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INTRODUCTION

INTRODUCTION

Volusia County Utilities makes every effort to provide high quality, reliable utility service to all customers. Providing such service requires that rules and guidelines be established fairly administered and clearly understood by all concerned. This publication has been prepared with this goal in mind.

DOCUMENT TITLE

The title of this document is "Utilities Design and Construction Standards," Additional Volusia County documents that supplement this document include the Volusia County Land Development code, the Utilities Ordinance, and the Reclaimed Water Ordinance.

JURISDICTION

This MANUAL shall apply to all proposed water, wastewater and reclaimed water facilities to be owned, operated or maintained by Volusia County Utilities. This manual shall not take the place of regulations imposed by F.D.E.P. or D.O.H. This manual is intended to add further detail to how to comply with these regulations. In the event of a conflict, the more stringent shall apply.

PURPOSE

These standards and specifications are intended 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 facilities owned and operated by Volusia County. Such facilities include water mains, reclaimed water mains, gravity sewers, wastewater force mains, wastewater pump stations, and miscellaneous related appurtenances associated with such systems.

SCOPE

This Document is divided into six parts:

Division I – General Requirements

Division II – Water Distribution

Division III – Reclaimed Water Distribution

Division IV – Gravity Sewers

Division V – Wastewater Force Mains

Division VI – Wastewater Pump Stations

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.

AIR GAP – means a physical separation sufficient to prevent backflow or back-siphonage between the free flowing discharge end of the reclaimed water system and any other system, physically defined as a distance to twice the diameter of the supply side pipe diameter but not less than one inch.

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

AQUIFER – means a porous, water-bearing geologic formation. Generally restricted to regions capable of yielding an appreciable supply of water.

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

AVERAGE DAILY FLOW (A.D.F.) – means a measurement of the amount of reclaimed water treated by a pollution control plant each day. It is the average of the actual daily flows that occur within a period of time, such as a week, a month, or a year. Mathematically, it is the sum of all daily flows divided by the total number of daily flows used.

AVERAGE FLOW RATE – means the average of the instantaneous flow rates over a given period of time, such as a day.

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

BACKFILL – means (1) The operation of refilling an excavation, usually after some structure has been placed therein. (2) The material placed in an excavation in the process of backfilling.

BACKFLOW PREVENTER – means a device which prevents the reverse flow of water due to atmospheric or higher pressure by means of positive check members in addition to atmospheric ports which provide back-siphonage protection.

CHLORINATOR – means a type of equipment utilized for chlorination of reclaimed water supplies and specifically designed to feed continuously and accurately the desired amount of chlorine or chlorine compound.

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

COUNTY - means the Volusia County Department of Water Resources and Utilities, Volusia County, Florida, and/or its designated representative(s).

COUNTY UTILITY DEPARTMENT - means the County of Volusia, Department of Water Resources and Utilities.

CROSS CONNECTION – means (1) a physical connection through which a supply of potable water could be contaminated or polluted. (2) A connection between a supervised potable water supply and an unsupervised supply of unknown potability.

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

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

D.I.P.R.A. - means Ductile Iron Pipe Research Association.

DIRECTOR - means the Director of the Public Works Department for Volusia County, Florida, acting directly or through an assistant or other representative authorized by him/her.

DOUBLE CHECK – means an assembly of two independently operating spring loaded check valves with tightly closing shut off valves on each side of the check valve assembly plus properly located test cocks for the testing of each check valve.

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

DRY TAP – means a connection made to a main that is empty (see “Wet Tap”).

DUAL CHECK VALVE ASSEMBLIES - means an assembly of two operating spring loaded check valves.

EFFLUENT – means wastewater or other liquid – raw, partially or completely treated – flowing from a basin, treatment process or treatment plant.

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

E.R.U. – means equivalent residential unit. This meaning shall be synonymous with E.D.U. and E.R.C.

EXFILTRATION – means liquid wastes and liquid-carried wastes which unintentionally leak out of a sewer pipe system and into the environment.

FIRE FLOW – means the rate of flow, usually expressed in gallons per minute that can be delivered from a water distribution system at a specified residual pressure for fire fighting. The specified residual pressure is generally a minimum of 20 psi.

FLOTATION – means the stress or forces on a pipeline or manhole structure located below a water table which tends to fill or float the pipeline or manhole structure.

F.D.E.P. – means Florida Department of Environmental Protection.

F.D.O.T. - means the Department of Transportation, State of Florida.

FORCE MAIN – means a pipe that carries wastewater under pressure from the discharge side of a pump to a point of gravity flow downstream.

GALLONS PER CAPITA PER DAY (G.P.C.D.) – means a measurement of the average number of gallons of water used by the average person each day in a water system. The calculation is made by dividing the total gallons of water used each day by the total number of people using the water system.

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.

GRAVITY FLOW – means water or wastewater flowing from a higher elevation to a lower elevation due to the force of gravity. The water does not flow due to energy provided by a pump.

GROUNDWATER – means subsurface water in the saturation zone from which wells and springs are fed. In a strict sense, the term applies only to water below the water table.

INFILTRATION – means the water entering sewer pipes and service connections from the ground. Defective pipes, pipe joints, connections or manhole walls are a few of the common locations where infiltration may occur.

INFLOW – means the water discharged into a sewer system and service connections from such sources as, but not limited to, roof leaders, cellars, yard and area drains, foundation drains, cooling water discharges, drains from springs and swampy areas, around manhole covers or through holes in the covers, cross connections from storm and combined sewer systems, catch basins, storm waters, surface runoff, street wash waters or drainage.

INFLUENT – means wastewater or other liquid – raw or partially treated – flowing into a reservoir, basin, treatment process or treatment plant.

LAND DEVELOPMENT CODE - means the Volusia County Land Development Code, Ordinance #88-3, as amended.

LATERAL CLEANOUT – means a capped opening in a building lateral, usually located on the property line, through which the pipelines can be cleaned.

LIFT STATION – means a wastewater pumping station that lifts the wastewater to a higher elevation when continuing the sewer at reasonable slopes would involve excessive depths of trench. Also, an installation of pumps that raise wastewater from areas too low to drain into available sewers.

MANUAL - means this Volusia County Manual of Standards and Specifications for Utilities Design and Construction.

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

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

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

O.S.H.A. - 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.

PEAK DEMAND – means (1) The maximum momentary load placed on a water plant or pumping station. (2) The average maximum load in one hour or less, but may be specified as instantaneous or with some other short time period.

PLANS - means DRAWINGS as defined herein above.

POTABLE WATER – means water that does not contain pollution, contamination, objectional minerals, or infective agents and is considered satisfactory for domestic consumption.

RECLAIMED WATER – means water that has received at least secondary treatment, sand filtration and high level disinfection, and is reused after flowing out of a wastewater treatment plant and is non-potable water provided through a separate distribution system meeting F.D.E.P.'s requirements for public access use given in the Florida Administrative Code (F.A.C.), and F.D.E.P.'s ground water standards.

REDUCED PRESSURE PRINCIPLE BACKFLOW ASSEMBLY – means any assembly consisting of two independently approved check valves with an automatic operating differential relief valve located between the check valves, tightly closed shut off valves on each side of the reduced pressure device plus properly located test cocks for testing of the test assembly and relief valve.

RIGHT-OF-WAY USE PERMIT - means the Volusia County Right-of-Way Use Permit Regulations, latest edition.

SANITARY SEWER – means a sewer that carries water and water-carried wastes from residences, commercial buildings, industrial plants and institutions, together with minor quantities of ground, storm and surface waters (that are not admitted intentionally) to treatment or disposal facilities.

SPECIFICATIONS - means the specifications contained in this MANUAL.

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

STANDARD DRAWINGS - means the detailed drawings in this MANUAL related to water and wastewater main materials and installation.

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

TAPPING SLEEVES – means a split sleeve used in making a wet connection where a single branch line is to be tapped into a reclaimed water main under pressure.

THRUST BLOCK – means a mass of concrete cast in place between a fitting to be anchored against THRUST and the undistributed soil at the side or bottom on the pipe trench.

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

TRANSMISSION MAINS – means those conduits used to supply reclaimed water from the pumping station or treatment plant to the distribution mains. Also referred to as trunk mains.

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

VOLUSIA COUNTY - means Volusia County, Florida.

WASTEWATER – means the used water and water-carried solids from a community that flow to a treatment plant. Storm water, surface water, and groundwater infiltration also must be included in the wastewater that enters a plant. The term “sewage” usually refers to household wastes but this word is being replaced by the term “wastewater.”

WASTEWATER COLLECTION SYSTEM – means the pipe system for collecting and carrying water and water-carried wastes from domestic and industrial sources to a wastewater treatment plant.

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 AND WASTEWATER IMPROVEMENTS

This section is intended to supplement the County's Land Development Code. In the event of a conflict, the Land Development Code shall govern.

11.1 GENERAL

All submitted PLANS shall be standard size sheet (30" x 42" or 24" x 36") 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.

11.2 MASTER PLAN

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

11.3 PLAN AND PROFILE

All gravity sewers, all wastewater force mains, and off-site water mains shall be drawn in plan and profile. On-site water mains may be shown in plan view only, except for locations of utility crossing or conflict.

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

- a. General information such as north arrow, names of designer and engineer, revision block with dates, graphic scale(s) and sheet number.
- b. 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 relief, and other related appurtenances.
- h. Limits of special exterior coatings.
- i. Limits of special bedding requirements.
- j. Pipe restraint requirements.

- k. Details of connection to existing systems.
- l. Location(s) and general layout of wastewater pumping stations.
- m. Construction notes regarding cover, horizontal and vertical control, special construction requirements, and references to standard and special details.

11.4 DETAILS

The PLANS shall include all applicable Volusia County STANDARD DETAILS. Special details shall be prepared by the DEVELOPER'S ENGINEER for aerial and underwater crossings of rivers, streams, canals and ditches. Other special details shall be prepared by the DEVELOPER'S ENGINEER as required.

11.5 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.

11.6 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.

11.7 RECORD DRAWINGS

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

1. Drawings shall be legible marked to record actual construction.
2. Drawings shall show actual location of all underground and above ground water and wastewater piping related appurtenances. All changes to piping location including horizontal and vertical locations of utilities and appurtenances shall be clearly shown and referenced to permanent surface improvements. Drawings shall also show actual installed pipe material, class, etc.
3. Drawings shall clearly show all field changes of dimension and detail including changes made by field order or by change order.
4. 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.
5. Location of all manholes, fittings, hydrants, valves, and valve boxes shall be shown. All valves and fittings shall be referenced from at least two and preferably three permanent points.

6. Dimensions between all manholes shall be field verified and shown. The inverts and grade elevations of all manholes shall be shown.

Each sheet of the PLANS shall be signed, sealed and dated by the DEVELOPER'S 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 DEVELOPER'S ENGINEER. The "Certificate of Completion" will not be issued until correct "Record Drawings" have been submitted.

Five (5) blueline prints and a CD containing a complete set of "Record Drawing" as accepted by the COUNTY along with digital copies of all permits and clearances shall be provided. Digital documents shall be .dwg (AutoCAD) for drawings or MS Word formatted for text.

11.8 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 COUNTY to review and update Appendix 'A' as appropriate to ensure efficient operation of the services and facilities under the jurisdiction of this MANUAL. If the Developer/Contractor intends to use materials not listed in Appendix 'A', Shop Drawings shall be required to be submitted and shall be reviewed by the COUNTY to ensure the materials are equal to those specified.

SECTION 12

GENERAL CONSTRUCTION

12.1 GRADES, SURVEY LINES, AND PROTECTION OF MONUMENTS

12.1.1 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 execution 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.

12.1.2 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 COUNTY 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 COUNTY'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 COUNTY.

12.1.3 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.

12.2 UTILITY COORDINATION

12.2.1 LOCATION OF UTILITIES

Prior to proceeding with trench excavation, the CONTRACTOR shall contact Sunshine State One Call of Florida, Inc., seventy-two (72) hours prior to excavating in an area to aid in locating their underground services. It shall be the CONTRACTOR'S responsibility to contact utility companies a minimum of three (3) normal working days before starting construction or as required by law. 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.

12.2.2. DEVIATIONS OCCASIONED BY STRUCTURES OR UTILITIES

Wherever obstructions are encountered during the progress of the WORK and interfere to such an extent that an alteration in the PLANS is required, the COUNTY 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 COUNTY 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 COUNTY will require the addition of any manholes needed to maintain the integrity of the sewer system.

12.2.3 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 COUNTY. The costs for such test pits shall be borne by the CONTRACTOR.

12.3 MAINTENANCE OF TRAFFIC AND CLOSING OF STREETS

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

Unless permission to close a street is received in writing from the proper authority (COUNTY, CITY, F.D.O.T., 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 COUNTY.

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

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.

12.4 PROTECTION OF PUBLIC AND PROPERTY

12.4.1 BARRICADES, GUARDS AND SAFETY PROVISIONS

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

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

12.4.2 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.

12.4.3 OPEN EXCAVATION

All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. The CONTRACTOR shall, at his own expense, provide suitable and safe bridges with hand railings and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required. The length of open trench will be controlled by the particular surrounding conditions, but shall be limited to 300 feet unless otherwise approved by the COUNTY. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the COUNTY 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.

12.4.4 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.

12.4.5 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.

12.4.6 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 COUNTY.

12.4.7 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.

12.5 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 backfill 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 backfill shall be transported and disposed of off the site in disposal areas obtained by the CONTRACTOR.

12.6 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.

12.7 CONSTRUCTION HOURS

No WORK shall be done between the hours of 7:00 p.m. and 7:00 a.m., or on Saturdays and 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 COUNTY a minimum 24 hours before starting such items of the WORK.

12.8 CONSTRUCTION IN EASEMENTS AND RIGHTS-OF-WAY

12.8.1 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.

12.8.2 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.

12.8.3 CONSTRUCTION IN VOLUSIA COUNTY RIGHT-OF-WAY

WORK shall be governed by the Volusia County Right-of-Way Use Permit.

12.9 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.

12.10 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.

12.11 COOPERATION WITH OTHER CONTRACTORS AND FORCES

During construction progress, it may be necessary for other contractors and persons employed by the COUNTY to work in or about the site. The COUNTY 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 COUNTY 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.

12.12 SUBSURFACE EXPLORATION

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

12.13 CLEANING

12.13.1 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 COUNTY, such material, debris, or rubbish constitutes a nuisance or is objectionable.

12.13.2 FINAL CLEANING

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

12.14 SALVAGE

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

12.15 SHOP DRAWINGS AND SAMPLES

If requested by the COUNTY, prior to construction the CONTRACTOR shall submit three (3) copies of the shop drawings, signed by the DEVELOPER'S ENGINEER, to the COUNTY. 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 COUNTY, furnish certificates, affidavits of compliance, test reports, or samples for check analysis for any of the materials specified in this MANUAL.

SECTION 13

SITE PREPARATION, SURFACE REMOVAL AND RESTORATION

13.1 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 COUNTY prior to the beginning of any WORK. All site work shall conform to the applicable site clearing ordinance, and landscaping and tree ordinances of the COUNTY.

13.2 CLEARING AND GRUBBING

13.2.1 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 12.4.4. 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.

13.2.2 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 sub-grade. 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.

13.2.3 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.

13.2.4 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.

13.3 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 COUNTY.

13.4 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 COUNTY and F.D.O.T. 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.

13.5 RESTORATION

Restoration of all surfaces including road sub-base, soil cement, limerock base, 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 14

EXCAVATION, BACKFILL, COMPACTION AND GRADING

14.1 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 II, III and IV 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.

14.2 SOIL BORINGS AND SUBSURFACE INVESTIGATIONS

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

14.3 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 12.2 for utility coordination requirements.

The COUNTY 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.

14.4 MATERIALS

14.4.1 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 COUNTY, make an appropriate sample of this material available for testing by the COUNTY or its designated representative.

14.4.2 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 COUNTY.

14.4.3 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 COUNTY.

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 COUNTY, is not suitable for reuse, shall be spoiled as specified herein for disposal of unsuitable materials.

14.4.4 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.

14.4.5 BEDDING ROCK

Bedding rock shall be 3/16 inch to 3/4 inch washed and graded stone (F.D.O.T. #67). This stone shall be graded so that 90 to 100 percent will pass a 3/4 inch screen and 95 to 100 percent will be retained on a No. 8 screen. No stones larger than 1 inch in any dimension shall be accepted.

14.5 SHEETING AND BRACING IN EXCAVATIONS

14.5.1 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.

