SECTION 02732

WASTEWATER FORCE MAINS

PART - GENERAL

1.01 GENERAL:

A. This section includes the general requirements for design and installation of force main systems serving wastewater lift stations.

B. The relevant provisions set forth in Division 2, "Technical Requirements", and shown in "Standard Details – Wastewater Systems", shall be applicable to this section unless otherwise indicated herein or approved by the Utilities Engineer.

1.02 DESIGN STANDARDS:

A. Required Reference: The Contractor shall comply with the applicable design and installation requirements as established by the Florida Department of Environmental Protection, Rule 62-604.4.

B. System Design: Force main systems shall be no less than four inches in diameter (unless specifically approved in writing by the FPUA) and of adequate size to efficiently transmit the total ultimate peak operational flows, applied by the connected wastewater lift station(s), to the effluent point. Consideration shall be given to possible future connecting lift stations and this probability shall be reviewed with the FPUA. Capacity computations shall be coordinated with the proposed system(s), along with any future flow requirements, if applicable. In order to provide adequate pipeline cleansing, force main flow velocity shall not be less than two feet per second at ultimate design minimum pumping capacity; however, with multiple lift station systems or phase development, this requirement may not be possible and the system design shall receive special attention regarding cleaning maintenance. Force mains of less than four inches in diameter will be considered on an individual basis.

C. Operational Cost Considerations: For Type II and Type III lift stations (See Section 02735), in addition to initial capital expenditure, long term pumping station operational costs shall also receive consideration when sizing force main systems. Should a pipe size option be available within the design limits, the cost of sewage pumps and motors, force main system and pump operating power (computed for design average daily flow rate for ten years at existing electricity cost), shall be compared to like amounts for the alternate designs. The final force main size selection shall be directed towards the system with the least long range capital and operational cost. Said cost analysis shall be subject to review by the Department.

PART 2 - PRODUCTS

2.01 STANDARD REQUIREMENTS:

A. General: The materials of construction and general installation procedures shall comply with the specific applicable standards set forth under Section 02200, "Utility Excavation, Trenching and Backfilling", Section 02315 "Casing Pipe – Boring and Jacking", and Section 02600 "Pipe, Fittings, Valves, and Appurtenances", as well as "Standard Details – Wastewater Systems".

B. Approved Pipe, Fittings and Valves: The types tabulated below, within the size range indicated and for the applicable service, are approved for wastewater force main construction:

Pipe and Fittings	**Size Range**
Ductile Iron (DI) Pipe (Class 250) & Fittings – Polylined	All Sizes
Polyvinyl Chloride (PVC) Pipe DR-18	30 Inches or Less
High Density Polyethylene Pipe (HDPE) PE 3408	All Sizes
Valves	**Size Range**
Resilient Wedge Gate Valves	All Sizes

1. The minimum size of a force main shall be four inches unless specifically approved in writing otherwise by FPUA.

C. Joint Restraining: Pressure piping fittings and other items requiring restraint, shall be braced with restraining assemblies, as specified under Section 02600 and shown on Standard Detail Sheet. Said restraining devices shall be designed for the maximum pressure condition (testing) and the safe bearing loads for horizontal thrust, if thrust blocking is used. Thrust blocks shall only be allowed in special cases, and require prior written approval from the Department.

D. Pipe Depth and Protection: The standard minimum cover for wastewater force main systems shall be three feet from the top of the pipe to finish grade. However, should this design not be feasible, protective concrete slabs shall be provided over the pipe within the limits of the lesser cover. Where waterways, canals, ditches, or other cuts are crossed, ductile iron pipe shall be required across and to ten feet each side of the bottom. Additionally, approved utility crossing signs shall be placed on the pipe alignment at each side of the canal, etc., for waterways. Signs shall be approved by the Department and the Agency having jurisdiction of said waterway.

E. Connections and Structures: Where pipes are to extend into or through structures, flexible joints shall be provided at the wall face, "Link-Seal", or approved equal.

F. Special Exterior Protection for Corrosion: Extra protection shall be provided for underground ductile iron pipe and fittings within areas of severe corrosive conditions. This shall be accomplished by the installation of polyethylene encasement, per AWWA C109, as specified in Section 02600, through the area of concern. The soil-test evaluation to determine the necessity for extra protection in suspect areas shall be as set forth in ANSI Standard A21.5. Additionally, where other existing utilities are known to be cathodically protected, cast or ductile iron pipe crossing said utility shall be protected for a distance of 20 feet to each side; and, when installed parallel to and within ten feet of same, protection shall also be provided.

