference at each joint.
 - b. Show inside of manhole walls, manhole channel, and pipe connection to wall at both upstream and downstream manhole and lateral connections.
 - c. Move through line at speed no greater than 30 feet per minute stopping for minimum 10 seconds to record lateral connections, mainline connections, defects, and features and points of interest.
 - d. Maintain technical quality, sharp focus, and distortion free picture.
 - e. Videotape a section of sewer in its entirety with no breaks or interruptions.
 - f. Pan, tilt, and rotate as necessary to best view and evaluate

lateral connections, defects, features, and points of interest.

- g. Use power winches, powered rewinds, tractors, or other devices that do not obstruct camera view or interfere with proper documentation of sewer conditions to move camera through sewer.
 - 1) Whenever non-remote powered and controlled winches are used set up telephones or other suitable means of communication between manholes to insure good communications.
- h. Use hydraulic jet nozzle if necessary to remove standing water from line.
- i. Eliminate steam in line for duration of inspection.
 - 1) Utilize blower as needed to defog sewer line.
- j. Measurement for location of defects and service laterals
 - 1) At ground level by means of City Inspector-approved footage counter or metering device.
 - 2) Measurement Meters: Accurate to 0.2 foot over length of section being televised.
 - 3) Use measuring target in front of television as exact measurement reference point.
- k. Movement of television camera
 - 1) Mainline
 - a) Stop camera at service connections and inspect lateral with pan and tilt camera.
 - b) At active service connections where flow is discharging.
 - (1) Identify building address and confirm that laterals are active by obtaining flush, with or without dye, of property owner's commode or by using outside cleanout, if available.
 - (2) If no flows are being discharged from building, consider observed flow as infiltration/inflow.
 - 2) Laterals
 - a) Move camera through lateral at uniform rate.
 - b) Stop at each suspected defect to allow adequate

evaluation.

I. Identification of Defects

- 1) If roots, sludge, or sediment material impedes inspection withdraw camera and re-clean mainline by hydraulic jet.
 - a) Upon completion of re-cleaning operation resume internal inspection.
 - b) Furnish media confirmation for heavy cleaning (more than 3 passes with jet cleaner) to City Inspector.
- 2) If protruding tap impedes inspection trim protruding tap to 1/2 inch.
- 3) If obstructions are not passable and cannot be removed by sewer cleaning or reaming, withdraw CCTV equipment and perform inspection from opposite end.
 - a) Extract camera stuck in sewer line.
 - b) When additional obstructions are encountered after re-deployment of equipment, and no means are available for passing obstructions, remand to City Inspector for resolution.

B. Field Documentation

1. Mainline

- a. Submit original records, logs, DVD's, CD-ROMs, and electronic data for sewer line inspection to City Inspector at the end of the day's inspection. Copies of the inspection will be provided by the City at Contractor's request.
- b. Include, but not be limited to following information:
 - 1) Project Number.
 - 2) Basin Name.
 - 3) Owner.
 - 4) Date, time (begin to end inspections).
 - 5) Weather condition.
 - 6) Operator name.
 - 7) QA reviewer name.

- 8) DVD/CD number and index.
- 9) Address of upper most lateral.
- 10) Manhole number to manhole number.
- 11) Manhole depths.
- 12) Length of pipe segment.
- 13) Direction of CCTV (Upstream or Downstream).
- 14) Pipe size.
- 15) Pipe material.
- 16) General physical conditions.
- 17) Footage locations, clock position, descriptions, and estimated leakage rates for visible point sources of infiltration/inflow.
- 18) Footage locations, clock position, and descriptions for lateral connections and estimated flow from laterals.
- 19) Footage locations, clock position, and descriptions of defects such as obstructions, root intrusion, blockages in pipe, deteriorated joints, offset joints, holes, breaks, cracks, collapses, bends or sags in alignment, or protruding lateral connections.
- 20) Footage locations, clock position, and descriptions of other defects, features and points of interest found.
- 21) Whether CCTV was complete or incomplete.

c. DVD/CD-ROM Recording/Playback

- 1) At same speed that it was recorded.
- 2) Supply slow motion or stop motion playback features.
- 3) Once recorded, DVD/CD-ROM becomes property of the Commission.
- 4) Have DVD/CD-ROM and necessary playback equipment readily accessible for review by City Inspector during Project.

d. Observation Terminology Utilized During Audio Narration: Follow the Commission approved terminology.

e. DVD/CD-ROMs displaying poor video quality refers to, but is not limited to grease or debris on lens, camera under water, image too dark, washed-out, distorted, or out of focus, lines

improperly cleaned, and poor/no audio.