14.5.2 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 COUNTY. If, during the progress of the WORK, the COUNTY 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 COUNTY 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 COUNTY 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.

14.6 DEWATERING, DRAINAGE AND FLOTATION

14.6.1 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% of the optimum moisture content of the soil. The COUNTY 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.

14.6.2 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 sub-grade 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 sub-grade soils at proposed bottom of excavation.

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

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

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

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

14.7 EXCAVATION

14.7.1 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 sub-grade elevations without specific direction of the COUNTY. Unauthorized excavation, as well as remedial work directed by the COUNTY shall be at the CONTRACTOR'S expense. Such remedial work shall be performed as directed by the COUNTY.

If requested by the COUNTY, when excavation has reached required sub-grade elevations, a GEOTECHNICAL/SOILS ENGINEER shall make an inspection of conditions. If the sub-grade is unsuitable, CONTRACTOR shall carry excavation deeper and replace excavated material with select common fill or bedding rock, as directed by the COUNTY.

If the CONTRACTOR excavates below grade through error or for his own convenience or through failure to properly dewater the excavation or disturbs the sub-grade before dewatering is sufficiently complete, he may be directed by the COUNTY 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 COUNTY until required for backfill and fill. When needed in the WORK, material shall be located and graded at the direction of a GEOTECHNICAL/SOILS ENGINEER.

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

14.7.2 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.

14.7.3 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 COUNTY.

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 COUNTY.

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 sub-grade 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.

14.8 BEDDING AND BACKFILL

14.8.1 GENERAL

Material placed in fill areas under and around structures and pipelines shall be deposited within the lines and to the grades shown on the DRAWINGS or as directed by the COUNTY, 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 COUNTY. 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 14.4 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 a manner as to preserve the undisturbed state of the natural inorganic soils.

Prior to filling, the ground surface shall be prepared by removing vegetation, debris, unsatisfactory soil materials, 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 14.9 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 14.9. Backfill or fill material shall not be placed on surfaces that are muddy, frozen or contain frost or ice.

14.8.2**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 14.9.2 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 un-compacted 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.

14.8.3**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 14.9.

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 14.9.

14.9 COMPACTION

14.9.1 General

The CONTRACTOR shall control soil compaction during construction to provide the percentage of maximum density specified. The CONTRACTOR shall provide the COUNTY 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 14.9.2, 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.

14.9.2 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% 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% 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% of the maximum dry density as determined by AASHTO T-180.

14.9.3 COMPACTION TESTS

One compaction test location shall be required for each 300 linear feet of pipe and for every 100 square feet of backfill around structures as a minimum. The COUNTY 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. One test at the spring line of the pipe.
- b. At least one test for each 12" layer of backfill within the pipe bedding zone for pipes 24 inches and larger.
- 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.

14.10 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.

14.11 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.

14.12 INSPECTION AND QUALITY ASSURANCE

14.12.1 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 COUNTY if elevations of existing grade vary from elevations shown on DRAWINGS.

14.12.2 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 COUNTY.

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 15

BORING AND JACKING AND HORIZONTAL DIRECTIONAL DRILLING

15.1 GENERAL

Trenchless pipe installation where required shall be performed using either the boring and jacking method or Horizontal Directional Drilling.

15.1.1 The installation of a pipe by the method of boring and jacking is covered in this section. The overall WORK scope shall include, but not limited to, boring and jacking pits and equipment, sheeting, steel casing pipe, skid, steel straps, coatings, location signs as required, miscellaneous appurtenances to complete the entire WORK as shown on the DRAWINGS, and restoration. Applicable provisions of Division II, III, and IV 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.

15.1.2 The installation of a pipe using Horizontal Directional Drilling is covered in this section. The overall WORK scope shall include, but not be limited to, location of existing utilities (horizontal and vertical), preparation of pipe entrance and exit areas, fusing piping, sizing the equipment needed to perform the WORK as designed, staging the equipment, furnishing the manpower, equipment materials, traffic control, and experienced supervision for the project. All WORK shall be performed in strict compliance to the approved plans and SPECIFICATIONS.

15.2 BORE AND JACK MATERIAL

15.2.1 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>D.I.P. Carrier Nominal Diameter</u>	<u>Casing Outside Diameter</u>	<u>Casing Wall Thickness</u>
4"	16"	.250"
6"	18"	.250"
8"	20"	.250"
10"	24"	.250"
12"	24"	.312"
16"	30"	.312"
20"	32"	.375"
24"	36"	.375"
30"	48"	.500"
36"	54"	.500"
42"	60"	.500"
48" and larger – to be approved by County		

Field and shop welds of the casing pipes shall conform with the American Welding Society (A.W.S.) 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. All casing pipes shall be coated with 8 mils DFT coal tar epoxy. In area of field welds, two (2) coats of red primer shall be applied.

15.2.2 CARRIER PIPE

The carrier pipe shall be minimum class 50 ductile iron pipe (PR of 350 psi) with restrained joints. Ductile iron pipe shall comply with the SPECIFICATION outlined in Division IV and V.

15.2.3 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 COUNTY. 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 COUNTY.

15.3 DIRECTIONAL – PIPE MATERIAL

Piping used for directional drilling shall be either HDPE or PVC. HDPE shall be a minimum of DR17 with butt fused joints. PVC shall be DR18 C-900 with interlocking sleeves and splines. PVC shall only be used where appropriate setbacks.

15.4 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 COUNTY.

15.5 CONSTRUCTION REQUIREMENTS – BORE AND JACKING

15.5.1 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 COUNTY.

15.5.2 DEWATERING

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

15.5.3 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 stainless steel casing spacers. Casing spacers shall be bolt on style split shells made of T-304 stainless steel. 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.

15.5.4 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.

15.5.5 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.

15.6 CONSTRUCTION REQUIREMENTS – HORIZONTAL DIRECTIONAL DRILLING

15.6.1 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 COUNTY.

15.6.2 DEWATERING

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

15.6.3 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.

SECTION 16

PRESSURE PIPE RESTRAINT

16.1 GENERAL

Pressure pipe fittings and other items requiring restraint shall be held in place using restraining assemblies as specified in this section.

For PVC pipe, all restraining to prevent movement of lines and fitting under pressure at bends, tees, caps, valves, hydrants etc., shall be by using restraining glands or rings as specified in Section 16.2.

For DIP pipe all restraining to prevent movement of lines and fittings under pressure at bends, tees, caps, valves, hydrants, etc., shall be by using restraining glands, rings or gaskets, as approved.

Concrete thrust blocks shall only be used when specifically allowed by the COUNTY. Their use shall be discouraged, if possible.

16.2 RESTRAINED JOINT CONSTRUCTION

Sections of piping requiring restrained joints shall be constructed using pipe and fittings with restrained joints specifically for the application. Joints shall be capable of holding against withdrawal for line pressures 50 percent above the normal working pressure, but no less than 150 psi.

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

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

The required lengths of restrained joint ductile iron pipe shall be determined by the ENGINEER and shown in a tabular form as depicted on the "Restrained Pipe Table" in the STANDARD DRAWINGS. All calculation shall be based on the method outlined in publications recognized by A.W.W.A.

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.

16.3 MECHANICAL RESTRAINING DEVICES

16.3.1 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.

16.3.2

RESTRAINING GASKETS

Restraining gaskets shall be allowed only if accepted by the COUNTY. Restrained gaskets shall be furnished by the pipe manufacturer. Restraining gaskets shall not be used on pipes tested above 100 psi.

SECTION 17

PRESSURE CONNECTION

17.1 GENERAL

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

17.2 TAPPING SLEEVES

17.2.1 TAPPING VALVES

Tapping valves shall meet the requirements of Section 23.2 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.

17.3 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 COUNTY. The CONTRACTOR shall submit a written request to the COUNTY a minimum of three (3) 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 COUNTY shall review the submittal within two (2) working days after receiving it and inform the CONTRACTOR regarding approval or denial of his request. If his request is rejected by the COUNTY, the CONTRACTOR shall resubmit his request modifying it in a manner acceptable to the COUNTY.

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.

17.4 INSTALLATION

17.4.1 EXCAVATION, BACKFILL, COMPACTION AND GRADING

The applicable provisions of Section 14 shall apply.

17.4.2 CONSTRUCTION DETAILS

Sufficient length of main shall be exposed to allow for installation of the tapping sleeve and valve and the operation of the tapping machinery. The main shall be supported on concrete pedestals or bedding rock at sufficient intervals to properly carry its own weight, plus the weight of the tapping sleeve valve and machinery. Any

damage to the main due to improper or insufficient supports shall be repaired at the CONTRACTOR'S expense.

The inside of the tapping sleeve and valve, the outside of the main, and the tapping machine shall be cleaned and swabbed or sprayed with 10% liquid chlorine prior to beginning installation for water system pressure connections.

After the tapping sleeve has been mounted on the main, the tapping valve shall be bolted to the outlet flange, making a pressure tight connection. Prior to beginning the tapping operation, the sleeve and valve shall be pressure tested at 150 psi to ensure that no leakage will occur.

For pressure connections through 12" diameter or less the minimum diameter cut shall be 2" less than the nominal diameter of the pipe to be attached. For 14" through 20" installations the minimum diameter shall be 1-1/2" less; for larger taps the allowable minimum diameter shall be 2" to 3" less than the nominal diameter of the pipe being attached. After the tapping procedure is complete the CONTRACTOR shall submit the coupon to the COUNTY.

Crushed rock or 57 stone bedding shall be provided to prevent movement of the installation when test pressure is applied. Provisions of Section 16 shall apply.

DIVISION II

WATER DISTRIBUTION

SECTION 20

WATER MAINS

20.1 GENERAL

20.1.1 TYPE OF WATER MAINS

The COUNTY 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.

20.1.2 DESIGN PERIOD

Water mains should be designed for the estimated ultimate tributary population, as delineated in the approved Volusia County 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.

20.1.3 LOCATION

Water mains shall be located in dedicated rights-of-way or utility easements. When installed in rights-of-way, water mains shall, in general, maintain a consistent alignment with respect to the centerline of the road. All water mains located outside of dedicated rights-of-way shall require a minimum 15 foot easement. Additional easement widths shall be provided when the pipe size or depth of cover so dictate. If a water main is located adjacent to a road right-of-way, a minimum 10 foot easement shall be provided. 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, buildings, 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.

20.2 DESIGN BASIS

20.2.1 AVERAGE DAILY FLOW AND PEAK FLOWS

Average daily water flow shall be calculated in accordance with A.W.W.A. or F.D.E.P. approved sources. Maximum daily and peak hourly water flow rates shall be calculated by referencing peaking factors as identified in accepted A.W.W.A. or F.D.E.P. sources.

20.2.2 FIRE FLOW REQUIREMENTS

Fire flow requirements shall be determined in accordance with applicable Volusia County Fire Department and Land Development Codes. As a minimum, the requirements outlined in the Volusia County Subdivision Regulations shall be met. Where fire flow requirements exceed the anticipated available fire flow from the central water system, on-site fire protection system or other Fire Department approved mitigation measures shall be utilized.

20.2.3 DESIGN CALCULATIONS

DEVELOPER'S 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 20.3.1. Head losses through meters and backflow devices shall also be included in calculations.

20.3 DETAILS OF DESIGN AND CONSTRUCTION

20.3.1 PRESSURE

All water mains shall be designed in accordance with Section 20.2.3 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 minimum pressures may be required at commercial, industrial and high density residential areas. The normal working pressure in the distribution system should be approximately 60 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.

20.3.2 DIAMETER

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 (6) inch main, for fire flows.

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.

20.3.3 FIRE HYDRANT LOCATION AND SPACING

As a minimum, specifications outlined in the latest version of Volusia County Subdivision Regulations and applicable Volusia County Fire Department Codes shall apply. Hydrants shall be placed at 500 feet intervals, unless approved otherwise by the Utility Engineer and Fire Department.

20.3.4 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 COUNTY.

Where dead-end mains occur, they shall be provided with a fire hydrant or with an approved flushing hydrant or approved 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.

20.3.5 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.

20.3.6 SEPARATION OF WATER MAINS AND SEWERS

Refer to Section 22.3 of these SPECIFICATIONS for applicable requirements. No water pipe shall pass through or come in contact with any part of a sewer manhole.

In no case shall the separation of water lines and sewer lines, or any other potential hazard to the drinking water system not comply with Florida Department of Environmental Protection or Volusia County Health Unit regulations.

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. Proper separation shall be provided between water lines and septic systems.

20.3.7 SURFACE WATER CROSSINGS

The COUNTY shall be consulted before final PLANS are prepared. Requirements outlined in Sections 50.3.6 and 50.3.7 shall apply. All above ground pipe shall be painted as specified in Section 21.4.4 for water mains.

20.3.8 AIR RELIEF VALVES

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

20.3.9 CHAMBER DRAINAGE

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

20.3.10 DISINFECTION FOLLOWING REPAIR OR REPLACEMENT

Any part of the COUNTY 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 22.6 of these SPECIFICATIONS.

20.4 WATER SERVICES AND CONNECTIONS

Water services and connections shall conform to the applicable provisions of Section 21 and 22 and the STANDARD DRAWINGS. Only 1", 1-1/2", 2", 4", 6" and 8" services will be permitted. Where water services greater than 8" are required dual services shall be provided. Water services and connections to existing COUNTY systems up to 1 1/2" will be made by the COUNTY after payment of applicable fees and charges. Services and connections to new water systems and to existing systems, sizes 2" and larger shall be made by the CONTRACTOR.

20.5 WATER METERING

20.5.1 GENERAL

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

20.5.2 SINGLE FAMILY, DUPLEX, AND MULTI-FAMILY SUBDIVISIONS WITH PUBLIC RIGHTS OF WAY

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

20.5.3 SINGLE FAMILY AND DUPLEX SUBDIVISIONS WITH PRIVATE STREETS

Individual meters may be permitted in accordance with Section 20.5.2 if the private streets are designed to COUNTY 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 20.5.5.

20.5.4 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.

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

Installation and Easement 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 double detector check assembly as determined by the

COUNTY. Individual meters to each unit may be considered on a case-by-case basis subject to the DEVELOPER executing a Utility Service Agreement.

20.5.6 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.

20.5.7 METER INSTALLATION

All meters less than 2" will be installed by the COUNTY 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 by the DEVELOPER. In general, meters larger than two inch shall be located in a meter easement located adjacent to the public right of way.

20.5.8 METER SIZING

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

20.6 LOCATION AND IDENTIFICATION

A means for locating and identifying all water mains and valves shall be provided in accordance with Sections 21, 22, and the FIGURES AND DETAILS.

20.7 CROSS CONNECTION CONTROL

20.7.1 GENERAL

In order to protect the public water supply system from contamination due to cross-connections, the DEVELOPER shall install COUNTY 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 the cross connection control devices are listed below. However, the DEVELOPER'S ENGINEER must obtain COUNTY approval before finalizing the design of a Cross Connection Control Device.

20.7.2 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.

20.7.3 IRRIGATION SYSTEMS

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

20.7.4 LOCATION AND INSTALLATION

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

20.8 FIGURES & DETAILS

The designer shall refer to the COUNTY'S FIGURES AND DETAILS, which are attached. These DETAILS have been provided to illustrate the minimum requirements and typical installation of specified materials and equipment. The details are not intended to represent a solution to all situations but rather to provide guidance for the designer as to the minimum requirements of the COUNTY.

SECTION 21

PIPE MATERIAL FOR WATER MAINS AND SERVICE CONNECTIONS

21.1 GENERAL

These SPECIFICATIONS cover the pipe, fittings, and accessory items used for water distribution systems.

Pipe used in water distribution systems shall be either polyvinyl chloride (PVC), ductile iron pipe (DIP) or High Density Polyethylene (HDPE).

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 COUNTY, 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.

21.2 PIPE INSPECTION AND TESTING

Requirements specified in Section 41.5 shall apply.

21.3 PVC PIPE

21.3.1 PVC PIPE

C900 All PVC pipe of nominal diameter four (4) through twelve (12) inches shall be manufactured in accordance with AWWA standard C900, latest edition. PVC larger than 12" shall meet AWWA C905, latest edition. The PVC pipe shall have a minimum working pressure rating of 150 psi and shall have a dimension ratio (DR) of 18. Pipe shall be the same O.D. as ductile iron pipe. PVC pipe of nominal diameter four (4) inches may be AWWA Standard, DR 18 or PVC pipe with a Standard Dimension Ratio (SDR) of 21. PVC for water mains shall be blue in color.