G. Air and Vacuum Venting: Where the force main profile is such that air pockets or entrapment could occur, resulting in flow blockage, provisions for air release shall be provided. Manually operated vent valves shall be provided along minor force mains where continual problems are not anticipated. Manual air release assemblies shall be installed where venting is required on all major force mains and at critical points on lesser mains. At profile break points on major force mains, such as tops of hills, etc., where free flow will occur during operation or after pumping stops, combined are release and vacuum valve assemblies may be required. Air and vacuum valves and/or air release valves shall be as specified under Section 02600 and shall be suitably housed in a properly vented underground chamber (manhole), if in an open area, and are required to be coated with Koppers Bitumastic No. 300M, coal tar epoxy, or approved equal.

H. Valve Locations: Valves shall be installed on all subsidiary force mains at 3000 foot maximum separation, and at the point of connection to the major main in order to isolate said pipeline for maintenance. Where force mains are to be extended, valves shall be placed at the future connection point to preclude line shutdown at the time of extension. At future connection branches or ends, the valves shall not be installed within the run of individual force mains, nor for pipe sizes in excess of 14 inches, without special consideration. Valve locations shall be marked as stated in Section 02600.

I. Terminal Discharge: Force mains shall enter the terminal facility (gravity wastewater manhole, lift station wet well or other) at a point equal to the operational water level of said receiving unit. Should an elevation drop be required to obtain the outlet connection, the prior down-slope of the force main shall not exceed 45 degrees, and adequate air venting shall be provided at the profile break point.

J. Identification: In order to preclude possible domestic water tapping, all installed underground wastewater force mains shall bear identification markings which will remain legible during normal handling, storage and installation; and which have been applied in a manner that will not reduce the strength of the product or otherwise damage the pipes. Marking on the pipe shall include the following and shall be applied at intervals of not more than 3 feet; nominal size, material code designation, the word "SEWER PIPE", and dimension ratio, pressure class, manufacturer's name or trade mark and production record code. PVC force main pipe shall be green in color or white in color. PVC, DIP or HDPE pipe shall have the words "FORCE MAIN" permanently printed on three sides for the entire length of pipe or identification tape with the words "FORCE MAIN" may be used and must be attached to the top of the pipe.

K. Locator Wire and Locator Boxes for Force Mains: All force mains shall be marked by the use of a continuous multi-strand wire, 12 gauge, THHN, green in color for the entire length of the pipe. Where splices are required they shall be in accordance with FPUA standard details. All force mains shall have locator boxes installed a minimum of every 1,000 feet.

PART 3 – EXECUTION

3.01 TESTING:

A. The Contractor shall perform hydrostatic testing of all wastewater force mains, as set forth in the following, and shall conduct said tests in the presence of representatives from the Engineer and FPUA with 48 hours advance notice provided.

B. Piping and appurtenances to be tested shall be within sections between valves or adequate plugs, with prior approval from the Engineer. Testing shall not proceed until

restraining devices are installed. All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of all foreign matter. Flushing velocities of at least 2.5 feet per second must be obtained. Adequate means must be provided to insure the required velocity is achieved. While the piping is being filled with water, care shall be exercised to permit the escape of air from extremities of the test section, with additional release cocks provided if required.

C. Hydrostatic testing shall be performed at 100 psi for two hours. The testing shall continue for an uninterrupted period of not less than two hours. Testing shall be in accordance with the applicable provisions as set forth in Section 4.1 of AWWA Standard C600. Should the testing pressure drop 5 psi or greater at any time during the test, the test is considered to have failed. The allowable rate of leakage shall be less than the number of gallons per hour determined by the following formula:

$$L = \frac{SD\,(P)\,½}{133{,}200}$$

L = allowable leakage in gallons per hour
S = length of pipe tested in feet
D = nominal diameter of the pipe in inches
P = average test pressure maintained during the leakage test in pounds per square inch gauge

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

E. Should the test fail, necessary repairs shall be accomplished by the Contractor and the test repeated until within the established limits. The Contractor shall furnish the necessary labor, water, pumps, gauges, and all other items required to conduct the required wastewater force main testing and shall perform the necessary system repairs required to comply with the specified hydrostatic test. All visible leaks are to be repaired regardless of the amount of leakage.

F. Written Certification of Acceptance of the test data for compliance with FPUA Specifications will be made upon request and signed by the Engineer.

END OF SECTION