- 1) Re-televisé line if necessary and resubmit DVD/CD-ROM.

2. Laterals

a. Submit as above for mainline documentation.

b. Include but not limited to following information.

- 1) Project Number.
- 2) Basin Name.
- 3) Owner.
- 4) Date, time (begin to end inspections).
- 5) Weather condition.
- 6) Operator name.
- 7) QA reviewer name.
- 8) DVD/CD number and index.
- 9) Address of each lateral.
- 10) Length of lateral segment.
- 11) Direction of CCTV (from property line or from mainline connection).
- 12) Lateral size.
- 13) Lateral material.
- 14) General physical conditions.
- 15) Footage locations, clock position, and descriptions of defects and estimated leakage rates for visible point sources of infiltration/inflow.

3.2 POST-CONSTRUCTION SURVEY

A. Procedure: Follow procedures as specified for pre-construction survey above and as specified below.

1. Stop camera (minimum 10 seconds) at beginning and end of repairs and inspect repaired section.

APPENDIX C

LIFT STATION CONTROLLER / REMOTE TERMINAL UNIT

CITY OF WINTER GARDEN

STANDARD SPECIFICATIONS FOR UTILITY CONSTRUCTION

APPENDIX C

LIFT STATION CONTROLLER/REMOTE TERMINAL UNIT

GENERAL:

The lift station controller/remote terminal units (RTU's) shall be a Model LC150 Pump Controller/RTU radio telemetry transceiver as manufactured by Siemens Water Technologies Controls Division, represented in the State of Florida by Sanders Company, Inc. Each unit shall be mounted in a NEMA 4X fiberglass enclosure for operation on 120 VAC, single phase, 60 Hz service. The RTU will monitor & transmit the wet well level signal, low and high alarms, pump status, and other conditions (as detailed below) to the existing Master Terminal Unit via VHF FM radio link. The pumps shall be controlled in a pump down mode based on wet well level as monitored by a Model AI 000i 15PSI submersible level transducer also manufactured by Siemens Water Technologies.

MATERIALS:

<u>Qty</u>	<u>Item</u>
1	NEMA 4X fiberglass enclosure with padlocking hasp (16" H 14" W)
1	120 VAC incoming control power circuit breaker
1	Single phase surge protector with base
1	15 VDC power supply
1	LC 150 Pump Controller/RTU, Base unit only. RTU to monitor and transmit the following information to the Master:
	<ul style="list-style-type: none">• Wetwell Level, 0-10.0 ft. (includes HI and LO alarms)• Pump 1 Run• Pump 2 Run• Pump 1 Overtemp• Pump 2 Overtemp• Pump 1 Seal Failure• Pump 2 Seal Failure• Pump 1 Fail• Pump 2 Fail• Power / Phase Failure (Dry contact from power monitor, provided by others)• High Level Float (float switch provided by others)• Low Level Float (float switch provided by others)• FlowLogix - volumetric flow data
	<p>HMI: From the existing HMI Computer, the operator will have the ability to perform the following adjustments:</p> <ul style="list-style-type: none">• Pump Start/Stop Setpoint adjustment• Wetwell High/Low Level alarm adjustment• Pump Mode Selection "Auto-Off"
1	Incoming service terminal blocks

- 1 Transtronics BVUPS12PF Battery Charger
- 1 Radio, VHF (Dataradio Integra-TR)
- A/R Radio Accessories (LA, RF pigtail, serial interface cable)
- 1 FCC license coordination

SEPARATE FIELD MOUNTED ITEMS:

- 1 Antenna, VHF YAGI
- 40 Feet Cable, Coaxial, LMR400
- 2 Connector, Male-N for LMR400
- 1 Model A1000i Submersible level sensor, 15PSI, 4-20ma with 60' of cable
- 1 Model 157GSC lower unit cable suspension pipe and 30" of SS cable/clamp kit
- 1 Atmospheric pressure equalization system (for submersible transducer)
- 1 Battery 3.0 Ah for remote mounting by others

INSTALLATION:

- A. The installing contractor to provide for existing Master Transceiver and Human Machine Interface programming per site.