21.3.2 JOINTS

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

21.3.3 FITTINGS

Fittings used with PVC pipe shall conform to Section 21.4.

21.4 DUCTILE IRON PIPE AND FITTINGS

21.4.1 DUCTILE IRON PIPE

All ductile iron pipe of nominal diameter four (4) through fifty four (54) inches shall conform to ANSI/AWWA A21.51/C151. A minimum of Class 50 pipe shall be supplied for all sizes of pipe unless specifically called out in the DRAWINGS, or required by the COUNTY.

21.4.2 FITTINGS

Any fittings required shall be mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A21.10/C110, 250 psi minimum pressure rating, or ductile iron compact fittings four (4) through twelve (12) inches in accordance with ANSI/AWWA A21.53/C153.

21.4.3 JOINTS

Joints for ductile iron pipe and fitting joints shall be push-on or mechanical joints conforming to ANSE/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 16.2 and 16.3.

21.4.4 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 'A'.) 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.

21.4.5 POLYETHYLENE ENCASEMENT

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

21.5 HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS

21.5.1 HDPE PIPE

HDPE pipe shall be manufactured in accordance with ASTM F714 (SDR17.0/PR-100) and ASTM D3035, latest edition. The pipe shall have a minimum working pressure rating of 150 psi and shall have a dimension ratio (DR) of 17. Pipe shall be the same O.D. as ductile iron pipe. HDPE for water mains shall have blue stripes.

21.5.2 JOINTS

HDPE pipe joints shall be heat fused, between plain ends of pipe or fittings. Personnel performing the heat fusion shall be trained and certified.

21.5.3 FITTINGS

Fittings used with HDPE pipe shall be made by the pipe manufacturer and be of the same material as the pipe. Fittings shall be heat fused to pipe as recommended by the pipe manufacturer.

21.6 SERVICE PIPE, STOPS, FITTINGS, AND SERVICE SADDLES

21.6.1 SERVICE PIPE

All service lines shall be 1" or 2" high density polyethylene tubing conforming to specifications in AWWA C800 and AWWA C901. Tubing to be blue in color.

21.6.2 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.

21.6.3 FITTINGS

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

21.6.4 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. The COUNTY requires a stainless steel strap and fusion epoxy or nylon coated ductile iron body with stainless steel hardware in areas designated as corrosive.

21.6.5 SERVICE SLEEVES

Services two (2) inches or smaller, under roads shall be installed in two or four inch PVC sleeves. Sleeve shall be schedule 40 PVC casings.

SECTION 22

PIPE INSTALLATION FOR WATER MAINS

22.1 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.

22.2 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 COUNTY 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 COUNTY, 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 relayed. 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 COUNTY to ensure absolute cleanliness inside the pipe.

22.3 SEPARATION OF WATER MAINS AND SEWERS

22.3.1 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 below.

22.3.2 HORIZONTAL SEPARATION

NORMAL CONDITIONS:

Water mains shall be located at least 10 feet horizontally from pipes carrying raw wastewater, and 5 feet horizontally from pipes carrying reclaimed water, whenever possible; the distance shall be measured from inside edge of pipe to inside edge of pipe. This section is subject to change as mandated by changes in the F.D.E.P. Regulations.

UNUSUAL CONDITIONS:

When local conditions prevent a horizontal separation of 10 feet, a water main may be laid closer to a pipe carrying raw wastewater provided that the bottom of the water

main is at least 18 inches above the top of the sewer pipe and the water main is laid in a separate trench or on an undisturbed earth shelf.

22.3.3 VERTICAL SEPARATION

NORMAL CONDITIONS:

Water mains shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer.

UNUSUAL CONDITIONS:

When construction conditions prevent a vertical separation of 18 inches as described herein above, the sewer pipe shall be constructed of ductile iron pipe with mechanical joints.

22.3.4 CROSSING OF WATER MAINS AND SEWERS

Water mains shall be above the sewer whenever they cross.

A vertical separation of at least 18 inches shall be maintained between the top of the sewer and the bottom of the water main.

Adequate structural support for both the water main and sewers shall be provided to prevent excessive deflection of joints and settling.

Sewers shall be constructed of PVC, or ductile iron pipe with mechanical joints. The length of PVC or ductile iron pipe shall be minimum 18 feet and centered at the point of crossing so that the joints will be equidistant and as far as possible from the water main.

22.4 TRENCH PREPARATION AND PIPE BEDDING

22.4.1 TRENCH PREPARATION AND PIPE BEDDING

Applicable provisions of Section 14 shall apply. Also refer to the FIGURES AND DETAILS.

22.4.2 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 job site. Care shall be taken to not drop or dump pipe into trenches under any circumstances.

22.4.3 TRENCH DEWATERING AND DRAINAGE CONTROL

SPECIFICATIONS from Section 14 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.

22.4.4 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.

22.4.5 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 COUNTY 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.

22.4.6 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.

22.4.7 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.

22.4.8 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.

22.4.9 PIPE RESTRAINING AND THRUST BLOCK

Requirements specified in Section 16 shall apply.

22.4.10 BEDDING AND BACKFILL FOR PIPES

Requirements specified in Section 14 shall apply.

22.5 HYDROSTATIC TESTS

22.5.1 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 COUNTY. 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 COUNTY 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 COUNTY concurs that the concrete has cured and reached adequate strength.

22.5.2 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 COUNTY may require a 6 hour pressure test. The basic provisions of AWWA C-600 shall be applicable.

22.5.3 PROCEDURE FOR PRESSURE TEST

Each section of pipe to be tested, as determined by the COUNTY, 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 and M23, where applicable, shall apply.

22.5.4 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:

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

Note: L = Allowable leakage in gallons per hour.
S = Length of pipe tested, in feet.
D = Nominal diameter of the pipe in inches.
P = Average test pressure during leakage test in pounds per square inch gauge.

Leakage is defined as the quantity of water to be supplied in the newly laid pipe or any valved section under test, which is necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. Should any test of pipe laid disclose leakage greater than that allowed, CONTRACTOR shall locate and replace or repair the defective joints, pipe or valve until the leakage from subsequent testing is within the specified allowance.

22.6 DISINFECTION OF WATER MAINS

22.6.1 GENERAL

Before being placed in service, all new water mains shall be chlorinated in accordance with the specifications below and the procedures outline in A.W.W.A. C-651 "Standard Procedure for Disinfecting Water Mains".

22.6.2 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 COUNTY.

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

22.6.4 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.

22.6.5 POINT OF APPLICATION

The preferred point of application of the chlorinating agent is at the beginning of the pipe line extension or any valved section of it, and through a corporation stop inserted in the pipe. The water injector for delivering the chlorine-bearing water into the pipe should be supplied from a tap made on the pressure side of the gate valve controlling the flow into the pipe line extension. Alternate points of applications may be used when approved or directed by the COUNTY.

22.6.6 OPERATION OF COUNTY VALVES

Valves shall be manipulated by the COUNTY personnel so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water.

22.6.7 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.

22.6.8 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.

22.6.9 FINAL FLUSHING AND TESTING

Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity until the replacement water throughout its lengths shows upon test, a free chlorine residual not in excess of that normally carried in the system.

After flushing, water samples collected on 2 successive days from the treated piping system, as directed by the COUNTY, shall show acceptable bacteriological results. All bacteriological testing shall be performed by the COUNTY. However, in order to expedite testing, the DEVELOPER may request testing by a private laboratory. All such 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 COUNTY personnel.

Copies of testing results and all related correspondence with the Florida Department of Environmental Regulations (F.D.E.P.) shall be submitted to the COUNTY.

22.6.10 REPETITION OF FLUSHING AND TESTING

Should the initial treatment result in an unsatisfactory bacterial test, the original chlorination procedure shall be repeated by the CONTRACTOR until satisfactory results are obtained.

22.7 NOTIFICATION AND CONNECTION TO EXISTING MAINS

Requirements specified in Section 17.3 shall apply.

22.8 WATER SERVICE PIPING CONNECTION

Water service piping and connection shall be installed as indicated in the FIGURES AND DETAILS. The location of all service lines shall be as shown on the DETAILS 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 COUNTY.

22.9 LOCATION AND IDENTIFICATION

All water mains shall be installed with a continuous, insulated 12 gauge copper wire with a blue jacket installed directly on top of the pipe for location purposes. See FIGURES AND DETAILS. In addition, all PVC water mains shall be a solid blue color. 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 piping shall have a warning tape installed 12" directly over the top of the pipe. Warning tape shall be blue with 2" white letters.

SECTION 23

VALVES, HYDRANTS AND ACCESSORIES FOR WATER MAINS

23.1 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.

23.2 RESILIENT SEAT GATE VALVES

23.2.1 GENERAL

All gate valves fourteen (14) 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 'A'.)

23.2.2 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.

23.2.3 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.

23.3 BUTTERFLY VALVES

23.3.1 GENERAL

All shut-off valves sixteen (16) inches and larger shall be Butterfly valves. Butterfly valves and operators shall conform to the A.W.W.A. 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 'A'.)

23.3.2 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 A.W.W.A. C504.

23.3.3 FACE TO FACE DIMENSION

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

23.3.4 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.

23.3.5 VALVE OPERATOR

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

23.4 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 A.W.W.A. 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 COUNTY 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 22 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 COUNTY.

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.

23.5 VALVE BOXES

All buried valves shall have cast-iron three piece valve boxes. Valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as directed by the COUNTY. The barrel shall be two piece, sliding type, having 5-1/4-inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall be complete with cast iron covers. Covers shall have "WATER" cast into the top for all water mains. The actuating nuts for deeper valves shall be extended to come up to 4 foot depth below finished grade.

Care shall be taken while constructing valve boxes to ensure that valve stems are vertical and the cast iron box has been placed over the stem with base bearing on compacted fill and top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. CONTRACTOR shall remove any sand or undesirable fill from valve box prior to final inspection.

23.6 AIR RELEASE VALVES

The air release valves for use in water mains shall be installed as shown on the FIGURES AND DETAILS. The valves shall have a polypropylene body, cover and baffle, stainless steel float and stainless steel trim. Valves shall be provided with a vacuum check to prevent air from reentering the line. The fittings shall be threaded.

23.7 FIRE HYDRANTS

23.7.1 MATERIAL

Fire hydrants shall have 5 1/4 inch valve opening and shall comply with A.W.W.A. 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 A.W.W.A. Standard (pentagonal, measuring 1-1/2-inch point to flat). Fire hydrants shall be equipped with "O-Ring" packing.

23.7.2 PAINTING

All iron parts of the hydrant both inside and outside shall be painted, in accordance with AWWA C-501. All inside surfaces and the outside surfaces below the ground line shall be coated with asphalt varnish. They shall be covered with two coats, the first having dried thoroughly before the second is applied.

The outside of the hydrant above the finished ground line shall be thoroughly cleaned and thereafter painted with two coats of paint of a durable composition. Paint shall be yellow as designated by Volusia County Fire Service.

23.7.3 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 deliver 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 FIGURES AND DETAILS.

23.7.4

LOCATION

Fire hydrants shall be located in the general location as shown on the DETAILS. Final field location of all hydrants shall be as approved by the COUNTY or local fire district. 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 COUNTY.

DIVISION III

RECLAIMED WATER DISTRIBUTION

SECTION 30

RECLAIMED WATER MAINS

30.1 GENERAL

30.1.1 TYPE OF RECLAIMED WATER MAINS

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

30.1.2 DESIGN

Reclaimed mains should be designed for the estimated ultimate build out of the project to include future phases when applicable. The designer shall demonstrate the capacity of the system to take back an equivalent volume of reclaimed water to the sewage generated by the project. Application rates should be determined by geotechnical investigations, and should not result in any adverse effects to the site or adjacent properties. Ponding of the reclaimed water as a result of high application rates will not be permitted.

The designer shall review the County of Volusia's Reclaimed Water Take Back Ordinance, and abide its requirements.

30.1.3 LOCATION

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

30.2 DESIGN BASIS

30.2.1 AVERAGE DAILY FLOW

The intent of the design of the Reclaimed Water Distribution System is to return to the sewage producer an equal volume of Reclaimed Water. Thereby placing the responsibility of the disposal of the treated waste on the generator.

Average daily water flow shall be based on the average daily reclaimed water disposal capacity of the project. Flow rates shall be determined by a geotechnical review of the project and surrounding area to determine the existing area.

30.2.2 DESIGN CALCULATIONS

DEVELOPER'S ENGINEER shall submit signed, sealed and dated design calculations with the PLANS for all reclaimed water distribution projects. Calculation shall show the mains will have sufficient hydraulic capacity to transport flows. Head losses through meters and services shall also be included in calculations.

30.3 DETAILS OF DESIGN AND CONSTRUCTION

30.3.1 PRESSURE

The system shall be designed to maintain a minimum pressure of 45 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. For pressures greater than 90 psi special provisions may be required.

30.3.2 DIAMETER

Only 4", 6", 8", 10", 12", 16", 18", 20", 24", 30", 36", 42", 48" and 54" diameter mains shall be permitted. Size shall be determined based on the results of the design calculations.

30.3.3 VALVES

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

Valves up to 2" to be stainless steel ball valves, above 2" to 12" shall be resilient wedge gate valves, and above 12" shall be either gate valves or butterfly valves. Corporation stops and curb stops shall be provided on all service lines.

30.3.4 SEPARATION OF RECLAIMED WATER MAINS, WATER MAINS AND SEWERS

Refer to Section 22.3 of these SPECIFICATIONS for applicable requirements. No reclaimed water pipe shall pass through or come in contact with any part of a sewer manhole.

In no case shall the separation of reclaimed water mains water mains and sewer lines, or any other potential hazard to the drinking water system not comply with Florida Department of Environmental Protection or Volusia County Health Unit regulations.

30.3.5 SURFACE WATER CROSSINGS

The COUNTY shall be consulted before final PLANS are prepared. Requirements outlined in Sections 50.3.6 and 50.3.7 shall apply. All above ground pipe shall be painted as specified in Section 21.4.4.

30.3.6 AIR RELIEF VALVES

At high points in reclaimed water mains where air can accumulate, provisions shall be made to remove the air by means of hydrants or automatic air relief valves. Automatic air relief valves shall not be used in situations where flooding of the device may occur. See FIGURES AND DETAILS.

30.3.7 CHAMBER DRAINAGE

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

30.4 RECLAIMED WATER SERVICES AND CONNECTIONS

Water services and connections shall conform to the applicable provisions of Section 21 and 22 and the FIGURES AND DETAILS. Only 1", 1-1/2", 2", 4", 6", 8" and 12" services will be permitted.

30.5 RECLAIMED WATER METERING

30.5.1 GENERAL

All reclaimed water service connections shall be metered.

30.5.2 METER INSTALLATION

All meters will be installed by the COUNTY 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.

30.5.3 METER SIZING

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

30.6 LOCATION AND IDENTIFICATION

A means for locating and identifying all reclaimed water mains and valves shall be provided in accordance with Sections 21, 22, and the FIGURES AND DETAILS.

30.7 CROSS CONNECTION CONTROL

30.7.1 GENERAL

In order to protect the public water supply system from contamination due to cross-connections, the DEVELOPER shall furnish COUNTY approved materials and equipment as designated in this section.

30.7.2 IRRIGATION SYSTEMS

All irrigation systems shall be permanently connect to the reclaimed water system and be an in ground system. Irrigation systems shall not spray onto roadways or public walkways or otherwise create a nuisance to motorists or pedestrians. Reclaimed water shall also not be allowed to be connected to any systems which are connected to a potable water source or could be connected to a potable water source without reconfiguring the system.

30.7.3 USE RESTRICTIONS

In general, the use of reclaimed water shall be limited to lawns, athletic fields and decorative plants. Reclaimed water shall not be used for bathing, drinking, or washing. Use of Reclaimed Water on eatable crops is limited and special precautions needs to be used in for that use. Any use of Reclaimed water on eatable crops shall only be allowed with strict compliance with Florida Department of Protection regulations.

30.7.4 RECLAIMED WATER SIGNAGE

The DEVELOPER must provide the required signage to notify the public of the use of "Reclaimed Water" for irrigation. Signage shall be per the latest F.D.E.P. regulations.

30.8 FIGURES & DETAILS

The designer shall refer to the COUNTY'S graphical STANDARDS AND DETAILS, which are attached. These DETAILS have been provided to illustrate the minimum requirements and typical installation of specified materials and equipment. The DETAILS are not intended to represent a solution to all situations but rather to provide guidance for the designer as to the minimum requirements of the COUNTY.

SECTION 31

PIPE MATERIAL FOR WATER MAINS AND SERVICE CONNECTIONS

31.1 GENERAL

These SPECIFICATIONS cover 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), ductile iron pipe (DIP) or High Density Polyethylene (HDPE).

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 COUNTY, 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.

31.2 PIPE INSPECTION AND TESTING

Requirements specified in Section 41.5 shall apply.

31.3 PVC PIPE

31.3.1 PVC PIPE

C900 All PVC pipe of nominal diameter four (4) through twelve (12) inches shall be manufactured in accordance with AWWA standard C900, latest edition. PVC larger than 12" shall meet AWWA C905, latest edition. The PVC pipe shall have a minimum working pressure rating of 150 psi and shall have a dimension ratio (DR) of 18. Pipe shall be the same O.D. as ductile iron pipe. PVC pipe of nominal diameter four (4) inches may be AWWA Standard, DR 18 or PVC pipe with a Standard Dimension Ratio (SDR) of 21. PVC for reclaimed water mains shall be purple in color.

31.3.2 JOINTS

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

31.3.3 FITTINGS

Fittings used with PVC pipe shall conform to Section 21.4.

31.4 DUCTILE IRON PIPE AND FITTINGS

31.4.1 DUCTILE IRON PIPE

All ductile iron pipe of nominal diameter four (4) through fifty four (54) inches shall conform to ANSI/AWWA A21.51/C151. A minimum of Class 50 pipe shall be supplied for all sizes of pipe unless specifically called out in the DRAWINGS, or required by the COUNTY.

31.4.2 FITTINGS

Any fittings required shall be mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A21.10/C110, 250 psi minimum pressure rating, or ductile iron compact fittings four (4) through twelve (12) inches in accordance with ANSI/AWWA A21.53/C153.

31.4.3 JOINTS

Joints for ductile iron pipe and fitting joints shall be push-on or mechanical joints conforming to ANSE/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 16.2 and 16.3.

31.4.4 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 'A'.) Final field coat shall be purple for reclaimed 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.

31.4.5 POLYETHYLENE ENCASEMENT

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

31.5 HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS

31.5.1 HDPE PIPE

HDPE pipe shall be manufactured in accordance with ASTM F714 (SDR17.0/PR-100) and ASTM D3035, latest edition. The pipe shall have a minimum working pressure rating of 150 psi and shall have a dimension ratio (DR) of 17. Pipe shall be the same O.D. as ductile iron pipe. HDPE for reclaimed water mains shall have purple stripes.

31.5.2 JOINTS

HDPE pipe joints shall be heat fused, between plain ends of pipe or fittings. Personnel performing the heat fusion shall be trained and certified.

31.5.3 FITTINGS

Fittings used with HDPE pipe shall be made by the pipe manufacturer and be of the same material as the pipe. Fittings shall be heat fused to pipe as recommended by the pipe manufacturer.

31.6 SERVICE PIPE, STOPS, FITTINGS, AND SERVICE SADDLES

31.6.1 SERVICE PIPE

All service lines shall be 1" or 2" high density polyethylene tubing conforming to specifications in AWWA C800 and AWWA C901. Tubing to be purple in color.

31.6.2 STOPS

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

31.6.3 FITTINGS

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

31.6.4 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. The COUNTY requires a stainless steel strap and fusion epoxy or nylon coated ductile iron body with stainless steel hardware in areas designated as corrosive.

31.6.5 SERVICE SLEEVES

Services two (2) inches or smaller, under roads shall be installed in two or four inch PVC sleeves. Sleeve shall be schedule 40 PVC casings.

SECTION 32

PIPE INSTALLATION FOR RECLAIMED WATER MAINS

32.1 GENERAL

Pipe shall be installed in accordance with the manufacturer's specifications and instructions for the type of pipe used and applicable A.W.W.A. standards, such as C600 and C603, unless otherwise stated in these SPECIFICATIONS.

32.2 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 COUNTY 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 COUNTY, 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 relayed. 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 COUNTY to ensure absolute cleanliness inside the pipe.

32.3 SEPARATION OF WATER MAINS AND SEWERS

32.3.1 GENERAL

Reclaimed water mains that are laid in the vicinity of pipe lines designated to carry raw wastewater or potable water shall meet the horizontal and vertical separations specified below.

32.3.2 HORIZONTAL SEPARATION

NORMAL CONDITIONS:

Water mains shall be located at least 10 feet horizontally from pipes carrying raw wastewater, and 5 feet horizontally from pipes carrying reclaimed water, whenever possible; the distance shall be measured from inside edge of pipe to inside edge of pipe. This section is subject to change as mandated by changes in the F.D.E.P. Regulations.

UNUSUAL CONDITIONS:

When local conditions prevent a horizontal separation of 10 feet, a water main may be laid closer to a pipe carrying raw wastewater provided that the bottom of the water main is at least 18 inches above the top of the sewer pipe and the water main is laid in a separate trench or on an undisturbed earth shelf.

32.3.3 VERTICAL SEPARATION

NORMAL CONDITIONS:

Water mains shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer.

UNUSUAL CONDITIONS:

When construction conditions prevent a vertical separation of 18 inches as described herein above, the reclaimed water pipe shall be constructed of ductile iron pipe with mechanical joints.

32.3.4 CROSSING OF WATER MAINS AND SEWERS

Water mains shall be above the reclaimed water and sewer whenever they cross.

A vertical separation of at least 18 inches shall be maintained between the top of the sewer and the bottom of the water main.

Adequate structural support for the water main, reclaimed water main and sewers shall be provided to prevent excessive deflection of joints and settling.

Sewers shall be constructed of PVC, or epoxy lined ductile iron pipe when approved. The length of PVC or ductile iron pipe shall be minimum 18 feet and centered at the point of crossing so that the joints will be equidistant and as far as possible from the water main.

32.4 TRENCH PREPARATION AND PIPE BEDDING

32.4.1 TRENCH PREPARATION AND PIPE BEDDING

Applicable provisions of Section 14 shall apply. Also refer to the FIGURES AND DETAILS.

32.4.2 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 job site. Care shall be taken to not drop or dump pipe into trenches under any circumstances.

32.4.3 TRENCH DEWATERING AND DRAINAGE CONTROL

SPECIFICATIONS from Section 14 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.

32.4.4 SURVEY LINE AND GRADE

Pipe shall be laid to the liens 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.

32.4.5 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 COUNTY 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.

32.4.6 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.

32.4.7 LAYING DUCTILE IRON PIPE

All ductile iron pipe shall be installed in accordance with A.W.W.A. 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.

32.4.8 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.

32.4.9 PIPE RESTRAINING AND THRUST BLOCK

Requirements specified in Section 16 shall apply.

32.4.10 BEDDING AND BACKFILL FOR PIPES

Requirements specified in Section 14 shall apply.

32.5 HYDROSTATIC TESTS

32.5.1 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 COUNTY. 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 COUNTY 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 COUNTY concurs that the concrete has cured and reached adequate strength.

32.5.2 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 COUNTY may require a 6 hour pressure test. The basic provisions of A.W.W.A. C-600 shall be applicable.

32.5.3 PROCEDURE FOR PRESSURE TEST

Each section of pipe to be tested, as determined by the COUNTY, 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 A.W.W.A. C600 and M23, where applicable, shall apply.

32.5.4 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 A.W.W.A. C600 shall apply.

Allowable leakage in gallons per hour for pipeline shall not be greater than that determined by the formula:

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

Note: L = Allowable leakage in gallons per hour.
S = Length of pipe tested, in feet.
D = Nominal diameter of the pipe in inches.
P = Average test pressure during leakage test in pounds per square inch gauge.

Leakage is defined as the quantity of water to be supplied in the newly laid pipe or any valved section under test, which is necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. Should any test of pipe laid disclose leakage greater than that allowed, CONTRACTOR shall locate and replace or repair the defective joints, pipe or valve until the leakage from subsequent testing is within the specified allowance.

32.6 DISINFECTION OF RECLAIMED WATER MAINS (WHEN REQUIRED ON PLANS)

32.6.1 GENERAL

Before being placed in service, new reclaimed water mains shall be chlorinated in accordance with the specifications below and the procedures outline in A.W.W.A. C-651 "Standard Procedure for Disinfecting Water Mains".

32.6.2 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 COUNTY.

32.6.3 DISINFECTION CRITERIA

Before being placed into service, new reclaimed water mains and repaired portions of, or extensions to existing mains shall be chlorinated so that the initial chlorine residual is not less than 50/l mg and that a chlorine residual of not less than 25 mg/l remains in the water after standing 24 hours in the pipe.

32.6.4 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.

32.6.5 POINT OF APPLICATION

The preferred point of application of the chlorinating agent is at the beginning of the pipe line extension or any valved section of it, and through a corporation stop inserted in the pipe. The water injector for delivering the chlorine-bearing water into the pipe should be supplied from a tap made on the pressure side of the gate valve controlling the flow into the pipe line extension. Alternate points of applications may be used when approved or directed by the COUNTY.

32.6.6 OPERATION OF COUNTY VALVES

Valves shall be manipulated by the COUNTY personnel so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water. No new reclaimed lines are to be connected directly to the potable water system for the purpose of flushing or testing. The use of a jumper connection shall be required.

32.6.7 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.

32.6.8 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.

32.6.9 FINAL FLUSHING AND TESTING

Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity until the replacement water throughout its lengths shows upon test, a free chlorine residual not in excess of that normally carried in the system.

After flushing, water samples collected on 2 successive days from the treated piping system, as directed by the COUNTY, shall show acceptable bacteriological results. All bacteriological testing shall be performed by the COUNTY. However, in order to expedite testing, the DEVELOPER may request testing by a private laboratory. All such 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 COUNTY personnel.

Copies of testing results and all related correspondence with the Florida Department of Environmental Regulations (F.D.E.P.) shall be submitted to the COUNTY.

32.6.10 REPETITION OF FLUSHING AND TESTING

Should the initial treatment result in an unsatisfactory bacterial test, the original chlorination procedure shall be repeated by the CONTRACTOR until satisfactory results are obtained.

32.7 NOTIFICATION AND CONNECTION TO EXISTING MAINS

Requirements specified in Section 17.3 shall apply.

32.8 RECLAIMED WATER SERVICE PIPING CONNECTION

Water service piping and connection shall be installed as indicated in the FIGURES AND DETAILS. The location of all service lines shall be as shown on the DETAILS 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 COUNTY.

32.9 LOCATION AND IDENTIFICATION

All metallic reclaimed water mains shall be installed with a continuous, insulated 14 gauge copper wire with a blue jacket installed directly on top of the pipe for location purposes. See FIGURES AND DETAILS. In addition, all PVC water mains shall be a solid purple color. 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 piping shall have a warning tape installed 12" directly over the top of the pipe. Warning tape shall be purple with 2" white letters.

SECTION 33

VALVES AND ACCESSORIES FOR RECLAIMED WATER MAINS

33.1 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.

33.2 RESILIENT SEAT GATE VALVES

33.2.1 GENERAL

All gates valves fourteen (14) inches and smaller shall be resilient seat gate valves. Such valves shall be resilient seated, manufactured to meet or exceed the requirements of A.W.W.A. 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.

33.2.2 MATERIAL

The valve body, bonnet, and bonnet cover shall be cast iron ASTM A126, Class B. All ferrous surfaces 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 A.W.W.A. C509.

33.2.3 MISCELLANEOUS REQUIREMENTS

The valves shall be non-rising stems with the stem made of cast, forged, or rolled bronze as specified in A.W.W.A. 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.

33.3 BUTTERFLY VALVES

33.3.1 GENERAL

All shut-off valves sixteen (16) inches and larger 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 'A'.)

33.3.2 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 seat 30 inches and larger shall be field adjustable and replaceable without dismounting 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 inch and smaller shall have bonded or mechanically restrained seats as outlined in A.W.W.A. C504.

33.3.3 FACE-TO-FACE DIMENSION

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

33.3.4 VALVE SHAFT

The valve shaft shall be turned, ground, and polished constructed of 18-8 stainless steel and designed for both torsion 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.

33.3.5 VALVE OPERATOR

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

33.4 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 A.W.W.A. 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 COUNTY 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 would 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 roadbed 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 COUNTY.

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.

33.5 VALVE BOXES

All buried valves shall have cast-iron three-piece valve boxes. Valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as directed by the COUNTY. The barrel shall be two piece sliding type, having 5-1/4-inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall be complete with cast iron covers. Covers shall have "RECLAIMED WATER" cast into the top for all water mains. The actuating nuts for deeper valves shall be extended to come up to 4-foot depth below finished grade.

Care shall be taken while constructing valve boxes to ensure that valve stems are vertical and the cast iron box has been placed over the stem with base bearing on compacted fill and top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. CONTRACTOR shall remove any sand or undesirable fill from valve box prior to final inspection.

33.6 AIR RELEASE VALVES

The air release valves for use in reclaimed water mains shall be installed as shown on the FIGURES AND DETAILS. The valves shall have a polypropylene body, cover and baffle, stainless steel float and stainless steel trim. Valves shall be provided with a vacuum check to prevent air from reentering the line. The fittings shall be threaded.

DIVISION IV

GRAVITY SEWERS

SECTION 40

GRAVITY SEWERS

40.1 GENERAL

40.1.1 TYPE OF SEWERS

The COUNTY will approve PLANS for new sewer systems and extensions only when designed as separate systems in which precipitation, runoff and groundwater are excluded. No combined sewers shall be permitted.

40.1.2 DESIGN PERIOD

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

40.1.3 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 15 foot easement. Additional easement widths shall be provided when the pipe size or depth of cover so dictate. If a gravity sewer is located adjacent to a road right-of-way, a minimum 10 foot easement shall be provided. Additional easement widths shall be provided if the pipe size or depth of cover so dictated. No gravity sewers shall be placed under retention ponds, buildings, or other structures. In general, gravity sewers shall not be located along side or rear lot lines without appropriate easements. 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.

40.2 DESIGN BASIS

40.2.1 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 in accordance with A.W.W.A. or F.D.E.P. approved sources.

40.2.2 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.

40.2.3 DESIGN CALCULATIONS

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

40.3 DETAILS OF DESIGN AND CONSTRUCTION

40.3.1 MINIMUM SIZE

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

40.3.2 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 approved by the COUNTY for a short length of pipe where structural considerations are incorporated in the design. The depth shall be sufficient to serve proposed lots, utilizing minimum slopes for service laterals.

40.3.3 MAXIMUM DEPTH

Gravity sewers shall not exceed 12 feet in depth, as measured from the top of pipe to finish grade. Deeper sewers shall only be allowed if approved by the COUNTY.

40.3.4 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 0.013 for PVC and 0.014 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	0.30
12 inch	0.25
15 inch	0.20
18 inch	0.15
21 inch	0.12
24 inch	0.10
27 inch	0.08
30 inch	0.07
36 inch	0.06

Where design velocities greater than 10 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.

40.3.5 SIZE AND ALIGNMENTS

The size of the gravity sewer system shall design to deliver the build out flows. Minimum of 8" for main lines.

Size conversion between manholes shall not be allowed. All sewers shall be laid with straight alignments between manholes.

40.3.6 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 COUNTY 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 20 feet.
2. Sewer extension location at the initiating manhole shall be plugged to the satisfaction of the COUNTY.
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.

40.4 MANHOLES

40.4.1 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 COUNTY sewer system by a manhole located at the right-of-way line.

40.4.2 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.

40.4.3 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 inches in diameter, a 72 inch inside diameter manhole shall be provided.

Manhole frames and covers shall be U.S. Foundry, Model 170-S with "Volusia County Sanitary Sewer" cast in cover.

40.4.4 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.

The flow channel shall be field finished.

40.4.5 MATERIALS

Manholes shall be constructed of pre-cast units as specified in Section 43. Brick manholes shall not be permitted. Cast-in-place manholes may be accepted on a case by case basis for conflict resolution.

Manholes shall be coated with two (2) coats of coal tar epoxy inside and out. Each coat shall be a minimum of 8 mils-DFT. Manholes to receive flow from a force main shall be lined with a HDPE lining. The lining shall be cast into the manhole concrete liner must be approved by COUNTY.

40.4.6 CASTINGS

Cast iron frames and covers shall be as specified in Section 43.3. Bolt down and/or gasketed covers shall be provided where manholes are located in areas subject to ponding or flooding.

40.4.7 ACCESS

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

40.5 SERVICE CONNECTIONS

40.5.1 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.

40.5.2 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.

40.5.3 SLOPE

Service laterals shall have a minimum slope of 1%.

40.5.4 CONNECTION

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

40.6 GREASE TRAPS

40.6.1 GENERAL

All Food Preparation/Service Establishments shall have outside grease traps sized as discussed herein. All wastewater flow from the kitchen areas of these establishments must flow through approved grease traps prior to entering the COUNTY system. Please refer to Volusia County's Industrial Waste/Pre-treatment Regulations. In addition all food preparation/service establishments must comply with Department of Health and Florida Department of Environmental Protection Regulations.

40.6.2 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.

40.6.3 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.

40.6.4 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.

40.6.5 CONVENTION CENTER/MANUFACTURING CAFETERIAS

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

40.6.6 MISCELLANEOUS FOOD PREPARATION / SERVICE ESTABLISHMENTS

DEVELOPER'S ENGINEER shall consult with the COUNTY before finalizing the design.

40.7 MATERIALS, INSTALLATION AND TESTING

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

40.8 GRAPHICAL STANDARDS & DETAILS

The Designer shall refer to the COUNTY'S graphical STANDARDS AND DETAILS, which are attached as Appendix E. These DETAILS have been provided to illustrate the minimum requirements and typical installation of specified materials and equipment. The DETAILS are not intended to represent a solution to all situations but rather to provide guidance for the designer as to the minimum requirements of the COUNTY.

SECTION 41

PIPE MATERIAL FOR GRAVITY SEWERS

41.1 GENERAL

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

The CONTRACTOR shall be responsible for all materials furnished and storage of same, until the date of substantial completion. He shall replace at his expense all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by the COUNTY, 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.

41.2 PIPE MATERIALS

41.2.1 PVC GRAVITY SEWER PIPE

PVC Gravity Sewer Pipe (4"-15"), ASTM D3034, SDR 35. Uniform minimum "pipe stiffness" at five (5) percent deflection shall be 46 psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D3212 and ASTM F477. Applicable UNI-Bell Plastic Pipe Association standard is UNI-B-4. SDR 35 shall be used for all sewer pipe with more than 12' of cover.

PVC Gravity Sewer Pipe (18" - 27"), ASTM F679, SDR 26. Uniform Minimum "pipe stiffness" at five (5) percent deflection shall be 46 psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D3212 and ASTM F477. Applicable UNI-Bell Plastic Pipe Association standard is UNI-B-7.

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

41.2.2 DIP GRAVITY SEWER PIPE

Ductile iron pipe shall conform to ANSI/AWWA A21.51/C151, class thickness designed per ANSI/AWWA A21.50/C150, with mechanical or push on joints. An interior protective lining of protecto 401" ceramic epoxy shall be provided with a minimum dry thickness of 30 mils. Ductile iron gravity sewers, where called for by the COUNTY, shall be wrapped with polyethylene film, AWWA C105. (See Approved Manufacturer's list in Appendix 'A'.) The minimum standard length of pipe shall be eighteen (18) feet.

41.2.3 PIPE MARKINGS

All pipe shall have a homing mark on the spigot provided by the manufacturer. On field cut pipe, CONTRACTOR shall provide homing mark on the spigot in accordance with manufacturer's recommendations. Reinforced concrete pipe shall have markings indicating the minor axis of the elliptical reinforcement.

41.3 JOINT MATERIALS

41.3.1 PVC PIPE

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

41.3.2 DUCTILE IRON PIPE

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

41.3.3 JOINTS FOR DISSIMILAR PIPE

Joints between pipes of different materials shall be made with a flexible mechanical compression coupling with No. 304 stainless steel bands. (See Approved Manufacturer's list in Appendix 'A'.)

41.4 FITTINGS

Unless otherwise specified, wye branches shall be provided in the gravity sewer main for service lateral connections. Wyes shall be six (6) inches inside diameter, unless otherwise approved by the COUNTY. 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 COUNTY. The plug shall be secured to withstand test pressures specified in Section 45 of these SPECIFICATIONS.

41.5 INSPECTION AND TESTING

41.5.1 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.

41.5.2 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 COUNTY, a sample of pipe to be tested shall be selected at random by the COUNTY or the testing laboratory hired by the COUNTY.

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 COUNTY shall be removed from the site of the work by the CONTRACTOR and replaced with pipe which meets these SPECIFICATIONS.

SECTION 42

GRAVITY SEWER PIPE LAYING, JOINTING, AND MISCELLANEOUS CONSTRUCTION DETAILS

42.1 SURVEY LINE AND GRADE

The CONTRACTOR shall set Temporary Bench Marks (T.B.M.'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 COUNTY notified, and the cause remedied before proceeding with the WORK.

42.2 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.

42.3 SEWER PIPE LAYING

Laying of sewer pipe shall be accomplished to line and grade in the trench only after it has been dewatered and the trench has been prepared in accordance with specifications outlined in Division III. Refer to Section 42.4 for additional bedding requirements. Mud, silt, gravel and other foreign material shall be kept out of the pipe and off the jointing surface. All pipe laid shall be retained in position so as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. All pipe shall be laid to conform to the line and grade shown on the PLANS.

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

The sewer pipe, unless otherwise approved by the COUNTY, 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.

Depth of sanitary sewer shall not exceed 12' without approval from the COUNTY.

All PVC pipe shall be installed in accordance with the pipe manufacturer's written recommendations as approved by the COUNTY. Laying of Ductile Iron Pipe shall conform to the SPECIFICATIONS outlined in Section 22.4.7.

42.4 TRENCH PREPARATION AND PIPE BEDDING

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

Applicable provisions of Section 14 shall apply. Also refer to STANDARD DRAWINGS.

42.4.2 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 COUNTY, 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.

42.4.3 DEPTH OF BEDDING MATERIAL

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

42.5 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 22.3.

42.6 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.

42.7 PIPE JOINTING

All pipe shall be installed to the homing mark on the spigot. The COUNTY 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 41.3. All pipe and jointing for gravity sewers shall be subject to the tests specified in Section 45.

42.8 PIPE IDENTIFICATION

All gravity pipe shall be green in color and have identification type placed 12" above top of pipe. Identification tape shall be a minimum of 3" wide, green in color and the words "Sanitary Sewer" printed continuously along the tape.

42.9 TELEVISION LINES

All gravity piping shall be flushed clean and checked for line and grade. If warranted as determined by the COUNTY televising of the gravity piping may be required. Items which would warrant televising would include; standing water, misalignment or infiltration.

SECTION 43

MANHOLES

43.1 GENERAL

Manholes shall be leak-tight and constructed of pre-cast concrete units.

43.2 PRE-CAST CONCRETE SECTIONS

43.2.1 GENERAL

Pre-cast manholes shall conform to specifications for Pre-cast Reinforced Concrete Manhole Sections, ASTM Designation C478, except as otherwise specified below.

43.2.2 MISCELLANEOUS REQUIREMENTS

The minimum wall thickness shall be 8 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 F.D.O.T. Article 942-2. (See Approved Manufacturers' list in Appendix 'A'.)

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.

Pre-cast concrete top slabs shall be used where cover over the top of the pipe is less than 4 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 epoxy coal tar coating with a minimum dry mil thickness of 20 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.

Manholes receiving flow from sewage force mains shall be lined with an HDPE liner. Liner shall be "Agra Grip" or approved equal HDPE type liner. Wet wells shall also be required to be lined with HDPE. Coatings for wet wells shall be a minimum of 9 mils of coal tar epoxy.

43.2.3 INSPECTION

The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the COUNTY. Such inspection may be made at the place of manufacturer, 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 manufacturer. 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.

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.

43.3 CASTINGS

Gray iron castings for manhole frames, covers, adjustment rings and other items shall conform to the ASTM Designation A 48, Class 30 castings shall be U. S. Foundry Model 170-E with "Volusia County" cast into covers. 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. 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 (ie: flood prone areas).

43.4 CONSTRUCTION DETAILS

43.4.1 BEDDING

Base sections shall be placed on bedding rock or crushed stone conforming to the requirements in Section 14.8.2. 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 14.9.2 for density requirements. Refer to the STANDARD DRAWINGS for additional bedding details.

43.4.2 CAST IN PLACE BASES

Cast in place bases shall be utilized only when specifically approved by the COUNTY. 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. Reinforcement and connection to the riser sections shall be designed by the DEVELOPER'S ENGINEER and submitted to the COUNTY for approval.

43.4.3 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.

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.

43.4.4 EXCAVATION AND BACKFILLING

Requirements of Section 14 shall apply.

43.4.5 PLACING CASTINGS

Casting shall be fully bedded in mortar with adjustment brick courses placed between the frame and manhole. Bricks shall be a minimum two (2) and maximum four (4) courses. Mortar shall conform to ASTM C-270, type M, and the bricks shall be clay and conform to ASTM C-216, grade SW, size 3 2" (w) x 8" (L) x 2 1/4" (h).

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.

43.4.6 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. 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.

43.4.7 PIPE CONNECTIONS

Special care shall be taken to see that the openings through which pipes enter the structure are provided with watertight connections. For ductile iron and PVC pipe, connections shall conform with ASTM C 923, "Standard Specifications for Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes." For concrete pipe connection shall be made with non shrink nonmetallic grout.

43.4.8 DROP MANHOLE CONNECTIONS

Drop manhole connections shall conform in all respects to details shown on the FIGURES AND DETAILS.

43.5 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.

43.6 INSPECTION FOR ACCEPTANCE

No visible leakage in the manhole or at pipe connections will be permitted. All manholes shall be inspected by the COUNTY prior to acceptance. All manholes failing to meet the specification set forth in Section 43 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 44
SERVICE LATERALS

44.1 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 COUNTY.

The general requirements for construction of gravity sewers in Sections 41 and 42 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.

44.2 MATERIALS

PIPE, FITTINGS & JOINTS

Pipe, fittings & joints shall be PVC pipe and shall conform to the requirement for gravity sewer construction in Section 41 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 either a machine-made tap and suitable saddle, or a cast-in-place manhole as referenced in Section 40.4.5.

44.3 CONSTRUCTION DETAILS

44.3.1 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.

44.3.2 EXCAVATION AND BACKFILL

Excavation and backfilling for service sewers shall conform to the requirements of Section 14 and 42, excepting that no backfill in excess of that required to hold the pipe in true alignment shall be placed prior to inspection.

44.3.3 PIPE LAYING AND JOINTING

Pipe laying and jointing, except as hereinafter provided, shall in general conform to the requirements of Section 42. During the pipe laying and jointing, the service lateral shall be kept free of any water, dirt or objectionable matter.

44.3.4 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.

44.4 TERMINATION OF SERVICE LATERALS

Service laterals shall terminate at the right-of-way line in accordance with the FIGURES AND DETAILS. Clean outs shall be required at the property/Right-of-Way lines to facilitate the service from the property line to the main gravity line. Water-tight factory made plug(s) shall be installed at the end of each service lateral.

44.5 INSPECTION

Service sewers shall meet the inspection requirements specified in Section 41.5.

44.6 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.

44.7 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 COUNTY.

SECTION 45

TESTING AND INSPECTION FOR ACCEPTANCE OF GRAVITY SEWERS

45.1 GENERAL

All gravity sewers shall be tested for alignment, deflection and integrity prior to acceptance. In addition, a leakage test may be required for gravity sewers, solely at the discretion of the COUNTY. The leakage testing shall be performed by the CONTRACTOR who shall be responsible for furnishing all necessary labor and equipment to conduct such testing. Alignment, deflection and integrity testing shall be performed by the CONTRACTOR. Televised inspection may be required to determine the acceptability of a section of gravity sewer. Cost for flushing and televising shall be the responsibility of the OWNER/CONTRACTOR.

45.2 TESTING FOR LEAKAGE

45.2.1 TYPE OF TEST – INFILTRATION AND EXFILTRATION

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

45.2.2 SELECTION OF TEST SECTIONS

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

45.2.3 PREPARATION AND COORDINATION FOR TESTING

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

The results of all leakage tests shall be presented by the CONTRACTOR to the COUNTY in neat, legible writing. These written results shall be formatted and adequately labeled so that they are easily understandable.

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

45.2.4 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.

45.3 INSPECTION FOR ALIGNMENT, DEFLECTION AND INTEGRITY

Internal video inspection for the gravity sewer shall be performed by the CONTRACTOR to check for alignment and deflection. Televised inspection may also be required to check for cracked, broken or otherwise defective pipe, and overall pipe integrity.

Prior to video inspection, the CONTRACTOR shall flush all sewers with water sufficient in volume to obtain free flow through each line. Flushing water and debris shall not enter any pump station wet well. 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 video internal inspection will be performed in two stages. The first 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 video inspection shall be performed once the trench has been compacted up to the road base. The second inspection of the gravity sewer pipe will be before the end of the one year warranty period.

If the first or second video inspection reveals cracked, broken, or defective pipe, or pipe misalignment resulting in vertical sags in excess of 1-1/2" and in the case of PVC pipe a ring deflection in excess of 5%, the CONTRACTOR shall be required to repair or replace the pipeline. The COUNTY reserves the right to require the CONTRACTOR to pass a mandrel through the PVC pipe to confirm ring deflection.

Successful passage of both the leakage test and lamping shall be required by the COUNTY. Video inspection if required shall be performed to resolve any questionable sections of the gravity sewer prior to acceptance by the COUNTY.

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

DIVISION V

WASTEWATER FORCE MAINS

SECTION 50

WASTEWATER FORCE MAINS

50.1 GENERAL

50.1.1 DESIGN PERIOD

Force main systems shall be designed for the estimated ultimate tributary population, and shall take into consideration the approved Volusia County Wastewater Master Plan (latest edition) where delineated.

50.1.2 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 15 foot easement. Additional easement widths shall be provided when the pipe size or depth of cover so dictate. If a force main is located adjacent to a road right-of-way, a minimum 10 foot easement shall be provided. Additional easement widths shall be provided if the pipe size or depth of cover so dictate. Force mains shall not be placed under retention ponds, buildings, or under structures or in paved parking lots. 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.

50.2 DESIGN BASIS

50.2.1 AVERAGE DAILY FLOW

Provisions of Section 40.2.1 shall apply.

50.2.2 PEAK DESIGN FLOW

Provisions of Section 60.2.1 shall apply.

50.2.3 DESIGN CALCULATIONS

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

50.3 DETAILS OF DESIGN AND CONSTRUCTION

50.3.1 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 the piping manufacturers recommended velocities, but in no case exceed 8 feet per second. The minimum force main diameter shall be 4 inches.

50.3.2 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.

50.3.3 DESIGN PRESSURE AND RESTRAINT

Restrained joints shall be used to provide thrust restraint at all fittings. A restrained joint table shall be provided on the plans and prepared by an Engineer familiar with the soil conditions and maximum working pressures. In no case shall the design of restrained joints be based on less than 100psi working pressure.

50.3.4 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 6 inches above the flow line of the receiving manhole. Receiving manholes shall be lined as approved by the COUNTY.

50.3.5 AIR RELEASE AND VACUUM RELIEF VALVES

Air release valves, or air/vacuum relief valves, shall be provided, as necessary, to prevent air locking and vacuum formation. All such valves shall be clearly delineated on the force main profile in the DRAWINGS. The DEVELOPER'S ENGINEER shall submit calculations to the COUNTY justifying the valve sizing. See additional requirements in Section 51.6.

50.3.6 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 evaluation.

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 51.4.4 for above ground wastewater force mains. Use of epoxy coated steel pipe may be allowed on a case by case basis.

VALVES

Underground valves shall be provided at both ends of the crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding. An air release/vacuum relief valve shall be installed at the high point of the crossing. A vent line from the air release valve on force mains may be required to vent below grade into a valve box.

GUARDS

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

PERMITS AND REQUIREMENTS OF OTHER AGENCIES

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

50.3.7

UNDERWATER CROSSINGS

PIPE MATERIAL AND COVER

Under water crossings may be performed using DIP, PVC or HDPE. Each crossing shall be designed for that specific application. For direct burial installations, a minimum cover of three feet plus a 6" concrete slab shall be provided over the pipe. The pipe material shall meet appropriate A.W.W.A. Standards for use in submerged conditions. Directional horizontal drilling may also be used provided sufficient area and depth may be obtained.

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.

PERMITS

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

50.3.8 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 1000 feet. Additional valves shall be provided where force mains intersect to facilitate isolation of pipe segments.

50.4 LOCATION AND IDENTIFICATION

A means for locating and identifying all force mains and valves shall be provided in accordance with the provisions in Section 51 and the FIGURES AND DETAILS.

50.5 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 COUNTY prior to finalization of the design.

50.6 DETAILS

The designer shall refer to the COUNTY'S DETAILS, which are attached as FIGURES. These DETAILS have been provided to illustrate the minimum requirements and typical installation of specified materials and equipment. The DETAILS are not intended to represent a solution to all situations but rather to provide guidance for the designer as to the minimum requirements of the COUNTY.

SECTION 51

WASTEWATER FORCE MAINS

51.1 GENERAL

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

Pipe used in wastewater force main systems shall be either Polyvinyl Chloride (PVC), or Ductile Iron Pipe (DIP).

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 COUNTY, 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.

51.2 PIPE INSPECTION AND TEST

Requirements specified in Section 41.5 shall apply.

51.3 PVC PIPE

51.3.1 PVC PIPE

All PVC pipe of nominal diameter six (6) through twelve (12) inches shall be manufactured in accordance with A.W.W.A. standard C900. The PVC pipe shall have a minimum working pressure rating of 100 psi and shall have a dimension ratio (DR) of 25. Pipe shall be the same O.D. as ductile iron pipe. PVC pipe of nominal diameter four (4) inches may be AWWA Standard C900, DR 25 or PVC pipe with a Standard Dimension Ratio (SDR) of 21.

51.3.2 JOINTS

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

51.3.3 FITTINGS

Fittings used with PVC pipe shall conform to Section 51.4.

51.4 DUCTILE IRON PIPE AND FITTINGS

51.4.1 DUCTILE IRON PIPE

All ductile iron pipe of nominal diameter four (4) through fifty four (54) inches shall conform to ANSI/AWWA A21.51/C151. A minimum of Class 50 pipe shall be supplied for all sizes of pipe unless a higher class pipe is specifically called out in the DRAWINGS, or required by the COUNTY.

51.4.2 FITTINGS

All fittings shall be mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A21.10/C110, 250 psi minimum pressure rating, or ductile iron compact fittings four (4) through twelve (12) inches in accordance with ANSI/AWWA A21.53/C153.

51.4.3 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 16.3 or 16.4

51.4.4 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 A'A'.) Final field coat color shall be grey for raw wastewater and brown for treated wastewater.

All ductile iron pipe and fittings shall have an interior protective lining of coal tar epoxy or polyethylene with a minimum dry thickness of 30 mils applied by the pipe manufacturer. Polyethylene lining material shall comply with ASTM D-1248 and shall be fused to the interior of the pipe by heat forming a tightly bonded lining. (See Approved Manufacturers' list in Appendix 'A'.)

51.4.5 POLYETHYLENE ENCASEMENT

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

51.5 PIPE HANDLING

Requirements specified in Section 22.2 shall apply.

51.6 AIR AND VACUUM RELEASE VALVES

51.6.1 GENERAL

Wastewater force mains shall be equipped with either air or air/vacuum release valves located 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 'A'.)

51.6.2 WASTEWATER AIR/VACUUM VALVE

The valve body shall be of cast iron ASTM A126-B; the floats, float guide and stem shall be of stainless steel Type 304. The resilient seat shall be of Buna N. The valve shall be suitable for 150 psig working pressure. Valve shall have standard two (2) inch NPT inlets and outlet ports unless otherwise shown on the DRAWINGS. Provisions shall be made for back flushing the valve with clean water.

51.6.3 WASTEWATER AIR RELEASE VALVE

The valve body and cover shall be cast iron construction, ASTM A126-B, and all internal working parts shall be of stainless steel Type 304. The venting orifice shall be three-eighths (3/8) inch in diameter and the seating material shall be of Viton.

The inlet opening shall be standard two (2) inch NPT screwed connection, unless otherwise shown on the DRAWINGS. The valve shall include a flush out feature for periodic cleaning of the internal mechanism. The overall height of the valve body shall not exceed twenty-one (21) inches, unless otherwise shown on the DRAWINGS.

51.7 NOTIFICATION AND CONNECTION TO EXISTING MAINS

Pressure connection to existing wastewater force mains shall comply with the requirements of Section 17.3.

51.8 PLUG VALVES

51.8.1 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 'A'.)

51.8.2 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., shall be zinc or cadmium plated. 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 A.W.W.A. 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 A.W.W.A. C507 and C504.

Valve shaft seals shall be adjustable and comply with A.W.W.A. C507.

51.8.3 VALVE TESTING

Plug valves shall be tested in accordance with A.W.W.A. C504. Each valve shall meet the performance, leakage, and hydrostatic tests described in A.W.W.A. 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 A.W.W.A. C504.

51.8.4 ACTUATORS

Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floor stands, 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.

51.9 VALVE BOXES

Requirements specified in Section 23.5 shall apply, except that covers shall have "sewer" cast into the top.

51.10 SEPARATION OF FORCE MAINS AND WATER MAINS

Requirements specified in Section 22.3 shall apply.

51.11 FORCE MAIN CONSTRUCTION

Requirements specified in Section 22.4 shall apply.

51.12 HYDROSTATIC TESTS

Requirements specified in Section 22.5 shall apply except that all pipe sections to be tested shall be subjected to a hydrostatic pressure of 100 psi.

51.13 FINAL CLEANING

Prior to final inspection and acceptance of the force main by the COUNTY, CONTRACTOR shall remove 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 COUNTY'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.

51.14 LOCATION AND IDENTIFICATION

All non-metallic force mains shall be installed with a continuous, insulated 14 gauge copper wire installed directly on top of the pipe for location purposes. See STANDARD DRAWINGS. In addition, all PVC force mains shall be either a solid green or white with green lettering. All lettering shall appear legibly on the pipe and shall run the entire length of the pipe. Lettering shall read as is acceptable for the intended use.

All ductile iron force 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 green in color. Backfill shall not be placed for 30 minutes following paint application.

DIVISION VI

WASTEWATER PUMP STATIONS

SECTION 60

WASTEWATER PUMP STATIONS

60.1 GENERAL

The DESIGN STANDARDS outlined in this section apply to wastewater pump stations discharging 1,500 gallons per minute or less. All such pump stations shall be submersible type stations. For designing pump stations discharging more than 1,500 gallons per minute, the type of pump station and the basis of design shall be reviewed with the COUNTY and approval obtained before proceeding with the design.

60.2 DESIGN BASIS

60.2.1 DESIGN FLOWS

Design flow shall be based upon the total ultimate development flow from all contributory areas to the pump station. The design average daily flow shall be computed as outlined in Section 40.2.1. 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>Min. Peaking Factor for Peak Design</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.

60.2.2 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.

60.2.3 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. A minimum 5 HP motor shall be required unless approved by the COUNTY. Head capacity curves shall be prepared and submitted to the COUNTY along with the pump station plans. Such curves shall be based upon the friction losses outlined in Section 50.3.2 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.

60.2.4 DESIGN CALCULATIONS

DEVELOPER'S 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.

60.3 DETAILS OF DESIGN AND CONSTRUCTION

60.3.1 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.

60.3.2 ACCESSIBILITY

The pumping station shall be readily accessible by maintenance vehicles during all weather conditions. The access road to the pumping station shall be stabilized as a minimum, and be passable during a 100 year flood. The facility shall not be located in road rights-of-way.

60.3.3 BUOYANCY

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

60.3.4 PUMP REQUIREMENTS

Submersible wastewater pump stations shall comply with the requirements spelled out in Section 62. Only approved pumps listed in Appendix A 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.

The use of grinder pumps may only be used with prior approval of the COUNTY, and only for privately owned and maintained systems. The use of above ground/wetwell mounted pumping units may be used only after approved by the COUNTY.

60.3.5 WET WELL REQUIREMENTS

Wet well shall be minimum 6-foot diameter and shall have a minimum 4.5 foot depth below the lowest invert. 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 for all flow rates.

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. New wetwells shall be lined using an HDPE liner installed as part of the concrete casting process. Liner material must be approved by the COUNTY.

The wet well floor (fillets) 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.

60.3.6 PUMP STATION WATER SYSTEM

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

60.3.7 ELECTRICAL EQUIPMENT, POWER SUPPLY AND POWER CORDS

Requirements in Sections 62 and 63 shall apply.

60.3.8 CONTROLS

Requirements in Section 63 shall apply.

60.3.9 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 and plat to the COUNTY. 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 access road shall also be dedicated to the COUNTY by Warranty deed or plat. An exception to this requirement may be allowed on a case by case basis in the form of an ingress/egress easement for the access road. The "Pump Station Site Plan," shows the minimum area required. The size of the lift station site may increase depending on the size and depth of the station and gravity sewer.

60.3.10 SITE FENCING/SCREENING

Fencing at the pump station site perimeter shall comply with the technical criteria established in Section 61.7. In general, all pump station sites shall be fenced or screened. 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 security and landscape screening.

60.4 EMERGENCY OPERATION

All pump stations shall be provided with emergency power receptacles as specified in Section 63.9. In addition, stand-by emergency diesel powered by-pass pumps shall be provided at all wastewater pumping stations which are at critical points in the sewer system or which have a peak design capacity of 1000 GPM or more. Determination of pump station critical points shall be at the discretion of the COUNTY. Such stand-by diesel powered by-pass pumping facilities shall comply with the requirements spelled out in Section 61.6. All such by-pass pumps shall be rated and designed to operate the pump station under design conditions.

60.5 GRAPHICAL STANDARDS & DETAILS

The designer shall refer to the COUNTY'S graphical FIGURES AND DETAILS, which are attached. These DETAILS have been provided to illustrate the minimum requirements and typical installation of specified materials and equipment. The details are not intended to represent a solution to all situations but rather to provide guidance for the designer as to the minimum requirements of the COUNTY.

60.6 LIFT STATION CONTROLS

The lift station shall be equipped with a control system designed by a supplier regularly engaged in that type of work, and has a minimum of five years experience. The pump controls shall be based on PLC logic utilizing a Data-Flo, "Tach Pack," which the COUNTY has standardized on. Wetwell level shall be maintained by a 5 float system. The floats shall be as follows:

1. Emergency Off (Alarm)
2. Low Level Pump #1 Off
3. Pump #1 On
4. Pump #2 On
5. Emergency High Level (Alarm)

The alarm conditions shall activate a light and horn mount on the side of the central panel. Alarm conditions shall also provide signals for an RTU to signal the central monitoring/S.C.A.D.A. system. For lift stations with average daily flows in excess of 100,000gpd, a RTU per VOLUSIA COUNTY STANDARDS shall be provided in the control panel.

SECTION 61

WASTEWATER PUMP STATIONS

61.1 GENERAL

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

61.2 WET WELL AND VALVE VAULT

Wet well and valve vault shall be constructed as shown on the FIGURES AND DETAILS and in conformance with the SPECIFICATIONS outlined in this Section.

61.3 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 gas tight cover aluminum hatch and 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 FIGURES AND DETAILS (See Approved Manufacturers' list in Appendix 'A').

61.4 PUMPS AND CONTROLS

Pumps and miscellaneous accessories shall be as specified in Section 62. Controls and miscellaneous accessories shall be as specified in Section 63.

61.5 PIPING, VALVES AND ACCESSORIES

61.5.1 PIPING

Influent piping to the wet well shall meet the requirements of Sections 41 and 51 except that the influent pipe to the wet well shall be a section of HDPE. All pipe inside the wet well and the valve vault shall be as shown on the FIGURES AND DETAILS.

61.5.2 PLUG VALVES

Plug valves shall meet the requirements of Section 51.8.

61.5.3 CHECK VALVES

Check valves shall be flex swing type and shall meet the material requirements of A.W.W.A. C500. The valves shall be iron body, fully epoxy coated with resilient disc, 150 psi working water pressure, non-shock, and hydrostatically tested ends shall be 125 pound ANSI B16.1 flanges. Check valves shall be equipped with back flush devices. Manufacturers shall be Apco, Valmatic or equal.

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.

Valves shall be so constructed that disc may easily be removed and replaced without removing the valve from the line.

61.5.4 PRESSURE GAUGES

Pressure gauges shall be installed on each discharge pipe as indicated on the FIGURES AND DETAILS. Each pressure gauge shall be direct mounted to an ISO-Ring and be fitted with a 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 ranges.

Pressure gauges shall not be installed until after the substantial completion date unless otherwise requested by the COUNTY. (See Approved Manufacturers' list in Appendix 'A').

61.6 STANDBY DIESEL POWERED BY-PASS PUMP

61.6.1 GENERAL

A standby diesel by-pass pump shall be installed at pump stations as required by Section 60.4 for back-up pumping during lift station failure or loss of power.

61.6.2 BY-PASS PUMP SET

61.6.2.1 GENERAL

The standby diesel powered by-pass pump shall consist of a 4 inch x 4 inch vacuum assisted, horizontal sewage pump driven by a water-cooled diesel engine. The pump shall be fully automatic, self-priming from dry conditions and capable of handling large volumes of air, water, and solids. The diesel operated by-pass pump shall provide continuous back-up pumping for a minimum duration of 48 hours.

A complete diesel engine driven by-pass pump shall be furnished and installed with fuel pump, fuel tank, battery, battery charger, muffler, radiator, control panel, weather proof enclosure, and all other accessories required for an operational 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.

61.6.2.2 REQUIREMENTS

The complete pump package shall be manufactured in a plant that is registered to ISO 9001:2008 and a copy of the Certificate shall be provided as a submittal.

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 equipment shall be manufactured in such a manner so as to conform to the latest applicable IEEE, ANSI, ISA, NEMA, and EEIA Standards

The pump shall be designated and manufactured in conformance with CPB / AEM standards.

The manufacturer of the diesel pump shall own and operate a local service facility within 25 miles of Volusia County. This facility must stock spare parts for the pump model specified, employ at field service technician(s) available for 24/7 service calls, and have a rental fleet comprised of similar pump models.

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.

61.6.2.3 TESTS

The complete pump set shall be factory tested according to ANSI/HI 1.61994 by a certified quality technician. The pump shall be sound tested according to ISO 3744, ANSI/HI9.4 and CPB Sound Level Measurement Standard.

A copy of the test report shall be provided prior to start up.

Final tests shall be conducted at the site, after installation has been completed, in the presence of the COUNTY'S representative. The diesel by-pass pump manufacturer shall furnish a service representative to operate the pump during the tests, to check all details of the installation and to instruct the COUNTY'S representatives in proper equipment operation.

Field tests shall include operating the diesel by-pass pump for eight (8) hours, carrying normal lift station loads. The CONTRACTOR shall refill the fuel tank at the completion of the tests.

61.6.2.4 OPERATION AND MAINTENANCE MANUALS

The manual shall include, but not be limited to, installation, operation, maintenance instructions, spare parts lists giving manufacturer's stock or part number for each replaceable item, approval submittals and drawings.

Provide two paper copies, plus one copy on CD, deliver a minimum of five days prior to final inspection.

One of the provided copies is to be placed inside a rainproof document box, furnished with the unit.

61.6.2.5 WARRANTY

The manufacturer of the pumping unit shall warrant for a period of one year from the date of shipment that the entire unit and all equipment therein shall be free from defects in design, material, and workmanship.

61.6.2.6 DIESEL ENGINE

The engine shall be an Interim Tier IV EPA compliant three cylinder,(4) cycle water-cooled diesel engine, or equal capable of producing 28 continuous duty horsepower at 2,200 rpm.

The engine shall drive the pump via an elastomeric torsion drive coupling.

The engine shall have an industrial type battery with 175-amp hour rating and minimum 990 cold-cranking amps, with 175 amp reserve, mounted in a lockable

frame.

Provide a 12-volt starter and alternator charging system.

Provide an industrial silencer muffler.

Governor shall be a mechanical control type. Engine speed shall be adjustable to operate the pump between maximum and minimum design operating speeds.

Engine shall have safety shutdown switches for low oil pressure and high coolant temperature.

Provide a control panel in an enclosure mounted on rubber isolators to reduce vibration.

The control panel shall contain the following instrumentation and controls:

- A. key switch
- B. tachometer
- C. hour meter
- D. oil pressure gauge
- E. temperature gauge

61.6.2.7

CENTRIFUGAL PUMP

The centrifugal pump shall be a horizontal end suction solids handling centrifugal pump model.

The pump casing shall be constructed of high grade, class-30 cast iron with a minimum pressure rating of 100 psi.

Pump casing shall contain a cleanout cover for removing debris from the impeller without disturbing the suction or discharge piping.

The pump casing shall be constructed so that the suction flow path is in axial alignment with the impeller eye. There shall be no turns, chambers, obstructions or straightening vanes between the suction line and the impeller.

The impeller shall be a high efficiency non-clog type, 2-vane, enclosed design with full front and rear shrouds, containing back pumpout vanes, constructed of high grade 65-45-12 ductile iron and capable of passing a 3" spherical solid. Open type impellers and impellers that contain balancing holes shall not be considered.

Pump seal shall be an inside-mounted, self-cleaning John Crane component style mechanical seal with tungsten carbide rotating and silicon carbide stationary faces with viton elastomers and stainless steel spring and hardware. Outside mounted seals and seals that use the same material for both the rotating and stationary seal faces which are prone to heat checking shall not be considered.

The seal chamber shall include a tapered bore design to remove solids and abrasive material away from the seal area and purge air and gas pockets. Straight bore designs that are prone to vapor buildup and clogging shall not be considered.

An oil reservoir shall be provided for automatically circulating lubricant to the seal faces permitting indefinite dry running.

Shaft shall be constructed of modified SAE1144 stress proof alloy steel, machined and polished to transmit full drive output. Shaft shall be tapered for maximum strength.

The bearing frame shall be constructed of class 30 cast iron.

Bearings shall be of sufficient size to withstand the radial and axial thrust loads incurred during service. Bearings shall have a minimum L-10 bearing life of 100,000 hours. Bearings shall be grease lubricated.

Centrifugal pump shall be capable of the following performance duty point: 800 USGPM @ 67 feet of TDH. TDH includes a maximum 20' static suction lift, and a minimum 79% efficiency at this performance duty point.

Centrifugal pump shall be capable of delivering 1,200 gallons per minute at 54 feet of total dynamic head at 2,200 rpm.

Centrifugal pump shall be capable of generating a closed discharge valve (shutoff) head of no less than 132 feet at 2,200 rpm.

Centrifugal pump shall be capable of handling up to 3 inch diameter non-compressible spherical solids.

The pump inlet shall be equipped with a 4" 125-lb ANSI flange connection. The pump outlet shall be equipped with a 4" 125-lb. ANSI flange connection.

The pump shall be furnished with a liquid-filled vacuum gauge for system diagnostics.

61.6.2.8

OIL-LESS VACUUM PRIMING SYSTEM

The priming system shall be fully automatic eliminating the need to pre-fill the pump casing with water to achieve initial prime.

The priming system shall work in combination with the centrifugal pump to remove large volumes of air.

An air separation chamber shall be provided to prevent any carryover of the pumping fluid into the vacuum pump. Units not meeting this requirement are not acceptable.

The air separation chamber shall contain a single float and ball valve assembly mounted on a steel plate that can be easily removed as a unit without size specific tools.

The air separation chamber shall not include any mesh-type screens that can clog with sanitary sewer debris causing the priming system to fail.

The vacuum pump shall be a rotary claw, air-cooled oil-less version and have a nominal rating of 97 cubic feet per minute. Vacuum priming systems incorporating diaphragms, compressors, or oil-cooled vacuum pumps will not be accepted.

The vacuum pump shall be driven by a v-belt that can be easily replaced in the field without having to remove the pump from the engine. A spare v-belt shall be

pre-installed around the shaft and ready for immediate placement in the event of a failure to the primary v-belt.

A flapper type discharge check valve shall be provided to prevent pulling air through the discharge during priming.

61.6.2.9 MOUNTING FRAME AND FUEL TANK

The complete diesel by-pass pump shall be mounted on a combination frame/double wall fuel tank constructed of tubular steel, approximate length 70 inches, approximate width 38 inches, with a minimum fuel capacity of 34 US gallons.

The frame shall incorporate an integral lifting bail capable of lifting the entire unit.

Fuel tank shall have two clean-out ports located at opposite ends of the tank.

Fuel tank shall have a removable basket strainer mounted in the fill port and a lockable cap.

Installation contractor will be required to provide all labor and materials to connect the frame to the concrete pad.

61.6.2.10 SOUND ENCLOSURE

The entire unit including the pump and engine shall be completely enclosed in a lockable enclosure. Units not meeting this requirement are not acceptable.

The enclosure shall reduce operating noise at or below 72 dBA measured at 7 meters @ full speed. Units not meeting this requirement are not acceptable.

The enclosure shall be constructed with a modular galvanized steel frame and reinforced galvaneel panels. Fiberglass or plastic enclosures are not acceptable.

The individual panels shall be constructed of a sandwich construction solid galvaneel outer shell, with 1.5" thick 8-lb density mineral wool fill encapsulated with an aluminum foil moisture barrier, and 0.050 gauge perforated aluminum inner liner, type 3003-H14 with a mill finish. Air vents and openings are lined with open-cell foam utilizing high temperature adhesive.

The enclosure shall contain a minimum of 5 lockable-hinged doors; three sides, and two rear doors to allow unrestricted access to all compartments for servicing without having to disassemble and remove panels. The enclosure shall contain a modular lift off panel on top. Enclosures requiring disassembly in order to facilitate routine maintenance are not acceptable.

The enclosure shall contain two rear doors that can be opened and permit complete access to the pump and priming system for routine maintenance without having to disconnect the suction or discharge piping.

Enclosure shall utilize 1" thick open-cell foam surrounding all piping penetrations.

The enclosure shall be fully detachable as a single unit to facilitate major repairs such as replacing the engine or pump.

The enclosure shall utilize 1-3 mil powder coating. Other paint applications are not

acceptable.

61.6.2.11 BATTERY TRICKLE CHARGER

The pump set shall be equipped with a 10 amp, 120vac/12vdc, 60Hz battery charger. The charger shall be fully automatic, and meet ISO 8846 Marine and Ignition protection standards. The charger shall be able to fully charge the battery in less than 12 hours.

Installation contractor will be required to provide all labor and materials to properly assemble the pump battery charger to the pump station 120V power source.

61.6.2.12 PUMP CONTROL PANEL

An automatic engine controller shall be provided to start and stop the diesel engine in response to varying liquid levels via float switches.

The automatic start-stop engine controller shall be part of the main instrument panel. Multiple control panels shall not be considered.

The system shall contain a safety back-up feature allowing the unit to be operated manually and retain safety shutdown protection in the event of automatic engine controller failure.

The automatic engine controller shall be fully field programmable and contain pass code protection.

The automatic engine controller shall contain automatic and manual start modes.

The automatic start-stop system shall contain two mechanically activated hermetically sealed liquid level control floats; one to turn the pump on and one to turn pump off. Single float designs that are prone to frequent cycling leading to excessive component wear shall not be considered.

The floats shall be clearly marked, top or bottom, for easy installation into wet well. Floats shall be provided with 50-feet of cable.

The two floats shall be connected together with a single pin terminal for easy connection to control box.

61.6.2.13 PAINTING

A minimum 1-2 mil thick layer of Industrial Acrylic Enamel primer shall be factory applied to the entire pump set prior to the finish coat.

A minimum 1-2 mil thick layer of TPM Blue Industrial Acrylic Enamel Paint shall be factory applied over the primer coat.

61.6.3 EXECUTION

61.6.3.1 INSTALLATION

All equipment shall be installed and mounted as shown in the drawings and in accordance with the manufacturer's recommendations. Piping shall be run as shown on the plans and be connected to all units in a manner to prevent leakage of water or sewage. Any departures from the locations or arrangements of units or

connections shall be detailed by the Contractor and submitted to the Engineer and the County for approval.

61.6.3.2 FIELD QUALITY CONTROL

A qualified representative of the pump manufacturer shall inspect the installation and supervise start-up performed by the contractor's personnel. All components of the systems shall be tested for proper operation during the start-up operation, and approved by the pump manufacturer.

The pump manufacturer's startup representative shall complete a "PUMP STATION START-UP REPORT", and submit to the project engineer for acceptance.

Maintenance Procedures: After the equipment has been placed into operation, the qualified representative of the pump system supplier shall provide a minimum of 4 hours of on-site operations, maintenance, and application training to instruct Volusia County's personnel in proper operating and maintenance procedures without additional cost to the County.

61.7 CHAIN LINK FENCE

61.7.1 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.

61.7.2 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 wire fabric shall have a black PVC coating.
2. The coating on posts and braces shall be black PVC.

The base metal of the fabric shall be a good commercial quality 9 Gage Steel wire. The fabric shall be of uniform quality, and shall be 6 foot high with a 2 inch mesh size.

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

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

61.7.3 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 psi. 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-feet 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.

61.8 REQUIRED SUBMITTALS

Submittals shall be provided to the COUNTY 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 standard

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 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
 - Full load efficiency
 - Locked rotor current
 - High potential test data
 - Bearing Inspection report
 - Break horse power

61.10 ELECTRICAL GROUNDING SYSTEM

61.10.1 GENERAL

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

1. Wet Well Cover
2. Control Panels and telemetry
3. Utility Company Transformer
4. Main Disconnect Switch
5. Fence (at all corners)

61.10.2 MATERIAL AND INSTALLATION

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

61.11 INSPECTION AND TESTING

A factory representative knowledgeable in pump operation and maintenance shall inspect and supervise a test run at the pumping station covered by this MANUAL. A minimum of one (1) working day shall be provided for the inspections. Additional time made necessary by faulty or incomplete

WORK or equipment malfunctions shall be provided as necessary to meet the requirements in the MANUAL at no additional cost to the COUNTY. Upon satisfactory completion of the test run, the factory representative shall issue the required manufacturer's certificate.

The test run shall demonstrate that all items of the MANUAL have been met by the equipment as installed and shall include, but not be limited to, the following tests:

1. That all units have been properly installed.
2. That the units operate without overheating or overloading any parts and without 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.

SECTION 62

SUBMERSIBLE WASTEWATER PUMPS

62.1 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 FIGURES AND DETAILS.

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 FIGURES AND DETAILS (see Approved Manufacturer's list in Appendix 'A').

62.2 PUMP CONSTRUCTION DETAILS

62.2.1 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.

62.2.2 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.

62.2.3 MECHANICAL SEAL

Each pump shall be provided with a tandem double mechanical seal running in an oil reservoir, composed of two separate lapped face seals, each consisting of one stationary and one rotating tungsten carbide ring with each pair held in contact by a separate spring, so that the outside pressure assists spring compression in

preventing the seal faces from opening. The compression spring shall be protected against exposure to the pumped liquid. Silicone carbide may be used in place of tungsten carbide for the lower seal. The pumped liquid shall be sealed from the oil reservoir by one face seal and the oil reservoir from the 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 opening and penetration by pumping forces shall not be considered equal to tandem seal specified and required.

62.2.4

GUIDES

A sliding guide bracket (Flygt interchangeable design) 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.

62.3 MOTORS

62.3.1

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 degrees C maximum. Pump motors shall have cooling characteristics suitable to permit continuous operation, in a totally, partially or non-submerged condition. The pump shall be capable of running continuously in a non-submerged condition under full load without damage, for extended periods. The motor shall be capable of a minimum of 8 starts per hour. If required by the COUNTY, before final acceptance, a field running test demonstrating this ability, with 24 hours of continuous operation under the above conditions, shall be performed for all pumps being supplied. Motors 25 horsepower and below shall be rated 230/460 volt, 3-phase. Motors greater than 25 horsepower shall be 460 volt, 3-phase.

62.3.2 HEAT AND MOISTURE SENSORS

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

In lieu of moisture and temperature sensors, each pump motor shall have its motor winding insulation resistance monitored automatically by an automatic megger solid state electronics module. Each automatic megger must have an individual disconnect terminal plug, manual shut off switch, three lights to indicate 10 M ohm, 5 M ohm, and 1 M ohm, resistance values, two output circuits for external alarms, and two switches for manual testing. The power source shall be 110 VAC fused at 0.24 AMP. The test voltage shall be 500-700 volts dc. The automatic megger shall monitor the motor resistance only when the motor is off and shall activate an alarm system when the motor resistance drops to 1 M ohm.

62.3.3 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 cable shall be continuous, without splices from the motor to the control panel, unless otherwise approved by the COUNTY.

The junction chamber, containing the terminal board, shall be perfectly leak proof.

62.4 PUMP CONTROL SYSTEM

Refer to Section 63 for control system specifications.

62.5 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 COUNTY up to the time of the final acceptance test.

62.6 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.

62.7 WARRANTY

The pump manufacturer shall warrant the units being supplied to the COUNTY against defects in workmanship and material for a period of five (5) years or 10,000 hours.

SECTION 63

PUMP STATION ELECTRICAL POWER AND CONTROL SYSTEM

63.1 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 5 years experience in the building of pump control panels.

A pump station control panel shall be provided for each wastewater pump station. The control panel shall respond to liquid level float switches to automatically start and stop pumps as well as sound an alarm upon high or low wet well levels. The control panel shall operate 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. A failure of the alternator shall not disable the pumping system. The alternator shall include a safe, convenient method of manual alternation and also have provisions to prevent automatic alternation without disturbing any wiring. Should the "pump off" regulator fail, the system shall keep the station in operation and provide a visual indication of the regulator failure.

The control panel shall consist of main circuit breakers and generator breaker with mechanical interlock, an emergency power receptacle, a circuit breaker and magnetic starter for each pump motor, and 15 ampere, 120 volt circuit breakers as required. All pump control operations shall be accomplished by a float type liquid level control system with all control components mounted in one common enclosure. Control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall provide means to manually select or automatically alternate the position of the "lead" and "lag" pumps after each pumping cycle. A float type liquid level control system shall continuously monitor wet well liquid level and control operation of the low-level cutoff for the pumps and shall operate off a 24 volt circuit.

Use of a Data Flow pump control module will be required. Data flows "Tac-Pac," shall be included in the controls of the lift station. A data flow RTU shall be provided in areas where signals are available. The COUNTY shall determine the availability of a signal.

63.2 PANEL CONSTRUCTION

The duplex pump panel shall be housed in a NEMA 3R or 4X, Type 304, 14 Gauge stainless steel enclosure with 30% extra mounting space for additional equipment. Enclosure shall have provisions for padlocking the door and a dead front inner door unit for mounting controls. All exterior hardware and hinges shall be stainless steel.

There shall be permanently affixed to the interior side of the exterior enclosure door both a nameplate and a 10" x 12" pocket for log sheet storage. The nameplate shall contain the following information, voltage, phase, rated horsepower, speed, date manufactured and pump and control panel manufacturer's name, address and telephone number, pump data, including impeller data, operating point and head. KW input, and amps at the operating point and at least two other points on the pump curve.

The control panel enclosure shall be Underwriters Laboratories (UL) 50 type 3R listed with rain guard.

63.3 POWER SUPPLY AND MAIN DISCONNECT

Power supply to the control panel shall either be 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 unless pumps are 1hp or less and approved by the COUNTY prior to construction.

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.

63.4 CIRCUIT BREAKERS

63.4.1 MAIN BREAKERS

The panel shall have an inter-lock system between the normal power main breaker and the emergency breaker to ensure only one breaker is in the "on" position at a time. Both breakers shall be equal in size. (See Approved Manufacturers' list in Appendix 'A'.)

63.4.2 CIRCUIT BREAKERS

All circuit breakers shall be heavy duty molded case breakers. The handle on the circuit breakers shall be operational through the inner door. (See Approved Manufacturers' list in Appendix 'A'.)

63.5 MOTOR CIRCUIT PROTECTORS

Each pump motor shall be protected by a 3-pole motor circuit protector. (See Approved Manufacturers' list in Appendix 'A'.) The motor circuit protector shall be operated by a toggle-type handle and shall have a quick make, quick break over center switching mechanism that is mechanically trip-free from the handle so that the contacts cannot be held closed against a short circuit and abnormal currents which cause the motor circuit protection to trip. Tripping shall be clearly indicated by the handle automatically assuming a position midway between the normal ON and OFF positions. All latch surfaces shall be ground and polished. All poles shall be so constructed that they open, close, and trip simultaneously. Motor circuit protector must be completely enclosed in a high-strength glass polyester molded case. Ampere ratings shall be clearly visible. Contacts shall be of non-welding silver alloy. Arc extinction must be accomplished by means of arc chutes. A manual push-to-trip button shall be provided for manual exercising of the trip mechanism. Each pole of these motor circuit protector's shall provide instantaneous short circuit protection by means of an adjustable magnetic-only element.

63.6 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 'A'.) Local power company regulations shall govern.

Selector switches shall be installed on the face of the inner door unit. Selector switch shall be a heavy duty oil tight "Hand-Off-Auto" three position switch to control the operation mode of each pump motor starter.

63.7 PUMP ALTERNATOR

An eight pin plug-in solid state alternator (See Approved Manufacturers' list in Appendix 'A'.) shall be provided to change the pump starting sequence on each pumping cycle. A three position alternator

test switch shall be provided to control the alternation operation. Switch positions to include the "Auto" to provide normal automatic sequence, "Off" position to disable alternator, and "test" position with a spring return to allow the alternating of the pump sequence to check alternator operation.

63.8 LIGHTS AND ALARMS

63.8.1 INDICATOR LIGHTS

There shall be installed on the face of the inner door unit, heavy duty oil tight indicator lights as shown on the FIGURES AND DETAILS.

63.8.2 HIGH LEVEL ALARM

A vapor proof red light and horn shall be mounted on the side of the panel for high level alarm. Also, there shall be an alarm silence push-button on the inner door and a silence relay which will silence the horn and automatically reset when these signals are restored to normal. The push-button shall be heavy duty oil tight. The red globe shall be the screw-on type.

63.9 EMERGENCY POWER RECEPTACLE

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

63.10 ADDITIONAL REQUIREMENTS

63.10.1 WIRING

All power wires shall be THW or THWN 75 Degree C insulated stranded copper conductors and shall be approximately sized for the given load application. All control circuit wire shall be type THW; Size 14, stranded type. All wiring within the enclosure shall be neatly routed by the use of slotted type wiring duct with snap on type covers. Wiring on the rear of the inner door shall be neatly bundled with nylon ties and include sufficient loop across the hinges to prevent wire damage, with each end of conductor marked (I.D.), Color: Red, 24 volt; white, neutral; black, 120 volts.

63.10.2 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.

63.10.3 ENGRAVED NAMEPLATES

All circuit breakers, control switches, indicator pilot lights and other control devices shall be identified with permanently affixed legend plates and lamicoid-type engraved nameplates where applicable.

63.10.4 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 manufacturer's specifications, surge protectors shall be attached to the main

disconnects.

63.10.5 ELAPSED TIME METERS

Elapsed time meters shall be 115 volt not-reset type and shall totalize pump running time in hours and tenths of hours to 99999.9 hours.

63.10.6 CONVENIENCE RECEPTACLE

On the face of the inner door unit, there shall be installed a 15 AMP 120 volt, duplex convenience receptacle. It shall be provided with its own single pole, 15 AMP circuit breaker for protection. Ground fault interrupt type shall be required.

63.10.7 CONTROL TERMINAL BLOCKS

Control terminal blocks shall be of the clamp screw type, rated for 600 volts. Amperage rating shall accommodate the control circuit amperage. An additional 30 space terminal strip shall be installed in the cabinet for future use, with RTU equipment.

63.10.8 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. This control power transformer is required only on 480 volt control panels.

The signal required by the float switches and relays shall be 24VAC. This shall be provided by a 24VAC control power transformer properly sized with a fused secondary.

63.10.9 CONTROL RELAY

The level control relays shall operate from 24VAC. They shall be enclosed, plug-in 8 pin type with octal-style screw terminal sockets.

63.10.10 ELECTRICAL SCHEMATIC

There shall be permanently affixed to the interior side of the exterior enclosure door an electrical schematic diagram and a copy supplied to COUNTY personnel at start-up. The schematic diagram shall include the rated amperage and voltage for all components.

63.10.11 PHASE MONITOR

For all 240 volt stations an eight pin plug-in type phase monitor shall be provided for protection of electrical components due to phase loss. Adequate dummy pin protection shall be provided to prevent accidental interchanging of the eight pin phase monitor with the eight pin alternator. All 480 volt stations shall have surface mount type phase monitors.

63.10.12 FLOATS

Liquid level in the wet wells shall be monitored by a five (5) float system. Low level alarm (1), pump #1 off (2), pump #1 on (3), Pump #2 (4), on and high level alarm (5).

Floats shall be a Mercury type switch operating on 24 volts. Floats shall have rubber coated stainless steel bodies with permanently sealed cables. A minimum of 25 ft. cables shall be provided.

63.11 TESTING, SERVICE AND WARRANTY

63.11.1 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.

63.11.2 SERVICE

The control panel manufacturer shall maintain a service organization in Volusia County that is available for service.

63.11.3 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.

APPENDIX A
LIST OF MATERIALS AND APPROVED MANUFACTURES

WASTEWATER MAIN MATERIALS		
ITEM	MANUFACTURERS	MODEL/PART NO.
Air Release & Vacuum Valves	1. A.R.I Flow Control 2. Val-Matic	1. D-025 2. 102 S
Ball Valves (4" – 10")	1. American	1. Series 4000D
Weighted Arm Swing Check Valves (4" & Larger)	1. Kennedy 2. American-Darling 3. M&H 4. McWane 5. Mueller/Pratt	1. Figure 106 2. Series 50-SC/600 3. C 508 4. 106 LW 5. 2600
Tapping Valves (Resilient Seat Only)	1. Kennedy 2. M&H 3. American Flow Control 4. McWane 5. Mueller	1. 4950 2. Style 4067 3. Series 2500 4. 2638 5. 2360/2361
Valve Boxes	1. Tyler	1. Series 6850
Flexible Expansion Joints	1. EBBA Iron 2. Proco 3. Red Valve 4. Sigma	
DI Fittings (epoxy lined)	1. Star 2. Tyler Union 3. Sigma	
Restrained Joints	1. EBAA Iron 2. Sigma 3. Star	
PVC Gravity Fittings	1. Harco 2. Vasallo 3. GPK 4. J-M MFG. 5. Multi Fittings	
Manhole Lining System (new manholes)	1. GU Liner 2. Agru Liner 3. HDPE Liner	
Manhole Frame & Cover	1. U.S. Foundry 2. Vulcan	1. #170-E 2. V1357
Manhole Jointing Material	1. K.T Snyder 2. Conseal	1. Ram-Nek 2. CS-102
Manhole Surface Coatings	1. TBD	1. TBD
DI Pipe Epoxy Lined Sewer Force Main 4"- 12" Class 350 16"- 24" Class 250 24"- 64" Class 200	1. American Pipe 2. U.S Pipe 3. McWane	
Casing Spacers	1. Cascade 2. PSI	12" Width Min.
Vault Frame & Cover for Air Release/vacuum relief valves	1. U.S Foundry 2. AF C	1. USF 7665 2. Trench Adapter

APPENDIX A
LIST OF MATERIALS AND APPROVED MANUFACTURES

WASTEWATER MAIN MATERIALS (cont.)		
ITEM	MANUFACTURERS	MODEL/PART NO.
Pipe (PVC) Sewer Force Main (green color) C900 or C909, DR-18	1. Diamond Plastics 2. National 3. North Star 4. J&M	
Pipe (PVC) Gravity Main (green color) SDR 35	1. Diamond Plastics 2. National 3. North Star 4. J&M	
Stainless Steel Tapping Sleeves/Saddles	1. Smith Blair 2. JCM 3. American Flow Control 4. Ford 5. Romac Industries 6. U.S. Pipe	1. 665 2. 412 3. Series 2800 4. FTSS 5. SST 6. T9
Stainless Steel Line Stop Saddles	1. Romac Industries	1. SST-X
Painting - Field Primer: Aerial Piping, Fittings & Valves	1. Porter/Int'l 2. Koppers 3. TNE MEC 4. Glidden	
Painting – Finish (Exterior): Aerial Piping, Fittings & Valves	1. Porter/Int'l 2. Koppers 3. TNE MEC 4. Glidden	
WASTEWATER PUMP STATION MATERIALS		
ITEM	MANUFACTURERS	MODEL/PART NO.
Generator Systems	1. Caterpillar 2. Onan Cummins 3. Tradeswinds 4. Genrac 5. Detroit Diesel	
Pressure Gauges/Isolation Ring	1. Onyx	
Generator Auto Transfer Switch	1. Asco	

APPENDIX A
LIST OF MATERIALS AND APPROVED MANUFACTURES

WASTEWATER PUMP STATION MATERIALS (cont.)		
ITEM	MANUFACTURERS	MODEL/PART NO.
Submersible Pumps	1. Flygt 2. ABS 3. Hydromatic	
Aluminum Wet Well Access Frames & Covers	1. Halliday Products, Inc 2. U.S. Foundry 3. Bilco	
Stainless Steel Control Panels	1. Sta-Con, Inc 2. Quality Control, Inc 3. Unitron Controls 4. Flygt 5. Hydromatic 6. ABS	
Alarm Light	1. American Electric 2. Red Dot	1. F32552 2. 899 B
Generator Receptacle (GR)	1. Russell Stoll Receptacle 2. Russell Stoll 20 degree angle adapter	1. 100 amp - JRS1044FR, 200 amp – JRS2044FR 2. JAA10
Circuit Breakers	1. Square D	
Transformers	1. Square D 2. Westinghouse 3. General Electric	
Float Regulator (FR)	1. Roto-Float 2. Flygt	
Wet Well Level Bubbler	1. Data Flow Systems	
Motor Starter	1. Square D	
Phase Monitor	1. Diversified	
Pump Automatic Alternator (PAA)	1. Diversified	
SCADA System	1. Data Flow Systems 2. Data Flow Systems	1. Telemetry Control Unit (TCU) 2. Remote Telemetry Unit (RTU)

APPENDIX A
LIST OF MATERIALS AND APPROVED MANUFACTURES

WATER MAIN MATERIALS		
ITEM	MANUFACTURERS	MODEL/PART NO.
Air Release Valves	1. A.R.I Flow Control 2. Val-Matic	1. TBD 2. TBD
Casing Spacers	1. Cascade 2. PSI	12" Width Min.
Butterfly Valves (16" & Larger)	1. Kennedy 2. M&H 3. Clow (McWane) 4. Mueller	
Gate Valves (4" to 12")	1. Kennedy 2. American Flow Control 3. M&H 4. Clow (McWane) 5. Mueller	
Corporation Stops (No Lead)	1. Ford 2. McDonald 3. Mueller	1. F-1000, FB-1000 2. 4701-T 3. H-15008, B25008
Curb Stops (No Lead)	1. Ford 2. McDonald 3. Mueller	1. single-B43-342W, double-BA13-232W/U48-43 2. single-6100 MTW, double-4604N/3795-T 3. single-H-14350, double-H-14265/H-15363
Flexible Expansion Joints	1. EBBA Iron 2. Proco 3. Red Valve 4. Sigma	
Restraint Joints	1. EBBA Iron 2. Star 3. Sigma	
DI Fittings	1. Star 2. Tyler Union 3. Sigma	
Fire Hydrants	1. Mueller 2. American-Darling 3. Clow	1. Super Centurion 250 2. B-84-B-5 1/4 3. Medallion F-2545
Water Meters	1. Sensus	
Backflow Valves 3/4" – 2" (No Lead)	1. Wilkins	1. RPZ 975XL, DC 950XL
Painting - Field Primer: Aerial Piping, Fittings & Valves	1. Porter/Int'l 2. Koppers 3. TNEMEC 4. Glidden	

APPENDIX A
LIST OF MATERIALS AND APPROVED MANUFACTURES

WATER MAIN MATERIALS (cont.)		
ITEM	MANUFACTURERS	MODEL/PART NO.
Painting – Finish (Exterior): Aerial Piping, Fittings & Valves	1. Porter/Int'l 2. Koppers 3. TNE MEC 4. Glidden	
DI Pipe Water Main 4"- 12" Class 350 16"- 24" Class 250 24"- 64" Class 200	1. American Pipe 2. U.S Pipe 3. McWane	
Pipe (PVC) Water Main (blue color) C900 or C909, DR-18	1. Diamond Plastics 2. National 3. North Star 4. J&M	
Polyethylene Tubing (SDR-9 water service, blue color) ¾"- 2"	1. Endot Endopure	1. PE-3408
Service Saddles	1. Smith Blair 2. JCM 3. Robar Baker 4. Ford 5. Romac Industries 6. Mueller	1. 317 2. 402 3. Shur Seal-0 4. F-202 5. 202 NS 6. Series DRZA
Stainless Steel Tapping Sleeves/Saddles	1. Smith Blair 2. JCM 3. American Flow Control 4. Ford 5. Romac Industries 6. U.S. Pipe	1. 665 2. 412 3. Series 2800 4. FTSS 5. SST 6. T9
Stainless Steel Line Stop Saddles	1. Romac Industries	1. SST-X
Tapping Valves (Resilient Seat Only)	1. Kennedy 2. M&H 3. American Flow Control 4. McWane 5. Mueller	1. 4950 2. Style 4067 3. Series 2500 4. 2638 5. 2360/2361
Valve Boxes	1. Tyler	1. Series 6850
Vault Frame & Cover for Air Release valves	1. U.S Foundry 2. AFC	1. USF 7665 2. Trench Adapter

APPENDIX A
LIST OF MATERIALS AND APPROVED MANUFACTURES

RECLAIMED WATER MAIN MATERIALS		
ITEM	MANUFACTURERS	MODEL/PART NO.
Air Release Valves	1. A.R.I Flow Control 2. Val-Matic	1. TBD 2. TBD
Casing Spacers	1. Cascade 2. PSI	12" Width Min.
Butterfly Valves (16" & Larger)	1. Kennedy 2. M&H 3. McWane	
Gate Valves (4" to 12")	1. Kennedy 2. American Flow Control 3. M&H 4. McWane 5. Mueller	1. 8571 2. Series 2500 3. Style 4067-01 4. F-6100 5. Series 2360/2361
Corporation Stops	1. Ford 2. McDonald 3. Mueller 4. Hays	1. F-1000, FB-1000 2. 4701-T 3. H-15008, H-15013 4. 5200DF, 4400DF
Curb Stops	1. Ford 2. McDonald 3. Mueller 4. Hays	1. single-B43-342W, double-BA13-232W/U48-43 2. single-6100 MTW, double-4604N/3795-T 3. single-H-14350, double-H-14265/H-15363 4. single-4317-1DF, double-25013/5591DF
Flexible Expansion Joints	1. EBBA Iron 2. Proco 3. Red Valve 4. Sigma	
Restraint Joints	1. EBBA Iron 2. Star 3. Sigma	
DI Fittings	1. Star 2. Tyler Union 3. Sigma	
Painting - Field Primer: Aerial Piping, Fittings & Valves	1. Porter/Int'l 2. Koppers 3. TNEMEC 4. Glidden	
Painting – Finish (Exterior): Aerial Piping, Fittings & Valves	1. Porter/Int'l 2. Koppers 3. TNEMEC 4. Glidden	

APPENDIX A
LIST OF MATERIALS AND APPROVED MANUFACTURES

RECLAIMED WATER MAIN MATERIALS (cont.)		
ITEM	MANUFACTURERS	MODEL/PART NO.
DI Pipe Reclaimed Water Main 4"- 12" Class 350 16"- 24" Class 250 24"- 64" Class 200	1. American Pipe 2. U.S Pipe 3. McWane	
Pipe (PVC) Water Main (purple color) C900 or C909, DR-18	1. Diamond Plastics 2. National 3. North Star 4. J&M	
Polyethylene Tubing (SDR-9 reclaimed water service, purple color) ¾"- 2"	1. Endot Endopure	1. PE-3408
Service Saddles	1. Smith Blair 2. JCM 3. Robar Baker 4. Ford 5. Romac Industries 6. Mueller	1. 317 2. 402 3. Shur Seal-0 4. F-202 5. 202 NS 6. Series DRZA
Stainless Steel Tapping Sleeves/Saddles	1. Smith Blair 2. JCM 3. American Flow Control 4. Ford 5. Romac Industries 6. U.S. Pipe	1. 665 2. 412 3. Series 2800 4. FTSS 5. SST 6. T9
Stainless Steel Line Stop Saddles	1. Romac Industries	1. SST-X
Tapping Valves (Resilient Seat Only)	1. Kennedy 2. M&H 3. American Flow Control 4. McWane 5. Mueller	1. 4950 2. Style 4067 3. Series 2500 4. 2638 5. 2360/2361
Valve Boxes	1. Tyler	1. Series 6850
Vault Frame & Cover for Air Release valves	1. U.S Foundry 2. AFC	1. USF 7665 2. Trench Adapter